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SCOR Proceedings, Volume 43
REPORT OF THE 38th SCOR EXECUTIVE COMMITTEE MEETING

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38th SCOR EXECUTIVE COMMITTEE MEETING
Radisson SAS Royal Hotel, Bryggen
Bergen, Norway

26-28 August 2007

1.0 OPENING

1.1 Opening Remarks and Administrative Arrangements

Bjørn Sundby opened the meeting, welcoming everyone to his home town of Bergen, Norway. He introduced Peter Haugan, the local host of the meeting and chair of Norwegian SCOR Committee. Haugen also arranged Norwegian support for the meeting. He welcomed participants and noted that this is the first annual SCOR meeting in Norway. It is timely because the International Polar Year is ongoing and many IPY activities are going on in Bergen. The location of the meeting in the Bryggen area of Bergen highlights that the area is subsiding and sea level is rising; in another 50 years, it might be impossible to have a meeting in the same location. Sundby asked all participants to introduce themselves. A moment of silence was observed to recognize the deaths of Grant Ingram (Canada) and Dale Krause (USA).

1.2 Approval of the Agenda

Bjørn Sundby noted changes in the agenda, which were approved. Gordon McBean will discuss the International Council on Science (ICSU) Natural and Human-Induced Environmental Hazards and Disasters activity on Tuesday. Vladimir Ryabinin will present on the World Climate Research Programme (WCRP) on Monday before lunch. A presentation by Tom Rossby on new observations from voluntary observing ships will be given over lunchtime on Sunday. The discussion of the SCOR 50th Anniversary symposium will be delayed to Monday afternoon.

1.3 Report of the President of SCOR

Bjørn Sundby reported on his activities in the past year as SCOR President. It was a busy year, with a lot of travel, but very productive. Sundby highlighted SCOR's relationship with its "mother organization", ICSU, which has improved with a real recognition that SCOR is the focal point for oceans in ICSU. For example, Sundby was asked to represent ICSU at the Intergovernmental Oceanographic Commission (IOC) annual meeting. SCOR hasn't received any monetary support from ICSU since about 2002, but the recognition is important. Sundby and Ed Urban represented SCOR and ICSU at the IOC meeting; their interventions were well received and generated a lot of discussions. The letter of agreement with IOC in relation to the International Ocean Carbon Coordination Project (IOCCP) was renewed, as it has been useful in helping guide SCOR-IOC interactions related to IOCCP.

Another important event was the SCOR summit on large-scale research projects in London, co-chaired by Sundby and Peter Burkill (UK). More information about the summit was presented later in the meeting.

Sundby represented SCOR at the International Geosphere-Biosphere Programme (IGBP) Science Committee meeting in Brazil, which made clear the importance of prudent financial management; IGBP and several other of SCOR's sister organizations are experiencing financial problems due to the difficult international financial environment. The SCOR Finance Committee at this meeting should continue SCOR's style of careful financial management.

In regard to capacity building, we have a new committee established under leadership of Venu Ittekkot, who is now a Co-opted member of the SCOR Executive Committee. Sundby expressed his pleasure that Gordon McBean is attending the meeting, both to represent the Canadian SCOR Committee and the global change SysTEM for Analysis, Research and Training (START), creating good opportunities for linkages. Sundby finished by noting that SCOR is working with the Scientific Committee on Problems of the Environment (SCOPE) and the International Association for the Physical Sciences of the Oceans (IAPSO) on a book on problems of the marine environment (see PACKMEDs later); this is a good experience for SCOR.

1.4 Report of SCOR Executive Director

Ed Urban gave a few logistical remarks and then referred to his written report in the meeting background book. Urban reiterated Sundby's comments about financial management. Many of SCOR's sister organizations are suffering financially. SCOR needs to ensure that scientific quality comes first. We need to diversify our income beyond dues and U.S. grant funds, stressing the importance of involving national committees. Urban thanked the China (Beijing) Committee for increasing its level of membership. One action that Urban noted had not been completed since last year's meeting is the re-design of the SCOR Web site, due to the lack of time since last year's meeting (only 10 months). The site is kept up to date, but is not very visually exciting. Urban stated that he is excited about SCOR's plans in capacity building. He noted that SCOR supports its projects in many ways. The SCOR project summit reviewed many issues important to all SCOR projects.

The SCOR Secretariat will move to the University of Delaware later in 2007; the College of Marine and Earth Studies is enthusiastic about having SCOR located there. The Secretariat lost its Administrative Assistant at the end of 2006 and Elizabeth Gross has been filling in since then. A new person will be hired in 2008, after the secretariat is moved. In reply to a question from Catherine Jeandel (France), Urban emphasized the importance of being sure that SCOR resources are focused on topics where SCOR is scientifically strong and that other organizations are not already doing better.

1.5 Appointment of an *ad hoc* Finance Committee

The SCOR Constitution requires that a Finance Committee be appointed at every SCOR meeting. It must consist of three members of SCOR who are not members of the Executive Committee. The Finance Committee reviews the administration of SCOR finances during the previous year and the current year, and proposes a budget for the coming year. The Executive Committee approved a committee before the meeting so they could prepare. Missy Feely (USA) chaired the committee at the meeting, assisted by Lucas Stal (Netherlands) and Eeva-Liisa Poutanen (Finland) as members. The committee's work is described in Section 8.3.

1.6 Appointment of an *Ad hoc* Committee to Review the Disciplinary Balance of SCOR's Activities

The Executive Committee meeting in 1999 agreed that at future SCOR meetings, after the consideration of working group proposals is complete, the current disciplinary balance of SCOR groups should be assessed. Scientific gaps should be identified and communicated to national committees when the next request for working group proposals is sent. Laurent Labeyrie (France) agreed to lead this group again. Bjørn Sundby asked for people to help Labeyrie and noted that someone will need to take over this task after Labeyrie rotates off the Executive Committee in 2008. Gordon McBean noted that ICSU has decided to get much more into subject areas like socio-economics. Is SCOR doing anything in relation to geophysics in polar regions and how this research is impacted by national sovereignty? Labeyrie expressed that this might be a dangerous direction for SCOR to go. Ed Urban added that projects are beginning to get involved in more social science issues and that he would like to see a working group proposal that includes social science issues. Most organizations of our type are moving in this direction to some extent, for example, the work of the U.S. SCOR Committee (the Ocean Studies Board of the U.S. National Research Council) that extends beyond its SCOR responsibilities.

1.7 Results of Elections for SCOR Officers

The SCOR Past President serves as the chair of the SCOR Nominating Committee. Robert Duce reported that in 2008 the positions of the President (Bjørn Sundby) and all three Vice-Presidents are open for election. One Vice-President (Victor Akulichyev) will have served his maximum term. Duce referred to the election procedures in the meeting book (which can also be found on the SCOR Web site at <http://www.scor-int.org/constitution.htm>). He would like to have four members on the committee (3 are required). Duce asked for volunteers or suggestions for the committee so that the list could be finalized at the meeting. Members of the Nominating Committee must be national SCOR members.

2.0 WORKING GROUPS

2.1 Disbanded Working Groups

2.1.1 WG 78—Determination of Photosynthetic Pigments in Seawater

Ed Urban reported that SCOR approved funds in 2006 for production of Volume 2 of *Phytoplankton Pigments in Oceanography*. The book chapters are being produced and about US\$9600 has been raised from external sources to publish the book. Chapters are expected to be submitted to the publisher in December 2007. A publisher has not yet been arranged. Urban had proposed to use a private publisher to publish the report and the Executive Committee also suggested that we look at a non-profit publishers as a 3rd option. Urban noted that one goal is to avoid producing books in the future that are as costly as *The Biogeochemistry of Iron in Seawater*, which is now listed at \$450 per copy. Several questions were raised. Why don't we just make over publications available as pdf files on the Web? Mike MacCracken (IAMAS) cited his experience with the Arctic Climate Impact Assessment and Cambridge University Press: the book is published, marketed, stored, and sold, but they also made the copyright available to be used on Web. Gordon McBean noted that the quality of their professional editing was excellent.

Bjørn Sundby noted that SCOPE sometimes commissions a popularized book after the technical book is produced. There is value in hard copy books with the SCOR logo on them, but this needs to be balanced against the availability and cost of hard copies versus pdf copies only. Peter Haugan suggested the “print on demand” option. Sundby emphasized that accessibility is important. Laurent Labeyrie added that an “unknown publisher” is not a good idea. The meeting agreed that Urban should review the options and bring a recommendation to the Executive Committee later. The funding needed for Volume 2 of *Phytoplankton Pigments in Oceanography* depends on this decision.

2.2 Current Working Groups

The Executive Committee Reporter for each working group presented an update on working group activities and progress, and will make recommendations on actions to be taken. The Executive Committee made funding recommendations for 2008, based on the progress of working groups and the merits of their requests. The Finance Committee will take into account the recommendations of the Executive Committee as it develops the 2008 SCOR budget, which is then subject to final approval by the meeting.

2.2.1 WG 111—Coupling Winds, Waves and Currents in Coastal Models

The group is developing a book entitled *Coupled Coastal Wind-Wave-Current Dynamics*, which will be published by Cambridge University Press. Lawrence Mysak, who has taken over as the Reporter for the group, noted that this group's publication is long overdue. Chris Mooers, one of co-chairs, is taking a more active role to ensure that it comes to completion. The SCOR Secretariat should be involved before a contract is signed. Laurent Labeyrie asked whether we need to think about a SCOR-CUP series. There was no conclusion. Marta Estrada (Spain)

suggested that if a partnership with a publisher is being considered, SCOR should get proposals from several different publishers. Bjørn Sundby asked whether we need to return to the practice of having a Publications Officer or committee.

Mysak noted that SCOR/IAPSO WG 129 on Deep Ocean Exchanges with the Shelf thinks this book is in hand; a delay by WG 111 will impact WG 129.

2.2.2 WG 115—Standards for the Survey and Analysis of Plankton

The group held its final meeting in May 2006 in Plymouth, UK at the Sir Alistar Hardy Foundation for Ocean Sciences and group members plan a series of papers for a special issue of the *Journal of the Marine Biological Association of the U.K.* Unfortunately, only one of the papers has been completed as planned and the timeline has slipped. Annelies Pierrot-Bults attended the working group symposium. Group members are not producing their manuscripts and the papers are becoming less timely. If the special issue is not completed soon, the publication will not be worthwhile. Peter Burkill has discussed this with Chris Reid, a member of the working group; two of the main participants in the group have changed jobs or retired. Reid assured Burkill that they were on track to get the publication in press with JMBA by end of 2008. The Executive Committee should get a commitment on paper from them as to the timetable. Pierrot-Bults will speak with Reid about getting the job done within one year.

2.2.3 WG 116—Sediment Traps and ²³⁴Th Methods for Carbon Export Flux Determination

The group completed its work with an article in the *Journal of Marine Research*.¹ SCOR approved the group's request in 2005 for extra funding for color figures in the publication and for reprints. Laurent Labeyrie, the Reporter for the group, noted that the group's article submitted to *EOS* was rejected because it was considered too specific. There was a general discussion about whether SCOR should have a list of approved journals for working groups to use. Mike MacCracken noted that some journals allow authors to purchase the right to the pdf file for placing on the Web. Ed Urban will e-mail all working group chairs (and Executive Committee Reporters) to stress the point that publications need to be open access. He will discuss the issue of the WG 116 report with JMR and try to get pdf file (see <http://www.scor-int.org/Publications/WG116.pdf>). The meeting agreed to disband the group.

2.2.4 SCOR/IOC WG 119—Quantitative Ecosystems Indicators for Fisheries Management

The 2006 SCOR meeting approved applying leftover registration fees from WG 119's symposium for a workshop on "Coping with global change in marine social-ecological systems". This workshop will contribute to the objectives of both GLOBEC and IMBER. Peter Burkill discussed the situation with the co-chair, Philippe Cury, and this seems to be an appropriate use of the funds. Burkill recommended disbanding the group and transferring the funds to meeting. The meeting agreed to disband the group.

¹Buesseler et al. 2007. An assessment of the use of sediment traps for estimating upper ocean particle fluxes. *Journal of Marine Research* 65:345–416.

2.2.5 WG 120—Marine Phytoplankton and Global Climate Regulation: The *Phaeocystis* Species Cluster As Model

The group convened its symposium in September 2005 as their final meeting. Jorma Kuparinen, the Reporter for this group, noted that it has done a fine job. The papers from the meeting were published in a special issue of the journal *Biogeochemistry* (see <http://www.springerlink.com/content/g12x20148815/?p=1d1789a4d9e24f9aa783b65b5dbea74e&pi=3> for the online version. No further actions is needed and the group should be disbanded with thanks. Meeting participants agreed to disband the group.

2.2.6 SCOR/IAPSO WG 121—Ocean Mixing

Victor Akulichev, the Reporter for the group, noted that it was created in 2002 and their symposium was in 2004. The final meeting of the group was held in conjunction with the 2007 IUGG General Assembly, where there will also be a special session on this topic. The purpose of the final WG meeting was to focus on how well the group met its goals, revisit the recommendations published in the *Deep-Sea Research* special issue, discuss plans for a series of Gordon Research Conferences on ocean mixing, and address any other issues that might be seen as bearing on the group's goals or legacy. A primary goal of this final meeting will be to discuss and outline a brief final report to be submitted for publication in a suitable journal such as *EOS*, *Oceanography* magazine, or the *Bulletin of the American Meteorological Society*. Group members submitted a proposal to initiate a Gordon Conference series in 2009. There was some discussion about whether to disband the group this year or wait until their final publication is completed. Lawrence Mysak stated that their session in Perugia was excellent, but asked whether they will finish their final paper. Ed Urban replied that, knowing the chair (Robin Muench), the paper will get done, but he will check on the timing. Laurent Labeyrie asked whether this topic should be included among the working groups for the SCOR 50th Anniversary symposium. Gordon McBean stated that this topic is very important. Do the various groups involved in the issue (e.g., CLIVAR, IMBER etc) talk to each other?! Urban responded that CLIVAR, IMBER and GLOBEC are are planning a training workshop on "Climate driving of marine ecosystem changes" (CLIMECO) to demonstrate how climate variability data and modeling in CLIVAR can be extended and made available to the other projects. Mysak added that since the Perugia session was so successful, IAPSO has asked someone to take the lead on an ocean mixing symposium at their 2009 meeting. Bjørn Sundby suggested that the group be disbanded and to tell them that we look forward to the final article. Meeting participants agreed.

2.2.7 SCOR/LOICZ/IAPSO WG 122—Estuarine Sediment Dynamics

Bjørn Sundby, the Reporter for the group, noted that the group has been a little slow, but will meet on 23-27 September at the University of Colorado, Boulder, Colorado, USA. The meeting will focus on final work on the Terms of References of the group and defining the publication of its findings for a special issue to *Coastal and Estuarine Science*. Ed Urban noted that this journal is reluctant to release the pdf files for the publications. Sundby responded that he will try to persuade them.

2.2.8 SCOR/IMAGES WG 123—Reconstruction of Past Ocean Circulation (PACE)

A special theme section on Past Ocean Circulation for the American Geophysical Union (AGU) publication, *Geochemistry, Geophysics, Geosystems* (G-cubed) published the papers that were

presented at the 2005 workshop as well as related papers on the subject.² The group's work also resulted in a paper in *Science*.³ Laurent Labeyrie, the Reporter for the group, thinks they have done a good job; he attended two of their meetings. It was time for a survey of techniques for reconstruction of past ocean dynamics. The journal will make pdf files available, not of the final, formatted version, but of the final pre-publication version. This should be requested and put on SCOR Web site. Marie-Alexandrine Sicre (France) responded that the pdf files were only available for two weeks, but Labeyrie thinks that SCOR can still get the files. Marta Estrada (Spain) suggested that perhaps the "pre-prints" can be obtained from each author. Mike MacCracken cautioned that we need to make sure that the final citation we post is correct. Ralph Schneider added that IMAGES gives a "first prize" to this group for their good work. He recommended that the group be disbanded and meeting participants agreed. Also, the report that the group submitted to SCOR should be placed on the SCOR Web site.

2.2.9 SCOR/IMAGES WG 124—Analyzing the Links Between Present Oceanic Processes and Paleo-records (LINKS)

The group met for the final time on 20–24 November 2006, in Delmenhorst, Germany. It is preparing a series of 5 manuscripts that mainly target understanding of the changes in ocean productivity and the connection to the recorded signal at the seafloor. The papers are designed to review the present state of the art in modern ocean process studies and in paleoceanography as well as to give recommendations for future studies. The main goal of the international workshop was the discussion of these manuscripts to finalize them for publication in a peer-reviewed journal (potentially *Biogeosciences* or *Global Biogeochemical Cycles*). Laurent Labeyrie, the Reporter for this group, stated that the group is also doing a good job, but not yet finishing. He is worried that the co-chair that has a new job will find it difficult to finish the editing job. Labeyrie asked Marie-Alexandrine Sicre (France), the other co-chair of the group, if there is an editorial group. Sicre responded that they are still working on the draft manuscripts. Not all of the papers are at the same stage, but they hope to submit them in early 2008. The journal allows free access. Ralph Schneider commented that IMAGES is happy with the working group and is looking forward to a good final product. No action was required.

2.2.10 WG 125—Global Comparisons of Zooplankton Time Series

The group held a full meeting in Lima, Peru in association with the International Conference on the Humboldt Current System: Climate, ocean dynamics, ecosystem processes, and fisheries (27 Nov. 27-1 Dec. 2006) and an opportunistic meeting in May 2007. The group is making good progress in bringing together zooplankton data from around the world. The NOAA National Marine Fisheries Service has committed funds to bring more participants (and data) into the process. The final meeting of the group will be held May 2008 in Gijon, Spain, before the symposium on "Effects of Climate Change on the World's Oceans". During the symposium, the group will present one jointly authored summary paper in the symposium plenary session on

² <http://www.agu.org/contents/sc/ViewCollection.do?collectionCode=POCIRC1&journalCode=GC>

³ Jean Lynch-Stieglitz, Jess F. Adkins, William B. Curry, Trond Dokken, Ian R. Hall, Juan Carlos Herguera, Joël J.-M. Hirschi, Elena V. Ivanova, Catherine Kissel, Olivier Marchal, Thomas M. Marchitto, I. Nicholas McCave, Jerry F. McManus, Stefan Mulitza, Ulysses Ninnemann, Frank Peeters, Ein-Fen Yu, and Rainer Zahn. 2007. Atlantic Meridional Overturning Circulation During the Last Glacial Maximum. *Science* 316: 66-69.

“Impacts on Marine Ecosystems,” and has also requested a half-day workshop session on zooplankton time series. Papers on this topic will be collected for a special issue of *Progress in Oceanography* (editor-in-chief Cisco Werner has given pre-approval for a special issue to appear in late 2008, and Pierre Pepin has agreed to serve as “arms-length” guest editor for the issue). Annelies Pierrot-Bults, the Reporter for the group, finished by stating that she is looking forward to the results. She recommended that SCOR provide the requested financial support in 2008. Ed Urban commended the group for obtaining extra funding from NOAA.

2.2.11 WG 126—Role of Viruses in Marine Ecosystems

Jorma Kuparinen, the Reporter for the group, stated that the group has been active and is making process. The group had a very productive meeting in Bergen, Norway in May 2007. The major outcome of the Bergen meeting was a multi-lab comparison of techniques. The group established some mesocosms at the Bergen facility and used them as samples (one with nutrients added, one without, to produce communities of differing trophic status). Different counting techniques, different virus production techniques, and different molecular tools were compared. The group’s book, tentatively entitled *Methods in Aquatic Viral Ecology*, is expected to be ready for publication in 2009. The group and a related group from EurOCEANS have been asked to write a perspective for *Nature Reviews: Microbiology*, which will be submitted soon.⁴ Currently, the group is planning to hold its final meeting in 2009, most likely somewhere central to most of the members. This is a slight departure from the planned final meeting in 2008, but the group feels it is prudent as it will allow the group to see the book through to its completion. There was no funding request for 2008. The meeting approved the group’s plans to postpone their next meeting until 2009.

2.2.12 SCOR/IAPSO WG 127 on Thermodynamics and Equation of State of Seawater

The group held its second meeting on 7-11 May 2007 in Reggio Calabria, Italy, where progress on their terms of reference was reported. Many of the tasks are being pursued by individual members or subcommittees and five peer-reviewed publications are planned.⁵ The group plans to meet next in Berlin on 4-10 September 2008 in conjunction with the International Association of the Properties of Water and Seawater. There will be a joint session between the two groups. Lawrence Mysak, Reporter for the group, noted that it is moving along well. He recommended that they be supported in 2008 and the meeting agreed.

2.2.13 WG 128 on Natural and Human-Induced Hypoxia and Consequences for Coastal Areas

Robert Duce, the Reporter for the group, reported that the group has been very good about including him in all their communications. The group plans to meet for the second time on 20-23 September in Shanghai, China, in conjunction with the IMBER/LOICZ Continental Margins

⁴ Brussaard, C.P.D., S.W. Wilhelm, F. Thingstad, M.G Weinbauer, G. Bratbak, M. Heldal, S.A Kimmance, M. Middelboe, K. Nagasaki, J.H. Paul, D.C. Schroeder, C.A. Suttle, D. Vaqué, and K.E. Wommack. 2008. Global-scale processes with a nanoscale drive: the role of marine viruses. *The ISME Journal* 2:575 - 578 (03 Apr 2008), doi: 10.1038/ismej.2008.31

⁵ For example, Millero, F.J., R. Feistel, D.G. Wright, and T.J. McDougall. 2008. The composition of Standard Seawater and the definition of the Reference-Composition Salinity Scale. *Deep Sea Research, Part I* 55:50-72.

Open Science Meeting, where they will present a special session. Most of the papers for their special issue (potentially for *Biogeosciences*) are underway and will be discussed at the Shanghai meeting. In Shanghai, the group will discuss the tasks for their final meeting. Funding for a 2008 working group meeting was approved.

2.2.14 SCOR/IAPSO WG 129 on Deep Ocean Exchanges with the Shelf (DOES)

Michael MacCracken, the Reporter for this group, noted that the group was approved last year and has made a good start. It met for the first time on 10-11 July in Perugia, Italy in conjunction with the IUGG meeting there, and MacCracken and Lawrence Mysak were able to attend parts of the meeting. The group discussed how it will fulfill its term of reference and interact with related groups, as well as starting planning for a workshop in 2008. The group would like to hold its 2008 meeting in Cape Town, South Africa in order to do capacity building on their topic. Funding for the working group meeting and for SCOR travel funds were approved. The group asked permission to make a small revision to their terms of reference to clarify the end product and to add a few additional processes, which the SCOR Executive Committee approved. Mysak added that the group is planning a symposium for its final meeting at the IAPSO meeting in Montreal in 2009.

2.2.15 SCOR WG 130 on Automatic Plankton Visual Identification

Peter Burkill, the Reporter for this group, noted that it met for the first time on 2-3 June 2007 in Hiroshima, Japan, in conjunction with the Fourth International Zooplankton Production Symposium there. The group developed an ambitious plan to fulfill its terms of reference, and made progress on several topics:

- Open source software - define necessary standards and quality assurance
- Access to taxonomically validated data sets - establish recommendations for standards and key species.
- Developing training workshops in automated visual identification
- Artificial intelligence - will make contacts with the community
- Established reasonable timelines

The group arranged funding from a Brazilian oil company for its 2008 meeting, so they need only minimal funding from SCOR in 2008. Burkill reported that this is clearly an enthusiastic group. He expressed concern on a couple of aspects: this is a huge new area and it may take longer to fulfill their terms of reference than they expect. We need to make sure they meet the SCOR requirements, such as developing a Web site, as SCOR requested. Burkill will push them gently along these lines. He recommended the addition of the person proposed as an Associate Member and will arrange for SAHFOS to fund her participation. Laurent Labeyrie responded that he was impressed. The group has gone from an original narrow concept to cover a much wider range of related topics in response to comments from SCOR. But, they should not go too far! Burkill responded that SCOR should make sure they have enough funding for the second meeting and then they should come back to SCOR to ensure funding for their final meeting.

2.1.16 General Comments on WGs

Robert Duce noted that the last 6 or 7 working groups have had very enthusiastic reports, but the

earlier ones had more negative comments. Is there a problem? The general consensus was that we are getting better at managing the working groups in a shorter period of time. SCOR's review of past SCOR working groups showed that the longer a group lasts, the more trouble it typically has in finishing its work.

2.3 New Working Group Proposals

Bjørn Sundby outlined the procedure for consideration of working group proposals. Three proposals were received by the SCOR Secretariat and sent to national SCOR committees for comments. SCOR can fund one or two new working groups to begin in 2008, about which the Finance Committee will make a recommendation.

2.3.1 Working Group on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems

Jorma Kuparinen introduced the discussion by summarizing the comments received from national SCOR Committees. Major issues that need to be addressed include the perceived overlap and potential synergy with other activities, especially GEOHAB; the feasibility of Term of Reference 4 in terms of species-specific responses to nutrient inputs; the vagueness of the final product of the group; and the desirability of increased geographic balance of the group. Kuparinen reported that the proposed chairs of the working group are very willing to modify the proposal and to modify the membership. Kuparinen does not think that overlap is a serious issue, rather that the working group would help GEOHAB.

The UK SCOR Committee believes that this is an urgent high-priority issue with important social dimensions. It is good to see the interface with land-based scientists. If the topic is not being covered by GEOHAB, then it is a good one for a working group. The membership is a good mix of "heavyweights" and local experts. The UK committee gave this proposal their top ranking. The Russian SCOR Committee supports the proposal, as the problem is important. The Japanese SCOR Committee believes that this group addresses a key need, but did not understand why it is needed alongside GEOHAB. Perhaps addition of issues of watershed nutrients to GEOHAB should be recommended. The proponents need to provide a more concrete explanation of why a SCOR working group is needed, so they ranked it the lowest. The Belgian SCOR Committee believes this is a good proposal, but wondered about the interaction with other programs. The Finnish SCOR Committee would like to see filamentous blue-green algae added, which is a big problem in the Baltic Sea. Otherwise, they believe this is a good topic for a SCOR working group. The Netherlands SCOR Committee thought this was an excellent proposal, although at first sight it seems redundant. The membership is good. The fourth term of reference will be difficult to achieve without knowing the responses of specific species to nutrient loads. However, since other proposals are also so good, they ranked the proposal lowest. The U.S. SCOR Committee rated this proposal the highest, because it seeks to develop a predictive capability and aims to assist coastal managers. They are concerned about the overlap with GEOHAB, but see a great potential for input to coastal observing systems. The Spanish SCOR Committee believes this is a well-focused topic and ideal for a working group. The Associate Member list should be broader geographically. The French SCOR Committee thought that the proposal was a bit vague about the models to be developed and the data to be used.

Ed Urban commented regarding the relationship of the proposed working group with GEOHAB. The proposed chair is also chairing the GEOHAB Core Research Project on HABs and Eutrophication, and several proposed members are involved in this core project. It will be important to make sure that the connections are tight between the working group and GEOHAB, if the group is approved and funded, but GEOHAB would not take on this kind of activity on its own. GEOHAB does not have the funding and the working group could provide a link between Global NEWS and GEOHAB.

Gordon McBean had no input from Canada on this working group, but he was not sure why a SCOR working group is needed. Why not convince GEOHAB and LOICZ to work together on this issue?

The Norwegian SCOR Committee thought this was an appropriate topic for a SCOR working group, to provide these linkages. They ranked the proposal the highest among the three. Mike MacCracken (IAMAS) stated that he thinks the database needs to be built, as proposed, to be useful in the future in a changing environment. The proposal covers only land issues such as land-cover change, but what about CO₂ concentrations, warmer climate, etc.? Robert Duce asked if the proposal is a bit premature. The co-sponsorships mentioned should have been firmed up so as to ensure the right linkages ahead of time. Lawrence Mysak (IAPSO) was concerned about overlap with GEOHAB. His specific concern was that it could be useful to bring in members from nations with high levels of pollution, such as China and India. The proposal mentions the involvement of geographic information system (GIS) experts, but are they ocean oriented? Many GIS experts only have land experience. Still, the proposal is timely and IAPSO ranked it first. Harald Loeng (Arctic Ocean Science Board) drew attention to an ICES group on this topic. Venu Ittekkot stated that it was exciting that a SCOR working group would propose to use databases collected from various sources, but noted that Hong Kong is not a country.

Bjørn Sundby summed up. The consensus seems to be that the topic is important, but there is a concern about the overlap with GEOHAB. Still, SCOR needs to make sure the topic is addressed. Some issues about membership are easily addressed. Jorma Kuparinen asked for comments about exactly how the proposal should be addressed to make it more “mature.” The chair has agreed with the proposed changes. Sundby continued by stating that some people raised the issue of whether the group should be limited to nutrient inputs only or should it address other changes like increasing CO₂ and climate changes. Lucas Stal added that he doesn’t see how they can predict changes in occurrence and composition of HABs without knowing the responses of individual species to changes in nutrient loads. Can the goals be achieved in the time frame of a working group? Marta Estrada responded that the proposal is not promising to make predictions. Marie-Alexandrine Sicre asked whether nutrients are the only cause of HABs. Ed Urban responded that this is a controversial point. Some people claim that the worldwide increase in HABs is caused by increased nutrients, but this is not certain. Sundby responded that if this proposal brings us closer to an answer, that would be good, but it’s not clear if the group will achieve that. Peter Burkill added that we must involve people from eastern Asia, someone from China in addition to Hong Kong. Sundby asked if the distinction between this group and GEOHAB is clear. Catherine Jeandel responded that someone from the GEOHAB SSC must be a member of the group. Gordon McBean added that there should be a connection to LOICZ and

IOC also. These connections are not well developed in the proposal. The proponents should be given time to work this out. Urban responded that we could ask LOICZ to be a cosponsor.

2.3.2 Working group on the Coral Triangle: The centre of maximum marine biodiversity

Peter Burkill presented comments from the SCOR national committee and reviewed the proposed terms of reference. Coral reefs are important systems for biodiversity and nurseries for fish. The so-called coral triangle is located in southeast Asia. Burkill spoke for the countries not represented at the meeting. The Brazilian and Chilean SCOR Committees ranked the proposal second. Burkill's contacts in the field of biodiversity consider the issue of connectivity critical, in that the degree to which the system is sustainable depends on larval dispersal and input. He is concerned about lack of link to coral monitoring networks. Annelies Pierrot-Bults (who is a proposed member of the group) thinks it is an important topic and there is a lot of knowledge about biodiversity in Holland. The proposal could use some trimming down and tighter focus.

The Netherlands SCOR Committee noted that the proposed chair is Dutch and was very convincing in explaining the rationale for the group and they ranked it first. But the written justification is not so convincing. We need to understand why this particular region is so diverse. The U.S. SCOR Committee ranked the proposal last. The objectives are not well defined, the geographic boundaries are too amorphous, the terms of reference are too ambitious, and the proposal needs more specificity. The proposal is timely, but immature. The Spanish SCOR Committee had similar comments. Does the proposed membership list include the right people?

The French SCOR Committee ranked the proposal third. They raised questions about the lack of links to the Census of Marine Life (CoML) and the Census of Coral Reefs (CReefs). The group needs a physicist and/or biological modeler to deal with issues of larval exchange and gene flow between populations. Gordon McBean offered personal comments: the proposal seems to focus on the current status of reefs rather than changing environmental conditions. There are interesting things in the proposal but it doesn't come together into a forward-looking package. The Norwegian SCOR Committee asked to what extent this regionally focused group intended to develop methodologies that could be used elsewhere. This committee ranked the proposal third. Lawrence Mysak also reported that IAPSO ranked the proposal third. They felt that the proposal was a bit vague and the membership needs a physical oceanographer to deal with connectivity issues. Robert Duce added that three of the 7 proposed members are from the United States. Also, the proposed Associate Members include 9 people from the Chair's institute. Mike MacCracken (IAMAS) stated that the proposal doesn't look ahead to what is happening, in that there is no mention of the significance of increasing CO₂ levels. Changing chemistry of the ocean must be considered if the group is to be relevant. Climate change means they need to look at additional indicators. Laurent Labeyrie added that there is nothing on variability. Annelies Pierrot-Bults added that the proposed members are mostly taxonomists. Peter Burkill stated that we need to figure out what these coral systems are sensitive to now and then we can look to the future. Laurent Labeyrie asked if we understand the dynamics of repopulation of reefs after bleaching events. Pierrot-Bults responded that this is being worked on and could/should be included. Venu Ittekkot added that there are ongoing international programs sponsored by the UN Environment Programme and others that should be connected with this activity. The meetings mentioned in the proposal will take place whether or not the working group is formed,

so what does the proponent really want from SCOR? He apparently doesn't need any funding. The document is fine up to the point they introduce the idea of a SCOR working group, then it becomes weak.

Peter Burkill reported that the UK SCOR Committee stated that the proposal's subject is timely because of the need to define marine protected areas and availability of new biomarkers. There are clear links to CoML and the Millennium Ecosystem Assessment. There are no linkages to acidification, increasing temperature and sea level rise. The terms of reference are too vague. The proposed membership includes too many members from the United States and the Netherlands. The UK SCOR Committee ranked the proposal third. The Japanese SCOR Committee ranked the proposal second. It is timely, but focused on taxonomy and regional observations of the present status of reefs. In order to preserve biodiversity in the region, the causes of deterioration of the systems need to be addressed. They should include a term of reference on environmental sciences, stress mapping, etc., and revise the membership accordingly.

The Finnish SCOR Committee ranked the proposal third, but they don't have an expert in corals in Finland. Luis Icochea reported for the Peruvian SCOR Committee that they are interested in this proposal because this is the area where El Niño starts and the conditions in the region vary a lot with the El Niño cycle. Gordon McBean added that this effort should link to DIVERSITAS, if it is approved.

Bjørn Sundby summarized. He has no personal expertise on this topic, but he thinks the work of the group would be fascinating. He heard that this is a broad, perhaps too vague and ambitious proposal. But it is timely and the region is important. Questions arose about links to other programs, especially CoML. Several comments were made on the proposal's focus on the present, rather than looking ahead at how these systems will deal with the current forcing factors. There are some good and not so good things about the proposed membership. The proposal has potential, but it needs strong input from SCOR. Can it be made ready soon, or do we need to put it off for consideration next year? Peter Burkill responded that the proponents need to convince SCOR that the work really requires a SCOR working group and would not go ahead anyway. They should come back in a year. The value added from a SCOR working group would be the multi-disciplinary approach. Venu Ittekkot added that IOC/WESTPAC, UNEP and CoML might be good international partners, as they all have relevant interests in the region. The working group could also be a valuable platform for capacity building. Gordon McBean added that the START program has an office in Fiji. Sundby concluded that the proponents should get a "warm letter" summarizing the discussion and tell them to come back next year, if they wish. Marta Estrada added that we should be very precise about what needs to be done. Peter Burkill added that the proponents have to do two primary things: (1) add physical oceanography and (2) add aspects of environmental forcing with respect to global change.

2.3.3 The Legacy of *in situ* Iron Enrichments: Data Compilation and Modeling

Robert Duce introduced the discussion by saying that a similar proposal was submitted last year and generated a lot of discussion. Last year, SCOR decided to go back to the proponents with suggestions. Bjørn Sundby wrote and encouraged them to resubmit. Duce sent a more detailed

letter with specific suggestions. The proponents have revised the proposal, but have they addressed our concerns from last year?

1. Delete the first term of reference on data compilation. SCOR thought that the agencies that funded the experiments should fund the data compilation and not SCOR. The proponents kept this term of reference, but tried to justify it.
2. They added a physical oceanographer.
3. We wanted more focus on future benefits to be gained from the first 11 experiments, for example, for design of future experiments. They have addressed this.
4. They have not added members from developing countries.

They now propose to have the working group implemented in two steps:

1. bringing all the data together
2. If this is done satisfactorily, then SCOR would allow them to move on to the remainder of their proposed tasks.

The proposal has enthusiastic endorsements from SOLAS, GEOTRACES, and IMBER.

Duce views the data issue as the critical point; it involves data recovery as well as data compilation. There has been a lot of recent discussion about this on e-mail. The group could work with the data center at WHOI funded by U.S. NSF. They would be willing to compile the data from past experiments, but funding will be needed. These two options have only emerged in the last week or two. The proponents should pursue these possible solutions. Catherine Jeandel made the additional suggestion that the EurOCEANS data office could do the compilation.

Robert Duce expressed his view that the proponents addressed most of the issues raised by SCOR last year and that they are starting now to focus seriously on the data issue. He opened the floor for national comments. Lucas Stal expressed that he doesn't believe that if the proponents haven't already put the data together, the \$15,000 from SCOR per year will make them do it. The data issue isn't a SCOR issue, but the other terms of reference are. The Netherlands SCOR Committee ranked the proposal second. The U.S. SCOR Committee believed that the proponents seem to want to focus on the data compilation and this isn't where SCOR funding should go. So, the U.S. SCOR Committee ranked it second. Bjørn Sundby noted that his letter told the proponents to get the data together first and then come back to SCOR. Marta Estrada suggested that it would be good to get the name of SCOR behind the data effort, but not the money! The task has to be done and is needed, but Estrada was not sure whether SCOR money should go into it. The French SCOR Committee was in favor of the proposal last year and still was in favor and they ranked it first. Gordon McBean offered his personal views on behalf of the Canadian SCOR Committee that this is a very important issue that some group has to step up to because there are a lot of uninformed statements being made about geo-engineering. Someone has to get the data together and then make some high-level, scientifically based statements. McBean was not sure about the other terms of reference and was not convinced this is the right group to carry out these terms of reference. The Norwegian SCOR Committee agreed with many of the comments already stated. They ranked the proposal second.

If the initial data compilation could be done by other means, then SCOR could form a working group to do the synthesis later.

Lawrence Mysak stated that IAPSO ranked the group second, and he was surprised that the proponents had not undertaken the data compilation as they were asked to do. Mike MacCracken added that IAMAS agreed with the comments from IAPSO. Commercial interests in the United States are developing the use of ocean fertilization with iron for carbon credits, proposing large-scale experiments, etc. An authoritative source of unbiased information is important. Is SCOR the group to provide this? Bob Duce responded that there are at least two authoritative statements on iron enrichment experiments, from SOLAS and the International Maritime Organization (IMO). AGU is also considering a statement. Ed Urban also added that there is a statement in the report from the first symposium on The Ocean in a High-CO₂ World. Duce asked if SCOR needs to make a statement. MacCracken thought that another statement is not needed, but we need to build up the base of information and expertise to address questions that will arise. The UK SCOR Committee thought that the proposal was much more focused, but still not enough. The iron limitation question has been settled, but the consequences have not. Does real CO₂ drawdown result from iron fertilization? This is so important that SCOR will appear weak if we don't address it. It would be much more efficient to do the data compilation now than to spend the money on data archeology a decade from now. The membership should include a modeler as a full member to maximize the synthesis capability. The Russian SCOR Committee ranked the proposal second. The Japanese SCOR Committee thought that the proposal was timely since there have already been 11 experiments; it is timely to start data integration and synthesis. The membership makes the first term of reference feasible. The other three terms of reference should be pursued in collaboration with projects like SOLAS, IMBER GEOTRACES, etc.

The Finnish SCOR Committee noted the effort already put into iron experiments. They ranked the proposal second. But, after having listened to the discussion Jorma Kuparinen was concerned about the feasibility of getting the data sets together. The Belgian SCOR Committee thought that the risk of failure is high, but the proposal deserved to be first. Luis Icochea noted the lack of iron experiments in areas close to upwelling, for example, in Peruvian waters. Should there be new experiments. The Peruvian SCOR Committee ranked the proposal first.

Bjørn Sundby summarized that the discussion had been fascinating. Experiments have been carried out and data produced and the data are residing in the personal computers of individual scientists. We need incentives to make sure people are willing to put their data on the table. But for whom? SCOR needs to make sure that it's not just for the people who did the experiments. His letter did not accomplish the objective of getting the proponents to work on the data compilation. There are no guarantees that the people proposed will actually put their data into the compilation. If we decide that this issue is one for which SCOR can become the scientific authority, then we need to be sure the people involved will do the job. Lawrence Mysak responded that this is why the group needs a modeler; they may not do the compilation in a way that is useful to modelers and others who will actually use the database. Catherine Jeandel estimated the global costs of the 11 iron experiments at \$80-100 million, but the data issue has obviously not been handled well. We need a catalyst to make sure this happens and SCOR is the group that could do this for a small funding outlay. We should not miss out on this important

issue. Peter Burkill stated that there are two steps: (1) getting the data together and (2) followed by the synthesis and overview. If SOLAS, IMBER and GEOTRACES are prepared to do the former, we should ask them and then take on the synthesis and overview. Laurent Labeyrie responded that there were no standards for the 11 experiments, so putting the data together may be a problem. One option would be to give the proponents some homework. What is the status of each of the data sets? How big is the problem? It would be nice to have a list of the data sets, the problems with each, what are the commonalities between them, how can they be integrated in a global database, will the principal investigators give up their data? We would have some idea in advance of the likelihood of success. Robert Duce agreed; some of his email with the proponents reflect their willingness to do some of this. To clarify Peter Burkill's remarks, the proponents are only proposing to proceed with the first term of reference and would seek approval to proceed with the others after they have demonstrated that they can compile the database. That's all we're talking about now. Lucas Stal added that they shouldn't need money to travel to do this. Missy Feeley added that they haven't indicated how they will spend the money. How will they put the data together? Who will pay for the personnel involved? Thomas Rossby noted that archiving data is incredibly important. Gordon McBean responded that he sits on the foundation that funded the Canadian experiment, and they now require data submission. Marta Estrada stated that the original proposal said they would not need a meeting, but now they do. Maybe they just need an endorsement. Sundby responded that we agreed to this in reply to Hein de Baar last year. But a working group is more than a simple endorsement. We must insist that data go into a recognized data bank and will stay there. Catherine Jeandel added that they should have a meeting to increase the likelihood that people will contribute data rather than relying on them to do it via mail or electronically. A meeting gives a deadline and puts the people together face to face. Ed Urban responded that if they do have a meeting, it should include the person who is going to eventually manage the databases, that is, someone from the eventual repository. That should be part of their homework, to identify the home for the data first.

2.3.4 Overall Evaluation of New Working Group Proposals

Bjørn Sundby turned the discussion to evaluating which of the three proposals to approve. Meeting participants had agreed that the coral triangle working group was not acceptable as it stands and needs major revisions if the proponents want to resubmit it next year. This requires strong communication of the SCOR Executive Committee Reporter with the proponents. So now we are down to two proposals. Are both fundable? One? Or neither?

Nutrients and HABs: should this go ahead? Marie-Alexandrine responded that the proposal needs some changes. Can we do revisions here or should it come back next year? Catherine Jeandel added that if we are really constrained by funding, then consider that there is a real emergency about the iron issue. Robert Duce thinks we must see the data before agreeing to go further with the iron proposal; therefore, we should not commit to them for more than one year. Marta Estrada stated that the HAB proposal needs a membership adjustment and inclusion of physics/models. Jeandel suggested that the members of the iron working group should be required to make a commitment to contribute their data. Lucas Stal stated that the HABs and eutrophication proposal seemed to rank number 1 in the discussions; the iron proposal was second. But this ranking might be changed given that the iron group would be reduced to one term of reference and is not the same as the written proposal that countries ranked. Sundby

added that the HAB proposal needs direction from us, but it is a conventional proposal and will take 3 or 4 years. The iron proposal is different and there is some concern that it may not work. It is hard to balance two such different proposals, but we have to do it. The iron proposal has been submitted before and if we don't proceed now we will miss the chance. Mike MacCracken stated that we are clear what needs to be done with the iron issue, but we are not clear yet what should be done in the proposed HAB group. It's going to take a little work on how the harmful algal bloom working group would fit in with other activities like WG 129 on Deep Ocean Exchanges with the Shelf and others. Estrada cautioned about insisting on too many links.

Sundby proposed that the HAB be ranked first and iron group second. If the Finance Committee says there is money for only one working group, then it will be the HAB group. If there is a bit more money, then it would go to the iron group, providing they deal with the concerns about people submitting data and others. However, meeting participants expressed a preference for a one-year iron group (extendable later if they are successful in completing the first term of reference), followed by the modified HAB group.

3.0 LARGE-SCALE SCIENTIFIC PROGRAMS

3.1 SCOR/IGBP/IOC Global Ocean Ecosystems Dynamics (GLOBEC) Project

GLOBEC held its 2007 SSC meeting in Hiroshima, Japan in conjunction with the Fourth International Zooplankton Production Symposium in May 2007. GLOBEC continues its integration and synthesis activities to work toward its completion at the end of 2009. GLOBEC and IMBER are working together on an activity on end-to-end food webs and will be developing a transition team in fall 2007 to identify aspects of GLOBEC that IMBER might take on after GLOBEC ends. Peter Burkill gave an update on GLOBEC activities.

Laurent Labeyrie responded that the next two years are critical to ensure that there is a good merged program in place after GLOBEC is finished. Gordon McBean agreed. How do we ensure this merging is successful and how are cosponsors involved? Robert Duce responded that he will give the IGBP presentation and will address this. Bjorn Sundby asked for approved of the proposed new chair for the GLOBEC SSC, Ian Perry (Canada). Meeting participants agreed unanimously.

3.2 SCOR/IOC Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Program

Huasheng Hong, the Reporter for GEOHAB, was unable to attend the meeting, so Ed Urban gave the report. GEOHAB continues to develop its Core Research Projects (CRPs). The research plan for the HABs in Eutrophied Systems was published in 2007 and NOAA is providing funding for this CRP, through IOC. The SSC is beginning a discussion about adding a CRP on benthic HAB species, such as those that cause ciguatera. A new Asian GEOHAB activity is under development and a second meeting will be held in Vietnam in January 2008. A new GEOHAB Web site has been launched (see <http://www.obs-vlfr.fr/LOV/OMT/GEOHAB/>). Revised terms of reference were approved by SCOR and IOC this year. The next SSC meeting

will be held in Annapolis, Maryland, USA in April 2008. GEOHAB still needs an International Program Office. The GEOHAB SSC set up an Organizing Committee for GEOHAB Modelling, comprised of Dennis McGillicuddy (chair), Wolfgang Fennel, and Marcel Babin. The objectives include

- improve understanding of HAB processes through linkage of models, *in situ* observations, and remote sensing
- stimulate modeling activity in GEOHAB Core Research Projects (CRPs)
- foster linkage between HAB modeling and the broader community of ecosystem and population dynamics modeling
- entrain researchers at all levels (students, post-docs, faculty, etc.) into HAB modeling
- facilitate dialog between model developers and HAB researchers involved in process studies through joint training sessions
- improve capabilities for prediction of HABs

The workshop will include four connected elements:

1. Plenary talks comprised of (a) invited reviews on HAB modeling and other relevant approaches (ecosystem modeling, population dynamics modeling), and (b) contributed talks on models and observations in support of the CRPs.
2. Dialogue seminars given by HAB observationalists and modelers. Specific modeling needs of the CRPs will be identified; implementation plans will be developed, utilizing existing modeling infrastructure, where practical, and identifying needs for additional model development where gaps exist.
3. Tutorials and training on model design and application of models (geared toward students involved in CRPs).
4. Student project: participants build a model, conduct test runs, and describe the results in a report/presentation.

Funding is being sought for this workshop from European sources, or potentially jointly funded by European and U.S. sources. GEOHAB is considering creating its own newsletter. The project has had a session approved for the next biennial international HAB meeting, for the first time. GEOHAB documents will be provided at that meeting.

There were no specific questions to the presentation. The nominations for the SSC have not yet been developed.

3.3 SCOR/IGBP Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project

The IMBER SSC met in June 2007 in Victoria, B.C., Canada to discuss implementation activities. The IMBER Data Management Committee met in conjunction with the SSC meeting and is making good progress in developing the IMBER data management system. IMBER and LOICZ are planning a joint open science meeting on coastal margin science in Shanghai, China in Sept. 2007. IMBER will hold an open science meeting in late 2008, with an innovative structure of three concurrent (but interacting) science workshops, the IMBER Imbizo.

Robert Duce, the Reporter for IMBER, made a presentation about the project. He noted that IMBER has established several subgroups and he provided detailed information about each one:

- End-to-End Food web Task Team (IMBER/GLOBEC)
- Joint SOLAS/IMBER Carbon Research Working Group (IMBER/SOLAS)
- Joint LOICZ/IMBER Continental Margins Task Team (IMBER/LOICZ)
- Capacity Building Working Group
- Data Management Committee

IMBER has two contributing projects:

- EUR-OCEANS *European Network of Excellence for Ocean Ecosystems Analysis*, 60 research institutions and universities from 25 countries (2005-2008)
- CARBOOCEAN *Integrated Project Carboocean – Evaluation of the sources and sinks of marine carbon*, 47 international groups(2005-2010)

Regional activities so far include

- ICED *Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics in the Southern Ocean*, jointly with GLOBEC and EUR-OCEANS
- SIBER *Sustainable Indian Ocean Biogeochemistry and Ecosystem Research*, preparing a writing meeting for the development of an implementation plan

Ralph Schneider asked if IMBER works with IOCCP and Ed Urban answered that the SOLAS-IMBER Ocean Carbon group works with IOCCP. Victor Akulich asked if CLIVAR is involved with IMBER. Urban answered that CLIVAR and IMBER are working together (also with GLOBEC) to plan the CLIMECO (Climate driving of marine ecosystem changes: Training for Young Marine Scientists) workshop. Peter Burkill stated that he is delighted that IMBER is doing so well, and particularly is impressed with the deep ocean session planned for the IMBER Imbizo. This is a topic SCOR has not often addressed. Jeandel stated that IMBER wants to hire a data specialist; are they concerned with data submission problems? Urban responded that IMBER does have a Data Liaison Officer in the IPO already. They are adopting a distributed data management policy. Jeandel wanted to know more about what a data employee would do? For example, the French cruise data are already in their database, so what would this person do? Urban responded that the IMBER IPO staff member will mostly be handling the metadata, not

raw data. Laurent Labeyrie stated that programs like IMBER need to manage data well from the beginning; they should have someone assigned to ensure proper data management, and will begin to work on data integration in preparation for the synthesis phase of the program. This should be “high level” work. Urban responded that the IMBER Data Management Committee includes several data managers. Marie-Alexandrine asked if IMBER data will eventually go to CDIAC? Urban responded that different types of data are going to different relevant data centers.

3.4 GEOTRACES Project

The GEOTRACES Scientific Steering Committee held its first meeting in San Francisco, California, USA, on 16-18 December 2006. The major actions resulting from the meeting included formation of a standing GEOTRACES Data Management Committee; initial planning for a GEOTRACES Data-Model Synergy Workshop to be held at the Hanse Wissenschaftskolleg in Delmenhorst, Germany; and initial planning for three meetings for GEOTRACES cruises in the Pacific (26-29 June 2007 in Honolulu, Hawaii, USA), Atlantic (10-12 September 2007 in Oxford, UK), and Indian (October 2007 in Goa, India) oceans. GEOTRACES is also in initial discussions regarding the placement of an international GEOTRACES data management office. The GEOTRACES SSC will meet next in Barcelona, Spain in November 2007. At that time, the results of the four planning meetings will be presented and a global cruise plan will be developed.

Robert Duce, the Reporter for GEOTRACES, made a presentation about the project. He reported on GEOTRACES’ progress, including (for example) the potential cruises laid out at the Pacific Basin cruise planning meeting. Duce stated that Bob Anderson wanted Duce to especially commend Ed Urban for his work in getting GEOTRACES going. GEOTRACES is planning two intercalibration cruises, funded by the U.S. National Science Foundation. Duce presented a slide showing the leaders for each of the parameters included on the intercalibration cruises. (All are U.S. scientists because NSF is funding the cruises, but there are berths for scientists for other countries, but not U.S. funding for their participation.) A set of standard samples will be available for anyone who provides sampling containers appropriate to their elements. Catherine Jeandel added that all countries were invited to send input on their requirements for the U.S. proposal. Venu Ittekkot added that at the Gordon Conference on Chemical Oceanography, Bob Anderson presented information about GEOTRACES and invited a lot of input and participation to GEOTRACES. NSF has committed 50% of the funding for a GEOTRACES data management office outside the United States; the location should be announced by the end of 2007. [It was decided to locate the office at the British Oceanographic Data Centre (BODC) in Liverpool, UK and BODC has committed the other 50% of funding for 2 years.] There is urgency to get the office set up to receive data from the GEOTRACES IPY cruises and the intercalibration cruises.

3.5 SCOR/IGBP/WCRP/CACGP Surface Ocean-Lower Atmosphere Study (SOLAS)

SOLAS held its second open science meeting in Xiamen, China in March 2007 and also is planning its third summer school for 2007 (see <http://www.solas-int.org/>). SOLAS and IMBER

have created a cooperative research activity related to ocean carbon and have formed a working group to guide the activity and to interact with IOCCP. The SCOR Executive Committee and other co-sponsors approved a new chair (Prof. Dr. Doug Wallace, Germany) and members of the SSC in May 2007. Robert Duce made a presentation for Huasheng Hong, the Reporter for SOLAS, who could not attend the SCOR meeting. Duce began by conveying appreciation from SOLAS in relation to travel funds provided from SCOR for several meetings over the past two years. Duce updated SCOR on several SOLAS-sponsored meetings:

- SOLAS Science 2007 had 225 participants from 30 countries, 220 posters, 20 plenary talks, and 11 discussion sessions. SCOR provided travel funds to developing country scientists to this meeting.
- The 3rd SOLAS International Summer School will be held in Corsica on 22 Oct.-3 Nov. 2007, and is also being supported by SCOR.
- The first workshop for Comparison of Oceanic Dimethylsulfide Models (CODiM) was held on 4-8 December 2006, in Brussels, Belgium. Twenty scientists, both modelers and experimentalists, attended. The participants investigated the different DMS model simulations performed before the workshop and conducted a first comprehensive synthesis. This first CODiM exercise included two complementary initiatives that were jointly handled: (1) a 1-D initiative which aimed to apply and compare different 1-D DMS-ecosystem models at three different identified ocean sites, and (2) a 3-D initiative aimed to compare global mechanistically based DMS models against global data sets.
- Mesoscale Iron Enrichment Experiments 1993-2005: Synthesis and Future Directions, *Science*, Boyd *et al.*, 2007
- The Impact of Anthropogenic Nitrogen on the Ocean A SCOR/ International Nitrogen Initiative workshop (16-20 Nov 2006, Norwich, UK). Thirty scientists with very diverse, yet complementary, expertise participated in this meeting, co-funded by SCOR.
- COST is an European framework programme (FP)-funded mechanism for “European Cooperation in the Field of Science and Technical Research”. The project seeks to develop global air-sea flux products from existing or future concentration data sets.

Duce raised the following issues for discussion:

- SOLAS grant from SCOR (from NSF). It was US\$40,000 per year initially, but was reduced to \$25,000 per year. SOLAS would like to have the funds to support its scientific activities. Can SCOR appeal to NSF? Ed Urban responded that NSF is now splitting its funds for SOLAS between core funding and the summer schools, so his understanding is that the total has not decreased.
- SOLAS International Summer School. The event costs about US\$200,000, with more than 20 sponsors. Would the SCOR Committee on Capacity Building consider support for the 2009 Summer School? Urban responded that this request will be considered as part of the discussion on which meetings will be providing support for travel of developing country scientists.

Duce also referred to the SOLAS SSC statement on large-scale fertilization of the ocean and asked whether SCOR should endorse it. Ed Urban replied that he thought it should only be

endorsed after a deliberative process. Vladimir Ryabinin added that if we say that we don't know enough about the science, how can we make a definitive statement? MacCracken offered alternative wording. Duce asked whether SCOR should consider this issue and take some time to develop a statement for SCOR to issue, and pass it to ICSU and IGBP? Laurent Labeyrie responded that SCOR has no choice because the problem is important and involves the ocean. SCOR must take a stand and a decision on the statement should be made quickly. Surely the new working group on iron (WG 131) should contribute to this process and offer an opinion after the existing data have been integrated. Peter Burkill added that this is such a huge issue that SCOR must show leadership on it. It's untenable that one of SCOR's programs would take a stand and SCOR wouldn't. We need to convey what the scientific community thinks.

Mike MacCracken noted that IUGG passed a climate change resolution in Perugia; should SCOR do that too? Venu Ittekkot stated that this might be an appropriate action for SCOR's 50th anniversary year. Lawrence Mysak cautioned that developing such a statement takes time. Gordon McBean agreed with Burkill: the ocean science community should make such statements and ICSU is relying on SCOR as the focal point for the ocean. If we don't make a statement on this, what should we be doing? Laurent Labeyrie answered that if SCOR makes a statement on one issue, it will be expected to make statements on other important issues, such as CO₂ storage in the ocean, so we need to be careful about the precedent. Catherine Jeandel agreed with Burkill and McBean. SCOR is supporting a working group to put together the data from past iron enrichment experiments, but we already know that they show no long-term effect of iron fertilization. Lucas Stal thought that a statement would be premature. He mentioned many other factors, like natural inputs of iron to the sea, etc., that need to be considered. Urban stated that if SCOR were to do a statement like this, we need to be careful not to be seen as advocates rather than objective scientists. It should include references. (Elizabeth Gross noted that the SOLAS statement does have references attached to it on their Web site.)

Susan Roberts asked what instigated the SOLAS statement? Mike MacCracken responded that what probably prompted it is that there are companies out there starting to do these large-scale experiments. Bob Duce agreed with this assessment, which means we can't wait long to issue a statement. There is a meeting at the Woods Hole Oceanographic Institution in September to start the process of developing a position. Roberts thinks we could make a robust statement saying that there is not enough evidence to justify the experiments. Ed Urban responded that this is how the companies justify what they are doing, by admitting that they don't know whether carbon sequestration by iron fertilization is feasible, requiring new experiments. Annelies Pierrot-Bults drew attention to SCOPE's science-based policy briefs as a model of what SCOR might do, a statement easily accessible to non-scientific policymakers. IGBP has drafted a brief on this topic, but it hasn't been finalized yet. Bob Duce offered to follow up on this at the SC-IGBP meeting in three weeks. Perhaps a joint IGBP-SCOR statement would be effective. Vladimir Ryabinin added that IMO has drawn attention to this issue and UNEP has a relevant convention.

Bjørn Sundby summarized by saying that it is obviously a hot topic and he senses that most people at the meeting want to see SCOR act in some way. We need to recognize Ed Urban's point that SCOR is not an advocacy group. If we take an initiative towards a statement on behalf

of ICSU, involving other partners and insist on scientific rigor, we could accomplish something. Or, to put it another way, should SCOR go it alone? Robert Duce answered that it depends on the issue. For some issues SCOR may be the most appropriate group to make a statement. For the iron issue, it might be better to have SCOR plus IGBP plus SCOPE present ICSU with a statement to be disseminated from ICSU. If we assume that these companies will go ahead in spite of what anyone says, it would be best to urge them to set up an independent monitoring group to look at whether the results of the first experiments prove or disprove the effectiveness of iron fertilization, like independent monitoring of an election. Duce responded that such an approach should not take the place of a statement. Peter Burkill suggested that one approach would be to recognize that SOLAS is part of SCOR, take their statement, perhaps modify it and pass it on to higher level. Duce responded that the IGBP Officers meeting in three weeks would be an opportunity to do this.

Bjørn Sundby concluded that SCOR should do something. We will start here to develop a statement based on the SOLAS statement, and will decide later whether to suggest to ICSU that they take it up; if not we should issue the statement on our own. Robert Duce still thought we should involve IGBP.

4.0 OCEAN CARBON AND OTHER ACTIVITIES

4.1 IOC/SCOR International Ocean Carbon Coordination Project (IOCCP)

Ed Urban reported that IOCCP has continued to be very productive in the past year. The group led planning for a Surface Ocean CO₂ Variability and Vulnerabilities Workshop on 11-14 April in Paris, France. NSF is funding 1+ positions at IOC for IOCCP and is providing activity funding through SCOR. IOCCP is about to publish a revised CO₂ methods handbook.⁶ The group's major activity for the coming year will be a panel to revise the WOCE/CLIVAR hydrography manual. Urban showed some PowerPoint slides from Maria Hood that listed the members and their expertise, as well as history and operating principles. He continued with summaries of the major IOCCP activities:

- Underway / Surface CO₂: Surface Ocean CO₂: Variability and Vulnerability (SOCOVV) Workshop (April 2007)—This meeting resulted in recommendations to do the following:
 1. Comparison of the global data sets currently being used by different groups to generate seasonal CO₂ flux maps, to examine which data have been incorporated into the datasets and how those data are treated to generate the global compilation. This will make it possible to adopt a standard global community dataset to build on.
 2. An evaluation of the methods used to generate global seasonal flux estimates to understand why there is such a significant discrepancy among them.
 3. The workshop established surface CO₂ synthesis groups for the North Atlantic (including Arctic), the Pacific, the Southern Ocean, the Indian Ocean, and the

⁶ Guide to Best Practices for Oceanic CO₂ Measurements - A.G. Dickson, C. Sabine, and J. Christian, eds., PICES Series Publication 3, IOCCP Report No. 8, 191 pp.

Coastal Ocean. These groups were asked to identify key science questions in their regions that require regional and global datasets, and to identify data in their regions that are not yet part of the global data set.

4. Develop an international agreement recognizing the importance of sustained funding for the global surface ocean pCO₂ network from volunteer observing ships.
- O₂ on Argo Update—A subgroup of IOCCP developed a white paper that was presented at the 8th Argo Steering Team meeting in March 2007. The Argo Steering Team encouraged its continuation and close coordination with Argo. However, because of concerns about the unknown legal framework of taking O₂ measurements in Exclusive Economic Zones and concerns about impacts of these new floats on the basic Argo network sustainability, the Argo Steering Team stated that it would not officially endorse this activity as an Argo project. Therefore, in this initial phase, the organization will be managed through a “grass roots” team of national scientists.
 - Time Series Coordination—Maps and table inventories have been developed with CDIAC for time series of carbon measurements and put on the Web, including information on ship-based stations, permanent moorings, and coastal moorings. IOCCP is working to develop an international workshop on carbon and biogeochemistry at time-series stations to reinvigorate enthusiasm in the community for the unique and critical observing system platforms offered by time series and a network of time-series stations. This workshop should also work to develop a more dynamic and coordinated international science community to promote time series work (both shipboard and using in situ instrumentation) for carbon and biogeochemistry science.
 - Coastal Carbon—IOCCP is beginning to integrate coastal monitoring activities into the networks for time series. This is a crucial issue for ocean carbon studies, but that is largely outside of the mandate of the IOCCP. One issue that IOCCP could undertake is the promotion of best practices, standards, and methods for carbon-relevant coastal studies. The SSG agreed that this should be linked to IOCCP’s process studies actions.
 - Advisory Group on IRHC co-sponsored by IOCCP, CLIVAR, and SIC— IOCCP, CLIVAR GSOP, and the SOLAS-IMBER Carbon Group have established the Global Ocean Ship-based Hydrographic Investigations Panel (GO_SHIP).to define what the international community wants to see in a comprehensive international repeat hydrography and carbon network, including what information should be compiled and maintained as part of this network, how to develop a single information source and/or data directory for ship-based repeat hydrography, needs for updating the hydrographic program manuals, and how best to coordinate with other programs looking at ocean interior changes such as Argo, CLIVAR, and OceanSITES. The group will be co-sponsored by IOCCP, CLIVAR-GSOP and the SOLAS/IMBER Carbon Group (SIC).
 - High-Precision Atmospheric CO₂ from VOS Ships—An email-based working group was developed to investigate the feasibility and utility of installing high-precision continuous atmospheric sensors on VOSs in conjunction with the underway pCO₂ network that has been established. IOCCP and SIC have assembled a group of experts on the technical aspects of taking high-precision measurements of atmospheric CO₂, and modelers with expertise in the field of interpreting such data. A short report has been produced on the current status of the measurement technology and the options for modeling studies to assimilate and interpret the data. A more useful exercise might be to look at the best-

quality atmospheric CO₂ data already being collected from VOS ships in the Southern Ocean region as an example of the status of such measurements. The extra cost and effort of installing such instruments on current VOS lines may be greater than the scientific interest for the ocean community, but may have value for the atmospheric community.

- Coordinated Action for a Carbon Observing System—IOCCP has been asked to assist with the development of a proposal for the EU Framework Programme 7 called “Coordinated Action for a Carbon Observing System” (COCOS), and on the network advances made in the EU and CarboEurope. IOCCP’s role would be to ensure that the work of these EU groups is compatible and coordinated with activities and plans in other countries. This proposal aims to fund a series of workshops (10 small, 6 intermediate, 1 large at the end) and some post-doc time for synthesis work and organization of workshops as well as report writing. The proposal and objectives are currently being mapped onto the Global Earth Observations Societal Benefit Areas.
- Communications Services—One of IOCCP’s primary goals is to serve as a communications service for the ocean carbon community. This has been undertaken through the Web-based information databases on observation activities, through the Web and email-based news services, and the email list/bulletin board service. Several features that are particularly appreciated are the menu listing based on issues (e.g., observing systems, standards, data, etc.), the quick links to other carbon programs, and the image gallery (useful for teaching purposes and pulling together presentations).
- Guide of Best Practices for Oceanic CO₂ Measurement and Data Reporting—IOCCP and PICES co-sponsored this update of the 1994 DOE Handbook by Andrew Dickson. [The manuscript has been published; see footnote 6.] It will be made available on the CDIAC Ocean CO₂ Web site and hard copies will be printed. IOCCP will promote training courses based on the revised manual, but should try to get this initiative integrated into existing research programs rather than developing its own stand-alone workshops. IOCCP should focus its activities to promote a core program covering high-quality measurements of basic carbon system parameters and the importance of using standard data/metadata reporting procedures. SCOR sent copies of this document to its list of libraries in developing countries and countries with economies in transition.
- Sensor Inventory—IOCCP will investigate the possibility of joining with other organizations to develop a single comprehensive catalogue of ocean sensors. After several months of consultation, a large consortium has formed and proposed a 5-day “Symposium on Multi-disciplinary Sensors and Systems for Autonomous Observations of the Global Ocean” (OceanSensors08). Participating groups include the Ocean Research Interactive Observatory Network (ORION), OceanSITES, IOCCP, the GCOS-GOOS-WCRP Ocean Observations Panel for Climate, and the U.S. National Science Foundation. The SSG agreed that IOCCP should be involved with this initiative in order to ensure that carbon and biogeochemistry issues and needs are well-represented and that the eventual development of an on-line guide of sensors will be adapted to sensors of interest to the ocean carbon community.

Urban ended the presentation by expressing his concern about finding the right person to replace Maria Hood when she leaves IOC next year. Perhaps SCOR should send a letter to IOC about the importance of this, and of Maria’s work. Laurent Labeyrie noted that the IOCCP Web site is an excellent model of science communication.

4.2 SCOR-IOC International Symposium on “The Ocean in a High-CO₂ World”

SCOR, IOC, IAEA and IGBP are planning a second symposium, in Sept./Oct 2008, at the Oceanography Museum in Monaco. Half of the speakers for the symposium have been selected and half will be chosen on the basis of abstracts submitted. An email announcement has been distributed and a Web site developed (by Maria Hood at IOC) as a portal to international activities related to the science of ocean acidification (see <http://ocean-acidification.net/>). Robert Duce described the planning for this symposium. Jim Orr (IAEA) is chair of the planning committee, which met in late February. The sponsors are all making financial and/or in kind contributions. We hope that the Prince Albert Foundation will support local costs.

4.3 Other Activities

4.3.1 SCOR Summit of International Marine Research Projects

SCOR obtained funding from the Alfred P. Sloan Foundation to convene a second meeting of representatives of the major large-scale ocean research projects, both SCOR-sponsored and others. The meeting was held in London, England on 7-9 Dec. 2006, co-chaired by Peter Burkill and Bjørn Sundby. The meeting was preceded by a one-half day session convened by WCRP CLIVAR as a planning session for the CLIMECO training workshop focused on illustrating how climate data from CLIVAR can be utilized by other projects, sharing expertise with them. GLOBEC and IMBER have joined CLIVAR in planning this workshop. The major action items from the meeting were to create a SCOR panel to investigate data publications and persistent data identifiers for ocean sciences, creation of a letter to national funding agencies regarding the need to encourage collection and submission of bathymetric data from the Southern Ocean, creation of a Web portal of ocean capacity-building activities (see http://www.scor-int.org/Capacity_Building/index.htm), creation of a letter to space agencies on the urgency of maintaining ocean color and other satellite measurements of the ocean, and location of funding for a 2008 Project Summit. Peter Burkill congratulated Ed Urban for the work and the article in EOS.⁷ About 45 participants gathered in London in late 2006. Results of the meeting included the following:

- Time Series—Discussions of time series identified that it would be useful for the projects to know what parameters are being measured at time-series stations worldwide, so a list of OceanSITES sites, with location information, parameters measured, and contacts, were transmitted to meeting participants.
- Bathymetry—A letter was sent to representatives of the International Group of Funding Agencies (IGFA), asking for increased attention to Southern Ocean bathymetry, with copies sent to national SCOR and SCAR representatives.
- Capacity Building—A meeting participant, Murray Brown, developed a Web site portal on ocean capacity building (see http://www.scor-int.org/Capacity_Building/index.htm).

⁷Urban, E.R. Jr. 2007. International Ocean Research: Common Opportunities and Challenges. *EOS: Transactions of the American Geophysical Union* 88(25): 19 June 2007.

- *EOS* Article—A meeting report was published in *EOS* to highlight the need to address interruption of satellite observations, Southern Ocean bathymetry, and publication of data.
- Data Publication—Data management was addressed and the consensus was that we need more emphasis on making data available for the broader community. Bjørn Sundby amplified the last point. The tools to archive data exist, but the obstacle is the reluctance of scientists to submit their data to a data bank. Urban is working on terms of reference, appropriate membership, etc for a panel to examine this issue in greater detail.
- The SCOR Secretariat is consulting with experts on ocean science and data management to develop terms of reference for a panel to examine issues of data publication, persistent data identifiers, and other incentives for data submission to recognized databases.

The Summit was funded by the Sloan Foundation, but they will only fund 50% of the next summit. Projects will have to use their own funds to pay for one of their people to attend rather than SCOR paying for two for each major project. SCOR's goal is to provide a forum for discussion and action, not to direct the projects. Harald Leong, the Chair of Consultative Committee of ICES, asked to be invited to the next summit.

4.3.2 Panel on New Technologies for Observing Marine Life

The third meeting of the panel was held in Kobe, Japan in October 2006, in conjunction with the Census of Marine Life (CoML) Natural Geography in Shore Areas (NaGISA) project's open science meeting and Techno-Ocean 2006. The Panel convened a special session at the Techno-Ocean meeting to attract technology companies to work on CoML-related issues. The special session focused on applications of electronic tags and autonomous undersea vehicles to CoML projects. The panel will meet next at the CoML All Program meeting in Auckland, New Zealand in November 2007. In October 2007, the Panel will sponsor a special session on geolocation of electronic tags on marine organisms, at a major symposium on electronic tagging (see <http://unh.edu/taggingsymposium/>). One recommendation is that they should work with GOOS to promote biological observations. They are working with WG 130 on plankton observations. The panel did a review of technological achievements that could be used in the CoML projects. Pierrot-Bults was concerned about the Panel web site, which is very out of date. New panel members were supposed to be approved, but there were no names to consider. Ed Urban responded that he agreed with Jesse Ausubel of the Sloan Foundation to wait until after the November panel meeting to appoint new members, when a plan of activities will be developed for the next three years, Urban agreed that the Web site is a problem and he was working to update it. A lot of planned activities have not happened yet, but Urban described what is ongoing.

4.3.3 SOLAS/INI Workshop on Anthropogenic Nitrogen Impacts on the Open Ocean

Michael MacCracken reported that SCOR approved funding at its 2005 meeting for a joint SOLAS-International Nitrogen Initiative (INI) workshop on 17-20 November 2006 in Norwich, UK. This workshop focused on the current understanding of the potential for changes in open ocean health due to human alteration of the marine nitrogen cycle, either directly or indirectly. The goal of the workshop was to bring together a group of international experts to evaluate the effects of atmospheric inputs of anthropogenic nitrogen on the open ocean environment and to

produce a major synthesis paper. Robert Duce and Julie la Roche (Germany) are co-chairing this activity. They plan a *Science* article, which should be submitted 10 days after the SCOR meeting.⁸

Duce added that the INI workshop was an approach very similar to the IGBP Fast-track Initiative on the global iron cycle in which SCOR was a partner.

5.0 SCOR COMMITTEE ON CAPACITY-BUILDING

Venu Ittekkot reported that SCOR approved the formation of a Committee on Capacity Building at its 2006 meeting and also approved the terms of reference for the committee. The committee was approved by the SCOR Executive Committee in July 2007 and commenced work soon thereafter. Vivian Lutz was added as a South American member since then. Murray Brown has worked on the Web catalog of ongoing capacity building activities (see http://www.scor-int.org/Capacity_Building/index.htm), based on a questionnaire sent to SCOR member nations on requirements for and availability of capacity-building activities. So far, they have not had much response, only 5 or 6, but they will send a reminder. These replies, with the catalogue, will form the basis of the committee's future work. The committee will attempt to use this information to diversify and expand funding. Gordon McBean offered START cooperation in SCOR's activities, and Venu expressed his interest in pursuing such linkages as soon as possible. The POGO-SCOR Fellowships for Operational Oceanography and SCOR travel grants are ongoing. Ed Urban will present this information later. Ittekkot expressed his interest in working with WGs 129 and 130, which both have meetings planned in developing countries. IMBER and GEOHAB have summer schools and other meetings in developing countries (Turkey and Viet Nam). We should get feedback from them. GEOTRACES cruises will have several scientists from developing countries on board; some are already being trained in the United States.

5.1 Regional Graduate Schools of Oceanography and Marine Environmental Sciences

This activity is still unfunded, but the new Committee on Capacity Building will discuss potential funding sources. The committee will consider potential regional meetings to explore the idea on a regional basis. Venu Ittekkot stated that the concept was revived during the 2006 meeting in Chile. The important thing is to find a host institution that will really keep regional, rather than institutional or national, needs at the forefront. In order to diversify funding, we should not forget to try to get local funding. Very often there is money available in developing countries from local agencies. Gordon McBean reminded the meeting that contact should be made with the Inter-American Institute for Global Change Research (IAI), rather than START, if there is a South American regional meeting. Peter Burkill reminded that representatives of

⁸R.A. Duce, J. LaRoche, K. Altieri, K.R. Arrigo, A.R. Baker, D.G. Capone, S. Cornell, F. Dentener, J. Galloway, R.S. Ganeshram, R.J. Geider, T. Jickells, M.M. Kuypers, R. Langlois, P.S. Liss, S.M. Liu, J.J. Middelburg, C.M. Moore, S. Nickovic, A. Oschlies, T. Pedersen, J. Prospero, R. Schlitzer, S. Seitzinger, L.L. Sorensen, M. Uematsu, O. Ulloa, M. Voss, B. Ward, L. Zamora. 2008. Impacts of Atmospheric Anthropogenic Nitrogen on the Open Ocean. *Science* **320**:893-897;DOI: 10.1126/science.1150369

SCOR member countries that they need to make sure they submit their replies to the questionnaire that was sent. Burkill reported that POGO has \$2.5 million from the Nippon Foundation for a center of excellence. Venu Ittekkot reported that he is in touch with this activity, which could have a partnership with SCOR capacity-building activities.

5.2 POGO-SCOR Visiting Fellowships for Oceanographic Observations

38 applications were received for this program in 2007. POGO and SCOR awarded 13 fellowships. Ed Urban will ask for approval for continuation of SCOR support for the fellowship program, as part of the next item.

5.3 NSF Travel Support for Developing Country Scientists

SCOR is at the beginning of the third year of a three-year grant received from the U.S. National Science Foundation at a level of \$75,000 per year. The grants have been an important source of support for several SCOR-related meetings in the past year (see 2006 *SCOR Proceedings*). New requests were considered and funding was approved for the following meetings: Eastern Boundary Upwelling Ecosystems, Second Symposium on the Ocean in a High-CO₂ World, SCOR 50th Anniversary Symposium, PICES XVII Meeting, First World Conference on Marine Biodiversity, WG 129 Symposium on Deep Ocean Exchanges with the Shelf, and the IMBER Imbizo. Meetings late in 2008 will have to be contingent on the grant being renewed.

5.4 SCOR Reports to Developing Country Libraries

The SCOR Secretariat distributed three reports to developing country libraries since the 2006 SCOR meeting, the science plans for GEOTRACES and the GEOHAB Core Research Project on HABs in Eutrophied Systems, and the 2006 *SCOR Proceedings*. Marta Estrada noted that more and more libraries are going to electronic publications. We should take this trend into account.

6.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS

6.1 Intergovernmental Oceanographic Commission

Bjørn Sundby and Ed Urban attended the IOC Executive Council in June 2007 to represent SCOR. ICSU asked SCOR to represent ICSU at the meeting. Sundby and Urban made several interventions at the meeting on behalf of SCOR and/or ICSU. SCOR and IOC cooperate on several different activities, as discussed in the following sections.

6.1.1 Global Ocean Observing System (GOOS)

Huasheng Hong attended the 2007 GOOS Scientific Steering Committee on behalf of SCOR and ICSU. The project summit discussed under agenda item 4.3.1 included a discussion of the interactions between GOOS and the major international ocean research projects. Nominations are needed from SCOR for the GOOS SSC. John Field finishes his term next year. Urban was asked to send the list of current members around for information.

6.2 Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)

As noted at the 2006 SCOR meeting, a promising area of future interaction between SCOR and GESAMP could be in the area of capacity building. The SCOR Committee on Capacity Building will pursue cooperation with GESAMP. Robert Duce noted that GESAMP recently met for the first time in a few years. They had representatives from 25 regional bodies around the world and discussed how to work with them in the future. They tried to identify networks, how GESAMP could be useful, etc. They could do this because they have new support from the Swedish International Development Agency (SIDA), mostly for work with developing countries, but also for the first time they have a full-time staff person. Duce mentioned several new GESAMP topics that may be of interest to SCOR:

Working Group 1	Evaluation of hazards of harmful substances carried by ships
Working Group 39	Global trends in pollution of coastal ecosystems: retrospective ecosystem assessment
AoA Task Team	GESAMP Task Team for the Assessment of Assessments under the UN Regular Process
Working Group 34	Review of applications for 'active substances' to be used in ballast water management systems - BWWG
Working Group 35	Deepwater fisheries habitat and related ecosystem concerns
Working Group 36	Development of an ecosystem approach to offshore mariculture
Working Group 37	Expanded scientific review of mercury and its compound and threats to the marine environment
Working Group 38	Atmospheric input of chemicals to the ocean

There is presently a competition for the location of the new permanent GESAMP office; it will be placed either at the International Maritime Organization (IMO) or the International Atomic Energy Agency (IAEA). GESAMP has undergone a complete rejuvenation and will be much more beneficial to the community in the future.

6.3 North Pacific Marine Science Organization (PICES)

PICES conducts several activities that are relevant to SCOR interests and that implement SCOR activities in the North Pacific region. Bjørn Sundby will represent SCOR at the October 2007 PICES meeting in Canada. Victor Akulich reviewed the history and membership of PICES and their interaction with SCOR activities. PICES is an active organization. Their 2007 meeting is in Victoria in late October and their 2008 meeting is in Dalian, China.

Harald Loeng regretted that we did not have ICES on the agenda and no report. He gave dates for their next meeting. Liz mentioned that she had made a presentation on behalf of SCOR at the ICES/PICES Early Career Scientists meeting.

7.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

7.1 International Council for Science

ICSU has continued its development of regional offices in Africa, Southeast Asia, and South America. ICSU has designated SCOR its representative at IOC and GOOS Scientific Steering Committee meetings. Gordon McBean described the ICSU hazards program. The number of disasters is going up (a disaster is defined as anything that overwhelms a community). 75% of them are floods, storms, and droughts. (The committee does not include an oceanographer.) The scope of the program includes natural and human-induced hazards, mitigation and prevention (rather than response/recovery), and research on preparedness. It has an integrated approach. The legacy will be having fewer people die as a result of disasters. McBean reviewed the group's formal objectives, and the basic planning scheme for a project. The biggest gaps are actually in the social and economic sciences. The next steps will be for McBean to make a presentation to the ICSU Committee on Science Planning and Review in two weeks, and he is also talking to WMO, IOC, and others very soon. The ICSU group will work with the UN body on disaster reduction to connect to nations. McBean expected that the group will get approval at the next ICSU Assembly. He is trying to get funding for an office in Canada and hopes to have a program in place in 2008. Lawrence Mysak stated that the hazards group needs to start with capacity building and education. A couple of universities in Canada have introduced courses on natural disasters and hazards. There is a lot of energy out there. Catherine Jeandel asked if there is a relationship with GESAMP. McBean replied that there is not. Ed Urban stated that ICSU funded a meeting on risks of meteorite strikes, which is relevant to this new group, is the outcome of the earlier meeting included? (Mike MacCracken attended that ICSU-organized meeting on behalf of SCOR.) McBean responded that this is an interesting problem: how do you deal with a low-probability, but high-impact event.

7.1.1 International Geosphere-Biosphere Program (IGBP)

Bjørn Sundby attended the IGBP Science Committee meeting in Brazil in March 2007 to represent SCOR. SCOR and IGBP staff members have ongoing discussions in relation to co-sponsored projects. IGBP will hold its 2008 Congress in Cape Town, South Africa. Robert Duce, the IGBP Treasurer, presented PowerPoint slides from Wendy Broadgate. IGBP has many joint activities with SCOR, many of which have already been discussed: GLOBEC, IMBER, SOLAS, the Fast Track Initiative on Past Ocean Acidification, the Second Symposium on the Ocean in a High CO₂ World, and the Nitrogen Workshop. IGBP's vision is to *provide scientific knowledge to improve the sustainability of the living Earth*. IGBP studies the interactions between biological, chemical and physical processes and human systems. IGBP collaborates with other programmes to develop and impart the understanding necessary to respond to global change. IGBP wanted to raise three topics:

- IMBER-GLOBEC Integration
- Congress 2008
- IGBP-WCRP Merger

Bjørn Sundby noted that there have been complaints by our joint projects about the high costs of meeting in Cape Town. Ed Urban added that IGBP needs to be more careful about its choice of meeting locations, particularly as they are also reducing funding to the projects. These decisions

affect project co-sponsors. There was some discussion of the pitfalls of the IGBP-WCRP merger proposal. Gordon McBean noted there are very significant sensitivities between the scientific programs and sponsors like ICSU/IGBP and the intergovernmental programs like IOC and WMO. Lawrence Mysak added that he was at the meeting where IGBP was founded. He appreciates the sensitivities mentioned by McBean, based on his experience in dealing with science and government agencies. He doesn't think there should be a distinction between climate science and global change research and, thus, the WCRP-IGBP merger is sensible. Mike MacCracken added that the resulting body could be so big and broad that it is hard to run, especially if human dimensions are added.

Bjørn Sundby expressed that he thought they shouldn't waste 10 years on this merger, ironing out sensitivities, designing new logos, etc. Why not just encourage collaborations? Ed Urban added that another level of complication is being added since ESSP is setting up its own SSC, instead of using the chairs and directors of the four major programs, as was previously done. Robert Duce asked whether there are any formal things for him to carry from SCOR to the IGBP officers meeting in three weeks. Urban replied that SCOR will send its recommendations on the SSC nominations, but should also express our concern about the costs of their congresses, and how that impacts SCOR. Gordon McBean added that SCOR should be asked by ICSU for advice on SC-IGBP and JSC-WCRP membership.

7.1.2 World Climate Research Programme (WCRP)

WCRP is co-sponsoring the SOLAS project and SCOR projects are working well with CLIVAR, the part of WCRP most relevant to SCOR. CLIVAR representatives participated in the SCOR Project Summit in December 2006, and CLIVAR took advantage of this meeting to hold a planning meeting for the CLIMECO training workshop, which is being jointly sponsored with GLOBEC and IMBER. Vladimir Ryabinin made a presentation about WCRP, particularly the structure and current activities of WCRP (scientific and observational) and on their synthesis activities. Part of the synthesis is considering how to operationalize data assimilation (arising from GODAE). In addition to the activities of the four core projects, WCRP develops additional research in several areas that require contributions from several of its projects. Such activities include seasonal prediction, decadal predictability, monsoons, anthropogenic climate change, atmospheric chemistry and climate, sea-level rise, extreme events in a changing climate, and the International Polar Year.

Ryabinin concluded that

- WCRP should be and is changing, in many ways
- Expanding its domain -> Earth System
- Search for sources of predictability at all scales goes on
- More effort on crosscutting issues and implementation
- Turn towards science of impact of and adaptation to climate change
- More focus on regions – where is and will be the action
- More service to Conventions (UNFCCC, Vienna, ...), work with GEO, more attention to communications and networking

Ed Urban expressed that it is a good idea to explore interactions between WCRP and the physical oceanography working groups of SCOR. CLIVAR has good interactions with the SCOR-supported research projects, but WCRP and the working groups could probably do more together. Peter Burkill asked whether WCRP would co-fund the working groups. Laurent Labeyrie added that he could not find any recent outreach information on the WCRP Web site. Lawrence Mysak stated that WCRP does not seem to have picked up the new scientific evidence that the ice sheets are melting much more quickly than predicted.

Vladimir Ryabinin agreed that SCOR Secretariats should consider ways of increasing cooperation between WCRP activities and SCOR working groups, which seems to be the most efficient way of achieving results in conditions of severe funding shortage. He added that he could not present in his talk all results and directions on which WCRP was working, especially the new results of the Climate and Cryosphere projects whose leading scientists discovered the effect of lubrication the bottom of ice sheets by melted water. Ryabinin also noted that due to ongoing changes in the WCRP, the WCRP is finalizing its new website, and the work on it is ongoing.

7.1.3 Scientific Committee on Antarctic Research (SCAR)

SCAR and SCOR are co-sponsoring a joint Expert Group on Oceanography. Ed Urban helped obtain NOAA support for the meeting. Jorma Kupařinen is the liaison between SCOR and SCAR. He noted the information in the background book. Areas of common interest include data collection concerns, capacity-building interests, and the Group of Experts on Oceanography. This group met in Hobart, Australia in 2006 and will meet again this year in Bremen, Germany on Oct. 1-3, 2007. The Bremen meeting will focus on developing a draft plan for a Southern Ocean Observing System. SCOR will be represented by Ed Urban and most SCOR projects will have representatives at the meeting. We have an agreement to co-fund the Expert Group every year. Sarah Bowden added that SCAR and the International Arctic Science Committee (IASC) are co-hosting a mid-term review of IPY in St. Petersburg in July 2008.

7.1.4 Scientific Committee on Problems of the Environment (SCOPE)

Annelies Pierrot-Bults, a member of the SCOPE Executive Committee and SCOR's liaison to SCOPE, mentioned the relevant SCOPE activities, especially PACKMEDS. Bjørn Sundby added that PACKMEDS is one of the rapid assessments of SCOPE. But, it had a difficult start because of a funding issue, the funds had to be spent in very short time frame and many people couldn't attend the meeting. It was chaired by Jerry Melillo (past SCOPE President). Ed Urban is managing the review process. We were probably overly optimistic about the time it would take to do the job, but there will be a book.

7.1.5 System for Analysis, Research and Training (START)

Gordon McBean chair of START, noted that it is co-sponsored by IGBP, IHDP, and WCRP. He described START's various activities and regional research networks (START is nearly worldwide, but does not cover the Americans; IAI does). ICSU recently convened a Young Scientist Conference in Beijing. START would be interested in working with SCOR. Ed Urban responded that he thought this would be a good idea. Venu Ittekkot added that this is especially important in southeast Asia, as marine science activities are just starting. It would be a good time

for us to get together while we are developing a SCOR strategy for capacity building. Bjørn Sundby thanked McBean and stated that he looks forward to many opportunities for SCOR and START to work together.

7.2 Affiliated Organizations

7.2.1 International Association for Biological Oceanography (IABO)

Annelies Pierrot-Bults, the IABO President, noted that there was not much to report. IABO would like to update its Web site, but this is not possible due to a lack of funds. Many IABO board members are also involved in CoML. IABO hosted a joint session with IAPSO in Perugia and intend to cooperate with IAPSO on their 2009 Montreal meeting. IABO is looking for candidates for a new president.

7.2.2 International Association for Meteorology and Atmospheric Sciences (IAMAS)

IAMAS, as an association of IUGG, met at the IUGG General Assembly in Perugia, Italy in July 2007. The key IAMAS activities over the past year have been: (1) planning for the IAMAS-organized scientific symposia at the IUGG General Assembly in Perugia, 2-13 July, 2007; (2) planning for the IAMAS General Assembly, including the election of officers for the upcoming four-year term; (3) assisting in finalizing the assessment report prepared by the International Aerosol-Precipitation Assessment Group (IAPSAG) that has been co-sponsored by IAMAS and WMO; (4) representation of IAMAS with other organizations; (5) consideration of possible statute changes; and (6) improving communication via the Web and newsletters. Michael MacCracken, as IAMAS past-president, will continue as IUGG/IAMAS liaison to SCOR. IUGG approved the establishment of a new association on cryospheric sciences.

The major IAMAS activity is sponsorship of international meetings:

- IAMAS organizes a major Scientific Assembly every two years, every fourth year with IUGG (typical IAMAS attendance now about 800).
- IAMAS Scientific Assemblies are sometimes held with other IUGG Associations; the July 2008 Assembly will be joint with IAPSO and IACS.
- At IUGG Assemblies, IAMAS is very active in promoting joint symposia with other Associations.
- Several of the IAMAS Commissions (including Ozone, Radiation, Atmospheric Chemistry and Global Pollution, Clouds and Precipitation, etc.) plus the ICCP Nucleation Committee convene their own conferences about every four years (with attendance at each being about 250 to 550).
- IAMAS also co-sponsors meetings with other international organizations and research programmes

They sent 2 resolutions to the IUGG Assembly:

- Intensified Study of Aerosol Pollution Effects on Precipitation
- Urgency of Addressing Climate Change

Both passed unanimously among the roughly 40 countries present (a few abstained, apparently not prepared to move forward so rapidly). The resolution on the urgency of addressing climate change is pertinent to SCOR. It might be a model for a statement on iron fertilization. The style of language might be more appropriate.

7.2.3 International Association for the Physical Sciences of the Oceans (IAPSO)

SCOR and IAPSO are currently co-sponsoring WG 121 on Ocean Mixing, WG 122 on Estuarine Sediment Dynamics (with LOICZ), WG 127 on Thermodynamics and Equation of State of Seawater, and WG 129 on Deep Ocean Exchanges with the Shelf. Lawrence Mysak, IAPSO President, referred to his written report and updated it, with information from the Perugia meeting. Two highlights were the awarding of the 4th Prince Albert Medal, to Russ Davis. (Prince Albert I was the first President of IAPSO.) Also awarded was the Eugene LaFond medal to a Brazilian scientist.) A new IAPSO Executive has been formed. Mysak discussed plans for the next IAMAS/IAPSO meeting in Montreal in 2009 and issued an invitation to everyone to attend. Mike MacCracken added that this will be a good opportunity for other groups to meet, or to organize a symposium or session as part of this meeting. SCOR/IAPSO WG 129 on Deep Ocean Exchanges with the Shelf will hold its final meeting there.

7.3 Affiliated Programs

The benefit of continued affiliation to SCOR is evaluated at each General Meeting. All of these programs were invited to send representatives to the project summit sponsored by SCOR in December 2006. SCOR is using the project summits to help (among other benefits) the affiliated projects interact with other large-scale ocean research projects; there is no other forum for this interaction to take place.

7.3.1 Applications for New Affiliated Programs: InterMARGINS

InterMARGINS applied for affiliation to SCOR in 2005. The application was discussed and approved, pending clarification of the membership fee structure, to make it more feasible for developing countries to participate. At the 2006 SCOR meeting, Laurent Labeyrie recommended that InterMARGINS should be affiliated to SCOR, pending one additional change: their constitution needs to make it clear that Assistant Members can be on the steering committee (see clause 3.1), and that at least one Assistant Member be included on the committee to reflect the views of the others. Extra funds should be sought to help participation of these developing country members to attend steering committee meetings. SCOR requested changes in their membership structure, in establishing a token fee for developing countries that would not prevent them from sitting on the steering committee. InterMARGINS has not responded to this request. Laurent Labeyrie, the SCOR liaison to InterMARGINS, noted that it is a very active group. It has some interactions, but not enough, with paleoceanography groups. Their interest has waned since we asked them to accommodate our concerns. Laurent Labeyrie responded that they are interested in developing lobby groups to deal with the international Ocean Drilling Program. Labeyrie thinks that they are not yet ready for SCOR.

7.3.2 Census of Marine Life (CoML)

In 2010, this international research program will release its first report on the status of knowledge of marine biodiversity. To meet this deadline, CoML has begun implementing plans for integration, synthesis and visualization of marine biodiversity information, as well as the management needs to achieve them. This information is actively being collected by the 14 CoML Ocean Realm Field Projects and three cross-cutting initiatives in historical studies (HMAP – History of Marine Animal Populations), modeling and prediction (FMAP – Future of Marine Animal Populations), and data management and accessibility (OBIS – Ocean Biogeographic Information System). CoML will hold an All Program Meeting in Auckland in November 2007.

Odd Aksel Bergstad was invited to represent CoML, but speak mainly about the field project he leads, MAR-ECO, which is studying biodiversity of mid-ocean ridges. The MAR-ECO office is located in Bergen. Bergstad began by noting that we know little about biodiversity along the ridges. MAR-ECO's focus has been on the Mid-Atlantic Ridge (MAR). MAR-ECO is a study of the impacts of the photosynthetic food chain on MAR communities, as opposed to the usual focus on chemosynthesis. The goals are to analyse species composition and to develop and test technology. Bergstad discussed the *G.O. Sars* cruise, which sampled organisms down to about 3000 meters. The cruise included ROV studies of gelatinous organisms and sampling of pelagic fishes of all depth zones, resulting in a huge new collection of deep-water fishes. (They used a long-liner and bottom trawls to help sample fish.) In terms of acoustics, they use a 18-Khz sounder to make observations of scattering layers at 2000m and deeper. They have also deployed upward-looking sounders at 1000m. MAR-ECO has developed a good time series to look at seasonal migrations and population dynamics. In terms of bathypelagic squid, 44 species were collected. Species composition and distributions of top predators were documented, especially for cetaceans and seabirds. They tagged and tracked large whales. Bottom sampling in the rugged terrain of MAR is difficult. A series of papers based on the 2003-2005 field phase will be published in *Deep Sea Research II* and another special issue—dealing mainly with epibenthos—is being prepared for *Marine Biology Research*. A monograph on seamounts will also be published; there is a steadily growing list of references arising from MAR-ECO. The project fills significant gaps in knowledge on mid-ocean animals and their ecology. The project has had significant impact on agencies, has resulted in technological advances, and has created international and student networks. What are the next steps? Publications continue, as do education and outreach efforts. There are plans to transfer their approach to other ridge areas, particularly to the MAR in the South Atlantic Ocean. MAR-ECO has been extended to 2010.

Lawrence Mysak asked about horizontal variability. Are ridges boundaries or do they help spread species horizontally? Bergstad thinks that ridge zones are not boundaries, since they don't see much east-west variability. Annelies Pierrot-Bults noted that Marine Biodiversity and Ecosystem Functioning EU Network of Excellence (MARBEF) has a project based on MAR-ECO results. Laurent Labeyrie asked whether MAR-ECO has information on phytoplankton blooms that might have occurred prior to their collections of animals, that is temporal parameters such as nutrients in the water column. Bergstad answered that they have ocean color data. They did collect chlorophyll and nutrient data on the cruises, but that doesn't contribute information about the blooms before the cruises. The project Web site includes a portal for schools. They have produced a lot of material for the general public, designed for all ages. On *G.O. Sars* and

James Cook cruises, they had ship-to-shore communication, scientists wrote daily journals, there was a TV crew on board, etc. There is a travelling exhibition of project pictures and other results in Europe now. They hope to send the exhibition across the Atlantic Ocean later. Pierrot-Bults noted that Bergstad won the Descartes prize (for science communication) for these activities. Bjørn Sundby asked if they used coring to look at infauna. Bergstad answered that they did, on the *James Cook* cruise. Other CoML projects are also doing coring. Peter Burkill offered some general comments about CoML. It is a huge and very successful program. It has many projects all over the world, in all sorts of environments, and converging all types of animals. Much of their most exciting results can be observed on the project Web site. 2010 is the end of CoML, at least the first phase. They will produce a report on the status of knowledge on oceanic biodiversity. Annelies Pierrot-Bults noted that she has withdrawn as Executive Committee Reporter due to her participation in the program. CoML has started to scope out its synthesis report, in preparation of the end of Sloan funding in 2010. They are also starting to form a continuing group to carry the project forward beyond 2010.

7.3.3 International Antarctic Zone (iAnZone) Program

Alexander Orsi, one of the two iAnZone co-chairs, made a presentation about the program. It was created by Arnold Gordon and others in the late 1980s to develop and coordinate observation and modeling programs in the Southern Ocean relating to climate. iAnZone's goal is to, "through development and coordination of observational and modelling programmes, to advance our quantitative knowledge and modelling capability of climate-relevant processes, their seasonal cycle, their inter-annual and decadal variability, within the Southern Ocean's Antarctic Zone (region poleward of the Antarctic Circumpolar Current), with emphasis on ocean and atmosphere coupling in regions influenced by sea ice, and the link between the Antarctic Zone and the global ocean and climate system." iAnZone's terms of reference are

1. To identify, develop and coordinate research projects which address iAnZone goals.
2. To provide a forum for the exchange of iAnZone research ideas, plans, results, and data.
3. To assist in the coordination of Antarctic Zone research with global climate research programs and with other Southern Ocean programs.
4. To advise on the development of appropriate observing systems (e.g., for GOOS, GCOS), data sets and modelling strategies needed to understand the scales and mechanisms of climate variability within the Antarctic Zone.

Previous and current iAnZone projects include

1. 1992: ISW Ice Station Weddell, looked at oceanic, cryospheric and atmospheric processes in southwestern Weddell Sea.
2. 1994: Anzflux Antarctic Zone Flux Experiment, looked at ocean-ice-atmosphere fluxes in Maud Rise region.
3. 1997-1998: DOVETAIL Deep Ocean Ventilation through Antarctic Intermediate Layers, looked at ocean processes in the Weddell-Scotia Confluence.
4. 2003-2005: AnSlope Cross-Slope Exchanges at the Antarctic Slope Front, looked at ocean processes on the continental slope in Ross Sea. The major climate-related research

goal of AnSlope was to determine the role of the Antarctic Slope Front in the exchanges of mass, heat, and freshwater between the shelf and oceanic regimes.

5. 2004-2005: *ISPOL*, Ice Station Polarstern, looked at oceanic, cryospheric and atmospheric processes in southwestern Weddell Sea.
6. The most prominent activity of iAnZone presently is the Synoptic Antarctic Shelf-Slope Interactions Study (SASSI), which is a contribution to IPY (see <http://sassi.tamu.edu>). SASSI will provide a unique synoptic snapshot of the marine environment of the Antarctic continental shelf and slope, including physical (iAnZone), biogeochemical (GEOTRACES, SOLAS, IMBER) and biodiversity (CoML, GLOBEC) measurements. SASSI observations will deliver a baseline for assessing current ocean climate processes, effectively a legacy against which to measure future change. SASSI will deliver understanding of continental shelf and slope processes (a critical contributor to global climate variability) to adequately allow their accurate representation in climate models, that can then be used to predict this variability. Interannual and seasonal variability will be documented for the first time in many locations. The objectives of SASSI are to
 - a. Obtain a circumpolar synoptic view of Antarctic shelf and slope oceanography.
 - b. Assess quantitatively the properties and amount of inflow of warm, saline deep water onto the continental shelf, with a focus in regions known to be active sites for water transformation.
 - c. Assess the role of onshore oceanic heat transport in melting sea ice and ice shelves.
 - d. Determine where, when and how this oceanic inflow is transformed, through net cooling and freshwater fluxes during the seasonal sea ice melting/freezing cycle over the shelf domain into dense Shelf Water and its subsequent derivative Antarctic Bottom Water.
 - e. Assess the importance of ice shelves in the net upper ocean freshening process, including iceberg calving and melting, and determination of basal melt rates.
 - f. Assess the importance of coastal polynyas to water mass transformations.
 - g. Better understand the dynamics of the coastal current and slope-front systems, and how they influence the exchanges between sea ice, glacial ice, coastal and deep ocean waters.
 - h. Quantify freshwater transports around Antarctica through both currents and atmosphere-ocean-ice interaction.
 - i. Determine down-slope dynamics and associated meridional transports, integrating physical, geological and geophysical records with the currents in the bottom boundary layer.
 - j. Assess the degree to which present coupled ocean-ice models represent the shelf system and its variability.
 - k. Design a long-term monitoring system over the Antarctic continental margins that can act as an early indicator of global climate-related changes.
 - l. Identify key Antarctic shelf/slope processes that should be included or parameterised in future climate models.

- m. Explore and document the geology, chemistry and biology of underwater volcanic hot vents.
- n. Obtain a swath bathymetry map of the Antarctic continental shelf and slope, including beneath ice shelves.
- o. Assess the role of the microbial biomass and processes in regulating the carbon biological pump efficiency for the carbon sequestration on the Antarctic continental shelf.
- p. Understand the bio-optical processes that affect the ocean colour signal in the Southern Ocean.

iAnZone was formally affiliated to SCOR in 1997 and to SCAR in 2004, and has links to WCRP projects. It complements the work of the CLIVAR/CliC/SCAR Southern Ocean Region Implementation Panel and SCAR/SCOR Expert Group in Oceanography. Lawrence Mysak noted that IUGG has just formed the International Association for Cryospheric Sciences. Are there ice scientists involved in SASSI? Orsi responded that there are. iAnZone has accomplished all this with no staff and no funding for meetings. See <http://www.ldeo.columbia.edu/res/fac/physocean/ianzone/>. iAnZone data information is included on WCRP CLIVAR's Southern Ocean Region Implementation Panel Web site.

7.3.4 International Marine Global Changes Study (IMAGES)

SCOR and IMAGES are currently co-sponsoring WG 123 on Reconstruction of Past Ocean Circulation and WG 124 on Analyzing the Links Between Present Oceanic Processes and Paleo-Records. Laurent Labeyrie, the Reporter for the group, noted that they are very active. He thinks IMAGES should go through a period of evaluation and renewal, since they are about 10 years old now. They need to improve the links between the recent variability and the much longer time scales. Labeyrie would like to see IMAGES more deeply involved in multidisciplinary activities in SCOR. For example, GLOBEC tried to get them involved in paleoceanography studies, but IMAGES wasn't really interested. Perhaps in Woods Hole we could think about a more focused association between IMAGES and SCOR. Ralph Schneider, the IMAGES Executive Director, responded that he appreciated Laurent's critique. He also appreciated the Web site review that SCOR did as part of the 2006 Project Summit. IMAGES has released a new brochure. The time scales of importance to IMAGES are those that are relevant to human life and societal development. Organization of cruises is a major component of the project. There is a new IMAGES activity on the Indonesian Throughflow with PAGES and CLIVAR. Another is on ocean-atmosphere teleconnections, and another on land-ocean linkages to connect variations in the hydrological cycle to ocean temperature and circulation changes. Schneider noted that the links between IMAGES and PAGES is getting better. The new PAGES director is a marine person. IMAGES has a regular page in the PAGES newsletter and they will have a complete issue coming up. In terms of publications, IMAGES feels that it needs to renew its IMAGES Science Plan (which resulted from SCOR WG 100). Would SCOR be a reasonable organization to evaluate the new plan? Ed Urban responded with ideas for IMAGES-SCOR cooperation. It would be useful if Schneider could transmit information about the GEOTRACES cruise planning meetings to the IMAGES community. Also the symposium on the Ocean in a High-CO₂ World next year is a good opportunity to bring in paleoceanography aspects of the issue, such as

submitting posters, holding meetings of opportunity in conjunction with the symposium, etc. The GEOHAB project is interested in dinoflagellate cysts in sediments, especially in relation to its Core Research Project on Upwelling Systems, since there is evidence that some harmful algal blooms are stimulated by upwelling events and relaxation of upwelling, which can be studied through sedimentary records. Laurent agreed these dinoflagellate cysts are a very important proxy for paleoceanography. Schneider added that there are a lot of plans for paleoceanography components in programs like IMBER, SOLAS etc., but that they often fall apart because paleoceanography work is so costly in ship time, space and funding resources. There is a tension over this. Catherine Jeandel noted that the GEOTRACES paleoceanography activity is focused on proxy calibration. She raised other GEOTRACES issues and Schneider responded that he would like to see a liaison of IMAGES with GEOTRACES. Sarah Bowden added that she thought it would be useful for AOSB to have a link with IMAGES, because AOSB is developing new directions in paleoceanography. Ed Urban stated that SCOR would welcome a request to review a revised IMAGES Science Plan and it could help to forge the links to other SCOR-sponsored projects. Lawrence Mysak encouraged IMAGES representatives to participate in IUGG and IAPSO meetings.

7.3.5 InterRidge - International, Interdisciplinary Ridge Studies

After three successful years under the leadership of Colin Devey at IFM-GEOMAR in Kiel, Germany, the InterRidge (IR) program office has moved to the Woods Hole Oceanographic Institution (WHOI), Cape Cod, Massachusetts, USA. The InterRidge office will remain there for the next three years (2007-2009). InterRidge has an active program of working groups and scientific meetings, as well as significant education and outreach activities. Laurent Labeyrie, the Report for the group, stated that there are no problems with this project. Their working group process is very different from SCOR's. There should be more interactions on InterRidge with the ocean science community. Ed Urban responded that InterRidge is working with the ChESS program of CoML. Labeyrie continued that it would be positive for both InterRidge and SCOR to form joint working groups, since SCOR does not do much on the topic of marine geology.

7.3.6 International Ocean Colour Coordinating Group (IOCCG)

Two monographs have been published by IOCCG scientific working groups over the past year, bringing the total number of monographs in the IOCCG Report series to six. Five other scientific working groups are in various stages of progress. Jorma Kuparinen, the Reporter for the group, explained that IOCCG was affiliated to SCOR in 1998; next year is the 10th anniversary of the affiliation. They should make a larger report to SCOR at the Woods Hole meeting. Kuparinen described the purpose of IOCCG, "promoting the application of remotely sensed ocean-colour data through coordination, training, liaison between providers and users, advocacy and provision of expert advice." Jim Yoder is the Chair now and the office remains at the Bedford Institute of Oceanography. IOCCG operates somewhat like SCOR: the main activities are working groups focused on specific topics, which produce reports. Two reports were completed in the past year. IOCCG also conducts some capacity building initiatives (see www.ioccg.org). Kuparinen compliments the IOCCG Web site, where all the products are posted. The group seems to be well sponsored, maintained and organized.

7.4 Other Organizations

7.4.1 Partnership for Observation of the Global Ocean (POGO)

The 2008 POGO meeting will be held in Bermuda in January 2008. POGO and SCOR are participating together on the POGO-SCOR Visiting Fellowships for Oceanographic Observations. In the past year, the POGO Secretariat has moved to the Plymouth Marine Laboratory (UK). Tenders for a research cruise database were invited in 2006, evaluated by appropriate experts, including Ed Urban, and the tender from a SeaDataNet group selected. A proposal submitted to the Sloan Foundation to support the development was successful. The Web site can be found at <http://www.pogo-oceancruises.org/>. POGO devotes much effort to capacity building and to ocean input to the Global Earth Observing System of Systems (GEOSS). Bob Duce, the Reporter for POGO, added that POGO held its 2007 meeting in Qingdao, China. The Nippon Foundation has provided funding for a Center of Excellence in Oceanography Education and the deadline for institutions to apply to host the center is 31 Aug. 2007. Ed Urban added that it has to be in a developed country. SCOR and POGO work together in several activities and the POGO Executive Director, Shubha Sathyendranath, is on the SCOR Committee on Capacity Building.

7.4.2 Arctic Ocean Sciences Board (AOSB)

The AOSB re-established contact with SCOR this year, is interested in expanding its role in the global ocean programs, and will be looking to new linkages with various international marine science organizations such as SCOR and GOOS. Sarah Bowden, the AOSB Executive Director, reported that AOSB and SCOR used to have regular communication; it broke down for some reason, but is now being renewed. AOSB is an international organization dedicated to furthering research of the Arctic Ocean and surrounding seas. Its mission is to facilitate Arctic Ocean research by supporting multinational and cross-disciplinary natural science and engineering programs. AOSB was founded in 1984 by a small group of scientists with a vision to increase and improve their research in the Arctic through close collaboration and communication. It is a non-governmental body with members from research and government institutions in 15 countries who have met annually over the past 23 years to promote coordination and establish joint priorities and programs:

- Greenland Sea Project 1987-93
- International Arctic Polynya Program (IAPP) 1989-Present
- Arctic Paleo River Discharge (APARD) 1996-2000
- Arctic Subarctic Ocean Fluxes (ASOF) 1999-2006
- Shelf-Basin Exchanges (SBE) 2001-Present
- Integrated Arctic Ocean Observing System (iAOOS) 2006-Present. iAOOS is AOSB's contribution to GOOS.

The current research priorities of AOSB (in addition to the current projects) include

- Establishment of the International Study on Arctic Change (ISAC)
- Geosciences, especially supporting deep ocean drilling in the deep central basin (in

- coordination with the IODP)
- Seeding new activities identified through the ICARP II process.

Harald Loeng, the AOSB chair, presented specifics about iAOOS. He showed a map of the planned sections and specific national plans like Canada's, which will provide information on fluxes through the Canadian archipelago for the first time. A Norwegian effort will cover the flow through between Novaya Zemlya and Franz Josef Land. Other examples were given of national plans. Regarding the future restructuring of Arctic research organizations, the International Arctic Science Committee recently conducted a review and recommended that AOSB become the marine component of IASC, an idea that is developing. Lawrence Mysak stated that it would be good to link the AOSB shelf-ocean exchanges activity with SCOR/IAPSO WG 129.

8.0 ORGANIZATION AND FINANCE

8.1 Membership

8.1.1 National Committees

Bjørn Sundby and Ed Urban met with the UK SCOR Committee in December 2006 and with the French SCOR Committee in June 2007, in conjunction with other meetings. Several changes in Nominated Members were made since the 2006 General Meeting. The Executive Committee approved a procedure in 2003 to change the status of members not paying their dues, to "Suspended Member" status, with fewer benefits. At the end of 2006, the Philippines was moved to suspended status. No other countries need to be considered for suspension at this time. The suspended countries are listed on the SCOR Web site as "Observer Nations", to avoid stigmatizing these nations. No new members were added this year, and none lost. China-Beijing increased their membership by one level. Urban urged other countries to do the same. Peter Burkill noted that Karen Heywood is now the third Nominated Member from the United Kingdom. It would be good to invite new countries to the 50th anniversary symposium. Urban stated that it is good for national committees to have annual meetings. He and Sundby try to attend meetings when the opportunity arises. Mingyuan Zhu responded that the China-Beijing SCOR Committee will meet in September. Urban will be there, as will Julie Hall and Angelica Peña.

8.2 Publications Arising from SCOR Activities

Ed Urban summarized the different publications that have resulted from SCOR activities in the past year.

Publications from Working Groups and Major Projects—Major publications from SCOR activities produced since the 2006 SCOR meeting include the following:

- *GEOTRACES Science Plan*
- *Research Plan for GEOHAB Core Research Project on HABs in Eutrophied Systems*
- Jean Lynch-Stieglitz, Jess F. Adkins, William B. Curry, Trond Dokken, Ian R. Hall, Juan Carlos Herguera, Joël J.-M. Hirschi, Elena V. Ivanova, Catherine Kissel, Olivier Marchal, Thomas M. Marchitto, I. Nicholas McCave, Jerry F. McManus, Stefan Mulitza, Ulysses Ninnemann, Frank Peeters, Ein-Fen Yu, and Rainer Zahn. 2007. Atlantic Meridional Overturning Circulation During the Last Glacial Maximum. *Science* 316:66-69.
- Phaeocystis, major link in the biogeochemical cycling of climate-relevant elements. *Biogeochemistry* 83(1-3) March 2007 – Online publication available at <http://www.springerlink.com/content/g12x20148815/?p=1d1789a4d9e24f9aa783b65b5d6ea74e&pi=3> Hard copy publication expected in summer 2007.
- A version of *GEOTRACES Science Plan* will be published in *Chemie der Erde - Geochemistry*, a peer-reviewed journal.

2006 SCOR Proceedings—The *Proceedings* was printed and distributed in July 2007.

SCOR Web site—The SCOR Web site is updated and checked for dead links regularly. It is functional, but needs to be made more attractive.

SCOR Newsletter—The SCOR Electronic Newsletter was started late in 2004, to provide more frequent updates about SCOR activities between annual meetings. Nine issues have been distributed so far. (All are available on the SCOR Web site.) The SCOR Secretariat will issue three newsletters each year. The SCOR Secretariat improved the layout and design of the Newsletter in 2007 and will continue to have it printed in hard copy occasionally for limited distribution.

8.3 Finances

The annual audit was completed in May. Elizabeth Gross worked to prepare information for the auditors. The financial records and financial controls were found to follow accepted standards. SCOR received a new grant of \$20,000 from NOAA in 2007 for activities of WG 125. Missy Feeley reported on behalf of the ad hoc finance committee. The committee reviewed the auditor's report, reviewed the budget for 2007 and the 2008 budget. The committee recommended acceptance of the final 2006 statement.

In terms of the 2007 budget adjustments, the following were relatively large:

- The Phytoplankton Pigments in Oceanography book will not be published until 2008. There was also some discussion on costs depending on the publisher chosen.
- The SCAR/SCOR group Expert Group on Oceanography spent less than expected.
- The publications to libraries was less than originally budgeted.
- The salary line was less, but outside services larger because SCOR has been operating without an Administrative Assistant and Elizabeth Gross has been filling in.

The year-end projection is about \$161,000. Feeley noted the new practice of breaking out encumbrances, which would be things like registrations carried over from one year to the next or other income received in the current year that will not be spent until the following year. The reduction projected for year end is quite a bit less than in the first draft budget. The committee recommended approving the revised 2007 budget.

For 2008, Feeley showed the income, which includes a 3% increase in dues already agreed and an extra US\$10,000 from NSF for the SCOR 50th Anniversary Symposium. The committee recommend only funding one new working group, and that at a reduced level, to accommodate the uncertainty about funding from national committees for the SCOR 50th Anniversary symposium. The committee recommended that funding of \$7000 be committed to the iron working group only if there is a commitment from the PIs of the iron enrichment experiments to contribute their data sets. The \$7000 could support some time for a data specialist and a meeting of the two co-chairs. This would be more prudent then spending \$15,000 for a meeting that we aren't sure will be successful. Then, when the data are compiled, the proponents could come back to SCOR with a proposal for the next steps. The Finance Committee did not recommend funding the HAB working group, but if funds become available (through an unexpected budget surplus or external funding), the Executive Committee could reconsider it in early 2008. [The group was since funded by LOICZ and the Institute of Oceanology of the Chinese Academy of Sciences.]

The Finance Committee recommended a registration fee to cover costs for participants (except invitees) at the SCOR 50th Anniversary Symposium.

The committee formally recommended that the minimum year-end balance should be \$125,000 and recommended a 3% increase in dues for 2009. The current budget projects that SCOR can fund two new working groups in 2009. Projections for 2008 bring us down to \$125,000, two new working groups in 2009 would bring us well below that (\$113,000).

Robert Duce asked what ICSU is doing regarding dues increases. Ed Urban responded that ICSU's increases have been variable, but that they had an effective increase of about 25% a few years ago, when they changed (at parity) the dues from U.S. dollars to euros. SCOR had stayed at 1% every year, so that countries with weaker currencies wouldn't suffer too much. Now that the U.S. dollar is weaker and U.S. inflation is 2-3%, we need to recoup some of the ground we have lost in relation to other currencies.

Duce asked where the figure of \$7,000 came from for the iron working group. Missy explained that this is approximately half of what a usual working group would get for one meeting and the Finance Committee thought it would be sufficient for the proposed task. There was discussion about removing the funds budgeted for this group beyond the first year, since the proponents will have to come back to SCOR with a new proposal. It was agreed to take out the outyear expenses for now. Mike MacCracken suggested that perhaps we arrange some outside funding for the group.

Lawrence Mysak noted that the budget did not have any funding budgeted for the Rossby proposal. Ed Urban responded that we will have to go out and find some external funding for that activity. Mysak committed that IAPSO will pay \$1,500 for one person for the panel, if it is developed.

Mike MacCracken stated that we had two good proposals this year and we can't fund them. It would really help if national committees can help find funds for working groups. Ed Urban responded that the Finance Committee did recommend that the HAB working group be started if money can be found.

Marta Estrada expressed her concern about the downward trend in the bottom line of SCOR finances, which should be addressed. In some countries it is easier to accept a larger annual increase than to change categories. Following this comment discussion of the dues for 2009 concluded with a recommendation for a 5% increase in SCOR dues for 2009, which is the same as the ICSU increase for 2009. Meeting participants approved the other recommendations of the Finance Committee.

8.4 The Disciplinary Balance among SCOR Working Groups

Laurent Labeyrie worked with Peter Burkill on this task, working with an updated list of active working groups. The "general tools" working groups have decreased over time. Establishing the activity recommended by Tom Rossby would address this situation. Chemistry/geochemistry are decreasing. Biology has been constant. A new, simpler figure were introduced, compared with last year's. We are short on chemistry and climate-related working groups and we really need interdisciplinary groups. Labeyrie expressed his personal concern about links between natural variability and various time scales and spatial/temporal variability in biology in relation to physics and chemistry. Bjørn Sundby responded that he was not so worried about lack of chemistry, as long as it is integrated into interdisciplinary groups. Lawrence Mysak noted the lack of climate groups, but realizes there are many other organizations covering this topic. Labeyrie asked how we know about the deep water of the Atlantic Ocean, which left the surface just 100 years ago. We know nothing about this time scale of variability. Sundby stated that we need to integrate different disciplines and approaches to answer this question. Peter Burkill asked how we can integrate these different time scales in relation to critical ocean processes. He thought the balance is actually pretty good. So what we need to do is stimulate discussion when the next call for working group proposals goes out. Groups that are interdisciplinary will fit well with what SCOR is about. Gordon McBean suggested that another important topic would be rapid changes in marine ecosystems. Mike MacCracken added that there are plenty of interesting climate topics to think about, for example, effects of sea level rise, ocean circulation changes, ENSO variability, etc. Labeyrie thinks national committees need more imagination to submit more interesting proposals. Sundby noted that the number of proposals goes up and down, another variable process.

9.0 SCOR-RELATED MEETINGS

9.1 SCOR Annual Meetings

Meeting participants considered potential locations in which to hold future meetings, particularly in nations that have not recently hosted annual meetings.

9.1.1 2007 Executive Committee Meeting – Bergen, Norway

Bjorn Sundby thanked the Norwegian hosts for their hospitality and for their provision of extra funds to help SCOR pay for meeting expenses in Bergen.

9.1.2 2008 General Meeting -- SCOR 50th Anniversary— Woods Hole, USA

SCOR will hold its 2008 meeting in Woods Hole to celebrate SCOR's 50th Anniversary, since Woods Hole was the site of the first SCOR annual meeting, in 1957. The organizing committee (chaired by Laurent Labeyrie) updated meeting participants on plans for the 2008 meeting. The purpose will be to identify the scientific challenges of the next decades and what SCOR's potential role should be, particularly with input from young scientists. The format will include three keynote speakers, three panel discussions, and one large poster session with invited students and young scientists, with strong participation from developing countries. Labeyrie showed the current program. The following suggestions were made:

- Rephrase the question at the beginning of the section on programs so that it is worded in a negative sense.
- Bjorn Sundby should talk last, rather than first, in the last session in order to tie things up. Sundby said that he had in mind to talk about what is important for the survival of SCOR and for the good of ocean science. What about having the incoming President-elect do the wrap up after Bjorn?
- We really want to emphasize the input from young scientists and ask national SCOR committees to propose them.

Vladimir Ryabinin asked if there will there be a vision statement from the meeting. Ed Urban responded that he has a personal bias against this sort of manifestos that come out of meetings. SCOR has asked national committees to commit to three things: (1) to attend the meeting, (2) to send at least one student, and (3) to contribute financial support for it. Lucas Stal congratulated Labeyrie on the program. Labeyrie asked if the program makes people in the room want to attend? That's the point. Stal continued by noting that enough time should be allowed for good round-table discussion in the final panel. Talks at meetings are always are too long and cut into discussion time. Peter Haugan asked about how many participants are expected. Labeyrie responded that we can have up to 100 posters.

9.1.3 2009 Executive Committee Meeting

Tentative expressions of interest for locations of the 2009 SCOR meeting have been made by the International Atomic Energy Agency in Monaco and by the China-Beijing SCOR Committee. Other locations are also possible, depending on interests of National SCOR Committees.

Mingyuan Zhu said that the China-Beijing SCOR committee welcomes SCOR and he showed a few slides. The location will be determined later. The China-Beijing SCOR Committee will arrange for airport pickup, they will provide meals, and perhaps a one-day tour after the meeting. September and October would be the best times. The Executive Committee gratefully accepted China's offer to host the 2009 meeting. Catherine Jeandel noted that France is interested in hosting the 2010 General Meeting; they will provide one-half day of science presentations.

9.2 Other meetings of interest to SCOR

Other SCOR-related meetings are listed on the SCOR Web site.

Dan Walker made a presentation on "Charting the Course of Ocean Science in the United States for the Next Decade", which was issued by the U.S. Joint Subcommittee on Ocean Science and Technology (JSOST). Walker used to be at the U.S. National Academy of Science's Ocean Studies Board and has been at the President's Office of Science and Technology (OSTP) for 10 months. The report he discussed is significant for defining agency budgets. The effort ultimately resulted from the Ocean Studies Board's report *Oceanography for the Next Decade*. The Oceans Act of 2000 called for establishment of an ocean commission to produce a report that required a response from the U.S. Congress. Admiral James Watkins was the chair of the commission and its report has been influential. The Pew Commission ran concurrently and focused on resources. Congress produced the Ocean Action Plan (OAP). A common theme of these reports was that the agencies needed to work together. The OAP created a governance structure that linked to science and resource management, a cabinet level committee. Walker described the structure. Part of this process was the production of the report "Charting the Course..." setting the priorities for U.S. ocean science for the next decade. This is the first nation-wide effort to identify ocean science priorities, building on a lot of prior reports and community input. It is an administration document, so it should impact the government budget process. The report focuses on demonstrating the value of ocean science for society, rather than being formatted along traditional disciplinary lines. The report includes six societal themes:

1. Stewardship of Natural and Cultural Ocean Resources
2. Increasing Resilience to Natural Hazards
3. Enabling Marine Operations
4. The Ocean's Role in Climate
5. Improving Ecosystem Health
6. Enhancing Human Health

Each included about 20 priorities. The report includes cross-cutting themes, such as observing systems and modeling. It links science to decisionmaking and development of greater literacy in the United States about the ocean. The report identifies three "critical elements" to develop near-term priorities—Understanding and Capability to Forecast Ocean Processes, Enhanced Scientific Support for Ecosystem-Based Management, and Targeted Deployment of an Ocean Observing System:

1. Developed to initiate rapid progress toward the 20 national ocean research priorities
2. To be pursued in the next 2-5 years
3. Selected using priority criteria, with an added emphasis on impact, urgency and partnerships
4. Implementation plans for the near-term priorities are being developed

Walker presented some details on each of the four near-term priorities. The report is designed to influence the FY 2009 budget and to ensure that Congress understands the Administration's science priorities. In terms of the implementation strategy, the agencies have committed to produce a report for the coming 10 years every 5 years. International cooperation is included in the report. About every three years they will have a major workshop and they hope for international participation. Walker asked for comments from meeting participants.

Mike MacCracken asked whether ocean acidification, sea level rise, and hurricane forecasting are included in the report. Walker responded that these would fall within the climate change science program; ocean acidification is an "emerging" issue. Ed Urban asked whether there is any specific effort on outreach to international groups. Walker replied that there is not, but they would welcome input from SCOR. Ed Urban responded that one problem that should be addressed is to get co-funded projects between the EU and NSF, for example. A useful thing would be if this process could encourage or support more bilateral funding, for example, for a GEOTRACES cruise. The review processes are so different in NSF and EU; it would be more desirable to co-mingle funds and conduct reviews of the same proposals at both agencies and real joint activities. This would be an ideal to strive for.

Walker asked for feedback on common challenges and pitfalls that other countries have experienced. Peter Burkill responded that he appreciates the report. In the UK they are trying to grapple with long-term vision for ocean science. NERC sees itself as "an intelligent customer," but where does the long-term vision come from? They haven't come up with the process yet. At least in the EU, each Framework Plan does this to some extent. Until other countries have a long-term vision, it will be hard to have good international cooperation. Ralph Schneider responded that one problem with developing such plans is to leave people the room to come up with new ideas.

Robert Duce added that he co-chaired the review of the report and thinks it was very well done. In many countries, the scientific community often gives advice, but such advice is not taken. But in this case, the government asked the community for advice and has taken it and come up with a plan that may really benefit the science. This is a new approach. The review panel did raise the important issue of fundamental research. Bjørn Sundby stated that he likes the way the report brings the science priorities out. But the impact of earlier U.S. National Academy of Sciences reports should not be minimized; they have certainly impressed Sundby. Walker responded with thanks. The reports may have been compelling, but they didn't have much of an impact on the thinking of Congress or on budgets. Lucas Stal asked how much effort will be devoted to assess whether goals have been achieved. People get busy with the next vision and no one goes back to see if the goals of the previous one have been met. Walker responded that the U.S. Office of

Management and Budget does this kind of analysis. Susan Roberts asked how the plan has been received in Congress. Walker responded that the real impact is at the staff level. It is a constant educational process, because of staff turnover. Ed Urban noted that, in terms of outreach to the ocean science community, they should reconsider the venue (bringing everyone to a stand-alone meeting in Denver was not the best idea), or use a meeting of opportunity like AGU. Walker responded that they will have “town hall” sessions at scientific meetings in the future.

Bjørn Sundby closed the meeting by thanking Ed Urban and Elizabeth Gross.

ACRONYMS

ACCENT	Atmospheric Composition Change European Network of Excellence
AGU	American Geophysical Union
AICI	Air-Ice Chemical Interactions (SOLAS and IGAC)
AMEMR	Advances in Marine Ecosystem Modeling
APN	Asia Pacific Network for Global Change Research
AMT	Atlantic Meridional Transect (UK)
AOSB	Arctic Ocean Sciences Board
APARD	Arctic Paleo River Discharge
ASLO	American Society for Limnology and Oceanography
ASOF	Arctic Subarctic Ocean Fluxes
AWI	Alfred Wegener Institute for Polar and Marine Research (Germany)
BELSPO	Belgian Federal Science Policy
BENEFIT	Benguela Environment Fisheries Interaction and Training
BIOSOPE	Biogeochemistry and Optics South Pacific Experiment
BODC	British Oceanographic Data Centre
CACGP	Commission on Atmospheric Chemistry and Global Pollution (IAMAS)
CARBOOCEAN	Marine carbon sources and sinks assessment (EU Integrated Project)
CASIX	Centre of Excellence for the Observation of Air-Sea Interactions and Fluxes (UK)
CCC	Cod and Climate Change (ICES and GLOBEC)
CCCC	Climate Change and Carrying Capacity (PICES and GLOBEC)
CDIAC	Carbon Dioxide Information Analysis Center (US)
CliC	Climate in the Cryosphere (WCRP)
CLIMECO	Climate driving of marine ecosystem changes (CLIVAR, GLOBEC, IMBER)
CLIOTOP	Climate Impacts on Ocean Top Predators (GLOBEC)
CLIVAR	Climate Variability and Prediction project (WCRP)
CNRS	Centre national de la recherche scientifique (France)
COCOS	Coordinated Action for a Carbon Observing System
CODiM	Comparison of Oceanic Dimethylsulfide Models
CoML	Census of Marine Life
COPAS	Centro de Investigación Oceanográfica en el Pacífico Sur-Oriental (Chile)
COST	European Cooperation in the Field of Science and Technical Research
CReefs	Census of Reefs (CoML)
CROZEX	Crozet Natural Iron Bloom and Export Experiment
CRP	Core Research Project (GEOHAB)
CSIC	Institut de Ciències del Mar (Spain)
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
CYBER	CYcles Biogéochimiques, Ecosystèmes et Ressources (France)
DFO	Department of Fisheries and Oceans (DFO)
DiCANN	Dinoflagellate Identification by Artificial Neural Network
DIVERSITAS	An international program of biodiversity science
DLO	data liaison officer
DMC	data management committee
DMS	dimethylsulfide
DMS(P)	dimethylsulfide/dimethylsulfoniopropionate
DOES	Deep Ocean Exchanges with the Shelf
ECOMADR	Integration Analysis of North Adriatic Marine Ecosystem
EGU	European Geophysical Union
EIFEX	European Iron Fertilization Experiment

EO	Executive Officer
ESSAS	Ecosystem Studies of Sub-Arctic Seas (GLOBEC)
ESSP	Earth System Science Partnership (IGBP, WCRP, IHDP, and DIVERSITAS)
ESF	European Science Foundation
EU	European Union
EUROCEANS	European Network of Excellence for Ocean Ecosystem Analysis
FAO	Food and Agriculture Organization (UN)
FMAP	Future of Marine Animal Populations (CoML)
FOA	Friends of Oxygen on Argo
FP	Framework Programme (EU)
GCOS	Global Climate Observing System
GCP	Global Carbon Project
GEOHAB	Global Ecology and Oceanography of Harmful Algal Blooms program (SCOR and IOC)
GEOSS	Global Earth Observing System of Systems
GEOTRACES	An international study of the global marine biogeochemical cycles of trace elements and their isotopes
GESAMP	Group of Experts on the Scientific Aspects of Marine Environmental Protection (UN)
GIS	geographic information system
GlobalNEWS	Global Nutrient Export from Watersheds Program
GLOBEC	Global Ocean Ecosystem Dynamics project (SCOR, IGBP, and IOC)
GOOS	Global Ocean Observing System
GO_SHIP	Global Ocean Ship-based Hydrographic Investigations Panel
HAB	harmful algal bloom
HiT	Halogens in the Troposphere (SOLAS and IGAC)
HMAP	History of Marine Animal Populations (CoML)
IABO	International Association of Biological Oceanography (IUBS)
IAEA	International Atomic Energy Agency
IAI	Inter-American Institute for Global Change Research
IAMAS	International Association of Meteorology and Atmospheric Sciences (IUGG)
iAnZone	International Antarctic Zone program
IAOOS	Integrated Arctic Ocean Observing System
IAPP	International Arctic Polynya Program
IAPSAG	International Aerosol-Precipitation Assessment Group
IAPSO	International Association for the Physical Sciences of the Oceans (IUGG)
IASC	International Arctic Science Committee
ICED	Integrated analyses of circumpolar Climate interactions and Ecosystem Dynamics in the Southern Ocean
ICES	International Council for the Exploration of the Seas
ICSU	International Council for Science
IGAC	International Global Atmospheric Chemistry project (IGBP and CACGP)
IGBP	International Geosphere-Biosphere Programme (ICSU)
IGFA	International Group of Funding Agencies for Global Change Research
IHDP	International Human Dimensions of Global Change Programme (ICSU)
IMAGES	International Marine Global Changes Study (IGBP/PAGES)
IMBER	Integrated Marine Biogeochemistry and Ecosystem Research project (SCOR and IGBP)
IMO	International Maritime Organization
IMP	Implementation Group (SOLAS)
INI	International Nitrogen Initiative
InterMARGINS	An international and interdisciplinary initiative concerned with all aspects of continental margin research.
InterRidge	An initiative for international cooperation in ridge-crest studies

IOC	Intergovernmental Oceanographic Commission (UNESCO)
IOCCG	International Ocean Colour Coordinating Group
IOCCP	International Ocean Carbon Coordination Project (IOC and SCOR)
IPCC	Intergovernmental Panel on Climate Change
IPHAB	Intergovernmental Panel on Harmful Algal Blooms (IOC)
IPO	international project office
IPY	International Polar Year
IR	InterRidge
IRD	Institut de Recherche pour le Développement (France)
ISAC	International Study on Arctic Change
ISSN	International Standard Serial Number
IUBS	International Union of Biological Sciences (ICSU)
IUEM	Institut Universitaire Européen de la Mer
IUGG	International Union of Geodesy and Geophysics (ICSU)
JGOFS	Joint Global Ocean Flux Study (SCOR and IGBP)
JSOST	Joint Subcommittee on Ocean Science and Technology
KEOPS	Kerguelen :compared study of the Ocean and the Plateau in Surface water
KORDI	Korean Ocean Research and Development Institute
LDEO	Lamont-Doherty Earth Observatory (US)
LEFE	Fluid Envelopes and Environment project
LINKS	WG 124 on Analyzing the Links Between Present Oceanic Processes and Paleo-Records (SCOR and IMAGES)
LOICZ	Land-Ocean Interactions in the Coastal Zone project (IGBP and IHDP)
LORECS	Long-term Observation and Research of the East China Sea (China-Taipei)
MAP	Marine Aerosol Production (Ireland)
MAPHiNS	Marine Multi-Phase Halogen Chemistry and its Coupling to Nitrogen and Sulfur Cycles
MAR	Mid-Atlantic Ridge
MARBEF	Marine Biodiversity and Ecosystem Functioning Network of Excellence (EU)
MAR-ECO	Mid-Atlantic Ridge project (CoML)
MEAD	Marine Effects of Atmospheric Deposition (EU)
MOU	Memorandum of Understanding
NaGISA	Natural Geography In Shore Areas project (CoML)
NASA	National Aeronautics and Space Administration (US)
NERC	Natural Environmental Research Council (UK)
NIO	National Institute of Oceanography (India)
NIWA	National Institute of Water & Atmospheric Research Ltd. (New Zealand)
NM	Nominated Member (SCOR)
NOAA	National Oceanic and Atmospheric Administration (US)
NOC	National Oceanography Centre (UK)
NSF	National Science Foundation (US)
OAP	Ocean Action Plan (US)
OASIS	Ocean-Atmosphere-Sea Ice-Snow project
OBIS	Ocean Biogeographic Information System (CoML)
OBCM	ocean biogeochemical climate model
OceanSITES	a worldwide system of long-term, deepwater reference stations
OOMPH	Organics over the Ocean Modifying Particles in both Hemispheres
ORION	Ocean Research Interactive Observatory Network
OSC	open science conference
OSM	open science meeting

OSTP	President's Office of Science and Technology (US)
P2P	Precursors to Particles
PACE	WG on Reconstruction of Past Ocean Circulation (SCOR and IMAGES)
PACKMEDS	Dynamics of semi-enclosed marine systems: the integrated effects of changes in sediment and nutrient input from land (SCOPE, IAPSO, and SCOR)
PAGES	Past Global Changes project (IGBP)
PANGAEA	Publishing Network for Geoscientific & Environmental Data
PICES	North Pacific Marine Science Organization
POGO	Partnership for Observations of the Global Oceans
PROOF	French acronym for biogeochemical processes in the ocean and fluxes
SAGE	SOLAS-ANZ Dual Tracer Gas Exchange Experiment
SASSI	Synoptic Antarctic Shelf-Slope Interactions Study (iAnZone)
SBE	Shelf-Basin Exchanges project
SCAR	Scientific Committee on Antarctic Research (ICSU)
SCOPE	Scientific Committee on Problems of the Environment (ICSU)
SCOR	Scientific Committee on Oceanic Research (ICSU)
SEARCH	Study of Arctic Change
SEATS	South East Asia Time-Series Station (China-Taipei)
SEEDS	Sub-Arctic Ocean Enrichment and Ecosystem Dynamics Study (Japan)
SERIES	Subarctic Ecosystem Response to Iron Enrichment Study
SIBER	Sustained Indian Ocean Biogeochemical and Ecological Research
SIC	SOLAS/IMBER Carbon Research Implementation group
SIDA	Swedish International Development Agency
SOCO2V	Surface Ocean CO ₂ : Variability and Vulnerability meeting
SOFEX	Southern Ocean Iron Experiment
SOIREE	Southern Ocean Iron Enrichment Experiment
SOLAS	Surface Ocean-Lower Atmosphere Study (SCOR, IGBP, WCRP, and CACGP)
SOPRAN	Surface Ocean Processes in the Anthropocene (Germany)
SPACC	Small Pelagic fish and Climate Change project (GLOBEC)
SP/IS	Science Plan/Implementation Strategy
SSC	scientific steering committee
SSG	scientific steering group
START	the global change SysTEM for Analysis, Research and Training
SWEET	Straight Watch on the Environment and Ecosystem with Telemetry (China-Taipei)
TEIs	trace elements and isotopes
TNO	The Netherlands Institute for Applied Geoscience
TOS	The Oceanography Society
TTT	Transition Task Team (GLOBEC, IMBER)
UBO	Université de Bretagne Occidentale
UEA	University of East Anglia (UK)
ULB	Université Libre de Bruxelles
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNFCCC	UN Framework Convention on Climate Change
USP	University of São Paulo (Brazil)
VAMOS	Variability of American Monsoon Systems (CLIVAR)
VOCALS	VAMOS Ocean Cloud Atmosphere Land Study
WCRP	World Climate Research Programme (WMO, IOC, and ICSU)
WG	working group
WHOI	Woods Hole Oceanographic Institution (US)

WMO
W-PASS

World Meteorological Organization
Western Pacific Air-Sea Interaction Study

Annex 1 - AGENDA

1.0 OPENING

1.1	Opening Remarks and Administrative Arrangements	<i>Sundby, Urban</i>
1.2	Approval of the Agenda	<i>Sundby</i>
1.3	Report of the President of SCOR	<i>Sundby</i>
1.4	Report of SCOR Executive Director	<i>Urban</i>
1.5	Appointment of an <i>ad hoc</i> Finance Committee	<i>Sundby</i>
1.6	<i>Ad hoc</i> Committee to Review the Disciplinary Balance of SCOR's Activities	<i>Sundby</i>
1.7	2008 Elections for SCOR Officers	<i>Duce</i>

2.0 WORKING GROUPS

2.1	Disbanded Working Groups	
2.1.1	WG 78—Determination of Photosynthetic Pigments in Seawater	<i>Urban</i>
2.2	Current Working Groups	
2.2.1	WG 111—Coupling Winds, Waves and Currents in Coastal Models	<i>Mysak</i>
2.2.2	WG 115—Standards for the Survey and Analysis of Plankton	<i>Pierrot-Bults</i>
2.2.3	WG 116—Sediment Traps and ²³⁴ Th Methods for Carbon Export Flux Determination	<i>Labeyrie</i>
2.2.4	SCOR/IOC WG 119—Quantitative Ecosystems Indicators for Fisheries Management	<i>Burkill</i>
2.2.5	WG 120—Marine Phytoplankton and Global Climate Regulation: The <i>Phaeocystis</i> Species Cluster As Model	<i>Kuparinen</i>
2.2.6	SCOR/IAPSO WG 121—Ocean Mixing	<i>Akulichev</i>
2.2.7	SCOR/LOICZ/IAPSO WG 122—Estuarine Sediment Dynamics	<i>Sundby</i>
2.2.8	SCOR/IMAGES WG 123—Reconstruction of Past Ocean Circulation (PACE)	<i>Labeyrie</i>
2.2.9	SCOR/IMAGES WG 124— Analyzing the Links Between Present Oceanic Processes and Paleo-records (LINKS)	<i>Labeyrie</i>
2.2.10	WG 125—Global Comparisons of Zooplankton Time Series	<i>Pierrot-Bults</i>
2.2.11	WG 126—Role of Viruses in Marine Ecosystems	<i>Kuparinen</i>
2.2.12	SCOR/IAPSO WG 127 on Thermodynamics and Equation of State of Seawater	<i>Mysak</i>
2.2.13	WG 128 on Natural and Human-Induced Hypoxia and Consequences for Coastal Areas	<i>Duce</i>
2.2.14	SCOR/IAPSO WG 129 on Deep Ocean Exchanges with the Shelf	<i>MacCracken</i>
2.2.15	SCOR WG 130 on Automatic Plankton Visual Identification	<i>Burkill</i>
2.4	New Working Group Proposals	
2.4.4	Working Group on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems	<i>Kuparinen</i>
2.3.2	Working group on the Coral Triangle: The centre of maximum marine biodiversity	<i>Burkill</i>
2.3.3	The Legacy of <i>in situ</i> Iron Enrichments: Data Compilation and Modeling	<i>Duce</i>

3.0 LARGE-SCALE SCIENTIFIC PROGRAMS

3.1	SCOR/IGBP/IOC Global Ocean Ecosystems Dynamics (GLOBEC) Project	<i>Burkill</i>
3.2	SCOR/IOC Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Program	<i>Hong</i>
3.3	SCOR/IGBP Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project	<i>Duce</i>
3.4	GEOTRACES Project	<i>Duce</i>
3.5	SCOR/IGBP/WCRP/CACGP Surface Ocean-Lower Atmosphere Study	<i>Hong</i>

4.0 OCEAN CARBON AND OTHER ACTIVITIES

4.1	IOC/SCOR International Ocean Carbon Coordination Project (IOCCP)	<i>Sundby, Urban</i>
4.2	SCOR-IOC International Symposium on “The Ocean in a High-CO ₂ World”	<i>Duce</i>
4.3	Other Activities	
4.3.1	SCOR Summit of International Marine Research Projects	<i>Burkill, Sundby, Urban</i>
4.3.2	Panel on New Technologies for Observing Marine Life	<i>Pierrot-Bults</i>
4.3.3	SOLAS/INI Workshop on Anthropogenic Nitrogen Impacts on the Open Ocean	<i>MacCracken</i>

5.0 CAPACITY-BUILDING ACTIVITIES

5.1	SCOR Committee on Capacity Building	<i>Ittekkot</i>
5.1.1	Regional Graduate Schools of Oceanography and Marine Environmental Sciences	<i>Ittekkot</i>
5.1.2	POGO-SCOR Visiting Fellowships for Oceanographic Observations	<i>Urban</i>
5.1.3	SCOR Reports to Developing Country Libraries	<i>Urban</i>

6.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS

6.1	Intergovernmental Oceanographic Commission	<i>Sundby</i>
6.1.1	Global Ocean Observing System (GOOS)	<i>Hong</i>
6.2	Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)	<i>Duce</i>
6.3	North Pacific Marine Science Organization (PICES)	<i>Akulichev</i>

7.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

7.1	International Council for Science	<i>Sundby, Urban</i>
7.1.1	International Geosphere-Biosphere Program (IGBP)	<i>Duce, Sundby</i>
7.1.2	World Climate Research Programme (WCRP)	<i>Ryabinin</i>
7.1.3	Scientific Committee on Antarctic Research (SCAR)	<i>Kuparinen</i>
7.1.4	Scientific Committee on Problems of the Environment (SCOPE)	<i>Sundby, Pierrot-Bults</i>

7.2	Affiliated Organizations	
7.2.1	International Association for Biological Oceanography (IABO)	<i>Pierrot-Bults</i>
7.2.2	International Association for Meteorology and Atmospheric Sciences (IAMAS)	<i>MacCracken</i>
7.2.3	International Association for the Physical Sciences of the Oceans (IAPSO)	<i>Mysak</i>
7.3	Affiliated Programs	
7.3.1	Applications for New Affiliated Programs: InterMARGINS	<i>Labeyrie</i>
7.3.2	Census of Marine Life (CoML)	<i>Burkill</i>
7.3.3	International Antarctic Zone (iAnZone) Program	<i>Orsi, Kuparinen</i>
7.3.4	International Marine Global Changes Study (IMAGES)	<i>Labeyrie</i>
7.3.5	InterRidge - International, Interdisciplinary Ridge Studies	<i>Labeyrie</i>
7.3.6	International Ocean Colour Coordinating Group (IOCCG)	<i>Kuparinen</i>
7.4	Other Organizations	
7.4.1	Partnership for Observation of the Global Ocean (POGO)	<i>Duce</i>
7.4.2	Arctic Ocean Sciences Board (AOSB)	<i>Loeng</i>

8.0 ORGANIZATION AND FINANCE

8.1	Membership	
8.1.1	National Committees	<i>Duce, Urban</i>
8.2	Publications Arising from SCOR Activities	<i>Urban</i>
8.3	Finances	<i>Finance Committee, Urban, Gross</i>
8.4	The Disciplinary Balance among SCOR Working Groups	<i>Disciplinary Balance Committee</i>

9.0 SCOR-RELATED MEETINGS

9.1	SCOR Annual Meetings	
9.1.1	2007 Executive Committee Meeting – Bergen, Norway	<i>Sundby</i>
9.1.2	2008 General Meeting -- SCOR 50 th Anniversary— Woods Hole, USA	<i>Labeyrie</i>
9.1.3	2009 Executive Committee Meeting	<i>Sundby</i>
9.2	Other meetings of interest to SCOR	<i>Urban</i>

Annex 2 – Participants

38th SCOR EXECUTIVE COMMITTEE MEETING Bergen, Norway 26-28 August 2007

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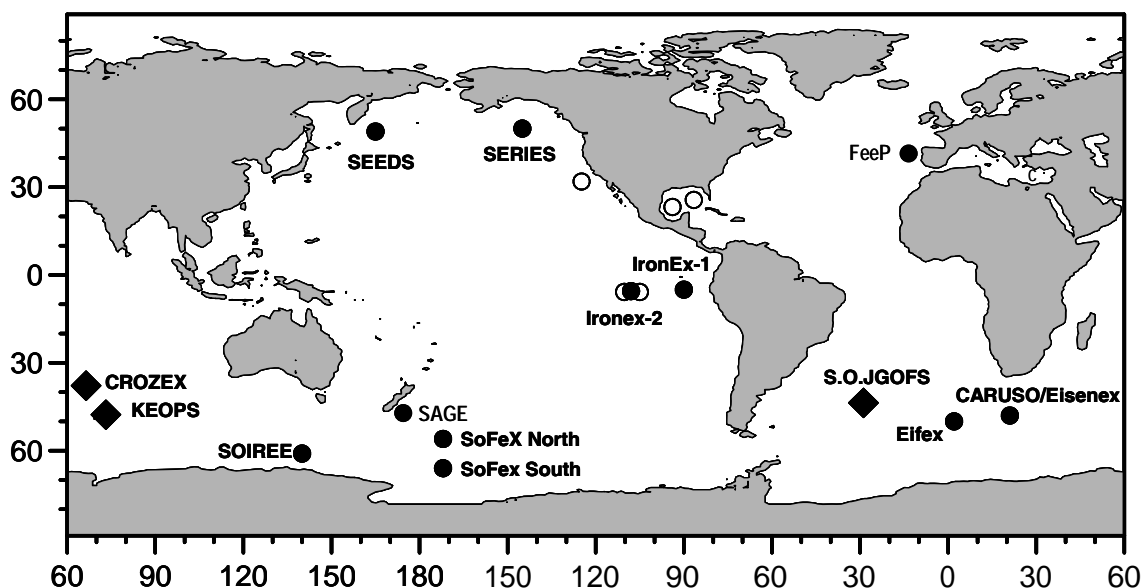
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Annex 3 - Proposal for a SCOR Working Group on The Legacy of *in situ* Iron Enrichments: Data Compilation and Modeling

Introduction

From 1993 onwards there have been 10 *in situ* iron fertilization experiments, from Ironex-1 (1993) to SEEDS-2 (2004), as well as 3 natural fertilization studies (1992 Southern Ocean JGOFS, 2004-2005 CROZEX, 2005 KEOPS). Primary results of individual experiments have been reported in *Nature* and *Science* as well as in oceanography journals, sometimes in special issues of journals like *Deep-Sea Research II* and *Progress in Oceanography*. For the most recent experiments (e.g. Eifex 2004, SEEDS-2, CROZEX, KEOPS) several articles have either been published or are accepted for publication.

Synthesis of the combined experiments has only just now started with one first semi-quantitative effort by multiple authors (*de Baar et al., 2005*) focusing on only the most basic variables (i.e., primary production, major nutrients, CO₂ system variables) of the then-available 8 experiments. This is seen as the modest first step towards more rigorous quantitative assessment by ecosystem simulation modeling of these unique time-series experiments. Nevertheless, several remarkable trends are becoming apparent from the combination of experiments. For example, light limitation due to depth of the wind-mixed layer was highly significant, and the major floristic response was always by larger size class diatoms, with almost universal flourishing of *Pseudonitzschia* sp. Unfortunately, during this first synthesis effort it was found that integrated datasets of even the earlier single experiments of the 1993-2000 period hardly existed, with one laudable exception (SOIREE, data CD in 2001 *DSR-II* special issue). At most, the individual scientists had their own data files which were kindly and generously made available. Sometimes fundamental data (e.g., hydrography, incoming sunlight or PAR) could hardly be traced; some other data of interest could not be located in time vis-à-vis the publication time frame of the synthesis article.



The *in situ* fertilization experiments (filled dots) and natural fertilization studies (filled diamonds) thus far: S.O.JGOFS (1992), IronEx-1 (1993), IronEx-2 (1995), SOIREE (1999), CARUSO/EisenEx (2000), SEEDS-1 (2001), SOFeX-North (2002), SOFeX-South (2002), SERIES (2002), EIFEX (2004), SAGE (2004), FEEP (2004), SEEDS-2 (2004), CROZEX (2004/2005), KEOPS (2005). Cyclops (C in East Mediterranean) P fertilization, FeCycle (not shown) and various pilot experiments (open circles) are beyond scope of this WG proposal (map after *deBaar et al., 2005*)

In addition to this synthesis of basic variables of the first 8 experiments, there have been some recent articles combining 2-3 experiments for specific topics, that is, CO₂ budgeting (*Bakker et al. 2005*) and DMS(P) processes (*Turner et al., 2004*).

A special synthesis workshop (FeAX) was held in Wellington (New Zealand) in November 2005 under the aegis of SOLAS. The insights gained during that workshop have been reported in a recent multi-authored article in *Nature* (Boyd *et al.*, 2007). At this meeting it was unanimously agreed by all participants that a special effort should be developed towards establishing a common open-access database of the *in situ* iron enrichment experiments. From this unanimous agreement follows this proposal for a SCOR WG. Success of this group could provide a model for data synthesis within SOLAS, IMBER, and other projects.

Rationale

The iron enrichment experiments have been done at great expenditure of scientists' time, research vessel time, and other costs. Thus overall, taxpayers of various nations worldwide have invested heavily in these experiments. Yet apart from the typical first round of articles on any single experiment, this investment has not led to an international resource or heritage. The already collected but thus far widely scattered data, once brought together, would be extremely valuable for various reasons:

- the ocean science community needs to fully exploit the results of preceding *in situ* experiments before proposing and implementing the next generation of experiments. In other words, there is no credibility to continue asking taxpayers to subsidize one experiment after another in the future, unless the ocean science community first fully exploits the investments of the past decade. Full use of existing data may yield insights to help design future experiments.
- properly compiled datasets of both natural and *in situ* iron fertilizations will allow the application of 'generic' simulation modeling, thus yielding insights and model robustness far beyond what is feasible by simulating just one experiment.
- the value of the experiments is far beyond the 'iron issue'. For example, the experiences and findings of labeling (SF_6 and sometimes ^3H as well) and following a patch of water are most valuable for designing future 'lagrangian' experiments for a wide variety of purposes. If nothing else, the dispersion of the added tracer(s) is a powerful tool for quantifying lateral and vertical mixing in the surface oceans. Moreover, the practical ability to follow a surface water mass or 'patch' over periods of weeks to months allows a wide range of topical biogeochemistry studies.

Objectives

The objectives of the proposed working group are twofold:

1. Data compilation. Assembling a common open-access database of the *in situ* iron experiments, beginning with the first period (1993-2002; Ironex-1, Ironex-2, SOIRE, EisenEx, SEEDS-1; SOFeX, SERIES) where primary articles have already been published, to be followed by the 2004 experiments where primary articles are now in progress (EIFEX, SEEDS-2; SAGE, FeeP). Similarly for the natural fertilizations S.O. JGOFS (1992), CROZEX (2004/2005) and KEOPS (2005).
2. Modeling and data synthesis of specific aspects of two or more such experiments for various topics, such as physical mixing, phytoplankton productivity, overall ecosystem functioning, iron chemistry, CO_2 budgeting, nutrient uptake ratios, DMS(P) processes, and combinations of these variables and processes.

1. Data compilation

An international Working Group under the aegis of SCOR and with full endorsements by SCAR, SOLAS, IMBER is deemed essential for success in compiling all the appropriate databases. At the planning stages of each experiment, mutual access of data is commonly agreed and most funding agencies require the data to enter the public domain within 24-36 months after completion of the granted project. Nevertheless, in practice, compilations beyond individual investigators rarely occur, for a variety of reasons:

- Projects tend to be under-funded, often subject to budget cuts before granting, and the originally intended data management often is quietly sacrificed.

- At the level of the individual scientist only the most essential data are rapidly picked out for publication of articles, and an individual dataset often is not even compiled. Scientists are under considerable time pressure for publishing scientific articles and applying for future research funding. As a result the data management and submission to a central database too often is neglected.
- Some types of data can be produced relatively rapidly, and are sometimes already available at the end of the cruise, while other types of data require much painstaking labor afterwards in the home laboratory. Physical oceanography data tend to become available for the community at large within 2-3 months, but marine chemists and biologists seem to be far slower in data dissemination.

In summary, our marine science community at the onset of each new project has been intending data management and eventual open access, yet for various reasons in the end this has rarely been accomplished. This proposal aims to remedy this situation for the *in situ* iron enrichment experiments and natural fertilization studies, which may also serve to improve data practice of other, future ocean experiments.

An international Working Group will be able to set the example (i) for readily making available data, first to colleagues of the given experiment and next to the open access database, (ii) for proper recognition of the original scientist, (iii) for spreading the good practice of fast data dissemination in one discipline to other disciplines with a slower culture for data dissemination, and (iv) for re-assuring hesitant scientists about protection of their interests as the original data producer.

2. Modeling and data synthesis

Simulation models pivoting around phytoplankton ecology have thus far been performed independently for SOIREE (Hannon et al., 2001), IronEx (Chai et al., 2002), SEEDS-1 (Yoshie et al., 2005), SERIES (Takeda et al., 2005; Denman et al., in press), and comparison of Ironex-SOIREE-SEEDS (Fujii et al., 2005; Fujii and Chai, submitted). Moreover, there exists a refined simulation model on DMS(P) of SERIES (LeClainche et al., 2006). For physical mixing versus dispersion of SF₆ tracer, efforts are being made by Goldson, Law and others. Implications for Ocean Biogeochemical Climate Models (OBCMs) including full ocean circulation and cycling of trace element iron are being pursued by Follows, Sarmiento and others. In general within each class of models, that is, plankton models, mixing models, OBCMs, the individual models vary widely in design and objectives, and much can be learned by comparison between such models.

The Working Group will in a suite of 2-3 workshops bring together these modelers and key experimentalists to encourage data synthesis, compare models, define common standard scenarios for validation and, in general, make available the compiled datasets (objective 1) to the wider scientific community.

Terms of Reference

Within the proposed 4-year period of existence, the WG plans to achieve the below objectives. Work on the first objective is already underway for several of the experiments, yet on the other hand this first objective is also essential before the next objectives 2, 3, and 4. can be realized. Therefore, we propose approval and implementation of the WG in two steps. In the first step, the WG would be formed and would be funded to work on only the first Term of Reference. Once this is realized and approved by SCOR, the remaining second part of the usual WG funding would be approved by SCOR and allocated towards realization of the remaining objectives 2. and 3. and 4. Thus, the corresponding four Terms of Reference would be as follows:

1. Compilation of a database for open access (via the Internet) of the following experiments:
 - 1.1. the 1999-2001 era (IronEx-1, IronEx-2, SOIREE, EisenEx, SEEDS-1), plus 1992 S.O. JGOFS
 - 1.2. the 2002 experiments (SOFeX-North, SOFeX-South, SERIES)
 - 1.3. the 2004 experiments (Eifex, SEEDS-2, SAGE, FeeP), plus natural fertilizations CROZEX, KEOPS

This effort will include a commonly agreed data policy for users to best acknowledge the original data producers (e.g., by offering co-authorship and perhaps assignment of digital object identifiers for individual data sets). Obviously, a practical description of methods used, calibration etc. (so-called metadata) will also be included. In essence, the WG members are committed to send their data files to the common data centre, and encourage their colleagues in any given experiment to do the same. Finally, an official data publication or publication(s) will be placed in a suitable venue, for example, in the

special issue on the SCOR WG (see item 4. below) and in *Eos* (Transactions Am. Geophys. Union). In 2006-2007 efforts are already underway for compilation and rescue of the EisenEx dataset, also there is very good progress for SEEDS-2, SERIES, CROZEX and KEOPS. However, the statement in the original proposal that no meeting would be necessary to achieve the first term of reference was overly optimistic. It appears that a face-to-face meeting sponsored by SCOR or some other internationally recognized organization is necessary to work out the details of bringing together the data sets in a way that will make it possible to achieve the other terms of reference.

2. Organization of 2-3 workshops where simulation modelers and key scientists of the experiments will meet. These workshops will be publicized in advance (SCOR website, other websites and newsletters) to allow colleagues beyond the actual WG membership to express interest in participation. Colleagues from developing nations will actively be encouraged to attend.

3. Organization of 2-3 special sessions at international marine science conferences will encourage a broad participation from scientists not yet involved in the activity.

4. Publication of new synthesis papers based on data comparison, a suite of simulation modeling articles, as well as the common database (i.e., its brief description) in a special issue of an oceanographic journal, as well as a multi-authored paper with recommendations for the next generation of *in situ* experiments and other types of process studies. The latter will include guidelines and advice on standardization of measurement protocols, as well as best procedures to ascertain timely submission of experimental data to a common database.

Optional. Beyond the above 4 terms of reference to be accomplished, the WG may organize or contribute to a training and education activity, for example, a summer school.

Data Management

The EUR-OCEANS Network of Excellence comprises a Data Integration and Networked Database task force with major objectives: (1) to rescue relevant historical datasets, (2) to organise long-term archiving of scientific information, (3) to develop an electronic portal for online access and dissemination. Dr. Nicolas Dittert, as head of this task force, will also be Full Member of the proposed SCOR WG, and relies on the permanent data centres World Data Centre-MARE (Bremen) and PANGAEA (AWI, Bremerhaven) for implementation of the above Terms of Reference number 1. The WDC-MARE is within the WDC Network linked with the relevant data centres in North America (e.g., CDIAC at Oak Ridge), Asia and other regions. The World Data Centres will also ensure long-term data storage.

Working Group Membership

Full and associate membership aims for a good mix of junior and senior scientists in both categories, where senior colleagues are urged to pursue own funds for workshop participation, thus allowing optimal allocation of the WG budget to participation of junior scientists.

Membership includes a mixture of pivotal leaders of the experiments, as well as scientists from the range of disciplines, as well as various modelers. In accordance with SCOR requirements, the Working Group consists of 10 Full Members. An extensive group of Associate Members will be sought in order to ensure the necessary additional expertise, as well as representation from the various *in situ* experiments, natural experiments, and simulation modeling. Both for Full Members and Associate Members, appropriate representation of both gender and developing country scientists is achieved. Several more excellent scientists are envisioned to contribute datasets and/or modeling expertise via liaison with the Full and Associate Members, and workshops will be open to draw in a broad involvement. Below is a suite of names of Liaison Scientists, to which more names will be added in due course.

<u>Name</u>	<u>Major Relevant Expertise</u>	<u>Experiment(s)</u>	<u>Nation</u>
<i>Co-chairs:</i>			
Bakker, Dorothee	CO ₂ system	S.O.JGOFS, SOIREE, EisenEx, CROZEX	UK
Boyd, Philip	plankton ecology	SOIREE, SERIES	New Zealand
<i>Other Full Members:</i>			
Bathmann, Uli	polar mesozooplankton	S.O. JGOFS, EisenEx, Eifex	Germany
Coale, Kenneth	iron-biota experiments	Ironex-1&2, SOFeX	USA
De Baar, Hein	iron and CO ₂ , Geotraces	S.O.JGOFS, EisenEx	Netherlands
Dittert, Nicolas	data management	EUR-OCEANS and WDC-MARE	European Union
Minhan Dai	ocean cycling of carbon and metals	GEOTRACES	China
Levasseur, Maurice	DMS(P) and plankton	SEEDS-2, SERIES	Canada
Takeda, Shigenobu	iron chemistry & biology	SEEDS-1&2, SERIES	Japan
Pollard, Raymond	physical oceanography	CROZEX	UK
<i>Associate Members:</i>			
Assmy, Philip	diatom responses	EisenEx, Eifex	Germany
Blain, Stephane	iron biogeochemistry	KEOPS	France
Buesseler, Ken	export production	IronEx, SOFeX	USA
Croot, Peter	iron chemistry	Eisenex, SOFeX, Eifex	Germany
Denman, Ken	modeling	SERIES	Canada
Goldson, Laura	tracer dispersion & mixing	EisenEx, SOFeX	UK
Follows, Mick	various modeling including OBCMs		USA
Fujii, Masahiko	simulation modeling	SEEDS-1&2, SERIES	Japan
Hong, Huasheng	ocean biogeochemistry		China
Kozyr, Alex	ocean CO ₂ data management	CDIAC, Oak Ridge	USA
Law, Cliff	tracer dispersion & mixing	SOIREE, SERIES	New Zealand
Marchetti, Adrian	diatom responses	SERIES	Canada
Nishioka, Jun	iron physical chemistry	EisenEx, SEEDS-1&2, SERIES	Japan
Rijkenberg, Micha	iron photoredox chemistry	SOIREE, EisenEx	UK
RutgersVanDerLoeff, Michiel	export production	GEOTRACES, S.O. JGOFS, EisenEx	Germany
Schoemann, Veronique	iron-phytoplankton, <i>Phaeocystis</i>		Belgium
Strass, Volker	polar physical oceanography	EisenEx, Eifex	Germany
Tsuda, Atsushi	zooplankton ecology	SEEDS-1&2, SERIES	Japan
Tung, Yuan-Ho	marine chemistry and ecology		Taiwan
Turner, Sue	DMS(P) cycles	IronEx, SOIREE, EisenEx	UK
Timmermans, Klaas	iron-diatom interactions	EisenEx, KEOPS	The Netherlands
Twining, Benjamin	intracellular iron	SOFeX	USA
Watson, Andy	CO ₂ system, tracer dispersion	IronEx I, SOIREE, EisenEx	UK
Wingenter, O.	rarely studied trace gases	SOFeX	USA
Wang, Wen-Xiong	trace elements uptake and transfer in phyto-zooplankton		China
Zhong, Shaojun	GEOTRACES Standards and Intercalibration task team		China

Liaison Scientist:

(Liaison Scientists will be informed about and invited to all activities, they will submit datasets and/or are involved as simulation modeling experts. The below names merely are the beginning of a growing list of enthusiastic colleagues, each with excellent scientific credentials)

Gnanadesikan, Anand	ocean modeling including OBCM's, iron cycle		USA
Le Clainche, Yvonnick	ecosystem DMS(P) modeling	SERIES	Canada
Nightingale, Philip	tracer dispersion, air/sea	IronEx, EisenEx	UK
Rivkin, Richard	bacterial responses	SERIES	Canada
Sanders, Richard	carbon export	CROZEX	UK
Sarmiento, Jorge	ocean modeling including OBCM's, iron cycle		USA
Savoye, Nicolas	export production	Eifex	France
Vezina, Alain	ecosystem inverse modeling, DMS(P)		Canada

Endorsements and Financial Support and Budget

This SCOR Working Group proposal has been endorsed by SCAR in its July 2006 meeting at Hobart, and by the Scientific Steering Committees of SCOR-IGBP-SOLAS, SCOR-IGBP-IMBER, and SCOR-GEOTRACES. These endorsements are of primary importance for fostering the constructive, collaborative spirit essential to meet the terms of reference. Copies of endorsement letters/documents are available on request. Nevertheless, SCOR is envisioned to take primary responsibility and accountability for the proposed working group.

The standard budget for a SCOR WG would allow organization of 3 workshops for 10-12 Full Members at a cost of US \$ 15000 per workshop, i.e. in the order of US \$ 45000 in total. The first installment of the subsidy would be allocated for the first workshop aiming primarily at the first Term of Reference.

Other participants would finance their travel costs from their own sources. Nevertheless additional finances may well be realized towards supporting Associate members, as well as financing other costs such as data management expenses or publication costs. We envision considering video-conferencing as another approach in order to save travel time and expenses as well as to avoid CO₂ emissions. Once this initiative is approved and established as a SCOR Working Group, we hope that national agencies (and the European Union) will be more convinced that their contributions are justified. These may range from a travel grant of one scientist of such nation, to hosting one of the workshops. For example Dr. Minhan Dai (China) and Prof. De Baar (The Netherlands) are confident in being able to raise national support for hosting one workshop in their country.

References of overview articles each containing many more references

- Boyd, P., T. Jickells, C. Law, S. Blain, E. Boyle, K. Buesseler, K. Coale, J. Cullen, H. de Baar, M. Follows, M. Harvey, C. Lancelot, M. Levasseur, R. Pollard, R. Rivkin, J. Sarmiento, V. Schoemann, V. Smetacek, S. Takeda, A. Tsuda, S. Turner, A. Watson (2007) Mesoscale iron-enrichment experiments 1993-2005: synthesis and future directions. *Science*, 315, 612-617.
- De Baar, H.J.W., P.W. Boyd, Kenneth H. Coale, Michael R. Landry, Atsushi Tsuda, Philip Assmy, D.C.E. Bakker, Y. Bozec, R.T. Barber, M.A. Brzezinski, K.O. Buesseler, M. Boyé, P. L. Croot, F. Gervais, M.Y. Gorbunov, P. J. Harrison, W.T. Hiscock, P. Laan, C. Lancelot, C. Law, M. Levasseur, A. Marchetti, F. J. Millero, J. Nishioka, Y. Nojiri, T. van Oijen, U. Riebesell, M.J.A. Rijkenberg, H. Saito, S. Takeda, K.R. Timmermans, M. J.W. Veldhuis, A. Waite and C.S. Wong (2005) Synthesis of Iron Fertilization Experiments: From the Iron Age in the Age of Enlightenment. In: Orr, J. C., S. Pantoja, and H.-O. Pörtner (eds.) *The Oceans in High CO₂ World*, Special Issue of *J. Geophys. Res. (Oceans)*, 110, C09S16, doi:10.1029/2004JC002601, pp 1-24.
- Jickells, T.D., Z. S. An, K. K. Andersen, A. R. Baker, G. Bergametti, N. Brooks, J. J. Cao, P. W. Boyd, R. A. Duce, K. A. Hunter, H. Kawahata, N. Kubilay, J. laRoche, P. S. Liss, N. Mahowald, J. M. Prospero, A. J. Ridgwell, I. Tegen, R. Torres (2005) Global Iron Connections Between Desert Dust, Ocean Biogeochemistry, and Climate, *Science*, 308,

67-71.

Recent relevant article on the natural Fe fertilization study KEOPS:

Blain, S., B. Queguiner, L. Armand, S. Belviso, B. Bombled, L. Bopp, A. Bowie, C. Brunet, C. Brussaard, F. Carlotti, U. Christaki, A. Corbiere, I. Durand, F. Ebersbach, J.-L. Fuda, N. Garcia, L. Gerringa, B. Griffiths, C. Guigue, C. Guillard, S. Jacquet, C. Jeandel, P. Laan, D. Lefevre, C. Lo Monaco, A. Malits, J. Mosseri, I. Obernosterer, Y.-H. Park, M. Picheral, P. Pondaven, T. Remenyi, V. Sandroni, G. Sarthou, N. Savoye, L. Scouarnec, M. Souhaut, D. Thuiller, K. Timmermans, T. Trull, J. Uitz, P. van Beek, M. Veldhuis, D. Vincent, E. Viollier, L. Vong, T. Wagener (2007) Effect of natural iron fertilization on carbon sequestration in the Southern Ocean, *Nature*, 446, 1070-1075.

Annex 4 - Proposal for SCOR Working Group on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems

Abstract

Nutrient over-enrichment (*eutrophication*) from land-based sources has degraded estuarine and coastal marine waters worldwide. Eutrophication has been linked to the increased prevalence of harmful algal blooms (HABs) that cause serious ecological, economic, and human health impacts. Yet, the linkage between nutrient loading and HABs currently lacks a firm, quantitative foundation. This working group will assess and compare *spatial* relationships between changing global nutrient exports and loads and the proliferation of major HAB species around the world. However, nutrient loads alone are likely not sufficient to predict where certain HABs may occur. Therefore, the patterns in nutrient loads and HABs will be further evaluated in the context of physical characteristics of the receiving waters (the typology) as well as the type of HAB (functional group) and their physiological characteristics. We will use a range of global databases and models in these analyses, including spatially explicit watershed nutrient export models, ecosystem and physiological models, and statistical approaches. This project will advance predictive capability of the extent of blooms, the dominant harmful taxa involved, and our ability to manage these HABs by an improved understanding of the impacts of nutrients on HABs. Products will be 1) a series of peer-reviewed papers, ideally in a dedicated special issue, 2) an atlas of maps of global HABs and nutrient export, as well as future predicted scenarios which will be included in the papers and on a web site; 3) a graphic-rich report (under the GEOHAB umbrella) which will be produced and made available in print and on the web; and 4) short articles for the GEOHAB newsletter and/or GEOHAB and Global NEWS websites.

Rationale

Nutrient over-enrichment (*eutrophication*) is one of the most serious aquatic pollution problems throughout the world (National Research Council 2000, Smil 2001, Cloern 2001, Howarth et al. 2002, Seitzinger et al. 2002, 2005, Wassmann 2005). Nutrient pollution arises from human activities such as use of synthetic fertilizers, energy production, and expansion of industrialized agriculture and aquaculture operations. An important adverse consequence of eutrophication is the increased prevalence of harmful algal blooms (HABs) that can cause oxygen depletion and fish kills, seafood poisoning, and undesirable shifts in food webs (Smayda 1990, Hallegraeff 1993, Anderson et al. 2002, Glibert et al. 2005a,b). Although eutrophication is generally known to stimulate many harmful estuarine and marine algal species (Anderson et al. 2002), the relationship is complex (Glibert et al. 2005a,b, Glibert and Burkholder 2006). Through improved global, spatially explicit models of nutrient loading from watersheds to coastal systems, and the development of new spatially referenced global databases of HAB occurrences, we are now in the position to begin to link patterns of eutrophication with HAB occurrence around the world in a more rigorous and quantitative way.

A SCOR working group is the ideal mechanism to address this issue. The questions are international in scope, build on existing SCOR and Intergovernmental Oceanographic Commission (IOC) activities, and will provide the kind of global synthesis that is only possible when individuals who have developed these databases and models come together to integrate their knowledge. Knowledge of these relationships is also important for developing countries, as these areas are experiencing rapid changes in nutrient export and HABs as the use of fertilizers and large-scale aquaculture grows in those regions.

The activities of this working group are relevant to several SCOR and IOC international research programs. They are directly relevant to the Global Ecology and Oceanography of Harmful Algal Blooms Programme (GEOHAB 2006; <http://www.geohab.info>) which has specifically identified the following questions as priorities in the Core Research Project on HABs and Eutrophication, chaired by P. Glibert, “What HAB species or species clusters are indicators for nutrient over-enrichment at global and regional levels?” and “How are long-term trends in nutrient loading changing HAB bloom patterns and dynamics?” (GEOHAB 2006). The working group can address these questions in a fundamentally different way from the activities of GEOHAB, however, since GEOHAB is focused on ecology,

physiological adaptive strategies of species, and oceanography (GEOHAB 2001), but does not have expertise on watershed nutrient loading or the development of coastal typology databases. The synergy of this working group with GEOHAB comes from addressing similar fundamental questions, and common members on this proposed working group and the GEOHAB subcommittee on HABs and eutrophication (see www.geohab.info and table of members below). The Global Nutrient Export from Watersheds Program (Global NEWS), chaired by S. Seitzinger, has developed and applied spatially explicit models that predict nutrient (nitrogen, phosphorus, carbon) loading from watersheds to coastal systems globally. Global NEWS has been an ad hoc workgroup of IOC (<http://www.marine.rutgers.edu/globalnews/>). This SCOR working group will bring the expertise of both groups together to achieve a synthesis that is not otherwise possible.

Questions of nutrient export and its effects in the coastal zone are relevant to many global change programs. Nutrient fluxes and their key impacts are relevant to the mission of LOICZ, IMBER, and the International Nitrogen Initiative (INI), which is cosponsored by IGBP and SCOPE. Global NEWS has received endorsement from LOICZ, and HABs and Eutrophication is a core research project of GEOHAB. Although independently endorsed activities, and we will seek endorsement from LOICZ, GEOHAB and IMBER for this joint SCOR working group. The working group will build on existing data sets and models, synthesize relationships and lay the groundwork for new research which can, and likely will, be proposed under the auspices of these global programmes. Our working group will be composed of biologists, chemists, hydrologists and modelers, as well as those who have experience in large-scale data and GIS analysis.

Scientific Background

The questions related to understanding the linkages between HABs and eutrophication are many. Our goal is to determine if there are patterns in the relationships between nutrient loading and HABs, by building on existing global nutrient loading models and HAB databases.

There are literally hundreds, if not thousands, of reports of HAB occurrences around the world. Historically, the data on HAB occurrence were scattered in government reports, websites, and scientific journals, and often data on nutrients and coastal typology were not included in those reports. Therefore, to date, our attempts to relate the occurrence of particular HAB species with nutrient loading have largely been based on using a limited amount of data from the literature on HAB occurrences where nutrient loading and other parameters could also be found. However, a major effort has been underway by the IOC-HAB program to develop a global database that documents the occurrence of species, along with many site characteristics (<http://ioc.unesco.org/hab/data.htm>). Maps based on frequency of occurrence are also available for ICES nations for the past ten years (<http://www.ices.dk/marineworld/hab.asp>). There are also a number of excellent databases for particular regions that have not yet been submitted to the IOC-HAB program and thus are not yet included in the database.

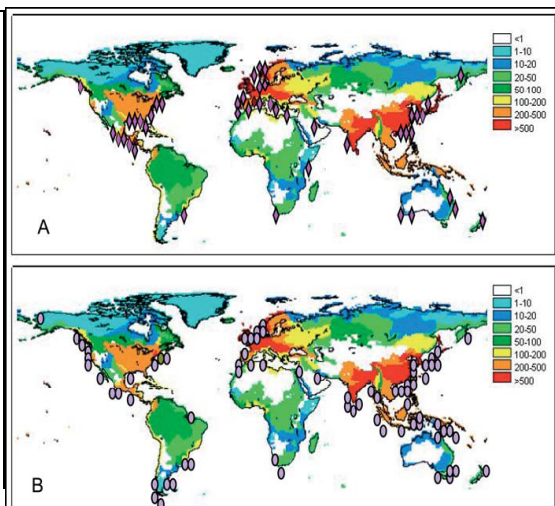
The IOC-HAB database is a critical component of any attempt to relate the global patterns of HAB occurrence with coastal eutrophication. However, most of the studies in that database do not contain specific information on nutrient loading rates, and in many cases details of the coastal typology. The Global NEWS efforts make available those needed data and expertise. The Global NEWS group maintains a global database of measured and modeled river nutrient loads and watershed nutrient sources (including IOC-UNESCO, LOICZ, U.S. Geological Survey and others (<http://www.marine.rutgers.edu/globalnews/>)). Estimating nutrient export to the coastal zone has been a challenge, but enormous advances have been made with respect to global models over the past several years. The first global model of nitrogen loading to coastal systems was published less than 10 years ago (Seitzinger and Kroeze 1998). Global NEWS has now developed models of nutrient export for dissolved inorganic, organic and particulate nitrogen, phosphorus and carbon, as well as for dissolved silica. These models account for nutrient sources (natural as well as anthropogenic, including fertilizer, atmospheric deposition, crops, manure and sewage), hydrology and physical factors watershed characteristics such as river discharge, land use, precipitation intensity, human population and in-river processing and removal. Results for estimates of the 1995 global condition were published in a special issue of *Global Biogeochemical Cycles* in 2005 (see especially Beusen et al. 2005; Bouwman et al. 2005a,b; Dumont et al. 2005; Harrison et al. 2005a,b; Seitzinger et al. 2005). Since 2005, Global NEWS has advanced models of global nutrient stoichiometry, and have developed preliminary scenarios for nutrient export for the years 2030 and 2050 based on the Millennium Assessment (www.millenniumassessment.org) assumptions.

Our initial efforts combining literature data on HAB species occurrences with the outputs of global nitrogen loading models suggested a high degree of correspondence for one group of HABs, as represented by the dinoflagellate *Prorocentrum minimum*, but a lesser correspondence for the species that tend to form paralytic shellfish poisoning (Fig. 1; Glibert and Burkholder 2006). While these results are interesting, these initial efforts represent only a small portion of HAB species groups and the data were not geo-referenced (they were derived from literature reviews). Also, the data in Fig. 1 are only for nitrogen export models and comparable relationships for other nutrients or nutrient forms are not yet available. Through the work of the Global NEWS workgroup, global models of nitrogen, phosphorus and carbon exports, by form, are available for use. These models demonstrate that the **amount** of nutrient discharge is unevenly distributed, the **nutrient forms and their ratios** vary with land use, and the **composition** of the nutrient discharge is changing due to land-use patterns. These new models need to be compared to HAB distributions.

Development of these models also allows us to now ask questions about whether different nutrient elements, forms and ratios are related to different functional groups of HABs. A gradient of habitats has been characterized which tend to foster distinct types of dinoflagellate HABs (Reynolds and Smayda 1998; Smayda and Reynolds 2001). Some types of HABs, such as the high-biomass bloom former *Prorocentrum minimum*, seems to mirror the global export of nitrogen as shown in Figure 1, with hot spots along the U.S. east coast, European and Asian coasts, and appears to be increasing, along with its deleterious effects (Heil et al. 2005). However, other species groups, such as *Karenia mikimotoi*, on the other hand, are dinoflagellate species that bloom in open coastal waters, aggregate in fronts and are transported by coastal currents (Dahl and Tangen 1993; Vargo et al. in press). They proliferate in oligotrophic waters (Heil et al. 2001), but appear to be maintained in nearshore waters. We aim to compare the global nutrient export models with the available global data of these HAB types. An additional source of

information about some types of blooms can come from remote sensing data, and these data bases are currently being used in the context of coastal nutrient criteria development. There are several classification schemes of estuarine and coastal typology that are now available that have been related to algal composition, but not necessarily HABs (e.g., Ferreira et al. 2005). We aim to build on these efforts and to use that information to develop relationships that predict the probability of occurrence of different HAB groups. We aim to focus on the

Figure 1. Global distribution of recorded incidences of major toxic HAB species super-imposed on a global map of modeled nitrogen export (base map from Seitzinger and Kroeze 1998). Nitrogen export is calculated as $\text{kg N} \cdot \text{km}^{-2} \cdot \text{year}^{-1}$



dinoflagellates, as most data are available for this class of HABs, but may explore relationships for other HAB groups, including raphidophytes or cyanobacteria, if sufficient data are available.

The results of this analysis will also be used to link the future predicted magnitude of sources to the anticipated future occurrences of HABs. Previous modeling explored the effect of a number of global change scenarios on nitrogen export, including changes in population, and food and energy production (Kroeze and Seitzinger 1998; Kroeze et al. 2001; Seitzinger et al. 2002a; Bouwman et al. 2005b). Model forecasts predict that large increases in dissolved inorganic nitrogen export to coastal ecosystems will occur by 2050 for many world regions, due to predicted large increases in the global population and in associated food and energy production. The Global NEWS workgroup is

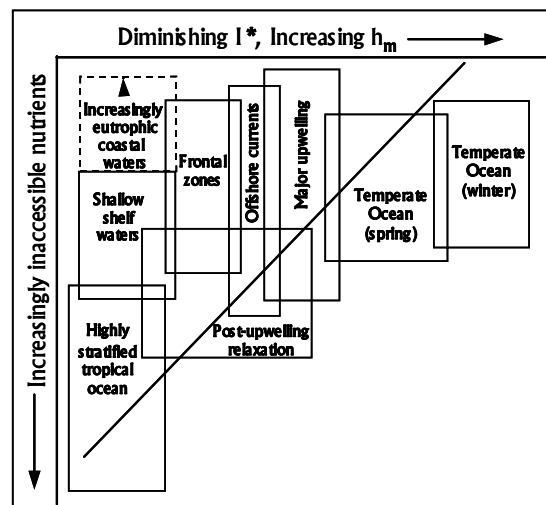


Figure 2. Habitats in marine coastal waters as a function of light and nutrient regimes (Smayda and Reynolds 2001). These habitats select for certain HAB species, species clusters, or species functional groups. The model incorporates parameters describing the abilities of the species to grow in these hydrographic regimes as physical/chemical factors or behavior alter vertical distributions and growth potential.

currently developing input databases for their nutrient export models that are consistent with the four scenarios for the year 2030 outlined in the Millennium Assessment (<http://www.maweb.org/documents/document.332.aspx.pdf>). The Global NEWS models will be run with these input databases to explore the changes in nutrient loading to coastal systems around the world under these four development scenarios. In this proposed SCOR working group we will use these Global NEWS model predictions in concert with the relationships we develop between nutrient loading and HAB occurrence to explore future scenarios of HAB occurrence. *Thus, this effort also will begin to link human dimensions with coastal ecosystem effects.*

Neither GEOHAB nor Global NEWS has the mandate or the resources to conduct the kind of analysis that is proposed for this working group.

Terms of Reference

The working group will integrate existing data on HABs and eutrophication by conducting the tasks listed below:

1. Integrate the existing IOC-HAB database and nutrient loading databases into a compatible GIS format.
2. Advance the development of a GIS coastal typology database.
3. Interrogate the above databases for relationships between HAB species, nutrient loading/forms/ratios, and coastal typology and develop broad relationships between nutrient loading and distributions of specific HABs.
4. Explore possible changes in HAB occurrences in the future (year 2030), using the relationships developed above (3.) and global nutrient export patterns under the Millennium Assessment scenarios for 2030.
5. Publish the results of these analyses in peer-reviewed scientific journals. We have explored, and will continue to pursue, the extra funding required for a dedicated special issue (\$40,000-60,000). Journals such as *Global Change Biology* or *Estuaries and Coasts* would be suitable for such an issue. Papers will be developed on (a) the global perspective, including the next generation of global nutrient and HAB maps; (b) regional highlights; and (c) individual case studies. We will also develop articles for the GEOHAB newsletter and for the GEOHAB and Global News websites, and a graphic-rich report (under the GEOHAB umbrella) that will be targeted for management.

Approach and Products

The groundwork for the working group effort will be laid by accomplishing the first term of reference. This will be done through volunteer efforts by several of the working group members in advance of the first group meeting by examining each data record in the HAB database and formatting it for GIS application using the same grid format employed for the NEWS model. GIS expertise is represented on the working group. We will also work to develop a detailed global coastal typology using high resolution GIS coastal delineations to define open coastal environments, enclosed estuaries, shallow lagoons, and fjords, including their size, freshwater flow, retention time, and depth.

Through the working group process, we will then combine and develop/explore the databases for relationships between HAB species, nutrient loading/forms/ratios, and coastal typology. The first product will be series of maps in which various HAB groups are compared to the global maps of nutrient by form (e.g. nitrogen as nitrate, organic nitrogen, phosphorus by phosphate and organic phosphate), by ratio (e.g. N:P, N:Si, C:N), by season, or by physical factors such as flow or retention time. Regional maps will be made by working group members for the regions in which they have expertise. Based on the global models, estimates of forecasts of nitrogen and phosphorus export (by form) under future scenarios will be developed by using the land use changes as predicted in the Millennium Assessment under their four global change scenarios. These forecasts will then be related to future estimated HAB occurrences based on the relationships established for existing data (by nutrient form, ratio, etc.). The synthesis products expected include interdisciplinary, concept-driven, peer-reviewed papers, ideally in a dedicated issue, that will include a series of maps, global interpretation, regional syntheses and individual case studies. The expertise of the working group will guide the emphasis on particular regions and HAB types. Progress reports, maps and conceptual syntheses will be made broadly available through the global publication *Harmful Algal News*, similar regional/national publications, websites (such as <http://www.geohab.info> (GEOHAB), <http://www.whoi.edu/redtide>,

<http://www.marine.rutgers.edu/globalnews/>, and the institutional and laboratory websites of the working group members. We will also publish several outreach newsletters and reports on the web and in print, through GEOHAB, LOICZ and other outlets.

Proposed Activities/Timeline

A series of 3- to 5-day workshops will be conducted over 3 years:

1. Spring 2008 in the Netherlands— The first meeting will be to advance the database as much as possible, to introduce the Global NEWS models to the HAB community and the complexities of HABs to the Global NEWS members. A list of the desired relationships and maps will be developed, and explored at the meeting and in post-meeting efforts.
2. Fall 2009 in Beijing, in conjunction with the 2nd Open GEOHAB Meeting on HABs and Eutrophication— The second meeting will be to critique and interpret the maps and relationships developed, and to outline the projections of future scenarios required; and
3. Fall 2010, in conjunction with the 14th International HAB meeting in Greece—The third and final workshop will be to assess the scenarios developed from applying the Millenium Assessment projections; to critique, interpret and discuss all the findings of the working group; and to prepare the final manuscripts and report.

A newsletter will be prepared at the end of each workshop and made available through GEOHAB, *Harmful Algal News* or other outlets.

Participants –The working group will be chaired by the current chair of the GEOHAB Core Research Project on HABs and Eutrophication (**Glibert**) and Co-Chair of the IOC ad hoc working group on Global NEWS (**Bouwman**). These chairs bring together knowledge and experience on HABs and global nutrient use and land-use changes.

The following individuals have the expertise required for the working group. This list includes 5 of the 7 members of the GEOHAB Core Research subcommittee on HABs and Eutrophication.

<i>Name</i>	<i>Country</i>	<i>Expertise</i>	<i>Member of GEOHAB Core Research Sub-committee on HABs and Eutrophication</i>
Patricia Glibert* CO-CHAIR	USA	HABs and Eutrophication, GEOHAB Core Research Project Chair	√ (Chair)
Lex Bouwman CO-CHAIR	Netherlands	Land Use and Nutrient Export, Global database development; GIS modeling, Global NEWS Co-chair	
Sybil Seitzinger	USA	Global nutrient export, biogeochemistry, GIS modeling, Global NEWS Chair	
Paul Harrison	Hong Kong	Nutrient Export, Biogeochemistry, HABs	√
J. Icarus Allen	United Kingdom	Numerical modeling of marine systems, coupling of ecosystem and physical models, ecosystem forecast	√

Willem Stolte	Sweden	HABs and Eutrophication	
Adnan Al-Azri	Oman	Time series of HABs; HABs in Arabian Gulf and Arabian Sea	
Sandor Mulsow	Chile	Nutrient input to the coastal zone; Global NEWS; GIS modeling, effects of land-use change and aquaculture on coastal ecosystems	
Mingjiang Zhou	China	Nutrient export to the coastal zone, eutrophication, China HABs	✓
Jorge A. Herrera-Silveira	Mexico	Nutrient export, HABs, Global NEWS, GIS modeling	

* cv available at: <http://www.hpl.umces.edu/faculty/glibert.html>

We anticipate that there will be associate members of this working group who will participate in some or all the workshops. We will work with SCOR to identify additional associate members from developing countries. The preliminary list of associates will include the following people:

<i>Name</i>	<i>Country</i>	<i>Expertise</i>
Charlie Vörosmary	USA and Italy	Hydrology
K. Padmakumar	India	HABs in India
Hak-Gyoon Kim	Korea	Asian HABs; eutrophication
Gustaf Hallegraeff	Australia	Australia and New Zealand HABs; eutrophication
Vera Trainer	USA	North Pacific HABs; time series databases
Grant Pitcher	South Africa	African HABs, nutrient relationships, GEOHAB Core Research Project chair
David Dickey	USA	Statistics, time series analysis, nutrient trends with time
Suzanne Bricker	USA	Eutrophication assessments
Paul Wassman	Norway	Nutrient export to the coastal zone; impacts and effects including HABs
Joao Ferrera	Portugal	Assessment of eutrophication, including effects of aquaculture

Anticipated Results and Beneficiaries

Impacts of HABs on human health, ecological health and coastal economies are increasing worldwide (e.g., Glibert and Pitcher 2001, Ramsdell et al. 2005), and many of these blooms have been linked to eutrophication (Smayda 1990, National Research Council 2000, Anderson et al. 2002, Glibert et al. 2005a,b). At present, however, scientists, public health officials, federal and global agencies concerned with managing and protecting marine resources lack a firm, quantitative foundation on which to manage and mitigate this global epidemic. In this workshop series, we will assess the importance of eutrophication in stimulating various HAB species by applying quantitative and comparative analysis to global nutrient export/HAB data. Through this analysis an increased understanding of the potential to manage these threats by nutrient reductions will also be attained.

The work of this group will contribute to GEOHAB Core Research Project on HABs and Eutrophication by providing an in-depth analysis of the relationship of HAB occurrences to land-based factors, which GEOHAB is not

addressing. The results should also contribute to LOICZ and IMBER. The work of the group will add value to, and leverage, the results of Global NEWS.

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Annex 5 - Global Ocean Ecosystem Dynamics (GLOBEC) Project

Report of the SCOR/IOC/IGBP GLOBEC International Project for 2006/ 2007 to the SCOR Executive Committee. Bergen, Norway, 26-28 August 2007

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1. RECENT PROGRESS: Symposia and Workshops

1.1. GLOBEC-sponsored symposia

Most symposia of GLOBEC are currently aligned to synthesis efforts. GLOBEC is conducting this synthesis at various levels, including along the regional scale that was so successfully used in the implementation phase of GLOBEC. The table below summarises the regional synthesis symposia planned or conducted during recent years:

REGIONAL GLOBEC PROGRAMMES	SYNTHESIS SYMPOSIA
GLOBEC-ICES CCC	- Bergen, Norway, 11-14 May 2004
GLOBEC-PICES CCCC	- Honolulu, USA, 19-21 April 2006
SPACC	- Brest, France, 2-5 October 2006 (workshop) - Eastern Boundary Upwelling Ecosystems. Las Palmas, Spain, 2-6 June 2008 - Herring: linking biology, ecology and status. Galway, Ireland, 26-29 August 2008
SOUTHERN OCEAN GLOBEC	TBC
ESSAS	- 1 st OSM Victoria, Canada, 16-20 May 2005 - Tromsø, Norway, 12-15 March 2007
CLIOTOP	- 1st OSM La Paz, Mexico, 3-7 December 2007
3 rd GLOBEC OSM	- Paris, France, May 2009

GLOBEC symposia (or symposia with specific GLOBEC sessions) during this reporting period include:

- ***PICES XV meeting. Yokohama, Japan, 13 - 22 October 2006.***

This meeting included the following GLOBEC/PICES CCC sessions:

1. Modelling and historical data analysis of pelagic fish, with special focus on sardine and anchovy
2. Key recruitment processes and life history strategies: bridging the temporal and spatial gap between models and data
3. Synchronous and asynchronous responses of North Pacific boundary current systems to climate variability

In addition a pre-meeting CCCC workshop was held on “Climate forcing and marine ecosystems”.

- ***ESSP Global Environmental Change: regional challenges. An Earth System Science Partnership Global Environmental Change Open Science Conference. Beijing, China, 9-12 November 2006.***

This was the 2nd Open Science Conference of the Earth System Science Partnership (IGBP, WCRP, IHDP and DIVERSITAS). It included a GLOBEC session "**Marine ecosystems: trends, feedbacks and predicting future states**", co-convened by Francisco Werner and Manuel Barange, as a contribution to GLOBEC's synthesis.

- ***The Humboldt Current System: climate, ocean dynamics, ecosystem processes, and fisheries. Lima, Peru. 27 November - 1 December 2006.***

This multi-sponsored symposium had the following main topics:

1. Intra-annual to inter-annual, multi-decadal to centennial-scale variability in the Humboldt Current System
2. Climate and ocean dynamics, and biogeochemical cycles
3. Lagrangian processes, plankton dynamics and larval survival of fish resources
4. From phytoplankton to apex predators and fishers, and back
5. Adaptive strategies of fish and other key species in a highly variable ecosystem
6. Adaptive management

The symposium contributed significantly to the SPACC synthesis effort and the proceedings will appear in a special issue of *Progress in Oceanography*.

- ***GLOBEC ESSAS Symposium: Ecosystem dynamics in the Norwegian Sea and Barents Sea. Tromsø, Norway, 12-15 March 2007.***

A suite of projects on ecosystem changes and interactions in several high-latitude environments have been or are currently carried out in the Norway and Barents Seas under the GLOBEC umbrella. These include the ADAPT, CLIMAR and NESSAS projects, and the new GLOBEC regional programme, Ecosystem Studies of Sub-Arctic Seas (ESSAS), together with the upcoming International Polar Year (IPY). All of these activities focus on fundamental research in the Arctic and Sub-Arctic Seas and this symposium offered an opportunity to present the results and findings from these programmes. The symposium sessions were as follows:

1. Bottom-up versus top-down effects on ecosystems
2. Resilience of feeding habits and major trophodynamic pathways
3. Behaviour, life histories and reproduction strategies
4. Recruitment processes
5. Climate effects on food webs
6. Coupled processes between physics and biology
7. Mechanisms for large-scale changes and future directions in platforms to reveal food web dynamics

The proceedings will be published in a special issue of *Deep Sea Research II*, including approximately 40 papers. The symposium's website is <http://www.nfh.uit.no/hmenyvis.aspx?id=2554&locallang=uk>.

- ***GLOBEC CLIOTOP 1st Symposium "Climate Impacts on Oceanic Top Predators". La Paz, Mexico, 3-7 December 2007.***

The first CLIOTOP symposium will focus on implementing the synthesis objectives of CLIOTOP following on from three years of intensive workshops. The symposium has a special interest in presenting comparative studies between regions or species and papers dealing with an integrated approach, combining observation/experiments and modelling. SCOR is a co-sponsor of this symposium through a fund for support of developing country scientists. The symposium sessions are:

1. Early life history of top predators
2. Physiology, behaviour and distribution of top predators
3. Trophic pathways in open ocean ecosystems
4. Synthesis and modelling
5. Socio-economic aspects and management strategies
6. Climate change and top predators/pelagic ecosystems
7. Meso-scale issues (including downscaling and upscaling from and to the global scale) in CLIOTOP
8. Global change implications for management and conservation strategies of top predators
9. Future scientific challenges: what is needed from the field, what is needed from the models, where are the gaps

- **GLOBEC/PICES/ICES 4th International Zooplankton Production Symposium: human and climate forcing of zooplankton populations. Hiroshima, Japan, 28 May-1 June 2007.**

Zooplankton research is central to GLOBEC, and for this reason GLOBEC has been a sponsor of this series of symposia for some time. The 4th IZPS followed on the very successful 3rd IZPS held in Gijon, Spain in May 2003, also co-sponsored with ICES and PICES. The symposium was attended by 334 participants from 46 countries, who contributed 141 oral and 250 poster presentations. It had the following sessions:

1. Global comparisons of zooplankton time series
2. Importance of zooplankton in biogeochemical cycles
3. The role of zooplankton in food webs: changes related to impacts of climate variability and human perturbation
4. Mortality impacts on the ontogeny and productivity of zooplankton
5. Zooplankton functional groups in ecosystems
6. Microbial loop vs classical short food chains: implications for appraisal of food web efficiency and productivity
7. Environmental and other constraints on zooplankton behaviour, life histories and demography
8. Zooplankton biochemistry and physiology: practical and potential biotechnology application
9. Advances in image technologies and the application of image analysis to count and identify plankton
10. Analysis and synthesis: modelling zooplankton in aquatic ecosystems

Plus three pre-symposium workshops:

1. Temporal and regional responses of zooplankton to global warming: Phenology and poleward displacement
2. Zooplankton research in Asian countries: Current status and future prospects
3. Krill research: Current status and its future

There will be two special issues from the symposium, one in the *ICES Journal of Marine Science*, covering most of the contributions presented, and one in *Deep-Sea Research II* on “Krill biology and ecology”, resulting from Workshop #3. SCOR supported three developing country scientists to the meeting: Patricia Ayon (Peru), Anja Kreiner (Namibia) and Leonardo Castro (Chile). For more information on the symposium visit http://www.pices.int/meetings/international_symposia/2007_symposia/4th_Zooplankton/4th_Zoopl.aspx.

- **PICES XVI Annual Meeting. Victoria, Canada, 26 October-4 November 2007.**

The meeting will include the following GLOBEC/PICES CCC sessions:

1. Towards ecosystem based management: Recent developments and successes in multi-species modelling
2. Fisheries interactions and local ecology
3. Operational forecasts of oceans and ecosystems

It will also include a pre-symposium workshop on “Climate scenarios for ecosystem modelling.

- **BENEFIT-BCLME synthesis symposium. Swakopmund, Namibia, 19-21 November 2007.**

Recognising that the BCLME and the GLOBEC-BENEFIT programmes are reaching their conclusion, and noting the inauguration of the Benguela Current Commission (BCC), a concluding event will be held, to focus on key scientific outcomes and other activities and achievements made over the last decade in the Benguela region. The goal is to present the key outputs of the BCLME and BENEFIT programmes, record this legacy and to consolidate plans for future integrated management, sustainable development and protection of the Benguela Current ecosystem.

Themes will range from marine scientific research, transboundary management of shared fish stocks, links between fisheries and the environment, monitoring the state of the ecosystem, data management, forecasting and global climate variability, ecosystem health and pollution, impacts of seabed mining and oil and gas exploration and production, socio-economics and governance. Attention will also be given to the philosophy and history leading to the development of regional cooperation and lessons learnt in establishing and implementing the programmes.

- ***ICES/PICES/IOC symposium on “Effects of climate change on the world's oceans”. Gijón, Spain, 19-23 June 2008 (co-sponsored by GLOBEC, WCRP and SCOR).***

The symposium has its origins on the high scientific and social relevance to assess the consequences of climate change on the world's oceans and on our poor understanding of the sensitivity and adaptability of natural and managed ecosystems to climate change. The symposium will focus on the major issues of climate change that affect the oceans: oceanic circulation, climate modelling, cycling of carbon and other elements, acidification, oligotrophy, changes in species distributions and migratory routes, sea-level rise, coastal erosion, etc. It will bring together results from observations, analyses and model simulations at a global scale, and will include discussion of climate change scenarios and the possibilities for mitigating and protecting the marine environment and living marine resources. For more information visit

http://www.pices.int/meetings/international_symposia/2008_symposia/Climate_change/climate_background_3.aspx

- ***GLOBEC-IMBER-SOLAS-EUROCEANS symposium on “Dynamics of Eastern Boundary Upwelling Ecosystems: Integrative and comparative approaches”. Las Palmas, Spain, 2-6 June 2008.***

This will be the first symposium co-sponsored by all three SCOR marine projects, and a request for funding from SCOR to invite scientists from developing countries will be sought (see Appendix 1). The symposium will consider most aspects of the dynamics, structure and functioning of the four major eastern boundary upwelling ecosystems linked to the Benguela, California, Canary (African Canary and Iberian Peninsula) and Humboldt Current systems. These aspects include climate and ocean dynamics, climate change, physics of the ocean and atmosphere, biogeochemistry, ecosystem production, ecology (including behavioural ecology), food-web structure and dynamics, trophic interactions, fisheries assessment and management. The symposium will be convened by Pierre Fréon, IRD (France), Javier Aristegui, ULPGC (Spain) and Manuel Barange, PML (UK). Members of the steering committee include Jack Barth, Oregon State University (USA), Eric D. Barton, CSIC-Vigo (Spain), Gabriella Bianchi, FAO (Italy), Bruno Blanke, Laboratoire de Physique des Océans (France), Francisco Chavez, MBARI (USA), Werner Ekau, ZMT (Germany), Véronique Garçon, LEGOS (France), Dimitri Gutiérrez, IMARPE (Peru), Salvador Lluch-Cota, CIBNOR (Mexico), Colleen Moloney, UCT (South Africa), Vivian Montecino, IFOP (Chile), Abdelatif Orbi, INRH (Morocco) and Cynthia Tynan, University of Washington (USA). The symposium website is

<http://www.upwelling-symposium.org>.

- ***Advances in Marine Ecosystem Modelling Research symposium (AMEMR). Plymouth, UK, June 2008***

Following on from the success of AMEMR 2005, the Plymouth Marine Laboratory, in association with GLOBEC, EUR-OCEANS and IMBER has announced that the second Advances in Marine Ecosystem Modelling Symposium is scheduled to be held in Plymouth in June 2008. The symposium is being convened as a forum for presentation and discussion of all aspects of model-based marine ecosystem research, encompassing numerical, conceptual, mathematical and statistical approaches. This symposium will contribute to the next generation of model-based exploration by providing scientists and students an opportunity to discuss and contrast recent advances, outstanding problems and future requirements.

- ***GLOBEC-FAO-EUROCEANS symposium on “Coping with global change in marine social-ecological systems”. Rome, Italy, 8-11 July 2008.***

This symposium is the culmination of the GLOBEC Focus 4 working group activity.

Social-ecological systems have marine (including physical-biological sub-systems) and human (including cultural, management, economic, and socio-political sub-systems) components that are highly inter-connected and interactive. The recent 4th Assessment Report of the International Panel on Climate Change (IPCC) identified a number of climate-related changes that are very likely to occur to marine systems in the near future. It identifies the need to make social-ecological systems more resilient by building "adaptive capacity". However, "natural" marine ecosystems are usually studied independently from their human components, and by different scientific disciplines

with largely different scientific traditions ("natural" scientists; "social" scientists and humanists). Understanding the important issues and collaborating with other disciplines is essential for correctly interpreting the causes and dealing with the consequences of global changes in marine social-ecological systems. The central goals of the symposium are to share experiences across disciplines and to identify key next steps and common elements and approaches that promote resilience of marine social-ecological systems in the face of global changes. This involves:

1. exploring conceptual issues relating to social-ecological responses in marine systems to global changes;
2. analysing case studies of specific examples of social-ecological responses in marine systems to significant environmental changes manifested locally;
3. synthesising the work of natural and social scientists and building comparisons of social-ecological responses in marine ecosystems subjected to major environmental variability;
4. developing innovative approaches to the use of science and knowledge in management, policy and advice; and
5. identifying lessons for governance for building resilient social-ecological systems.

The meeting will be convened by R. Ian Perry (Fisheries & Oceans Canada, Nanaimo, Canada), Rosemary Ommer (University of Victoria, Victoria, Canada) and Philippe Cury (IRD/CRH, Sète, France). Members of the Steering Committee include Kevern Cochrane (FAO), Manuel Barange (GLOBEC), Kathleen Miller (CLIOTOP, US), Svein Jentoft (Norway), Edward Allison (Malaysia), Astrid Jarre (Denmark/South Africa), Rashid Sumaila (Canada), Olivier Thebaud (France), Renato Quinones (Chile) and John Kurien (India). For more information visit <http://www.peopleandfish.org>.

- ***ICES-GLOBEC symposium “Linking Herring: linking biology, ecology and status of populations in the context of changing environments”. Galway, Ireland, 26-29 August 2008.***

This symposium is intended to provide the ultimate link to our understanding of herring populations in the Atlantic and Pacific oceans. The conveners are Maurice Clarke (Ireland), Mark Dickey-Collas (The Netherlands) and Aril Slotte (Norway). Scientific Steering committee members include Emma Hatfield (UK), Doug Hay (Canada), Richard Nash (Norway), Deirdre Brophy (Ireland) and Øyvind Fiksen (Norway). The meeting has the following planned sessions:

1. Herring in the middle - the trophic and ecological interactions and impacts of herring - Andrew Bakun (USA)
2. Managing change - management and exploitation of herring in a dynamic environment, within the context of long term change - Martin Pastoors (The Netherlands)
3. Variable production - particularly the role of reproduction, recruitment and life history strategies
4. Population integrity - the rigidity of stocks and the drivers of migration
5. Counting herring - qualitative and quantitative estimation of herring and its application - John Simmonds (UK)
6. Advances in herring biology - Audrey Geffen (Norway)

The symposium website is <http://www.linkingherring.com/>.

1.2 GLOBEC workshops

The following is a collection of GLOBEC-sponsored workshops hosted during the reporting period or planned for the forthcoming year:

- ***GLOBEC Focus 1 workshop on impact of climate variability on marine ecosystems: a comparative approach. Berlin, Germany, 4-8 September 2006.***

This workshop was a major I+S effort for GLOBEC which was to be held at the Museum for Natural History in Berlin, Germany, and was structured into four groups:

1. *Climate variability and teleconnection patterns of marine populations*
2. Impacts of past climate variability on marine ecosystems (over the past two millenia)
3. Mechanisms linking climate variability to marine ecosystems
4. Sensitivity of marine ecosystems to climate and human exploitation

A total of eleven background papers were prepared and distributed prior to the workshop. An additional 4 group papers were prepared during the workshop. The collection is currently in press as a special issue of *Journal of Marine Systems*.

- ***SPACC synthesis workshop. Roscoff, France, 2-6 October 2006.***

This workshop was intended to bring together the lead authors of the SPACC synthesis book and the SPACC Executive Committee members, to plan the final stages of the publication. At this meeting the authors circulated their draft chapters, so that areas of overlap, knowledge gaps and style differences could be resolved. Following the workshop the papers were submitted, reviewed and are in the process of receiving final acceptance. The book will be published by Cambridge University Press in 2008. It has 16 chapters and is co-authored by over 50 scientists worldwide. The title is "Climate Change and Small Pelagic Fish" and is co-edited by Dave Checkley, Claude Roy, Juergen Alheit and Yoshiro Oozeki.

- ***ICES/GLOBEC workshop on long-term variability in SW Europe. Lisbon, Portugal. 20-24 November 2006.***

This is a new working group of ICES, chaired by Juergen Alheit, Maria Borges, Alicia Lavin and Andres Uriarte, set up with the objective to rescue, collate and jointly analyse decadal-scale, long-term time series of physical, chemical and biological data from ecosystems surrounding the Iberian peninsula, with a focus on long-term changes of small pelagic fish. The scientific objectives of the meeting were to identify possible links to climate variability and to look for possible telecommunication patterns within European and other marine ecosystems.

- ***CLIOTOP WG3 workshop "Role of squid in pelagic marine ecosystems". Hawaii, USA, 14-17 November 2006.***

The purpose of this workshop was:

1. to consider the role of squid in pelagic ecosystems that support tunas and other upper-level predators;
2. to consider how climate change might impact squid populations and the ecosystem;
3. to consider the recent range expansions of *Dosidicus gigas* in the Pacific Ocean, especially in terms of its effects on the ecosystems; and
4. to identify research needs for large pelagic squid to meet the goals of GLOBEC-CLIOTOP.

The workshop has resulted in a special GLOBEC Report that is currently in press.

- ***CLIOTOP WG3 and WG4 workshop "Designing an ocean Mid-trophic Automatic Acoustic Sampler". Sete, France, 15-19 January 2007.***

Despite the wide spatio-temporal distribution and huge abundance of mid-trophic level organisms (from meso-zooplankton to micro-nekton) and their major influence on top predator population dynamics, they are still one of the less known components of pelagic ecosystems. To address this critical lack of information, the CLIOTOP Steering Committee decided during its most recent meeting to promote the development and deployment of acoustic recorders to monitor these organisms. The goal of the meeting was to set up a project to develop a novel tool for large-scale monitoring of mid-trophic level prey organisms, their horizontal and vertical size-resolved distribution and abundance in the pelagic environment. The result of the workshop has been a research proposal submitted to the European Commission for funding, and the creation of a specific working group inside CLIOTOP on mid-trophic sampling.

- ***CLIOTOP WG5 workshop “The challenge of change: Managing for sustainability of oceanic top predator species”. Santa Barbara, USA, 12-14 April 2007.***

CLIOTOP aims to contribute to sustainable management of these species by identifying and modelling the key processes involved in the dynamics of oceanic pelagic ecosystems in a context of both climate variability and change, and intensive fishing of top predators. WG5 seeks to foster research on policy development and implementation under these dynamic circumstances. Oceanic top predators, such as tuna and sharks and billfish, have been intensively harvested in competitive fisheries, resulting in population declines, damage to by-catch species, and associated impacts on ocean ecosystems. The management of these highly migratory species is complicated by the fact that migratory patterns, recruitment, prey availability, and other population dynamics are sensitive to imperfectly predictable climate variability and change. The purpose of the workshop was to foster the development of a research community capable of addressing the many sources of change and uncertainty affecting the international management of marine top predator species. The workshop was funded by NSF and hosted 50 attendees. The proceedings will appear in a book entitled “Fast Fish, Faster Fishers and a Changing Environment: Challenges for the Management of Oceanic Top Predators”.

- ***CLIOTOP WG1 and 4 meeting. Shimizu, Japan, 14-17 May 2007.***

This was a joint workshop between CLIOTOP WG1 (early life history) and WG4 (synthesis and modelling), co-sponsored by the Fisheries Research Agency of Japan. It gathered field scientists, experimentalists and modellers to put together joint research proposals linking models, observations and experimentations. It was also used to plan and prepare presentations to the forthcoming CLIOTOP Symposium.

- ***ESSAS Workshops on the “Role of sea-ice cover in marine ecosystems” and “Evaluation of future ESSAS climate scenarios”. Hakodate, Japan, 4-8 June 2007.***

The first workshop focused on what will happen to the amount, timing and fate of primary production as the temporal and spatial scale of ice cover, as well as its thickness, decreases in response to warming. The second workshop was intended to develop realistic scenarios of the effects of global warming on the climate of sub-arctic seas. Both workshops are expected to result in key group publications, led by the chairs of the workshops: Drs Egil Shakhshaug, Sei-ichi Saitoh and John Bengtson (workshop 1) and Dr Jim Overland (workshop 2).

- ***GLOBEC-ICES workshop on the integration of environmental information into fisheries management and advice (WKEFA). Copenhagen, Denmark, 18-22 June 2007.***

This workshop, co-sponsored by EUR-OCEANS, was convened to (a) estimate the consequences of environmental variability (including “regime shifts”) for the biological reference points and other measures which are currently used to guide fisheries management; (b) carry out analyses and formulate short-, medium- and long-term integrated advice for the selected cases; (c) bearing in mind possible fisheries and ecosystems objectives, identify, develop and evaluate procedures for improving fisheries management strategies and advice by including environmental information and (d) identify future directions and needs, including operability, to bring forward the process of incorporating ecosystem advice in the ICES area. The report of the workshop will be available soon through the GLOBEC website.

- ***GLOBEC synthesis book planning meeting. Dartington, UK, 2-4 July 2007.***

This meeting brought together the lead authors and editors of the final GLOBEC synthesis volume. This is to be published by Oxford University Press, Island Press or Springer. More than 50 leading GLOBEC scientists are involved in this project and the book is planned to be printed and distributed in time for the 3rd GLOBEC OSM in May 2009.

- ***3rd Japan-Korea-China GLOBEC symposium. Hakodate, Japan, 13-15 December 2007***

The 3rd regional symposium will provide new information and a forum for discussion regarding new research findings of the national GLOBEC programmes in this region. Particular topics of interest are ecosystem structure and environmental

factors, food web tropho-dynamics, physical-biological processes and models, climate change, regime shifts, bottom-up and top-down control of marine ecosystems, and ecosystem-based management. How to integrate GLOBEC and the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) project after 2009 will be discussed at the symposium.

- ***GLOBEC workshop on long-term variability in the Mediterranean. Barcelona or Heraklion, Autumn 2008.***

This workshop follows on a series of meetings dealing with long-term data series linking climate, ecosystem variables and fisheries, which started in La Jolla (1997) and continued in Cape Town (2001, for the Benguela), Lima (2002, for the Humboldt), Tokyo (2003, for Japanese data) and Lisbon (2006, for the Atlantic Iberian region). It will be convened by Juergen Alheit, Gabriel Gorsky and Isabel Palomera.

Other workshops/meetings that are not reported on for space limitations:

- 1st US GLOBEC pan-regional synthesis meeting. Boulder, USA, 27 November-1 December 2006.
- BASIN meeting. Resolving the impact of climate processes on ecosystems of the North Atlantic basin and shelf sea: integrating and advancing observation, monitoring and prediction. Hamburg, Germany, 23-25 January 2007.
- AMEMR workshops: Skill assessment of plankton functional-type models on a global scale (6-8 February 2007) and Modelling the response of marine ecosystems to increasing levels of CO₂ (13-15 February 2007), Plymouth, UK.
- GLOBEC-EUROCEANS-IMBER international workshop on "Parameterisation of trophic interactions in ecosystem modelling". Cadiz, Spain, 20-23 March 2007.
- 2nd GLOBEC Spain and 1st IMBER Spain symposium. Valencia, Spain, 28-30 March 2007.
- BASIN workshop: Resolving the impact of climatic processes on ecosystems of the North Atlantic basin and shelf seas. Chapel Hill, North Carolina, USA, 1-3 May 2007.
- 2nd US GLOBEC pan-regional synthesis meeting. Seattle, USA, 25-28 September 2007.
- GLOBEC-endorsed 6th European Conference on Ecological Modelling. Challenges for ecological modelling in a changing world: global changes, sustainability and ecosystem based management. Trieste, Italy, 27-30 November 2007.

In addition, GLOBEC has hosted/will host the following SSC/working group meetings in 2006/2007:

- 26-29 September 2006: GLOBEC-IMBER Executive Committees Meeting. Plymouth, UK
- 10-12 May 2007: GLOBEC-CLITOP SSC meeting. Shimizu, Japan
- 24-26 May 2007: GLOBEC SSC meeting. Hiroshima, Japan
- 8 June 2007: GLOBEC-ESSAS SSC meeting, Hakodate, Japan
- 7-9 October 2007: GLOBEC-IMBER Executive Committees Meeting. Brest, France
- 4-5 May 2008: GLOBEC SSC meeting. Cape Town, South Africa

More information is available on the GLOBEC website.

2. RECENT DEVELOPMENTS AND PUBLICATIONS

2.1. Links with IMBER

The GLOBEC and IMBER Executive Committees will meet in Brest, France, 7-9 October 2007, with the specific objective of appointing (with IGBP and SCOR) a Transition Task Team (TTT) that would draft an addendum to the IMBER Science Plan and Implementation Strategy. The TTT will therefore implement the agreement of the sponsors of both GLOBEC and IMBER (IGBP, SCOR) to merge both projects into a single ocean research project in the IGBP structure. Correspondence regarding this matter is handled directly between the sponsors and the SSC Chairs. The following are current common activities between IMBER and GLOBEC:

- GLOBEC-IMBER End to End Food web Task Team
- Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics in the Southern Ocean (ICED)
- Chinese GLOBEC/IMBER programme
- EUR-OCEANS

Details of the above were provided in last year's report to SCOR.

2.2. Links with CLIVAR

At a meeting of the Atlantic Implementation Panel of CLIVAR (Venice, October 2005) a GLOBEC representative informed the panel of the importance of climate variability for the marine environment and submitted a list of questions from the GLOBEC community to CLIVAR. At the SSG meeting of CLIVAR (Buenos Aires, April 2006) CLIVAR proposed to follow the "GLOBEC questions" through a workshop together with the marine programs of SCOR/IGBP. On 7 December 2006, representatives of the SCOR/IGBP marine programmes, CLIVAR and others, met to shape such a workshop. Plans are underway to host a 30+ participant workshop in April 2008 in Brest, France. Geir Ottersen (ex-GLOBEC SSC member) represents GLOBEC in the planning committee.

2.3. Publications

*The GLOBEC publication list can be interactively searched at www.globec.org. Since 2000 the list includes a **total of 2,820 publications** (2463 refereed).*

This is an underestimate of the total publications of GLOBEC researchers, as they have to be logged in the website by the authors themselves and have to acknowledge their contribution to GLOBEC in the article. The real figure is likely to be at least an order of magnitude higher. The following are special issues of GLOBEC:

1. **Barange M., Nykjaer L. (eds).** 2003. ENVIFISH: Investigating environmental causes of pelagic fisheries variability in the SE Atlantic. *Progress in Oceanography*, 59(2-3), 177-338.
2. **Batchelder, H.P., Lessard, E.J., Strub, P.T., Weingartner, T.J.** 2005. US GLOBEC biological and physical studies of plankton, fish and higher trophic level production, distribution, and variability in the northeast Pacific. *Deep-Sea Research II*, 52(1-2), 1-374.
3. **Batchelder, H.P., Powell, T. (eds).** 2002. Physical and biological conditions and processes in the northeast Pacific Ocean. *Progress in Oceanography*, 53(2/4), 105-411.
4. **Beardsley, R.C., Smith, P.C., Lee, C.M. (eds).** 2003. US GLOBEC: Physical processes on Georges Bank (GLOBEC). *Journal of Geophysical Research*, 108(C11).
5. **Bograd, S.J., Checkley, D.A., Wooster, W.S. (eds).** 2003. CalCOFI: a half century of physical, chemical, and biological research in the California Current System. *Deep-Sea Research II*, 50, 2349-2594.
6. **Coombs, S., Harris, R. Perry, I., Alheit, J. (eds).** 1998. Proceedings of the GLOBEC 1st Open Science Meeting, Paris, France. *Fisheries Oceanography*, 7(3/4), 175-390.
7. **Drinkwater K.F., Loeng H., Megrey B., Bailey B.A., Cook R.M. (eds).** 2005. The influence of climate change on North Atlantic fish stocks. Proceedings of an ICES Symposium, Bergen, Norway, 11-14 May 2004. *ICES Journal of Marine Science*, 62(7), 1203-1542.
8. **Fogarty, M.J., Qinlan, J. (eds).** 2002. The US GLOBEC program. *Oceanography*, 15(2), 1-89.
9. **Hanesson, R., Barange, M., Herrick, S., Jr. (eds).** 2006. Climate change and the economics of the world's fisheries: Examples from pelagic fish stocks. *New Horizons in Environmental Economics Series*. Edward Elgar, New York. 310pp.
10. **Harris, R., Barange, M., Werner, F.E., Tang, Q. (eds).** 2003. Proceedings of the GLOBEC 2nd Open Science Meeting, Qingdao, China. *Fisheries Oceanography*, 12(4/5), 221-522.

11. **Hofmann, E.E., Wiebe, P.H., Costa, D.P., Torres, J.J. (eds).** 2004. Integrated ecosystem studies of Western Antarctic Peninsula continental shelf waters and related Southern Ocean regions. *Deep-Sea Research II*, 51(17-19), 1921-2344.
12. **Kishi, M.J., Megrey, B.A., Ito, S.-I. Werner, F.E. (eds.).** 2007. Special issue on NEMURO and NEMURO.FISH - modeling of North Pacific marine ecosystems. *Ecological Modelling*, 202(1-2), 1-223.
13. **Mackas, D.L., de Young, B. (eds).** 2001. GLOBEC Canada: Response of marine ecosystems to environmental variability. *Canadian Journal of Fisheries and Aquatic Sciences*, 58(4), 645-761.
14. **Pinardi, N. (eds).** 2006. Seasonal, Interannual and decadal variability of the Atmosphere, oceans and marine ecosystems. *Climate Research*, 31(2-3), 135-271.
15. **Reid, P.C., Mathews, J.B.L., Smith, M.A. (eds).** 2003. Achievements of the continuous plankton recorder survey and a vision for its future. *Progress in Oceanography*, 58, 115-358.
16. **Sugimoto, T. (ed).** 2002. Long-term variations in the Northwest Pacific Ecosystems. A Korea-Japan GLOBEC Symposium. *Fisheries Oceanography*, 11(6), 315-370.
17. **Tande, K.S., Miller, C. (eds).** 2000. Population dynamics of *Calanus* in the North Atlantic: Results from the trans-Atlantic study of *Calanus finmarchicus*. *ICES Journal of Marine Science*, 57, 1527-1874.
18. **Valdés L., Harris R.P., Ikeda T., McKinnell S.M., Peterson W.T. (eds).** 2004. The role of zooplankton in global ecosystem dynamics: comparative studies from the world oceans. The Third International Zooplankton Production Symposium, Gijón, Spain, 20-23 May 2003. *ICES Journal of Marine Science*, 61(4), 441-738.
19. **Wiebe, P.H., Beardsley, C. (eds).** 1996. Physical-biological interactions on Georges Bank and its environs. *Deep-Sea Research II*, 43(7-8), 1437-2006.
20. **Wiebe, P.H., Beardsley, R.C., Bucklin, A.C., Mountain, D.G. (eds).** 2001. Coupled biological and physical studies of plankton populations: Georges Bank and related North Atlantic regions. *Deep-Sea Research II*, 48(1-3), 1-684.
21. **Wiebe, P.H., Beardsley, R.C., Mountain, D.G., Lough, R.G. (eds).** 2006. Dynamics of plankton and larval fish populations on Georges Bank, the North Atlantic US GLOBEC study site. *Deep-Sea Research II*, 53(23-24): 2455-2832.
22. **Zavatarelli, M., Pinardi, N. (eds).** 2001. First SINAPSI Symposium. *Archivio di Oceanografia e Limnologia*, 22, 1-233.

In addition we have a number of special issues in press, which have not been mentioned above or in any of the workshop reports:

- *Progress in Oceanography – Proceedings CCC-GLOBEC synthesis symposium (2006) – 16 papers*
- *Deep-Sea Research – Proceedings GLOBEC-ESSAS symposium (2005) – 23 papers*

2.4. GLOBEC Integration and Synthesis plans

GLOBEC is embarking on an I+S phase that will lead the programme to its conclusion in December 2009. On the webpage I+S activities can be proposed on line, and the community has the opportunity of requesting information on specific outputs.

A major I+S activity currently under planning is the final GLOBEC book, to be published in the IGBP Book Series (currently in Elsevier, but possibly this volume will be published by another publisher, so above). The draft structure of the book is as follows:

Global Change and Marine Ecosystems

Editors: Manuel Barange, John Field, Roger Harris, Eileen Hofmann, Ian Perry, Cisco Werner (alphabetical order at this stage)

- Preface
- Introduction (Explaining the roadmap) [5,000 words]
Werner, C., M. Barange

Section 1. The changing ocean ecosystems

- 1.1 Climate forcing on marine ecosystems [10,000 words]
Drinkwater, K., G. Beaugrand, G. Hunt, P. Lehodey, S. Lluch-Cota, E. Murphy, Y. Sakurai, F. Schwing, S. Sundby
- 1.2 Human impacts on marine ecosystems [15,000 words]
Brander, K., B. Planque, S. Jennings, I. Perry, M. Heath, M. Fogarty, K. Wieland, L. Cianelli, L. Shannon, L. Botsford

Section 2. Advances in understanding the structure and dynamics of marine ecosystems

- 2.1. Dynamics of marine ecosystems: physical processes [15,000 words]
De Young, B., E. Hofmann, D. McGillicuddy, J. Barth, C. Roy, G. Ottersen, S. Kim, H. Yamazaki
- 2.2. Dynamics of marine ecosystems: ecological processes [20,000 words]
Moloney, C., J. Field, A. Jarre, S. Kimura, O. Maury, E. Murphy, W. Peterson, M. St. John, C. Tadokoro
- 2.3. Dynamics of marine ecosystems: observation and experimentation [15,000 words]
Harris, R.P., T. Dickey, D. Gifford, X. Irigoien, P. Wiebe, C. van der Lingen, J. Runge, R. Campbell, T. Kiørboe, E. Siaz, S. Chiba.
- 2.4. Dynamics of marine ecosystems: integration and modelling [15,000 words]
Werner, C., H. Batchelder, F. Carlotti, Ø. Fiksen, M. Kishi, O. Maury, D. McGillicuddy, E. Murphy, R. Rose

Section 3. The human dimensions of marine ecosystem change

- 3.1 Interactions between changes in marine ecosystems and human communities [15,000 words]
Perry, I., R. Ommer, M. Barange, L. Hamilton, A. Jarre, R. Sumaila, K. Cochrane, M.-C. Badjeck
- 3.2 Management of marine resources in the face of change [15,000 words]
Barange, M., K. Cochrane, C. Cunningham, M. Fogarty, A. Jarre, L. Kell, J. King, F. Koester, B. O'Boyle, K. Reid, M. Sinclair, A. Yatsu

Section 4. A way forward

- 4.1 Ocean ecosystem responses to future global change scenarios: a way forward [15,000 words]
Ito, S.-I., J. Overland, K. Brander, S. Sundby, K. Drinkwater, C. Miller, Y. Yamanaka
- 4.2. Ocean ecosystem responses: a synthesis [10,000 words]
E.E. Hofmann

For more details, follow the links to Integration and Synthesis plans in www.globec.org.

2.5. Carbon Offsetting

To play our part in tackling climate change, GLOBEC has teamed up with Climate Care© to offset our greenhouse gas emissions. Climate Care© is an organisation that reduces greenhouse gases on behalf of companies and individuals by running sustainable energy and reforestation projects across the world. As well as cutting greenhouse gases, the projects help to improve people's standards of living and protect wildlife habitats. To find out more about Climate Care© and its projects, please visit <http://www.climatecare.org>.

From May 2006 attendees to GLOBEC-sponsored meetings are given the opportunity to voluntarily donate Climate Care £7.50 per tonne of CO₂ reduction associated with their flights to attend GLOBEC meetings. GLOBEC acts as an intermediary between attendees and Climate Care©, by holding per diem reimbursements as per voluntary requests. For fairness the amount deducted from claims is calculated as an average of flights taken by all participants to attend a given meeting (approximately USD10-35). Climate Care provides the GLOBEC IPO with a six-monthly certificate showing the projects that have benefited from the investment, which is available to those using this voluntary service.

2.6. GLOBEC SSC 2006

The membership of the GLOBEC SSC is shown in the Table below.

Name	Gender	Country	Function	Term end
Dr Jürgen Alheit	M	Germany	Chair Focus 1, SPACC Exec	(Ex-Officio)
Dr Kevern Cochrane	M	Italy	SSC – FAO link	1 st term 2008
Dr Ruben Escibano	M	Chile	SSC	1 st term 2007
Prof John Field	M	South Africa	SSC	1 st term 2004
Dr Roger Harris	M	UK	SSC Past-Chair, Focus 2	(Ex-Officio)
Prof Eileen Hofmann	F	USA	SSC, SO Chair	(Ex-Officio)
Dr James Hurrell	M	USA	SSC	1 st term 2007
Dr Astrid Jarre	F	Denmark	SSC	1 st term 2008
Dr Daniel Lluch-Cota	M	Mexico	SSC	1 st term 2008
Dr Olivier Maury	M	France	SSC	1 st term 2008
Prof Rosemary Ommer	F	Canada	SSC, Focus 4 co-Chair	2 nd term 2006
Dr Ian Perry	M	Canada	Focus 4 co-Chair	(Ex-Officio)
Dr David Runge	M	USA	SSC	2 st term 2008
Prof Yasunori Sakurai	M	Japan	SSC	1 st term 2008
Prof Svein Sundby	M	Norway	SSC	1 st term 2008
Prof Francisco Werner	M	USA	SSC Chair, Focus 3	2 st term as Chair 2007

At the end of 2007 one member rotates off (Prof John Field). The Chair also rotates from Prof Francisco Werner to a new chair. Nominations to replace these will be provided directly to the SCOR Secretariat.

Annex 6 - Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Program

ACTIVITIES 2006-2007

1. **SSC Meeting: Tokyo, Japan, March 2007**

The GEOHAB SSC met at the University of Tokyo in March 2007. The SSC discussed all aspects of GEOHAB work. The meeting discussions included how GEOHAB should operate in the future, the SSC's terms of reference, communications (including the revised Web site and a potential newsletter), implementation of the Core Research Projects, regional activities (specifically in Asia), GEOHAB modelling activities, the potential for a new CRP on benthic algae, interactions with other projects, and protocols for measurements.

2. **Implementation of Core Research Projects**

The GEOHAB *Implementation Plan*⁹, published in November 2003, specified the formation of Core Research Projects (CRPs) related to four ecosystem types—upwelling systems, fjords and coastal embayments, eutrophic systems, and stratified systems. Initiation of these CRPs has been the primary GEOHAB activity since the 2006 SCOR Executive Committee Meeting.

A. Core Research Project: HABs in Upwelling Systems

This sub-group is chaired by Grant Pitcher (South Africa). It held a “town hall meeting” in conjunction with the 12th International Conference on Harmful Algae in Copenhagen in September 2006 to inform the community about the CRP and entrain more HAB scientists in it. Group members are writing papers to be published in the journal *Progress in Oceanography* to synthesize previous research related to their topic, to serve as a foundation for new comparative research on HABs in upwelling systems. The group plans to meet next in Sept. 2007 to complete the special issue and plan activities for the coming year.

B. Core Research Project: HABs in Fjords and Coastal Embayments

This sub-group is co-chaired by Allan Cembella (Germany) and Leonardo Guzmán (Chile). Their Open Science Meeting took place in Viña del Mar, Chile from 26-29 April 2004. The report from the meeting is still in preparation and the co-chairs are expected to complete their report by 1 Sept. 2007.

C. Core Research Project: HABs and Eutrophication

The sub-group on HABs and Eutrophication is chaired by Patricia Glibert (USA). The research plan for this CRP was published in 2006. The group held their second meeting in Hong Kong in June 2007 to (1) review the status of special issue of *Harmful Algae* on HABs and Eutrophication, one of the outcomes of the 2005 GEOHAB Meeting in Baltimore, MD; (2) review the distribution of the GEOHAB HABs and Eutrophication report; (3) review of progress on the action items identified at the Eutrophication subcommittee meeting in Victoria, Canada, 2006; (4) introduce the new GEOHAB web site and discuss the content related to this CRP; (5) discussion core research in this CRP and its relationship to the developing Asian GEOHAB efforts and GEOHAB modeling activities; (6) discuss of the proposed 2nd GEOHAB Open science meeting on HABs and Eutrophication in Shenzhen, China. The group obtained extra funds from the U.S. National Oceanic and Atmospheric Administration for their activities.

D. Core Research Project: HABs and Stratification

The sub-group on HABs and Stratification is chaired by Patrick Gentien (France). The report from this meeting is still in progress and is expected by 1 Sept..

The GEOHAB SSC is beginning to discuss the possibility of starting a new CRP on benthic systems, which would include algae that contribute to ciguatera, probably the most widespread of all algae-related poisonings.

⁹ GEOHAB. 2003. *Global Ecology and Oceanography of Harmful Algal Blooms, Implementation Plan*. P. Gentien, G. Pitcher, A. Cembella and P. Glibert (eds.), SCOR and IOC, Baltimore and Paris, 36 pp.

3. GEOHAB Modelling

The GEOHAB SSC set up an Organizing Committee for GEOHAB Modelling, comprised of Dennis McGillicuddy (chair), Wolfgang Fennel, and Marcel Babin. The objectives include

- improve understanding of HAB processes through linkage of models, *in situ* observations, and remote sensing
- stimulate modeling activity in GEOHAB Core Research Projects (CRPs)
- foster linkage between HAB modeling and the broader community of ecosystem and population dynamics modeling
- entrain researchers at all levels (students, postdocs, faculty, etc.) into HAB modeling
- facilitate dialog between model developers and HAB researchers involved in process studies through joint training sessions
- improve capabilities for prediction of HABs

The work of the group will focus first on developing a workshop, which will include four connected elements:

1. Plenary talks comprised of (1) invited reviews on HAB modeling and other relevant approaches (ecosystem modeling, population dynamics modeling), and (2) contributed talks on models and observations in support of the CRPs.
2. Dialogue seminars given by HAB observationalists and modelers. Specific modeling needs of the CRPs will be identified; implementation plans will be developed, utilizing existing modeling infrastructure, where practical, and identifying needs for additional model development where gaps exist.
3. Tutorials and training on model design and application of models (geared toward students involved in CRPs).
4. Student project: participants build a model, conduct test runs, and describe the results in a report/presentation.

Funding is being sought for this workshop from European sources, or potentially jointly funded by European and U.S. sources.

4. XIIIth International Conference on Harmful Algae

This conference will be held in Hong Kong in November 2008 and the GEOHAB SSC has had a special session on the global ecology and oceanography of harmful algal blooms approved. GEOHAB will plan a variety of activities associated with the meeting to publicize GEOHAB and involve more members of the international HAB science community in GEOHAB. These international meetings have been excellent venues to disseminate information about GEOHAB, including reports.

5. SSC Meeting: Annapolis, Maryland, USA, April 2008

This meeting will review the progress on GEOHAB activities and will involve program managers from the United States. It may also include a session for the public.

6. International Programme Office [IPO]

GEOHAB, SCOR and IOC continue to seek the establishment of an International Programme Office to help implement, co-ordinate and manage GEOHAB resources in accordance with the approved international *GEOHAB Science Plan* and *Implementation Plan*. IOC and SCOR seek a commitment to host the IPO for GEOHAB with basic operational funds of US\$200,000 per year. For support of the Executive Officer and Administrative Assistant, IOC and SCOR seek international funds from national funding agencies for a period of no less than 3 years and preferably at least 5 years. Until the GEOHAB IPO is established, the co-sponsors of GEOHAB are responsible for sharing IPO duties, as one of their many tasks. This situation is unsatisfactory for the long-term progress and success of the programme.

7. Web site

An SSC member, Marcel Babin, arranged funding to re-design the GEOHAB Web site, which will be put on-line soon.

8. Newsletter

The GEOHAB SSC decided to develop a newsletter to provide regular updates about GEOHAB activities to the international harmful algal bloom research community. There was a lengthy discussion at the SSC meeting about the pros and cons of developing a newsletter and how it might impact *Harmful Algae News*, published by IOC.

9. Asian GEOHAB

A meeting focused on GEOHAB-related research in Asia was held in conjunction with the SSC meeting. It was concluded that formation of an Asian GEOHAB collaboration would be beneficial for research in this region. A second meeting is scheduled to be held in Vietnam in January 2008.

10. Terms of Reference

The GEOHAB SSC felt that it was important to revise their terms of reference and had significant discussion at their Tokyo meeting about what is GEOHAB's niche and how the SSC should operate. The following were proposed by the SSC and approved by SCOR and IOC:

SCOR/IOC Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Programme
Scientific Steering Committee (SSC)

Terms of Reference

The Scientific Steering Committee of the GEOHAB Programme will

1. Coordinate and manage GEOHAB Core Research Projects (CRPs) in accordance with the GEOHAB Science and Implementation Plans.
2. Identify gaps in knowledge required to execute CRPs, and encourage targeted research activities to fill those gaps.
3. Review progress on CRPs over time and initiate new CRPs in priority research areas.
4. Foster framework activities to facilitate implementation of GEOHAB, including dissemination and information tools.
5. Establish appropriate data management activities to ensure access to, sharing of, and preservation of GEOHAB data, taking into account the data policies of the sponsors.
6. Promote comparative and interdisciplinary research on harmful algal blooms by providing coordination and communication services to national and regional research groups, encouraging explicit affiliation with GEOHAB via the endorsement process.
7. Collaborate, as appropriate, with intergovernmental organizations and their subgroups (e.g., ICES, PICES, FANSA, ANCA, WESTPAC/HAB, HANA, NOWPAP), as well as related research projects (e.g., GLOBEC, LOICZ, IMBER) and observational systems such as the Global Ocean Observing System and its regional alliances.
8. Report regularly to SCOR, the IOC Intergovernmental Panel on Harmful Algal Blooms (IPHAB), and the global HAB research community on the state of planning and accomplishments of GEOHAB, through annual reports and, as appropriate, the GEOHAB Web site, a GEOHAB Newsletter, *Harmful Algal News*, special sessions at scientific meetings, and other venues.
9. Interact with agency sponsors to stimulate the support of GEOHAB implementation through various mechanisms (e.g., direct support of GEOHAB initiatives and integration of the GEOHAB approach in national programs).

Approved {date} by the SCOR Executive Committee and {date} by the Intergovernmental Panel on Harmful Algal Blooms.

Acronyms

ANCA = IOC HAB working group for Central America and Caribbean Sea

FANSA = IOC HAB working group for South America

HANA = IOC HAB working group for North Africa

GLOBEC = Global Ocean Ecosystem Dynamics project

ICES = International Council for the Exploration of the Seas

IMBER = Integrated Marine Biogeochemistry and Ecosystem Research project

IOC = Intergovernmental Oceanographic Commission

LOICZ = Land-Ocean Interactions in the Coastal Zone project

NOWPAP = UNEP Northwest Pacific Action Plan

PICES = North Pacific Marine Sciences Organization

SCOR = Scientific Committee on Oceanic Research

WESTPAC/HAB = IOC SubCommission for the Western Pacific HAB working group

Annex 7 – Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project



Integrated Marine Biogeochemistry and Ecosystem Research

IMBER Annual Report to SCOR June 2007

Contents:

Major Activities and Achievements.

Outreach Activities.

International Project Office.

Interactions with other projects and programmes.

Future activities.

Major Activities and Achievements:

Working groups

Five working groups or task teams have been formed and are active in the development and implementation of IMBER.

1. End-to-End food web Task Team

The End-to-End Food Web Task Team, a joint activity with GLOBEC, is co-chaired by Coleen Moloney (South Africa) and Mike St John (Germany). The group has submitted a review paper to *Trends in Ecology & Evolution* focused on the concept for end-to-end food web research. The Task Team is also preparing a longer paper for publication. A workshop to focusing on end-to-end food webs is planned as part of the IMBER IMBIZO¹⁰ to be held in late 2008.

2. IMBER/SOLAS Carbon Working Group

IMBER and SOLAS have established a joint carbon implementation group. The group is co-chaired by Truls Johannessen (Norway) and Arne Koertzing (Germany), and works closely with the International Ocean Carbon Coordination Panel (IOCCP). Three sub-groups have been formed to move forward the implementation of carbon research in the two projects. A Joint SOLAS/IMBER Carbon Research implementation plan has been published electronically (February 2006) (http://www.imber.info/products/Carbon_Plan_final.pdf) and will be published in hard copy in 2007.

Sub-Group 1 Surface ocean CO₂ fluxes (Chair: Nicolas Metzl, France)

This group is focused on synthesis, instrumentation and technology development, observations from Volunteer Observing Ships and mixed-layer sampling strategy. The first major activity of this group was to organize (with IOCCP) an Ocean Surface pCO₂ Variability and Vulnerabilities Workshop (UNESCO, Paris, 11-14 April 2007). The Co-chairs of the organizing committee are Nicolas Metzl and Bronte Tillbrook (http://www.ioc.unesco.org/ioccp/pCO2_2007.html). A special issue of *Deep-Sea Research II* is currently being prepared to disseminate information from this workshop.

¹⁰ *Imbizo* is the Zulu word for a gathering of leaders where an important issue is resolved.

Sub-Group 2 Interior ocean carbon storage (Chair: Nicolas Gruber, Switzerland)

This group covers inventory and observations, natural variability, transformation, designing a strategy for leverage for the ARGO program, and interaction with modelling. They have developed the initiative “Friends of Oxygen on ARGO” (FOA) and prepared a white paper that recommends the incorporation of oxygen sensors to Argo floats, which has been presented to the ARGO SSC. This group is also planning a series of basin synthesis activities. The first synthesis will be for the North Atlantic Ocean and will be conducted in collaboration with CARBOOCEAN.

Sub-Group 3 Carbon cycle climate sensitivities and feedbacks (Chair: Kitack Lee, Korea)

This group focuses on the response of ecosystems and biogeochemical cycles to natural and anthropogenic changes, feedbacks to the Earth System, and future perspective (prediction). The group is starting to move forward with a co-ordinating activity for ocean acidification research.

3. Continental Margins Task Team

LOICZ and IMBER have formed a joint IMBER/LOICZ Continental Margins Task Team. The task team consists of 10 members and is co-chaired by Jack Middelburg (The Netherlands) and Nancy Rabalais (USA). The group is organizing a Continental Margins Open Science that will be held at the East China Normal University in Shanghai on 17-21 September 2007 (<https://www.confmanager.com/main.cfm?cid=792>). The aims of the Conference are to estimate the relative importance of the changing forcing factors (global, local, and human) and to determine how much changes in shelf ecosystems can be attributed to each forcing factor. Based on the outcome of this conference, the task team will write a Science Plan and Implementation Strategy for continental margins research in the two projects. There is significant interest in the conference, with more than 150 registrations and 100 papers submitted so far.

4. Capacity Building Task Team

The Capacity Building Task Team (chaired by Wajih Naqvi, India) developed a capacity-building strategy and implementation plan for IMBER to guide capacity building activities (http://www.imber.info/products/Capacity_Building_final.pdf). One objective of the strategy is to enhance research capabilities in developing countries, especially those geographically close to interesting biogeochemical/ecosystem provinces. Another objective is to enhance research capabilities globally in those IMBER activities that have few practitioners, but are crucial for optimal implementation of the *IMBER Science Plan and Implementation Strategy*.

5. Data Management Task Team

The IMBER Data Management Committee (DMC) was formed in September 2006 and is chaired by Raymond Pollard (NOC, UK). The SSC also appointed the IMBER Deputy Executive Officer, Dr. Sophie Beauvais, as the IMBER Data Liaison Officer, to support the DMC and data management activities for IMBER. The Chair and DLO met with representatives from the British Oceanographic Data Centre (BODC) to discuss possibilities for the development of a realistic strategy for IMBER data management. The Chair and DLO also participated in the SCOR Marine Projects Coordination meeting held in London (December 2006) to discuss data management issues faced by all marine projects. The Data Management Committee met in Victoria, Canada in June and has developed an innovative strategy for data management within IMBER.

Human Dimension

IMBER is exploring a collaborative approach with other IGBP core projects to bring together natural and social science communities to develop the issues and questions for Theme 4 in the IMBER SP/IS. Julie Hall met with the Chair of IHDP (Oran Young), who encouraged IMBER to build on the activities of GLOBEC and LOICZ, rather than start a new activity. There is a session at the Continental Margins OCS on human interactions with continental margin systems, and IMBER will be involved in a GLOBEC Focus 4 (Human Impacts) Workshop in July 2008.

Regional Projects

Integrating Climate and Ecosystems Dynamics (ICED)

ICED is a new international multidisciplinary initiative launched in response to the increasing need to develop integrated circumpolar analyses of Southern Ocean climate and ecosystem dynamics. ICED has been developed in conjunction with GLOBEC and EUR-OCEANS. ICED held its first scientific session during the second SCAR Open Science Conference (OSC) in July 2006 in Hobart, Australia. The theme of the OSC was “Antarctica in the Earth System”, making this an ideal setting for the first ICED scientific session. Stimulating discussion sessions developed new ideas and potential multidisciplinary collaborations were discussed. ICED submitted a proposal to the International Polar Year (ICED-IPY) committee, which was endorsed and will link and coordinate 10 closely related [projects](#) within a consortium entitled "Ecosystems and Biogeochemistry of the Southern Ocean." The ICED team recently completed a Science Plan and Implementation Strategy, which will be reviewed jointly by IMBER and GLOBEC. Information about ICED can be found on their new website:

<http://www.antarctica.ac.uk/Resources/BSO/ICED/>.

Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER) Conference

October 3-6, 2006, Goa (India).

This event, hosted by India's National Institute of Oceanography (NIO), included 4 days of presentations, posters and working group discussions, with participation of more than 200 scientists from all over the world. The participants attended working group discussions organized around seven different themes. The presentations and working groups identified numerous gaps in our knowledge and defined several major scientific questions, including the need for carrying out basin-wide research on the potential role of mesozooplankton grazing in limiting phytoplankton production during the Southwest Monsoon, and relative importance of denitrification and the anaerobic ammonium oxidation (anammox) in the production of N₂. The SIBER workshop provided crucial information that will allow the development of a summary of the state of understanding the Indian Ocean and the definition of the major research questions that need to be addressed. The major outcomes of the workshop include a special journal issue and the development of a science plan to guide future research in the Indian Ocean basin and providing the basis for a major regional research program of IMBER. A workshop to develop a Science Plan for SIBER is being organised in late November in Goa, India.

Endorsed Projects

The marine carbon cycle from North to South along the Galathea route

Leading applicant: Katherine Richardson (funding: August 2006-April 2007)

In August 2006, a Danish research vessel embarked on a global 9-month research cruise: The Galathea Expedition. The cruise track can be seen at <http://www.galathea3.dk>. The largest project on the expedition, “The marine carbon cycle from North to South along the Galathea route”, is a multidisciplinary effort focusing on obtaining a better understanding of the carbon cycle in the upper ocean and in the lower atmospheric boundary layer, and the role of the ocean in climate change. This IMBER-endorsed project is compiling a global dataset describing the upper ocean processes controlling ocean-atmosphere carbon exchange, which will increase our understanding of how physical, chemical and biological processes in the sea influence the carbon dioxide (CO₂) content of the atmosphere.

Key Processes and Sustainable Mechanisms of Ecosystem Food Production in the Coastal Ocean of China

Leading applicant: Prof. Qisheng Tang, (funding: 2006-2010)

Following the kick-off meeting at Qingdao on January 24-26, 2006, the new national “973” project “Key Processes and Sustainable Mechanisms of Ecosystem Food Production in the Coastal Ocean of China” (2006-2010) started the implementation phase. In the first half of 2006, a series of meetings were organized in Qingdao and Hangzhou, during which the design for the cruises, field observation in the areas of marine culture, and international cooperation have been discussed and planned. The research cruises will focus on ecosystem function and diversity in the Yellow Sea, including the spring bloom and food-web dynamics. In the East China Sea research will focus on the biogeochemical cycles and its impact on the ecosystem, including the processes that drive shelf-break material

exchanges and hypoxia off the Yangtze River Estuary, taking into account the impact on the food web from end to end.

Integration Analysis of North Adriatic Marine Ecosystem (ECOMADR)

Leading applicant: Cosimo Solidoro (funding: 2006-2007, 20 months)

This project aims to identify key components of the trophic web of marine ecosystem in the northern Adriatic Sea, and to provide a first assessment of energy fluxes among such compartments. The dynamics of the lower levels of the food web (including microbial activity) have been extensively studied, so particular attention is devoted to explore the ecological role of small pelagic fishes (anchovies and sardines) and mussels, with analysis which include the determination of the daily food ratio in different seasons of the year and the development of bioenergetics models. However the research also includes a biogeochemical characterization of water column and upper sediment, the identification of abundance and composition of plankton communities, the determination of primary production, respiration, bacterial activity, and the analysis of space and time variability of major water quality parameters.

Biogeochemistry and Optics South Pacific Experiment (BIOSOPE)

Leading applicant: Hervé Claustre (funding: 2002-2006)

In 2006, the BIOSOPE group was involved in the analysis and quantification of the numerous hydrological, biological, biogeochemical and bio-optical data that were collected in the southeast Pacific Ocean in late 2004. At the scale of the 8000 km transect, from the Marquesas Islands to the upwelling conditions prevailing along the Chilean coast, a large gradient of hydrodynamic and associated trophic conditions was sampled. Along this gradient, a comprehensive understanding is now emerging about the particle and dissolved stock distributions, the structure of the planktonic ecosystem, its interaction with the cycle of elements (C, N, P, Si) and finally for the optical status of the waters. In particular, the extreme oligotrophic character of the South Pacific gyre waters, in the vicinity of Easter Island, is confirmed and described in great detail. Preliminary results have been presented in various meetings (ASLO, June 2005, Santiago de Compostela; AGU-ASLO-TOS, February 2006, Hawaii; Ocean Optics XVIII, October 2006, Montreal). Submissions to a BIOSOPE special issue in the journal *Biogeosciences* started in early January and papers are also appearing in other journals. The database will be publicly accessible by September 2007. (Contact claustre@obs-vlfr.fr) <http://www.obs-vlfr.fr/proof/vt/op/ec/biosope/bio.htm>

Kerguelen Ocean and Plateau compared Study (KEOPS)

Leading applicant: Stéphane Blain (funding: 2002-2007)

The general objective of KEOPS is to improve our understanding of the response of the Southern Ocean to global climate change. Particularly, KEOPS will study the effects of natural iron fertilisation of the ocean by the Kerguelen plateau on the biological pump of CO₂ and on the cycles of other chemical compounds relevant for climate. Careful examination of the large data set gathered during the natural iron fertilisation experiment (cruise in January-February 2005) has revealed original features. KEOPS results contrast with the observations made in short-term blooms triggered by deliberated iron fertilisation experiments. This is the case for the ecosystem structure, for the magnitude of the carbon export in response to the iron fertilisation, for the DMS production and for the decoupling between the nitrogen and the silicon cycles. Preliminary results have been presented as part of a special session at the Ocean Science meeting (Hawaii Feb 2006) and detailed papers are in the review process for publication as a special issue of *Deep-Sea Research II*. The data set will also fuel different coupled models aiming to describe and to understand the spatial and temporal variability of the natural bloom sustained by natural iron and major nutrient fertilisation. (Contact stephane.blain@univmed.fr) <http://www.obs-vlfr.fr/proof/vt/op/ec/keops/keo.html>

Outreach activities

IMBER website

The IPO developed a new IMBER website, which was made publicly available in March 2006 (www.imber.info). The website is a major communication tool for IMBER. Between July and December, the website was visited roughly 3600 times with an average of 7 visitors per day and 4 pages per visitors. The most visited pages are Newsletters, Working Groups, and Jobs. Visitors were primarily from USA, UK, Germany, Spain, Japan, Taiwan, Italy, Canada, and India. Two new pages were added recently:

1. The "**Science Highlight**" page is dedicated to IMBER research, ongoing projects, scientific news, etc... (http://www.imber.info/Science_Highlight.html);
2. The "**Young Scientists**" page includes information regarding Early Career Scientist Conferences, Student Courses, Summer Schools and Opportunities for developing country young scientists and students (http://www.imber.info/Education_and_Training.html).

IMBER update

Five issues of the electronic newsletter "*IMBER update*" have been published. The newsletter includes IMBER science highlights, reports from the activities of the IMBER working groups, summaries from IMBER-endorsed and contributing projects, reports from regional and national programmes, and a list of the upcoming IMBER-related conferences and workshops. All issues are downloadable from the IMBER website; <http://www.imber.info/newsletters.html>.

Brochure and Poster

An IMBER brochure and a poster are now available as a communication tool to promote the IMBER program. They introduce the global scientific context of IMBER and present the four themes of the program with a special focus on the major questions of Theme 2, which is the heart of IMBER. Information regarding how to get involved and how to contact the International Project Office (IPO) are also included. Both the brochure and poster can be downloaded from the IMBER website (www.imber.info/useful-downloads.html) and available on request at the IPO.

e-News

The IMBER e-news is sent to the IMBER email list monthly. This publication includes a list of upcoming IMBER activities, funding calls, job opportunities, conferences and workshops.

IPO report

In April this year, the IPO initiated an IPO activity report, which is a monthly report sent to SSC members to keep them up to date with IMBER activities.

International Project Office

The IPO is located in Brest at the Institut Universitaire Européen de la Mer. It is funded by Centre National de la Recherche Scientifique (CNRS), Institut de Recherche pour le Développement (IRD), Université de Bretagne Occidentale (UBO) and the Brittany Region. The office is fully staffed. Sylvie Roy was appointed Executive Officer in August 2005, Elena Fily started as administrative assistant in September 2005, Sophie Beauvais was appointed as the deputy executive officer in October 2005.

IPO Funding

IMBER's activities and international office are sponsored by:

- IGBP: support for SSC meeting (20K USD);
- SCOR: support from NSF (50K USD; 2006-2009);
- CNRS: support for activities and travel (32K USD; 2006-2008), for salary (80K USD, 2006-2008);
- IRD: support for salary (52K USD, 2006-2008);
- Region of Brittany: support for salary (33K USD, 2006-2008);
- University of Western Brittany (UBO and IUEM: support for rooms and stationery costs (16K USD, 2006-2008), plus in kind support.

Discussion has started with the current funders of the IPO regarding the renewal of IPO funding in July 2008. A meeting to bring together funders, the IMBER Executive and sponsor representatives is planned in conjunction with the IMBER Executive meeting in early October.

Interactions with other projects and programmes

SOLAS

Joint SOLAS/IMBER Carbon Research group: see earlier description.

LOICZ

Joint IMBER/LOICZ Continental Margins task team: see earlier description.

GLOBEC

Joint IMBER/GLOBEC End- to-end task team: see earlier description.

IMBER/GLOBEC Transition Team

IMBER and GLOBEC have been working together to develop the Terms of Reference and the membership of the Transition Team, which will draft the Addendum to the IMBER Science Plan. These will be presented at the SCOR Executive Committee meeting in Bergen for discussion and approval by SCOR.

CLIVAR

A committee involving CLIVAR, IMBER and GLOBEC has been formed to organize a "hands-on" workshop to be held in April 2008. The objective of this workshop is to bring together young marine scientists working in areas of biogeochemistry and ecosystems research with climate scientists. The goals of the workshop are to exchange information on climate variability impacts and marine impacts between physical climate science and marine biogeochemistry and ecosystems communities.

EurOceans

A Memorandum of Understanding (M.O.U) was signed between IMBER and EUR-OCEANS. IMBER and EUR-OCEANS co-sponsor activities focussed on marine biogeochemical and ecosystem research including:

- End-to-End food webs task team activities;
- Advances in Marine Ecosystem Modelling Research (AMEMR) modelling workshop,
- International Symposium on “Parameterization of trophic Interactions in Ecosystem Modelling” (March 2007);
- ICED;
- A “Floating university” project being developed for early 2008 in collaboration with the BONUS-GOODHOPE project.

CARBOOCEAN

CARBOOCEAN is a European integrated project that aims at an accurate scientific assessment of the marine carbon sources and sinks, with special emphasis on the Atlantic and Southern Oceans on a time scale of -200 to +200 years from now. An M.O.U was signed between IMBER and CARBOOCEAN and discussions are underway to develop joint activities.

GODAE

A joint IMBER/GODAE task team is being formed to review the present biogeochemistry and ecosystem development within GODAE systems and related issues, to identify common interests between IMBER and GODAE, to evaluate real-time datasets and assimilation schemes required for biogeochemistry and ecosystem applications and to provide a report to IMBER and GODAE to recommend further actions. A meeting of this group took place in June 2007.

National activities:

IMBER activities are starting in many countries (e.g., Chile, P.R. China, Finland, France, Germany, India, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Taiwan, Turkey, UK, USA). For example, China has 5-year funding for a IMBER/GLOBEC programme and will be hosting the Second Large Marine Ecosystems Conference. IMBER-JAPAN was established under the Science Council of Japan, chaired by Hiroaki Saito. A northwest Pacific Ocean cruise has been funded for Summer 2008. France just funded for three years the CYBER programme

"CYscles Biogéochimiques, Ecosystèmes et Ressources". Spain is developing a co-sponsored proposal with The Netherlands for a "Deep-water Oceanography" project and will be holding a Spanish IMBER symposium in March 2007.

Future Activities

Joint IMBER/LOICZ Continental Margins Open Science Conference: see earlier description

SIBER workshop

A workshop will be held in Goa, India November 27-30th to develop the Science Plan for the IMBER Indian ocean regional programme, based on the 2006 workshop described earlier.

IMBER/CLIVAR/GLOBEC workshop on climate variability: see earlier description.

1st IMBER IMBIZO

This activity is planned for late 2008 and will be a set of three concurrent, co-located workshops:

- (a) End-to-end foodwebs
- (b) Mesopelagic zone
- (c) Bathypelagic zone

These individual workshops will be brought together under the central unifying theme 'Biogeochemical and ecosystem interactions in a changing ocean'. The IMBIZO will have short daily joint sessions involving participants of the three workshops to stimulate interactions among the workshop participants. The potential to use a Dahlem conference approach to each of the workshops is being investigated.

IMBER supported meetings include:

- CLIOTOP Symposium December 2007, Mexico
- ICED Modeling Workshop early 2008.
- SIC meeting March 2008, USA.
- Climate Change Conference May 2008, Spain.
- Upwelling Conference, June 2008, Spain.
- GLOBEC Focus 4 workshop, July 2008, Italy.
- End-to-End Short Course September 2008, turkey.
- IMBER IMBIZO late 2008.

Annex 8 - Surface Ocean–Lower Atmosphere Study (SOLAS) (joint with IGBP, WCRP, and CACGP)

SOLAS International Project Office
Annual Report to SCOR 2006/2007

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30 June 2007

SOLAS Implementation Plans

The Surface Ocean - Lower Atmosphere Study (SOLAS) *Science Plan and Implementation Strategy* was published in early-2004. SOLAS has three foci, each administered by an Implementation Group (IMP):

- Focus 1:** Biogeochemical Interactions and Feedbacks between Ocean and Atmosphere
- Focus 2:** Exchange Processes at the Air-Sea Interface and the Role of Transport and Transformation in the Atmospheric and Oceanic Boundary Layers
- Focus 3:** Air-Sea Flux of CO₂ and Other Long-Lived Radiatively Active Gases

The Implementation Plan for Focus 3 was developed jointly with IMBER. The IMPs have successfully completed the task of development of the three Implementation Plans, and these are posted on the SOLAS website (<http://www.solas-int.org>). The ongoing role of the IMPs is to execute the science within the Plans.

SOLAS Scientific Steering Committee (SSC)

The SOLAS SSC met in Amsterdam in May 2006 and in Xiamen China in March 2007, prior to the SOLAS Open Science Meeting.

SOLAS International Project Office

The SOLAS International Project Office (IPO) is housed at the University of East Anglia (UEA) in Norwich UK, with five-year funding by the UK Natural Environment Research Council (NERC), into 2009.

Dr. Jeff Hare is the Executive Officer (EO) of the IPO and Dr. Emily Breviere is the IPO Project Officer (PO). Ms. Georgia Bayliss-Brown, who received a BS in Environmental Sciences (specialty in Meteorology) from UEA, works part time in the IPO as a Research Assistant.

In November 2006, Dr. Tom Bell was appointed as SOLAS Project Integrator. Tom received his PhD in Environmental Sciences from UEA in 2006, and his role is to act as the facilitator for the community to have access to project databases and for the development of global air-sea flux fields.

National Networks

Several nations have SOLAS research programs or projects in the planning stages, but research is active in many countries. Some highlights are presented below.

- **Australia** –SOLAS-related research occurs at academic institutions and government laboratories (CSIRO), and collaborations with scientists from New Zealand are frequent. Australian scientists led and executed the SOLAS-endorsed project, Precursors to Particles (P2P), at the Cape Grim Baseline Air Pollution Station in January 2006. Australia also has a new National Representative in Dr. Jill

Cainey (Cape Grim Observatory), and she was an invited speaker at the SOLAS Open Science Meeting in Xiamen, China.

- **Belgium** – The Belgian Federal Science Policy (BELSPO) has generously contributed funds to permit a half-time Secretariat for IMP1 over a 2-year period beginning January 2005, and Dr. Veronique Schoemann from the Université Libre de Bruxelles (ULB) fills that role. A proposal to renew the funding for this position is awaiting approval. This agency has also provided funding for research groups within the nation to consolidate SOLAS research activities into a Cluster. The funding has established a communications office and a database management system at ULB, has led to coordination of modeling efforts, and has funded the development of a national SOLAS website. In December 2006, ULB organized and hosted the Comparison of Oceanic Dimethylsulfide Models (CODiM) workshop, which brought together 20 scientists for intercomparison of 1-D and 3-D DMS models. The results of this synthesis are still under development, and plans have been made for another workshop in a few years. The Belgian National Representative for SOLAS is Christiane Lancelot (ULB), and she is also a member of the SOLAS SSC.
- **Brazil** – There have been four SOLAS experimental efforts in Brazil:
 1. FluTuA – Turbulent Fluxes over the Tropical Atlantic,
 2. Numerical Study of the Surface Fluxes in the South Atlantic,
 3. Sea Waves and Coastal Monitoring at Sao Paulo State, and
 4. Global Scale Studies of Oceanic Fluxes using Remote Sensing.

The Brazilian National Representative is Amauri Pereira de Oliveira (USP).

- **Canada** – The C-SOLAS program is the first funded national program within SOLAS, and their five-year funding cycle (including extensions) ended in mid-2007. The science program had three themes:
 1. Biogeochemical interactions and feedbacks between oceans and atmosphere (DMS-climate connection, halogen-climate connection, carbon-climate connection, iron-climate connection),
 2. Exchange processes at the air-sea interface, and
 3. Integration and modeling.

C-SOLAS developed a network of 43 researchers from 9 universities, 22 government researchers, 2 industrial partners, and (most significantly) more than 30 graduate students. For the field phase of the work, two independent series of cruises were executed (SERIES and SABINA) and a mooring was placed in the vicinity of Ocean Station Papa in the Northeast Pacific. The C-SOLAS network has produced an incredible number of refereed publications (over 1050) from the 5-year funding cycle. In 2006, the C-SOLAS network submitted a proposal to national funding agencies to continue work, but this proposal was not successful. The network held its final national open science conference in June 2006 in Toronto. Ongoing work within the network includes contributions to the International Polar Year effort. The National Representative for SOLAS in Canada is Maurice Levasseur (University of Laval), who was an invited speaker at the 2007 SOLAS Open Science Meeting.

- **Chile** – SOLAS research is conducted at COPAS (Centro de Investigación Oceanográfica en el Pacífico Sur-Oriental) at the University of Concepción, with other academic institutions also contributing. There are plans underway to coordinate SOLAS research with the upcoming CLIVAR Variability of American Monsoon Systems (VAMOS) Ocean Cloud Atmosphere Land Study (VOCALS) program field intensive in October 2008, and this collaboration involves significant participation by Chilean SOLAS researchers. Osvaldo Ulloa (Universidad de Concepcion) is the SOLAS National Representative and is a member of the SOLAS SSC.

- **China (Beijing)** – China SOLAS obtained more than US\$1 million to conduct SOLAS research from 2003 to 2007, networking with national neighbors (China-Taipei, Korea, Japan, etc) has increased, and the national scientists look forward to more progress in international cooperation across the Asian network. The Chinese are focused on the effects of dust and marine primary productivity, nitrogen loading in coastal waters and marginal seas, processes controlling mass and energy exchange at the air-sea interface, variability of CO₂ fluxes between the air and sea, and effect of these fluxes on cloud and radiative budgets. Cruises have been executed in the Yellow Sea and in the South China Sea. Chinese and Japanese scientists are leading an effort to establish the Asian Dust and Ocean Ecosystems (ADOES) project participants into a SOLAS Task Team, with a second ADOES workshop conducted in August 2006 in Inner Mongolia. China hosted the International SOLAS Open Science Meeting in Xiamen (March 6-9 2007). Guang-Yu Shi (Institute of Atmospheric Physics) is the National Representative to SOLAS, a member of the SOLAS SSC, and the Chair of the Organizing Committee for the 2007 SOLAS Open Science Meeting in China.
- **China (Taipei)** – National scientists continue to participate in three major SOLAS activities:
 - 1 Long-term Observation and Research of the East China Sea (LORECS; the goal is to investigate the biogeochemical processes in the East China Sea that lead to uptake of carbon dioxide and to detect changes due to the damming of the Yangtze River),
 - 2 the Straight Watch on the Environment and Ecosystem with Telemetry (SWEET), and
 - 3 the South East Asia Time-Series Station (SEATS; a long-term buoy deployment in the South China Sea to understand upper ocean dynamics and variability of biogeochemical fluxes).

Wu-Ting Tsai (National Central University) was an invited speaker at the 2007 SOLAS Open Science Meeting and is the National Representative for SOLAS.

- **Denmark** – The Danish SOLAS team was involved in the EU-funded Marine Effects of Atmospheric Deposition (MEAD) project, which investigated the effects of nitrogen deposition on coastal water biogeochemistry. An around-the-world cruise campaign was conducted from August 2006 until April 2007 (GALATHEA) to measure surface concentrations and fluxes of carbon dioxide. Lise Lotte Sorensen (Riso National Laboratory) was an invited speaker at the 2007 SOLAS Open Science Meeting in China and is the SOLAS National Representative in Denmark.
- **France** – French scientists are very active in SOLAS-related research, and the French program originally operated under the moniker of PROOF (acronym for biogeochemical processes in the ocean and fluxes). A new ‘umbrella’ for research within the SOLAS remit has been established: LEFE (Fluid Envelopes and Environment). This program includes projects on atmospheric chemistry (CHAT), biogeochemical cycles (CYBER), climate variability on a global scale (EVE), and interactions and dynamics of the ocean and atmosphere (IDAO). SOLAS-France plans a national meeting in September 2007. Remi Losno (LISA) and Veronique Garcon (SSC Member) are the SOLAS National Representatives. Dr. Garcon was an invited speaker at the 2007 SOLAS Open Science Meeting in Xiamen.
- **Germany** – D-SOLAS scientists are very active in the SOLAS research regimes, combining institutional (Max Planck Institutes) and university researchers. The SOLAS effort in Germany operates under the recently funded (6.5m EUR over 5 years) SOPRAN (Surface Ocean Processes in the Anthropocene) project. SOPRAN includes 12 institutions, 43 investigator, and has four main foci: interphase transfer at the air-sea interface, effect of anthropogenic CO₂ on marine ecosystems and sea-air flux of gases, production and emission of radiatively and chemically active gases in the tropics, and the oceanic response to dust deposition. D-SOLAS has teamed up with UK-SOLAS to plan the development of a unique atmospheric (UK) and oceanic (D) observatory in the Cape Verde Islands. Cruises and aircraft flights funded by each nation in the vicinity of the observatory are also planned, making optimal use of the facility and the continuous data set. In addition, collaborations have been

developed for Cape Verde with researchers in the United States. An atmosphere-related SOLAS proposal will soon be submitted to national funding agencies, and this program is called the Marine Multi-Phase Halogen Chemistry and its Coupling to Nitrogen and Sulfur Cycles (MAPHiNS). Doug Wallace (IfM-GEOMAR, Kiel) is one of the German National Representatives and has been approved as Chair of the International SOLAS SSC. He was also an invited speaker at the most recent SOLAS Open Science Meeting in China. The other National Representative is Uli Platt (University of Heidelberg).

- **India** – SOLAS and IMBER collaborate strongly in India, but resources within the nation are limited. Interest areas include oxygen dynamics in the upper ocean, halocarbon fluxes, and time-series measurements of biogeochemical species. The Indians have established a new time-series station in the coastal Bay of Bengal, and this project is funded for the next 3 years. Dileep Kumar (NIO, Goa) is the SOLAS National Representative and is a former member of the SOLAS SSC.
- **Ireland** – A small number of scientists are working on SOLAS-related research within the nation, and a planning and coordinating meeting was held in Galway in November 2006. Irish scientists led the 2006 experimental effort for Marine Aerosol Production (MAP), which was funded by the European Commission. Colin O'Dowd (Galway) is the SOLAS National Representative.
- **Japan** – SOLAS in Japan recently received a boost with the successful funding of the Western Pacific Air-Sea Interaction Study (W-PASS). This award amounts to about US\$9 million over 5 years to understand primary production in the Western Pacific, to determine how the marine ecological system will respond to changing atmospheric composition, to determine how production and emission of biogenic gases will affect the composition of the atmosphere, and to evaluate the contribution of marine biogenic gases to global warming. Mitsuo Uematsu (University of Tokyo) is the SOLAS National Representative and is a member of the SOLAS SSC.
- **Korea** – There are SOLAS activities within the nation, much of it occurring at the Korean Ocean Research and Development Institute (KORDI). In addition, university researchers are working on controlled (mesocosm) biogas transfer experiments, biogeochemical cycling, and other SOLAS research areas. Sung Yang (Gwangju University) is the SOLAS National Representative.
- **Netherlands** – The universities and government laboratories in the nation have a tradition of strong science in SOLAS research areas and have been successful at developing international projects funded by the EU. SOLAS research is in the fields of air-sea exchange of aerosols, DMS, CO₂ and momentum fluxes. Several institutions work on the EU Integrated Project CARBOOCEAN. Recent years have seen more emphasis on IMBER-related research. During the 2006 SOLAS SSC meeting in Amsterdam, the Netherlands SOLAS/IMBER/GEOTRACES network held a well-attended one-day workshop in which SSC members were invited to participate. Gerrit DeLeeuw (TNO) is an SSC Member and is the National Representative.
- **New Zealand** – A cruise was conducted in March 2006 to investigate the nitrogen cycle in the subtropical waters off NW New Zealand. Future NZ-SOLAS research includes investigations of event-based dust storms from Australia, and they plan to follow up on the two previous cruise expeditions with more perturbation and natural event investigations. Phil Boyd (NIWA) is the SOLAS National Representative.
- **Norway** – Norwegian SOLAS at present does not have direct national funding for SOLAS science, but several SOLAS-related activities are underway within the country. The Norwegians have been successful in obtaining EU funds for their SOLAS-related research, including work toward long-term measurements of natural carbon dioxide variability in the North Atlantic. Norwegian SOLAS scientists are involved in investigations of the cycling of bioreactive gases between the air and sea, mesocosm

perturbation experiments, coupled 3-D modeling, etc. CARBOOCEAN, which is endorsed by SOLAS, is housed at the University of Bergen. Abdirahman Omar (Bjerknes Centre) is the SOLAS National Representative.

- **Russian Federation** –A national climate program exists, and SOLAS-related studies in Russia include atmospheric anthropogenic gases and chemical components of Earth’s climate. Sergey Gulev (Russian Academy of Sciences) is a member of the SOLAS SSC and is the SOLAS National Representative.
- **Spain** – A SOLAS Committee has been established and includes 7 leaders within the Spanish community. Specific funding for SOLAS research is not available at the national level, but air-sea interaction is a national research priority. Spanish scientists work on quantification of air-sea carbon dioxide exchange and the marine biotic effects on this flux, the investigation of links between DMS and climate, the deposition of inorganic and organic compounds, and marine productivity and respiration in oligotrophic environments. Rafel Simo (University of Barcelona) is the SOLAS National Representative.
- **United Kingdom** - The UK-SOLAS programme has been developed in close cooperation with the Atlantic Meridional Transect project (AMT) and the Centre of Excellence for the Observation of Air-Sea Interactions and Fluxes (CASIX). The Natural Environmental Research Council (NERC) programme UK-SOLAS was initiated in early 2004 with \$21M over 5 years. The first annual meeting was held in July 2006 in Manchester, and the next annual meeting is scheduled for August in Leeds. Funding has also been approved for the installation of SOLAS atmospheric sampling station in Cape Verde, and German SOLAS will be coordinating some of their activities around this station as well. NERC has also generously provided funding for the SOLAS IPO over a 5-year period beginning in 2004. The National Representative for SOLAS in the UK is Phil Williamson (UEA).
- **United States** – US-SOLAS has published a Science Implementation Strategy which four foci:
 1. Quantification of biogeochemical interactions and feedbacks between the ocean and atmosphere,
 2. Understanding the exchange processes at the air-sea interface and the role of transport and transformation in the atmospheric and oceanic boundary layers,
 3. Characterization of air-sea fluxes of CO₂ and other long-lived radiatively active gases, and
 4. Promoting enabling technologies, outreach, and data management.

Funding for US-SOLAS is expected to come from a consortium of the National Science Foundation (NSF), the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA). As a scientifically powerful, relatively well-funded nation, a healthy US-SOLAS program is of fundamental importance to the continued success of the international effort. Wade McGillis (LDEO) is the SOLAS National Representative from the United States.

- **Europe** – SOLAS research is very strong across the continent, with more than 40% of the SOLAS research community residing in Europe. The IPO was recently awarded funding for a COST Action to create flux data products from ongoing SOLAS data collection. This COST Action (number 735) has held one meeting of the working groups and will work closely with the SOLAS Project Integrator to accomplish its goals. CARBOOCEAN, a European Union Integrated Project that seeks accurate scientific assessment of marine carbon sources and sinks over space and time, has been endorsed by SOLAS. The Marine Aerosol Production (MAP) campaign (see Ireland) and the Organics over the Ocean Modifying Particles in both Hemispheres (OOMPH) project are SOLAS efforts funded through European Union.

Other Activities

SOLAS International Summer School

The 1st SOLAS International Summer School was held in July of 2003, with 72 students in attendance. The 2nd Summer School was held in September 2005 with 73 participants, and the final selection of 72 students from around the world has been completed for the 3rd Summer School, scheduled for 22 October – 3 November 2007. Corinne LeQuere (UK), Veronique Garcon (France), and the IPO are responsible for the planning and operation of the Summer School, which will be held at the Institut d'Etudes Scientifiques de Cargese in Corsica, France. About 15-20 lecturers provide instruction on all aspects of SOLAS science, and this year there are plans to include discussions about publication of research and on the ethics of scientific endeavors. The site in Cargese provides a unique environment for the Summer School, with academic classrooms, laboratory facilities, and a nearby port. Collaborators within France have been able to secure a research vessel for ship-based practical workshops during the Summer School. The Summer School is highly successful, as evaluations from the students and lecturers have shown. The atmosphere is ideal for interaction between students and lecturers, and this capacity building is felt by SOLAS to be of fundamental importance to the long-term legacy of the project. There are plans to develop the lectures from the 2007 School into a textbook for SOLAS.

Open Science Meeting

Prior to the official establishment of SOLAS within the IGBP structure, an Open Science Meeting (OSM) was held in Damp, Germany in the spring of 2001. This conference established the SOLAS Science Plan. The 2004 SOLAS OSM was held in Halifax, Nova Scotia Canada, from 13-16 October. The SOLAS SSC made a subsequent decision to follow the format of the Halifax meeting for future OSMs. The unique opportunities to network and establish collaborations are felt to be incredibly useful.

The 2007 SOLAS OSM was held 6-9 March in Xiamen, China and was organized by local hosts at the University of Xiamen and the IPO. This OSM included a relatively small number of plenary talks (20), long poster sessions (posters were on display over the duration of the conference), and afternoon discussion and synthesis sessions on topics determined to be of importance by the community. The conference was attended by 235 scientists from about 30 nations.

Other Activities

A SOLAS-initiated meeting to review the results of the various large-scale iron enrichment experiments took place in Wellington, New Zealand from Oct. 30 to Nov. 4, 2005. This meeting included 21 scientists from 9 nations representing all major iron enrichment experiments, along with experts in various other aspects of ocean iron biogeochemistry. The aim of the meeting was to synthesize the results of the many enrichment experiments (natural and artificial). SCOR and the SOLAS IPO committed funding for the meeting. One of the most significant and discrete scientific developments for SOLAS within the past twelve months is the publication of the synthesis resulting from this meeting (*Science* article by Boyd et al., 2007).

The SOLAS SSC is concerned about the plans by some corporate interests to conduct large-scale iron fertilization of the ocean surface in the guise of "carbon offsetting." In response to this, the SSC has developed a position statement. "Large-scale fertilisation of the ocean is being actively promoted by various commercial organisations as a strategy to reduce atmospheric CO₂ levels. However the current scientific evidence indicates that this will not significantly increase carbon transfer into the deep ocean or lower atmospheric CO₂. Furthermore there may be negative impacts of iron fertilization including dissolved oxygen depletion, altered trace gas emissions that affect climate and air quality, changes in biodiversity, and decreased productivity in other oceanic regions. It is then critical and essential that robust and independent scientific verification is undertaken before large-scale fertilisation is considered. Given our present lack of knowledge, the judgement of the SOLAS SSC is that ocean fertilisation will be ineffective and potentially deleterious, and should not be used as a strategy for offsetting CO₂ emissions."

In November 2006, 30 scientists from a dozen nations met at the University of East Anglia for a workshop on the "Anthropogenic Nitrogen Impacts on the Open Ocean". Nitrogen is deposited to the ocean via atmospheric

and riverine inputs, but the impact of increased atmospheric nitrogen loading has not been discussed coherently within the scientific community. These concerns led SCOR, SOLAS, NOAA, the International Nitrogen Initiative (INI), and the European Science Foundation (ESF) to sponsor a four-day workshop in Norwich, UK. The output of the workshop is expected to be at least one seminal review paper on the topic, suitable for publication in *Science* or *Nature*.

Along with the International Oceanic Carbon Coordination Project (IOCCP), the Global Carbon Project (GCP), and IMBER, SOLAS co-sponsored the April 2007 workshop in Paris on “Surface Ocean CO₂ Variability and Vulnerabilities”. More than 100 scientists from 20 nations met in Paris to review the current knowledge base and develop deeper international collaboration to resolve the variability and processes governing ocean surface carbon dioxide. The workshop included a number of breakout working group meetings on topics of value to the ocean carbon community, a discussion on observing systems, and the development of a cross-basin synthesis of surface ocean carbon observations. The organizing committee is currently working on a summary report of the meeting which will include recommendations for further research and networking within the community.

SOLAS has also led the development of the Asian Dust and Ocean EcoSystem (ADOES) consortium of scientists who are interested in the response of the ocean surface biogeochemical system to inputs of masses of dust from the Asian plateau (see China above). Two ADOES workshops were held in 2005 and 2006, and plans are underway to consolidate the participants into a research initiative.

In December 2006, SOLAS sponsored a workshop for the Comparison of Oceanic Dimethylsulfide Models (CODiM) in Brussels. This workshop is a continuation of discussions held during the 2004 SOLAS Open Science Meeting in Halifax, and seeks to conduct a systematic comparison of DMS ecosystem models against common data sets to spur improvements and indicate future observations to better constrain the dynamics of DMS systems. The CODiM exercise consists of two complementary initiatives:

1. a comparison of different 1-D DMS-ecosystem models with data sets from three different identified ocean sites, and
2. a task to compare global mechanistically based 3-D DMS models against a database of DMS(P) measurements.

A review paper is in process, entitled “A first appraisal of ocean DMS models and prospects for their use in climate models”, and two detailed articles will be produced on 1-D and 3-D model inter-comparisons.

SOLAS has close relationships with three other IGBP Core Projects. With the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) project, SOLAS has developed a Joint Carbon Implementation Plan (SOLAS IMP3). With the International Global Atmospheric Chemistry (IGAC), SOLAS has joint projects on tropospheric halogens, polar research, and others. SOLAS is developing relationships with the Land - Ocean Interactions in the Coastal Zone (LOICZ), including projects to investigate air-sea fluxes of gases in nearshore regions and a collaborative effort (including IGAC) on MegaCities.

The Task Team on Halogens in the Troposphere (HitT), which is co-sponsored by SOLAS and IGAC, developed a white paper on the state of the science and strategies for future investigation. This document is available on the SOLAS website (<http://www.solas-int.org>).

The Ocean-Atmosphere-Sea Ice-Snow (OASIS) project has been endorsed by SOLAS. This large international project has links with the International Study of Arctic Change (SEARCH) and may be complemented by the work of the Climate in the Cryosphere (CliC) Arctic Panel.

The International Polar Year (IPY) should provide an opportunistic platform for OASIS, HitT and other research areas of SOLAS. Richard Bellerby of the Bjerknes Centre for Climate Research in Bergen is the point of contact for SOLAS polar activity.

Special SOLAS sessions were conducted at the February 2006 AGU/ASLO/TOS Ocean Sciences Meeting in Honolulu and at the April 2006 European Geophysical Union (EGU) General Assembly in Vienna. In addition, a SOLAS special session was held at the 2006 Fall AGU Meeting in San Francisco, and a joint IMBER/SOLAS special session was conducted at the 2007 EGU General Assembly in Vienna.

SOLAS sponsored the participation of Marie Boye of France in the workshop entitled “Modeling iron biogeochemistry and ocean ecosystems” at the October 2006 North Pacific Marine Science Organization (PICES) Annual Meeting in Yokohama, Japan.

SOLAS has been asked to partner with the CLIVAR VOCALS (Variability of the American Monsoon System Ocean Cloud Atmosphere Land Study) program, to provide information about surface biogeochemical links and interfacial exchange that contributes to the development of and the persistence of the unique stratus cloud (<http://www.eol.ucar.edu/projects/vocals/>). Current plans call for an October 2008 cruise with the possible participation of two research vessels.

SOLAS is working to develop a network in Africa, and this network has been initiated in South Africa. This network began to gel during the 2006 IGAC/CACGP/WMO Conference on Atmospheric Chemistry at the Interfaces in Cape Town, and subsequently, an initial meeting of interested scientists was held in Cape Town in March 2007.

A recent poll to contribute to a list of 2006 publications was provided over 110 entries.

Capacity Building and Inclusion of Developing Country scientists

The primary capacity-building activity of SOLAS is the biennial SOLAS International Summer School. To run the SOLAS International Summer School, we rely on the generous support of SCOR, the Asia Pacific Network for Global Change Research (APN), the Inter-America Institute for Global Change Research (IAI), the North Pacific Science Organization (PICES), the Atmospheric Composition Change European Network of Excellence (ACCENT), and other national funding agencies. SOLAS is grateful for the support from these programs.

The SOLAS IPO is developing the lectures from the summer school into an online learning tool and a SOLAS textbook. Currently, the presentations are available on the summer school Web site, but these will be expanded into an online reference. These will be sent on CD to all those who applied for the summer school, and to anyone else who requests a CD. It will also be available on the Web. The IPO will also provide free hard copies or CDs of the SOLAS Science Plan and Implementation Strategy to anyone who requests them.

Jeffrey Hare
Emily Breviere

Annex 9 – GEOTRACES Project
GEOTRACES PLANNING GROUP
ANNUAL REPORT TO SCOR 2006/2007
June 2007

Publication of Science Plan and formation of SSC

The Science Plan for GEOTRACES was published in August 2006 (ISSN 1932-7943 Print; ISSN 1932-7951 Online) and also available in hard copy. Copies can be downloaded from the GEOTRACES website (www.geotraces.org). As described in last years report to SCOR, the Science Plan received extensive informal and formal review, and was approved by SCOR prior to publication.

The SCOR-sponsored GEOTRACES Planning Group had been formed specifically to generate a Science Plan for the programme so, following publication of the Science Plan, this Planning Group was disbanded. A Scientific Steering Committee has been formed in its place to oversee and manage the implementation of the research outlined in the Science Plan. The SSC membership (listed above) contains representatives of 13 different countries, with diverse expertise including marine biogeochemistry of carbon and nutrients trace elements and isotopes as proxies for past climate conditions, land-sea fluxes of trace elements/sediment-water interactions, trace element effects on organisms, hydrothermal fluxes of trace elements, tracers of ocean circulation, tracers of contaminant transport, controls on distribution and speciation of trace elements; and ocean modelling.

GEOTRACES meetings during 2006/2007

The first meeting of the GEOTRACES SSC was held for three days (16-18 December 2006) immediately following the AGU meeting in San Francisco. This was attended by 13 of the SSC members along with one alternate (Jing Zhang, Japan, replacing Toshi Gamo). The chair of the GEOTRACES Intercalibration Subcommittee (Greg Cutter) also attended, as did Don Rice from US-NSF. In addition, representatives of other programmes attended the first day: Dick Feely from CLIVAR and Jeff Hare from SOLAS. Jay Cullen planned to attend to represent IMBER but was prevented from doing so by cancelled flights.

SSC discussions were wide ranging. In addition to funding issues and relationships with other programmes, major issues for discussion included measurement intercalibration, data management, ocean modelling, criteria for GEOTRACES participation, and reports of national activities.

Since the 2006 SSC meeting, there have been national meetings in this period (as described below) and several international meetings are planned for the remainder of 2007. This includes the next SSC meeting, which will be held in Barcelona on 6-8 November 2007. Other planned meetings are detailed in the next two sections.

Ocean Basin Workshops in 2007

Three international workshop meetings will be held in 2007 to plan the implementation of GEOTRACES science in each of the major ocean basins – Pacific, Atlantic, and Indian (note: initial work on the high-latitude oceans has been planned under IPY, as detailed below). These workshop are planned in:

Honolulu, Hawaii, USA. 26th to 29th June 2007 – Pacific Ocean
Oxford, UK, 10th to 13th September 2007 – Atlantic Ocean
Goa, India, 24th to 26th October 2007 – Indian Ocean

Further details of these workshops are available on the GEOTRACES website. Each meeting will bring together between 40 and 50 scientists with interests in GEOTRACES-related research in the relevant ocean basin. Discussion at each meeting will identify the key regions and research questions for that basin, and plan ocean sections (and to some extent process studies) to address the goals laid out in the GEOTRACES science plan. Recommendations of these Basin Workshops will be taken to the 2007 SSC meeting in November for approval and adoption as GEOTRACES implementation strategy.

Modelling and GEOTRACES

A fourth workshop is also planned during 2007 to address the role of modelling in the GEOTRACES programme. This workshop will be held at the Hanse Wissenschaftskolleg, Delmenhorst, Germany on 6-8 September 2007 and

will be hosted by Reiner Schlitzer (Alfred Wegener Institute, Germany) and Jim Orr (IAEA, Monaco). The workshop will review the present state of models of trace elements and isotopes (TEI) in the marine environment and will discuss promising new modelling approaches and projects in the light of recent advances in our understanding of TEI cycles and the expected increase in quality and quantity of TEI observations during GEOTRACES. The workshop will produce a set of recommendations that will be used by the GEOTRACES SSC to develop a coherent modelling and synthesis plan for the GEOTRACES program.

Measurement Intercalibration during the GEOTRACES programme

There was early recognition during the planning of GEOTRACES that intercalibration of measurements between laboratories would be critical to the success of the programme. To that end, a subcommittee on Intercalibration and Standardization was set up, chaired by Greg Cutter (Old Dominion University, USA). Following a meeting in Oct. 2006, the committee produced a report on intercalibration that has been open for input from the community and was approved by the SSC in December 2006.

Building on the recommendations from that report, Cutter, along with two U.S. colleagues (Ken Bruland, UCSC, and Rob Sherrell, Rutgers) wrote a successful proposal to the US-NSF which has secured ship time for two intercalibration cruises. The first will be in the Atlantic in June-July 2008, and the second in the Pacific early in 2009. These cruises have been widely publicised and efforts are underway to plan details of sampling techniques and sample distribution so that all interested laboratories can secure appropriate samples to assess all relevant measurements.

Data Management for GEOTRACES

The importance of good protocols for data management was also recognized early in planning for GEOTRACES and a subcommittee convened under the leadership of Chris Measures (Hawaii, USA) and Raymond Pollard (National Oceanography Centre, UK). That subcommittee met in December 2005 and produced a report that, after input from the community, was approved by the SSC in December 2006. The report is available from the GEOTRACES website.

The Data Management Committee, now chaired by Chris Measures and Reiner Schlitzer, will next meet immediately following the Modelling workshop on 8 September in Germany to plan initiation of Data Management procedures.

GEOTRACES cruises during IPY

A number of cruises are planned under the auspices of GEOTRACES during the International Polar Year (IPY). Hein de Baar (Netherlands) is acting as co-ordinator of these cruises. Briefly, planned cruises are as follows:

Arctic

- a Swedish cruise to European shelves
- a German/Netherlands/Spanish cruise to the European-Asian Arctic Shelves
- a Canadian cruise to the Beaufort Sea
- a Japanese cruise to the Sea of Okhotsk
- a Spanish cruise to the north of Iceland.

Antarctic:

- a German cruise to “Zero and Drake”
- a French cruise, also in the Atlantic Sector
- an Australian cruise south of Tasmania
- a Japanese cruise in the Indian sector

Links with other programmes

GEOTRACES remains committed to maintaining strong links to other relevant programmes.

Representatives of CLIVAR, SOLAS, and IMBER attended the SSC meeting, and GEOTRACES representatives attended the most recent SOLAS SSC (Jing Zhang, Japan) and IMBER SSC (Kristin Orians, Canada).

Developments at national level

USA: In addition to leading the Intercalibration efforts, the United States has been successful in establishing a national project office (at Lamont-Doherty Earth Observatory) which is now nearing the end of its first year of funding. To the extent permitted by available resources, this U.S. project office will assist with matters pertaining to international GEOTRACES until an international project office can be established (Contact Bob Anderson, Lamont-Doherty Earth Observatory). A U.S. GEOTRACES SSC was established in 2006 and met on 4-5 June 2007, to discuss U.S. priorities within the programme.

Canada: Canadian scientists, having met in 2005, are initially focusing on IPY, with a cruise planned in 2008 (contact Roger Francois), but also hope to run a cruise in the North Pacific Ocean, probably jointly with IMBER and/or SOLAS. Canadian scientists with GEOTRACES interests met in May 2007 to discuss future plans.

Germany: German scientists have taken part in an Atlantic Ocean transect to test some measurement techniques, and are involved in IPY activities. Additional cruises that may have a significant GEOTRACES component include one from Las Palmas to Canary Islands in May 2009 and another to study oxygen minimum zones in the Peru and Chile upwelling zones.

Japan: Two cruises have been funded which will include a significant component of GEOTRACES research. One is a meridional section in the Indian Ocean, part of which represents a Japanese contribution to IPY. The other is in the Sea of Japan (contact Jing Zhang, Japan). An IPY cruise in the Sea of Okhotsk also contains GEOTRACES activities.

Spain: Spanish scientists met in January 2007 to discuss GEOTRACES activities. Initial work is under the auspices of IPY, with high-latitude work likely to remain a particular focus.

Sweden: In addition to planned IPY activities, the Swedish icebreaker *Oden* will be leased to the United States for the next five years and plans are being developed to use that vessel to conduct Antarctic GEOTRACES work.

The above represent the most significant national developments, but GEOTRACES activities have also taken place in a number of other countries including Australia, Brazil, Chile, China, India, Netherlands, New Zealand, and the UK.

GEOTRACES sessions at international conferences

Open “town meetings” were held during the Fall meeting of the American Geophysical Union (11 December 2006, San Francisco) and at the winter meeting of ASLO (7 February 2007, Santa Fe, New Mexico). The general purpose of the meetings was to inform members of the oceanographic community about the objectives and status of the GEOTRACES program, and to encourage interested scientists to participate in the program, especially to encourage participation in the intercalibration effort and provide details of these efforts.

A special session entitled “Evolution of ocean chemistry: past, present and future” was held at the 2006 Goldschmidt Conference in Melbourne, Australia, 27 August - 1 September, 2006.

Acknowledgements

We offer our special thanks to Ed Urban, who continues to provide tremendous support and valuable advice to the planning of the GEOTRACES programme.

Annex 10 – Post-Audit Financial Statement for 2006

	INCOME		
	Discretionary Funds	Grants & Contracts	Total
INCOME			
Membership	\$256,777		\$256,777
IGBP Contributions:			
IMBER		\$20,000	\$20,000
SOLAS		\$20,000	\$20,000
Grants for IOCCG (NASA and NOAA)		\$69,532	\$69,532
NOAA Grants			
SOLAS/INI Workshop		\$5,000	\$5,000
WG 125		\$4,648	\$4,648
NSF Grants			
Working Groups and Projects	\$64,775	\$173,705	\$238,480
Travel Awards		\$61,221	\$61,221
Sloan Foundation Grants			
Ocean Technology Panel		\$34,352	\$34,352
Project Coordination Mtg		\$38,345	\$38,345
IAPSO Contribution re WG 127		\$4,000	\$4,000
IMBER Miscellaneous Funds		\$1,140	\$1,140
SOLAS Miscellaneous Funds		\$9,963	\$9,963
less unused SOLAS funds deferred to 2007		(\$3,366)	(\$3,366)
Miscellaneous and Interest Income	\$9,052		\$9,052
Total Income	\$330,604	\$438,541	\$772,510

	EXPENSE		
	Discretionary Funds	Grants & Contracts	Total
EXPENSES			
WG 115 -Plankton Surveys	\$12,211		\$12,211
WG 116 -Sediment Traps & 234Th Methods	\$3,286		\$3,286
WG 120 - Phaeocystis	\$21		\$21
WG 121 - Ocean Mixing Symposium - public'n	\$6,890		\$6,890
WG 122 - Estuarine Sediment Retention	\$20		\$20
WG 123 - PACE (w/ IMAGES)	\$46		\$46
WG 124 - LINKS (w/ IMAGES)	\$2,175		\$2,175
WG 125 - Zooplankton	\$15,799	\$4,648	\$20,446
WG 126 - Viruses	\$14,663		\$14,663
WG 127 - Equation of State	\$8,991	\$4,000	\$12,991
WG 128 - Hypoxia	\$17,085		\$17,085
Pigment Editorial Panel	\$11,029		\$11,029
GEOHAB	\$3,029	\$32,170	\$35,208
GEOTRACES	\$6,000	\$35,299	\$41,299
GLOBEC		\$65,359	\$65,359
IMBER	\$13,446	\$21,140	\$34,585
SOLAS	\$7,500	\$42,530	\$50,030
SOLAS INI Workshop	\$7,833	\$5,849	\$13,682
IOCCP (Ocean Carbon Coordination)		\$23,187	\$23,187
Ocean acidification (High CO2 Ocean)		\$908	\$908
IGBP/SCOR Meeting on High CO2	\$12,351		\$12,351
Sloan Ocean Technology Panel		\$34,352	\$34,352
Project Coordination Meeting		\$38,345	\$38,345
SCAR/SCOR Expert Group	\$9,205		\$9,205
IOCCG		\$69,532	\$69,532
Travel Awards & Capacity Building Meeting	\$952	\$61,221	\$62,173
Representation	\$17,991		\$17,991
Publications & Advertising	\$6,213		\$6,213
Annual Meeting (Chile)	\$27,155		\$27,155
Salaries and Benefits	\$127,780		\$127,780
less salaries allocated to project income	(\$11,000)		(\$11,000)
Outside Services	\$23,980		\$23,980
Communications	\$4,030		\$4,030
Office Equipment	\$107		\$107
Audit and Accounting Services	\$9,000		\$9,000
Meeting management costs	\$1,789		\$1,789
JHU/UD overhead charges	\$19,618		\$19,618
Miscellaneous, office supplies, bank charges	\$6,796		\$6,796
Total Expenses	\$385,999	\$438,541	\$824,540
Beginning Unrestricted Net Assets	\$236,737	From 2005 audit	
Income - Expenses (Discretionary Accounts)	(52,030)		
Ending Unrestricted Net Assets	\$184,707	Agrees with 2006 audit	

Annex 11 – SCOR-Related Meetings (2007-2010)

2007

4-10 September	WG 127 on Thermodynamics and Equation of State of Seawater	Berlin, Germany
6-8 September	GEOTRACES Data-Model Synergy Workshop	Delmenhorst, Germany
10-13 September	GEOTRACES Atlantic Basin Cruise Planning Meeting	Oxford, UK
17-21 September	IMBER/LOICZ Continental Margins Open Science Meeting	Shanghai, China
20-23 September	WG 128 on Natural and Human-Induced Hypoxia and Consequences for Coastal Areas	Shanghai, China
23-25 September	SCOR/LOICZ Sediment Retention in Estuaries (WG 122) Workshop	Boulder, Colorado, USA
1-3 October	SCAR/SCOR Expert Group on Oceanography Southern Ocean Observing System Workshop	Bremen, Germany
24-26 October	GEOTRACES Indian Ocean Cruise Planning Meeting	Goa, India
6-8 November	GEOTRACES SSC	Barcelona, Spain
12-16 November	CoML All Projects Meeting and SCOR Panel on New Technologies for Observing Marine Life	Auckland, New Zealand
26-30 November	GEOHAB Core Research Project on Upwelling Systems	Vigo, Spain

2008

9-12 April	GEOHAB SSC Meeting	Annapolis, Maryland, USA
May	WG 125 on Global Comparisons of Zooplankton Time Series	Gijón, Spain
5-6 May	GLOBEC SSC Meeting IMBER SSC Meeting SOLAS SSC Meeting	Cape Town, South Africa
6-9 May	WG 130 on Automatic Plankton Visual Identification	São Paulo, Brazil
17-19 June	SCOR/IODE Workshop on Data Publishing	Oostende, Belgium

28-31 July	WG 132 on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems	Geesthacht, Germany
7-13 September	WG 127 on Thermodynamics and Equation of State of Seawater	Berlin, Germany
6-8 October	Second Symposium on the Ocean in a High-CO ₂ World	Monte Carlo, Monaco
6-8 October	SCOR/IAPSO WG 129 Workshop on Deep Ocean Exchanges with the Shelf	Cape Town, South Africa
20-21 October	SCOR 50th Anniversary Symposium	Woods Hole, Massachusetts, USA
22-24 October	SCOR General Meeting	Woods Hole, Massachusetts, USA
6-11 November	GEOTRACES SSC and Data Management Committee	Toyama, Japan
10-13 November	IMBER Imbizo	Miami, Florida, USA
2009		
30 March-1 April	Third SCOR Project Summit	Newark, Delaware, USA
11-13 June	GEOHAB SSC	Galway, Ireland
15-19 June	GEOHAB Modeling Workshop	Galway, Ireland
22-26 June	GLOBEC 3rd Open Science Meeting	Victoria, B.C., Canada
November	SOLAS Open Science Meeting	Barcelona, Spain