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REPORT OF THE XXVIIIth SCOR General MEETING

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XXVIIIth SCOR GENERAL MEETING

Hotel El Araucano
Concepción, Chile

23-26 October 2006

1.0 OPENING

1.1 Opening Remarks and Administrative Arrangements

Carmen Morales introduced Franklin Carrasco, Dean of the Faculty of Natural and Oceanographic Sciences of the University of Concepción, who welcomed meeting participants to Chile and summarized the programs and accomplishments of the Department of Oceanography at the university. Bjørn Sundby thanked Carrasco and the other Chilean hosts and stated his pleasure to be in Chile. Although the meeting will focus on science business, there is plenty of actual science to discuss, including the conference on “Oxygen minimum systems in the ocean: Distribution, diversity and dynamics”. Participants introduced themselves. Sundby recalled those who have served SCOR and have died since the last General Meeting, including Agustin Ayala, Sergey Lappo, Henk Postma, Sayed El-Sayed, Robert Stewart, and Ümit Ünlüata, and a moment of silence was observed.

1.2 Approval of the Agenda

A few modifications were made to the agenda distributed before the meeting. The presentation about the Census of Marine Life was switched to Monday, because that was the only day that Victor Gallardo would be available. Two working group proposals were withdrawn, on coordinating the availability of a world register of marine species and on ocean time series. The plans for the SCOR 50th Anniversary Symposium were introduced on Monday to make it possible for participants to think about the plans. Marie-Alexandrine Sicre asked for the IMAGES presentation to be moved earlier in the meeting, after the working group proposals were considered on Tuesday. The revised agenda was approved.

1.3 Report of the SCOR President

Bjørn Sundby briefly reviewed his activities for SCOR since the SCOR Executive Committee Meeting in September 2005 in Australia. He had focused on relationships between SCOR and its partners, such as the Intergovernmental Oceanographic Commission (IOC), the Scientific Committee on Problems of the Environment (SCOPE), and the Scientific Committee on Antarctic Research (SCAR). SCOR has complementary goals with these organizations: to promote international cooperation in marine research.

John Field invited Sundby to attend the Global Ocean Observing System (GOOS) Scientific Steering Committee (SSC) meeting. It was an eye opener, with many acronyms. Sundby described the distinction between formal relationships among the organizations involved in GOOS, and real working relationships. Formally, SCOR is part of the International Council for

Science (ICSU) and sometimes acts on behalf of ICSU, but SCOR works directly with IOC on many activities. As SCOR is part of ICSU, IOC is part of UNESCO. Sometimes people try to work together but don't always speak the same language. Sundby had a chance to talk with Ümit Ünlüata about the International Ocean Carbon Coordinating Project (IOCCP) in early 2006, leading to a letter of agreement between SCOR and IOC in relation to IOCCP.

In March, Sundby and Ed Urban attended a meeting to discuss a joint project with SCOPE and the International Association on the Physical Sciences of the Oceans (IAPSO) on semi-enclosed coastal environments. SCOPE received US\$50,000 from ICSU to start this activity, but additional funds are needed to complete the project. Sundby attended the annual SCOPE meeting on behalf of SCOR in early October 2006. He noted the differences in how SCOR and SCOPE work, and a few ways in which SCOR could learn from SCOPE.

Sundby stated that he really wants to see capacity building continue to evolve in SCOR, especially the Regional Graduate Schools of Oceanography (RGSO). Sundby arranged Canadian funds to encourage an RGSO meeting in Sri Lanka, but the ongoing conflict there makes it very difficult to hold meetings. But, other aspects of capacity building will be discussed at this meeting. Sundby and Elizabeth Gross represented SCOR at another exciting event earlier in 2006: Ed Urban's wedding.

1.4 Report of the SCOR Executive Director

Ed Urban referred to his written report in the background book. SCOR is in a good financial position, although there will be a couple of lean financial years coming up. Most international organizations are struggling with financial pressures. All SCOR members need to help bring funds to SCOR for activities identified as priorities. SCOR needs National Committees to help in broadening SCOR's financial resource base. Urban mentioned the new International Project Office (IPO) of the International Marine Biogeochemistry and Ecosystem Research (IMBER) located in France and support from the United Kingdom for the IPOs of the Surface Ocean – Lower Atmosphere Study (SOLAS) and the Global Ocean Ecosystem Dynamics (GLOBEC) projects. Urban thanked these countries for their support.

SCOR is doing important work in many areas. One example is the symposium series on The Ocean in a High-CO₂ World and plans to continue this activity. A number of new publications have resulted from SCOR activities in the past year. Urban noted that SCOR's most important activity in capacity building is to make strong efforts to involve developing country scientists in all SCOR activities. This facilitates networking and provides a mechanism for longer-term interactions of developing country scientists with developed country scientists.

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 fiscal (calendar) year and the current year, and proposes a budget for the coming year. The Committee reported to the meeting under agenda item 8.3. Sundby reviewed the tasks of the

Finance Committee. The SCOR Executive Committee appointed (before the meeting) Colin Devey (chair, Germany), Birger Larsen (Denmark), and Temel Oguz (Turkey) to the committee.

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. Bjørn Sundby asked Laurent Labeyrie (France) to lead this analysis effort again to review the balance of SCOR activities and made an appeal for volunteers to help with this task. Huasheng Hong (China-Beijing), Allyn Clarke (Canada), and Jorma Kuparinen (Finland) agreed to assist Labeyrie.

1.7 Results of Elections for SCOR Officers

Bjørn Sundby noted that this is a General Meeting, therefore it is the time to elect some new SCOR Officers. Robert Duce (USA), as chair of the Nomination Committee, reported on the election process and results. Other members of the committee included John Compton (South Africa), Paola Rizzoli (USA/Italy), and Mingyuan Zhu (China-Beijing). Nominations were received from national committees and a slate of nominees was sent to all SCOR national committees. Victor Akulichyev will serve another term as a SCOR Vice-President. Huasheng Hong, Peter Burkill (UK), and Jorma Kuparinen were nominated for Vice-President positions. There were no nominations for Secretary, so Kuparinen was asked to serve as SCOR Secretary, which he agreed to do.

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 2005 for a meeting to scope out a Volume 2 of the book *Phytoplankton Pigments in Oceanography*. The meeting was held at the International Atomic Energy Agency (IAEA) in Monaco in April 2006. The meeting yielded an outline for Volume 2 and a budget for the activity, estimated at \$30,000. The SCOR Executive Committee instructed the authors to proceed. External funding is being sought.

2.2 Current Working Groups

The Executive Committee Reporter for each working group presented an update on working group activities and progress, and made recommendations of actions to be taken. The Executive Committee made preliminary decisions, based on the progress of working groups and the merits of the requests, about whether funding should be provided for 2007 activities of working groups that requested funds. The Finance Committee took into account the recommendations of the

Executive Committee as it developed the 2007 SCOR budget, which was then subject to final approval by meeting participants.

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

This group is developing a book entitled *Coupled Coastal Wind-Wave-Current Dynamics*, which is scheduled to be sent to Cambridge University Press for printing around 1 September 2006. Ed Urban noted that this is a long-standing group, but the papers are now going to press and we hope to see a printed book before next year's SCOR meeting.

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 Alister 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.* The deadline for papers to be submitted is the end of 2006 and publication is expected in 2007. Annelies Pierrot-Bults reported on the project and the meeting, which she attended. The group recommended a new term of reference for WG 125 on Global Comparisons of Zooplankton Time Series to evaluate how zooplankton monitoring is proceeding globally and that WG 125 should prepare an annual report on progress made." Ed Urban noted that WG 125 has agreed to take on this new term of reference, but this meeting needs to decide whether this is a good idea. Sundby asked for comments on this recommendation and there were no objections.

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

Laurent Labeyrie reported that this group is doing well and held an editorial meeting in Honolulu, Hawaii, USA in February 2006, after which it submitted a major paper to the *Journal of Marine Research* and is awaiting news of the paper's acceptance. SCOR approved the group's request in 2005 for extra funding for color figures in the publication and for reprints.

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

Akira Taniguchi reported that the SCOR Executive Committee (and IOC) approved a change in the focus of this group's final workshop, to "Comparing ecosystem dynamics in a global climatic context using meta-data analyses and ecosystem-based indicators: Increasing biological turnover rates in marine ecosystems

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

Julie Hall reported that this group is coming to the end of its work, close to completing its terms of reference. It had its final meeting (a symposium) late last year and a special issue of *Biogeochemistry* is in progress. Hein de Baar added that he attended the symposium and that the group is coming along very well.

2.2.6 SCOR/IAPSO WG 121—Ocean Mixing

Victor Akulich reported that the group's special issue of *Deep-Sea Research II* was published in early 2006 and distributed to all symposium participants. The final meeting of the group will be 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 working group meeting is to focus on how well the group has 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*. SCOR approved funding for a meeting in 2007.

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

Laurent Labeyrie reported that this group is planning a meeting in 2007. No annual report was received and Labeyrie was not able to contact them. They were planning a meeting in summer 2006, but the meeting did not take place. Meeting participants agreed that SCOR should make funding for the 2007 meeting conditional on receipt of an acceptable progress report. Labeyrie will inform them of this decision.

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

Laurent Labeyrie reported that this group is operating well. They held a conference on their topic in Atlanta, Georgia, USA in March 2005, bringing together physical oceanographers and paleoceanographers. They held their final meeting in Paris in April 2006 to prepare their summary document. A special issue on Past Ocean Circulation for the AGU publication, *Geochemistry, Geophysics, Geosystems (G-cubed)* will publish the papers that were presented at the 2005 workshop as well as related papers on the subject. Working group members Jean Lynch-Stieglitz, Olivier Marchal, and Catherine Kissell are serving as guest editors for the publication, which is now closed for new submissions. Most of the papers are in the review process and should appear in 2006. The group's request to use their remaining funds from SCOR for the co-chairs to get together for editorial work was approved. Labeyrie suggested that SCOR negotiate with AGU to obtain permission to link the *G-cubed* papers with the SCOR Web site.

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

This group is planning an international workshop on 20–24 November 2006, in Delmenhorst, Germany, as its final meeting. The group is preparing a series of 5 manuscripts that mainly target understanding 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 is the discussion of these manuscripts to finalize them for publication in a peer-reviewed journal (potentially *Global Biogeochemical Cycles*). It is planned to submit the papers in January 2007. No further financial commitment is needed beyond 2006.

2.2.10 WG 125—Global Comparisons of Zooplankton Time Series

Annelies Pierrot-Bults reported that the group held its first meeting in Silver Spring, Maryland, USA in November 2005. Their next meeting is planned for 4-7 December 2006 in Lima, Peru in association with the International Conference on the Humboldt Current System: Climate, Ocean Dynamics, Ecosystem Processes, and Fisheries. (The group had planned to hold a meeting in April 2006, but needed more time between meetings to advance their work.) The group is making good progress in bringing together zooplankton data from around the world. The NOAA

National Marine Fisheries Service will commit funds to bring more participants (and data) into the process, such as Aljona Arashkevich (Russia), a new Associate Member approved this year. After its December 2006 meeting, the group will not meet again until 2008, so no funds were requested for 2007.

2.2.11 WG 126—Role of Viruses in Marine Ecosystems

The second meeting of this group was held in Victoria, B.C., Canada in conjunction with the American Society of Limnology and Oceanography (ASLO) summer meeting in June 2006, and in conjunction with a Workshop on Methods in Virus Ecology in Marine Systems. Julie Hall reported that the group opened participation in their first meeting and had 40 people at their workshop, demonstrating growing interest in role of viruses in marine systems. The working group has made strong outreach efforts to other SCOR groups. Their publication will be in an electronic journal (*Limnology and Oceanography: Methods*) and will be freely available. The group is still deciding on the location and timing for their 2007 meeting, for which funding was approved.

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

Shiro Imawaki reported that this group met for the first time in Warnemünde, Germany in May 2006. It plans its next meeting for Italy during the week of 7-11 May 2007. At its first meeting, the group spent four days working through the 21 specific issues listed in its Terms of Reference. A set of position papers had been prepared before the meeting by several members of the working group. Progress was made on each item, with milestones constructed for work to be completed leading up to their 2007 meeting. The group has added two new Associate Members. They would like to add someone from a developing country. (Arthur Chen, a member of the group, reiterated that they had spent a lot of time discussing this at their first meeting, but it is hard to find someone with the needed skills; he asked for suggestions.) Patricio Bernal offered sponsorship and support from IOC and referred to past history and the role of IOC/UNESCO in the Joint Panel on Tables and Standards. Elizabeth Gross reiterated that this is important; an intergovernmental organization can insist on the adoption of new standards at national levels and has leverage with editors of journals. Funding was approved for the group to meet in 2007.

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

Robert Duce gave a positive report about this group and noted that many members of the working group were in Concepción for the oxygen minimum zone conference, including the co-chair, Denis Gilbert. This group met for the first time in Vienna, Austria in conjunction with the European Geophysical Union meeting in April 2006. At that meeting, the group discussed how to fulfill its terms of reference and developed a list of potential review papers and original research papers. The group plans to publish a subset of these papers in an EGU open-access journal such as *Biogeosciences* or *Advances in Geosciences*, so that papers can be published as they are accepted, and later collated into a special issue. Denis Gilbert reviewed papers planned for the publication. The group plans to meet next in Shanghai, China, in conjunction with a workshop on continental margins science being planned by IMBER and LOICZ for September 2007. LOICZ will provide a password-protected section of its Web site to allow working group members to share draft documents. Funding was approved for a 2007 meeting of the working group. Glibert reported that the group would like to add an economist, but have not been able to

find one. Julie Hall suggested that the group contact LOICZ to identify an economist, since LOICZ has strong links to the economics community.

2.3 New Working Group Proposals

Seven working group proposals were received by the SCOR Secretariat, but two were withdrawn before the meeting. SCOR can fund two new working groups to begin in 2007. Sundby reviewed the process for discussion of proposals for new working groups. SCOR must avoid even the appearance of conflict of interest. He asked anyone involved in a proposal to leave the room when their proposal was discussed.

2.3.1 Working Group on Deep Ocean Exchanges with the Shelf (see Annex 3)

Ed Urban introduced this working group discussion since Ilana Wainer, the original proposal monitor, had to cancel her participation in the meeting at the last minute. This topic came out of IAPSO's strategic plan and IAPSO proposed that it and SCOR create a joint working group. The proposal was originally submitted and reviewed last year, but not funded. The current proposal reflected the advice given to the proponents based on the discussion at the 2005 SCOR meeting. This proposal was very highly ranked by the national committees that responded before the meeting, although there were some comments about possible revisions to the terms of reference. Urban reviewed the terms of reference and the membership and asked for comments from meeting participants.

Allyn Clarke noted that the Canadian SCOR Committee gave the proposal a high ranking. Hein de Baar reported that the Netherlands SCOR Committee thought it is an important topic, but ranked the proposal low in relation to the other proposals. He noted that a biologist should be added. Peter Burkill reported that the UK SCOR Committee ranked this proposal first. It is a very strong and timely proposal since measurement tools and models needed are now in place. They liked the changes to the proposal since last year. One point of concern was that they thought the proposal might be overambitious. Physics is essential; perhaps the inclusion of biogeochemistry would make the group too ambitious. If topics beyond physics are included, the group would need to add members with appropriate expertise. According to Birger Larsen, the Danish SCOR Committee had similar comments to those of the UK SCOR Committee. The working group should be focused on the shelf break and this should be in the group's title. The proposal still has the problem of last year in that it seems to be two groups, one working on global scale and one working on shelf breaks. The proposal may need more work to focus it on the shelf break and leave global-scale models to another group. Temel Oguz also thought that this is the best proposal, but the Turkish SCOR Committee noted the need for biological and chemical modelers. Also, marginal seas are under-represented. Oguz offered names for Associate Members, including a biogeochemist and Black Sea specialist. Victor Akulichev reported that the Russian SCOR Committee supports the proposal.

Huasheng Hong added that the China-Beijing SCOR Committee strongly supports the proposal and also noted the need for modelers in other disciplines. The French SCOR Committee ranked the proposal as the best, according to Catherine Jeandel. Understanding shelf-ocean exchanges is key for many issues. New techniques and models are available and this group is timely, although the French SCOR Committee didn't completely support the inclusion of biogeochemistry. Julie

Hall reported that the New Zealand SCOR Committee ranked the proposal second out of the seven. They had the same question about the need to include biogeochemistry/biogeochemists. The proposal is very model oriented; it needs more observationalists, such as Jonathan Sharples (UK). The New Zealand SCOR Committee also wondered how the co-sponsorship with IAPSO will work. The terms of reference need tightening up. They liked the outreach to research projects. Colin Devey noted (on behalf of the German SCOR Committee) that he thinks that the proposal lacks clear deliverables.

Michael MacCracken (IAMAS) provided a comment from the modeling perspective: one proposed activity is to monitor progress in the modeling community. Why is this a working group task? How does it relate to the modeling groups of some of the projects? How would this activity continue after the working group has completed its work? Shiro Imawaki added that IAPSO strongly supports the proposal.

Toshitaka Gamo reported that from the Japanese SCOR Committee, most physical oceanographers gave support to the proposal, with the request that more emphasis should be paid to observations. Other comments were that a sea-going biologist should be added, as well as someone from the Western Arctic Shelf-Basin Interactions (SBI) Project. Kurt Hanselmann noted that the group has identified priority topics, but can these terms of reference be achieved in three years? He suggested that the group focus on fewer points, especially terms of reference 2, 4 and 6. Jorma Kuparinen added that the Finnish SCOR committee strongly supported this proposal. Frank Hall reported that the U.S. SCOR Committee ranked this proposal third of the seven proposals. One issue was to clarify the role of IAPSO; the U.S. committee thought that IAPSO should commit more resources. Another issue was the lack of geological expertise for things like tectonics, morphology etc. Arthur Chen reported that the China-Taipei SCOR Committee endorsed the proposal, with three concerns: (1) the proposal is too heavily oriented to modeling and needs more observations, (2) there is not enough biogeochemistry represented, and (3) marginal seas need more attention. Marta Estrada from the Spanish SCOR Committee agreed with some previous committees that the proposal is overambitious; the terms of reference could be focused. John Compton reported that the South African SCOR Committee discussed the proposal in the absence of their physical oceanographer. But, shelf-break processes are important in South African waters, so they ranked the proposal very high due to their national interests.

Patricio Bernal (IOC) called attention to Mike MacCracken's comment about the need for the group to focus. Bernal is concerned about linkages to ongoing programs that could benefit from the group's work. It's very important to IOC that links be made to IOC groups involved in modeling for climate.

A huge amount of seismic data is available for shelf-slope connections from oil companies and others. Such data could be very valuable for this working group. Somehow, the marine geologists and geophysicists have not usually worked with physical oceanographers and this group should help make this connection and make use of these readily available data. Frank Hall agreed with this point and reiterated the importance of tectonics for this group, for example, active versus passive margins, the relevance of deep-sea canyons, etc. Laurent Labeyrie summarized that it is evident that this group needs more focus. Most comments here are very pertinent. The proponents need to make choices about time and space scales. They didn't refer to

extreme events in this environment, such as tsunamis, turbidity currents, etc. Biology and biogeochemistry are very important in this shallow environment. Can they cope with all these topics? Labeyrie supported approval of the working group if it can be strongly focused on physical oceanography and narrow time scales, and include biogeochemistry only in terms of tracers of physical processes.

Bjørn Sundby summarized the discussion before continuing. He noted that there clearly is much interest in the shelf break, in all of its aspects. No single working group can address all the relevant issues. There is a strong interest in approving this group, but many critical remarks that it doesn't include this or that aspect. But, there is an equally strong interest to focus the group so that it can achieve its terms of reference. Choices have to be made.

Allyn Clarke replied that Canada's support of the proposal resulted because it was better focused than last year. The Canadian SCOR Committee liked the focus on physics and the open ocean-shelf exchange and thought the group didn't intend to look at details of how shelf break biology is modeled. Sundby agreed that the group should be pared down to essential physics. Mike McCracken is willing to take on task of working with the proponents to focus the group. Peter Burkill replied that he completely agrees and that the necessary modifications are minor, for example, deleting the fourth bullet in Term of Reference 1 ("chemical and biological flux exchanges between the deep ocean and coastal ecosystems") and delete "and chemistry" from the next bullet. It is better to do one thing well. Julie Hall reiterated the need to include modeling and observations. Temel Oguz asked about low-frequency processes, such as Rossby waves. Sundby agreed that episodic phenomena should be included. Catherine Jeandel commented that a focus on physics is appropriate because if we don't get the physics right, then the coupling to biology and physics will be difficult. She herself needs more physical information for her geochemical modeling. It's too soon to push the group to combine the coupling of physics with other processes. Hanselmann stated his support for focusing, but noted that this may require a change in membership. Sundby asked those interested to discuss the advice to the proponents with MacCracken. At the end of the discussion of all working groups and of SCOR finances, it was decided that this group would be funded in 2007, assuming that agreement can be reached on suggested changes. MacCracken was appointed to continue as the Reporter for this working group and to work with them to implement the changes requested by meeting participants.

2.3.2 Working Group on Automatic Plankton Visual Identification (see Annex 4)

Julie Hall introduced this working group proposal and summarized comments received in advance from SCOR National Committees. A key challenge has been identified, the low resolution in time and space when it comes to identification of key species of plankton, compared with physical and chemical measurements. A common imaging system needs to be developed to make observations comparable. Currently, several systems are being developed and this will cause problems regarding comparability. There is a need for cooperation in this field. Also, we are losing taxonomists, so there is a need for more automated techniques. Many different research and observational programs need this technology. It should result in open-source software supported by the community. Hall reviewed the group's proposed terms of reference. The group proposes strong links to SCOR WG 125 on Global Comparisons of Zooplankton Time Series and the SCOR Panel on New Technologies for Observing Marine Life.

Regarding comments received from National Committees, reviewers highlighted the technical challenge of the proposed work and some thought the group's goals are too ambitious. There was also concern about the group already deciding on which software to promote (ZooIMAGE). There is already commercial development going on on this topic. How will the group deal with this situation? Are the technical aspects of the group in line with what SCOR working groups usually do? Is it not clear whether the work will be focused on zooplankton, or includes phytoplankton. Bjorn Sundby asked for comments from SCOR National Committees represented at the meeting.

Allyn Clarke noted that the Canadian SCOR Committee shares some of the concerns related by Julie Hall. There is no work schedule in the proposal. Hein de Baar reported that the Netherlands SCOR Committee believes this is an important and timely proposal; it does seem to focus on zooplankton. Phytoplankton needs some attention in the terms of reference, but there are some phytoplankton experts in the proposed membership. Does the working group need more focus? The Netherlands SCOR Committee ranked this proposal in the top three of the original seven proposals, and first if only one new working group can be funded. Peter Burkill noted that the UK SCOR Committee was positive about this proposal because biologists can never obtain the same density of data as physical and chemical oceanographers, so this is very timely. Coupling of technology development and data analysis is an important feature of this proposal and it's badly needed. The terms of reference could be broadened to include all appropriate technology, including phytoplankton. The group may need a co-chair with broad biological interests.

Temel Oguz reported that the Turkish SCOR Committee ranked this proposal second for funding. This technology should be distributed as widely as possible. Victor Akulichiev added that the Russian SCOR Committee thought the proposal is worth supporting. Huasheng Hong stated that the Chinese-Beijing SCOR Committee was not clear whether phytoplankton is included. They also noted that the proposal lacks a timetable of work. The French SCOR Committee liked the proposal, according to Catherine Jeandel, with some reservations. They were especially concerned about the last term of reference, about promoting one software platform, which is not the role of a SCOR working group. Assuming that this concern can be addressed, the French SCOR Committee encouraged approval of this proposal and ranked it second, behind the Deep Ocean Exchanges with the Shelf working group.

Carmen Morales, from the Chilean SCOR Committee, noted that this proposal emerged from SCOR WG 115 on Standards for the Survey and Analysis of Plankton. This new technology is especially important for countries without facilities or specialists in plankton identification. The development of a common system is very important, in spite of the ongoing commercial developments. While we can collect plankton samples automatically, we cannot yet analyze them automatically. It would be good to bring together biologists and technologists in a group like this, without duplicating the membership of other working groups. Birger Larsen reported that the Danish SCOR Committee had similar concerns as the Chilean SCOR Committee. Julie Hall responded that the New Zealand SCOR Committee had some of same comments. The terms of reference and membership are contradictory with regard to inclusion of phyto- and zooplankton. Should the group be broadened to include other technologies? What are the commercial sensitivities? What will this working group actually produce? These issues need to

be clarified. The New Zealand SCOR Committee ranked this proposal fourth. Toshitaka Gamo reported that the Japanese SCOR Committee gave the proposal moderate support.

Kurt Hanselmann reported that the Swiss SCOR Committee liked the proposal (they ranked it second), particularly because it considers a developing technique and coordination is needed now. There is no technology that can address the microbial loop at the moment; perhaps something will emerge. However, the Swiss biologists asked what new knowledge will be gained as a result of this working group? Will they actually be able to get to species-level identifications? The Finnish SCOR Committee supported the proposal and ranked it in top three, according to Jorma Kuparinen. They had many of same comments as previously mentioned. Luis Icochea (Peru) asked whether this technology could be applied to monitor areas with strong changes in plankton communities, such as the Peruvian coast during El Niño events. Frank Hall added that the U.S. SCOR Committee ranked this proposal sixth of the seven, for many of the same reasons already mentioned. How will it advance science beyond what is being done with current technologies? How will data be sent back to institutions for use and analysis? Sakhile Tsotsobe reported that the South African SCOR Committee supported the proposal, although not strongly. Some of their concerns are the same as previously mentioned: there is no clear deliverable and timetable. Is the option of open-source software realistic? Is it a good idea to push a single software package? What is the resolution of identification, down to species level? The proposal doesn't give enough information on how the technology would work. Marta Estrada of the Spanish SCOR Committee suggested that if the group is funded it should be limited to zooplankton. The phytoplankton problem should be tackled separately sometime in the future. Wajih Naqvi reported that the Indian SCOR Committee sought comments from biologists in India, who were not enthusiastic about the proposal.

Ed Urban reported that the SCOR Panel on New Technologies for Observing Marine Life was concerned that the terms of reference focused on a single software package; there are others that deserve attention.

Bjørn Sundby summarized that there is a consensus that automated identification of planktonic marine organisms is desirable. Will this proposal help advance developments in automatic identification? He could not distinguish the advantages and disadvantages to limiting the group's activities to zooplankton only or to include both phyto- and zooplankton. What are the deliverables? Standards or tools? If the tools are being developed commercially anyway, what can this group do to steer the process? It has been ranked in the middle range for SCOR priority.

Mike MacCracken asked whether industry would support a group that would set standards across tools under development. He asked what is the main scientific advance that will come from having a lot more data? Will this really revolutionize what we know in biology? Peter Burkill responded that the tools are being developed in biomedicine. He didn't think that MacCracken's idea of leaving the job to industry would work; the fields for application of this technology are too different. Kurt Hanselmann responded that, one way or another, we need to influence the standards for these tools. Colin Devey stated that the scientific community needs to provide reference materials for testing machines and assessing their accuracy in single- and mixed-species samples. Allyn Clarke responded that this is the crux of the problem. The group seems to be proposing to work on the nuts and bolts of a particular type of image produced by a particular

type of technology that will also be used for other applications. The discrimination software needs to be properly tuned. Clarke thought this was a good proposal to send back to the proponents asking them to revise it to emphasize the need to convince the biological community that they can rely on this technology, that they really might “give up their nets and microscopes”. Peter Burkill responded that people working on climate are crying out for high-quality data, including biology, for models.

Carmen Morales reiterated the utility of a common set of standards for recognizing species or main taxa in a sample. The group has met in other settings and has focused on the one software. The standards can only be set by good taxonomists. They don't want to develop the machines, but they want to put the information we have now into the context of what the machine should recognize. Hein de Baar stated that if we can get to the level of identifying even five major taxonomic groups routinely, this would be a major leap forward. The proposal needs stronger leadership identified. Catherine Jeandel liked the training aspects of this working group because taxonomists are being lost. Colin Devey suggested a change to the fourth proposed term of reference (*Encourage the adoption of the open-source ZOOIMAGE to the marine ecology, taxonomy and systems developers*) to respond to the discussion so far (change “ZOOIMAGE” to “software”); this term of reference is really the one concerning everyone here. It's the focus on a single software package that is the problem. Julie Hall agreed with Devey's assessment and suggestion. If we take this approach, then what is the end product? A set of standards? What about the question of phytoplankton and/or zooplankton? Is the leadership appropriate given the narrow focus of the membership? Laurent Labeyrie stressed the importance of the open-source software aspect of the fourth term of reference.

Bjørn Sundby summarized the consensus that image recognition is an important new tool, setting standards is a good thing, and the leadership issue is not clear. Meeting participants agreed with terms of reference 1 to 3. The main disagreement is over the fourth one. We seem to have discussed it enough that later on we can be comfortable enough to rank this proposal in relation to other proposals. Kurt Hanselmann added his view that the group must include both phyto- and zooplankton. Carmen Morales responded that, from the list of members, it looks like they are planning to do this. Sundby responded that we can tell them that there is much interest in including phytoplankton, but we can't force them if they say it can't be done. Allyn Clarke asked why we should tell the group to limit itself to zooplankton? Patricio Bernal recommended that the group be told to explore the maximum potential of the technology.

Julie Hall added that if phytoplankton are included, it immediately brings in other technology issues like pigments and fluorescence. Carmen Morales responded that Phil Culverhouse is working on recognition systems for dinoflagellates and red tides, so the expertise is included in the group.

Bjørn Sundby stated that we could communicate the various concerns to the group if it is funded when the five groups are ranked later in the meeting. Peter Burkill responded that it would be an easy compromise; we could accept the first three terms of reference as they are, then replace “ZooIMAGE” with “software” in the fourth term of reference, as Colin Devey suggested. Allyn Clarke responded that the only remaining issue is the schedule; the proponents should be asked for it.

2.3.3 Working Group on The Legacy of in situ Iron Enrichments: Data Compilation and Modelling

Hein de Baar and Huasheng Hong left the room during the discussion of the working group, as they were proposed members of it. Robert Duce introduced this proposal. Iron-enrichment experiments are a new approach to understanding the dynamics of ocean biology. Some 13 artificial iron-enrichment experiments have taken place (the first in 1993), along with some natural ones (dust inputs). Some concern exists that it is now time to look at the results of all these experiments, to collate data, and make the data freely available in a common open-access database. All the data would be put into a common format in a common location (e.g., at a World Data Center) for availability to all. The activity would include some modeling workshops to use these standardized data in models that can be compared. The final products are defined in the proposal: two or three special sessions, plus a series of papers. The proponents have reached out to the relevant major research programs, such as SOLAS and IMBER, and the programs are supportive. SCAR has been approached as a cosponsor. Duce reviewed the proposed membership. The activity is broad, so they are proposing many Associate Members. Duce summarized the comments received from national SCOR committees and others. Several countries pointed to the lack of a physical oceanographer in the full membership. The co-chairs have commented that they agree, but they are reluctant to drop any of the Full Members in the proposal to make room for a physical oceanographer. The need for standardization of data collection methods is recognized. The group needs more members from developing countries. The Co-chairs agreed but didn't know anyone from a developing country who has participated in any iron-enrichment experiment. One reviewer commented that maybe this should not be a working group, but should use some other approach, which would eliminate the membership size problem. Duce thinks this is an important issue. Julie Hall added, in relation to SCAR involvement, that the SCAR/SCOR Expert Group on Oceanography was very supportive of the proposal at their meeting in July and recommended that SCAR cosponsor it, although SCAR has no money for financial co-sponsorship.

John Compton reported that the South African SCOR Committee recognized the significance of this activity, but didn't rank it very high because the relevance to South Africa is more limited than for the other proposals. Some concerns were expressed that some of the iron research groups might be less cooperative than others in sharing their data. The two co-chairs are from the same iron-enrichment experiment. Is it realistic to expect that they will convince other groups to contribute their data? A synthesis is a good idea and if there is an alternative to a working group, that might solve some of the concerns. Allyn Clarke reported that the Canadian SCOR Committee supports this proposal. Their only comment is that they were happy to see the major projects expressing support. There really is a need for a synthesis. Given that, perhaps the projects should fund the group. Peter Burkill reported that the UK SCOR Committee had most difficulty with this proposal. The iron-enrichment experiments have provided tremendous insight into ocean biogeochemistry. But, is a SCOR working group a good mechanism to do what this group proposes? Are data compilation, organizing workshops and writing papers appropriate working group activities? This proposal may have "too much handle turning and too little brainstorming" for a SCOR working group. Why can't the task be given to SOLAS? The terms of reference are inappropriate for a working group. The UK SCOR Committee feels it is important for SCOR to support such an activity, but not as a working group. They ranked the proposal fourth.

Temel Oguz reported that the Turkish SCOR Committee ranked the proposal third, not because it is bad, but because they felt that the group is just looking for endorsement from SCOR. They also want money for meetings from SCOR and, looking at the people involved, they should have other possibilities for funding through international programs. These people already get together several times each year. Asking for more money from SCOR is redundant and is the basis for the Turkish SCOR Committee ranking other proposals higher. Mingyuan Zhu reported that the China-Beijing SCOR Committee ranked the proposal second. He mentioned a couple of Chinese experiments that are not in this proposal. Bob Duce responded that the proponents have sent a new map that includes the experiments referred to by Zhu. The French SCOR Committee also ranked this proposal second, according to Catherine Jeandel. It is a timely idea. They also wanted to see a physical oceanographer on the group. If it is not appropriate for a SCOR working group, the proponents should go to programs and possibly to EuroOCEANS for funding. Duce responded that the proposal has been submitted to EuroOCEANS, but they proponents want SCOR's help to internationalize the effort.

Julie Hall reported that the New Zealand SCOR Committee thinks this is an important proposal, as they have done two of the iron-enrichment experiments. They ranked the proposal first, but also agree that a physical oceanographer should be added to the membership. After hearing the discussion so far, Hall wondered if a working group is the right mechanism. Is there another way to have SCOR involved, if not in a working group?

Ed Urban reported for the Netherlands SCOR Committee, since Hein de Baar was not participating in the discussion, that they ranked the proposal in their top three. Colin Devey offered his personal comment that term of reference 1 (compiling of existing data from iron-enrichment experiments) should be accomplished before the proposal is funded, since this task does not require travel. It is not clear why they haven't compiled the data already, since there is no science involved in this task. They should do this first to prove that they can work together, then come to SCOR. Shiro Imawaki noted the IAPSO view that there are varying results from various workshops, meaning that we don't know the implications of iron enrichment for climate. The scope of the activity should be reduced considerably. Are there too many people involved? Toshitaka Gamo reported that the Japanese SCOR Committee gave this proposal the highest ranking. It is really timely, and well justified for a SCOR working group. It will be necessary to hold workshops not only for data exchange, but also for planning future strategies for experimental and modeling work. The Japanese committee also recommends that a physical oceanographer be added to the membership.

Kurt Hanselmann stated that we all know these were interesting experiments and that it is important to summarize them. Synthesis should be done, but is SCOR the right organization to do this? All the iron-enrichment experiments were funded by many national agencies. Why don't they get together and fund the synthesis? It is a retrospective activity; is that what SCOR should support? The Swiss SCOR Committee ranked the proposal fifth of the seven. Jorma Kuparinen reported that the Finnish SCOR Committee ranked the proposal in their top three. The synthesis is obviously needed. It would be proactive of SCOR to make sure this happens. As previously mentioned by another committee, the Finnish committee noted that the co-chairs are from same experiment, which might cause problems in getting all the data together. Luis Icochea

noted that this is an interesting proposal and would like to see Peruvians included in the activity. Frank Hall reported that the U.S. SCOR Committee ranked this a close second to the tsunami proposal. This activity would help advance planning for future experiments and analysis. The U.S. committee had three minor areas of concern:

1. Will the modeling efforts be done regardless of whether there is a SCOR group?
2. The process for standardization is not addressed in the proposal.
3. Finally, there is no representation of developing country scientists. Overall, it is a timely and good proposal.

Arthur Chen reported that the China-Taipei SCOR Committee believes the proposal is timely. Taiwan maintains a dust-collecting station and its scientists have done quite a few experiments in the East China Sea. They have concluded it is not iron-limited, although the South China Sea may be iron-limited; they have a dust-collecting station there also. The usefulness of iron fertilization for carbon sequestration is not clear now. The China-Taipei SCOR Committee is neutral on whether this proposal should be funded. Marta Estrada reported that the Spanish SCOR Committee believes that the proposed activities should be the responsibility of the investigators and the agencies that funded them. Wajih Naqvi reported that the Indian SCOR Committee ranked the proposal third. Ed Urban commented in relation to membership that many proposals claim they need more than 10 members, but this can be an indication that the proposal is too broad.

Bjørn Sundby summarized that there are many data that need to be brought together and a synthesis would be useful. There is no doubt about this, but is it something SCOR should pay for? Peter Burkill pointed out that the terms of reference don't address scientific issues; they are organizational. The proposed working group members are well-funded scientists who should be able to organize these activities with their own resources and contacts. If the agencies that funded the experiments are interested in getting the synthesis and asked SCOR to help with this, that would be different. The proponents appear to want to use SCOR endorsement to leverage money from the agencies. This is important, but Sundby did not think a SCOR working group is the right approach. Sundby asked for feedback.

Robert Duce responded that SCOR might have a role here. The case that this idea might not be appropriate for a working group has been made well, but SCOR does have the responsibility on an international scale to assist in activities like this. It is doubtful that the agencies that sponsored the research will agree to fund the synthesis. We need to find a way to help the proponents make this happen. It's not just retrospective; if they can develop models that work with standardized data, that will help future planning for new experiments. Duce did not know what the mechanism should be. Michael MacCracken responded that their first task can be done without funds. He suggested that SCOR ask the proponents to do this and then come back to SCOR with a revised proposal to do the synthesis. Julie Hall added that the data compilation is underway already, starting with a SOLAS-funded meeting in New Zealand last year.

John Compton asked what are other options for SCOR activities beyond working groups? Ed Urban responded that SCOR can be pretty flexible. It could be set up a single meeting, or form a committee or a panel. The biggest issue is funding for a non-working group activity. Robert

Duce added that an example is the SOLAS/INI Review of Anthropogenic Nitrogen Impacts on the Open Ocean, which is a one-time workshop funded by SCOR (the organizers have also arranged other funds). A single workshop on the iron synthesis could be very valuable and give them the impetus to continue. Colin Devey added that references in the proposal indicate that the synthesis is starting. Urban responded that those were papers dealing with higher-level syntheses, not involving the data. Catherine Jeandel added that some of the people with iron-enrichment data are unlikely to put their data out into the public domain. Allyn Clarke suggested that perhaps we should support a workshop to show people how to work on the data after they have been compiled, using them in models, a sort of training activity. Clarke also was concerned about designing more iron enrichment experiments, since he is not certain that they should be funded; the results for climate are ambiguous. Is SCOPE a potential partner? Robert Duce pointed out that the proponents raised the possibility of training in their proposal. Perhaps that is what SCOR should support. Hanselmann responded that we are in a “clinch”; if we do not approve the proposal, their efforts to raise money elsewhere will be hindered, but if we can only fund two working groups, should this be one of them? Hanselmann thinks that other proposals have more merit for as SCOR working groups. Laurent Labeyrie responded that perhaps we should tell the proponents that it is an excellent idea, but not approved for a SCOR working group. Duce agreed; it is an important activity, but not appropriate for a SCOR working group. But, is there some way SCOR can help them to make progress? Colin Devey stated that, in his opinion as the Finance Committee chair, we cannot fund three new working groups. We can fund either two new working groups or one new working group and some other activity.

Bjørn Sundby summarized again. This activity is important, but it is beyond SCOR’s means and not appropriate for a SCOR working group. Peter Burkill thought that SCOR should give the activity some sort of endorsement. A discussion with them is needed. Perhaps we should encourage them to have a synthesis workshop. Temel Oguz liked the idea of a summer school. Robert Duce asked whether we could we use NSF travel money for a summer school? Ed Urban responded that he thought the training aspect is the least interesting thing in the proposal, in comparison to the data compilation and synthesis. A summer school doesn’t address the issues in the proposal. SCOR can endorse any activity it chooses to endorse. We could write them a letter of endorsement without financial support, but this may be a hollow gesture. Julie Hall offered a word of caution regarding a summer school. It was an add-on in the proposal; they didn’t define expectations and outcomes for such an activity.

Bjørn Sundby asked what we should do now? Perhaps SCOR should endorse the second term of reference, the modeling workshop. We still need to rank the proposals later. John Compton suggested that we could tell the proponents to get the data together and then come back to SCOR. Colin Devey stated that if we rank this with the other proposals, the unanimous feeling is that this is not a working group, so it will lose. Instead, perhaps we should tell the proponents that this is a good idea, but ask them to get the data together first and then can come back next year with something we can accept as a working group. Sundby agreed; a well-written letter will help them. Robert Duce agreed to draft the letter.

2.3.4 Working Group on Tsunamis: Examination, Modeling and Risk Estimation

Laurent Labeyrie, the monitor for this working group proposal, introduced the discussion. He started by reminding participants that, in 1751, Concepción was destroyed by an earthquake and

tsunami. There is no doubt that we need to better understand tsunamis, their causes and mitigation. As for the other proposals being considered this year, the tsunami group is ambitious, proposing to study the causes, evolution, variability and consequences of tsunamis, but would such a project fit in SCOR? There are numerous groups involved in tsunami research. For example, the International Union of Geodesy and Geophysics (IUGG) has a group on geohazards and IOC has activities related to coordination and intergovernmental aspects. This working group would have to find its niche, probably focusing on research, data management, and modeling. IUGG supports formation of this group. Labeyrie summarized national comments received before the meeting. The group would be timely, but its first priority should be on reducing risk. The proposal doesn't include anything about various kinds of causes of tsunamis, or on various geographical settings for tsunamis. Attention is needed to modeling of tsunamis as they approach coasts, and the many variables involved. No Indonesian member is proposed for the group, even though this area suffered the greatest damage in the 2004 Indian Ocean tsunami. The general goals of the group are too ambitious. The proposal was ranked in the lower third. Labeyrie asked for comments from the national SCOR representatives present at the meeting.

John Compton reported that the South African SCOR Committee didn't have many comments. They didn't rank the proposal high. It is a timely subject, but what new would the activity accomplish? What about the interface between science and getting information to the public? Allyn Clarke reported that the Canadian SCOR Committee also ranked the proposal quite low, due to a concern about overlap with other groups. The proposal didn't distinguish itself from other groups and it doesn't focus on new science. There is not enough attention to the origins of tsunamis; the initial shape of the wave is very important in the models. No one on the proposed group has expertise in that area. The topic is politically timely, but lots of other groups are getting involved in the topic. It might be better to wait two to three years and then put together a working group to assess what has been done.

Hein de Baar reported that the comments of the Netherlands SCOR Committee reflected those already expressed; the proposal should have made a stronger case for the need for yet another group. They ranked it as their lowest priority for funding. Peter Burkill gave the UK SCOR Committee view that the topic is timely and a high priority for SCOR, but they didn't feel a working group was appropriate, particularly a group with these terms of reference. The proponents need to identify the key problems. The UK SCOR Committee ranked this proposal in the middle. Temel Oguz reported that the Turkish SCOR Committee had a lot of discussion about this proposal (one of the co-chairs is from Turkey). They concluded that the work cannot be done in the normal lifetime of a SCOR working group and thus ranked the proposal in the middle. Victor Akulichiev added that the Russians are very concerned about the risk of tsunamis in the western Pacific and the Russian SCOR Committee supports the proposal.

The China-Beijing SCOR Committee agreed that this is an important topic, according to Huasheng Hong. However, it is not clear whether this working group would address the most important issues. Catherine Jeandel reported that the French SCOR Committee ranked the proposal low because its approach is too broad and seismologists are missing from the working group. Marta Estrada expressed her personal opinion that the output of the group should be something other than a book. Julie Hall added that the New Zealand SCOR Committee had similar concerns to other countries and ranked this proposal the lowest. There are so many other

groups active and it doesn't fit the SCOR model. Colin Devey reported that that German SCOR Committee had similar comments regarding other work going on. This proposal should at least define where they fit and clearly define its products. IAPSO had similar concerns, according to Shiro Imawaki. The group's relationship to the well-established IUGG Tsunami Commission is not clear.

Toshitaka Gamo reported that the Japanese SCOR Committee ranked this proposal only at a moderate level. The dynamics of tsunamis are already generally understood. The most important scientific aspect of the 2004 tsunami was that it left a number of general problems in natural disaster science that need to be better understood; perhaps SCOR should focus on these. Birger Larsen added that the Danish SCOR Committee had the same comments as many others. SCOR should have done something sooner, rather than joining a crowded field now. Rodrigo Nuñez provided the Chilean SCOR Committee perspective that it strongly supports SCOR becoming involved in tsunamis, but this proposal doesn't have good enough products; a list of papers isn't enough. How will the cooperation with IOC be achieved? There should be communication with new IOC tsunami unit. Jorma Kuparinen reported that the Finnish SCOR Committee wonders whether this topic is timely for a SCOR working group as there is so much going on. Should there be an integrating activity in a few years?

Patricio Bernal stated that the scientific community working on tsunamis is small, working under the umbrella of IUGG. This proposal is not sharply defined scientifically. Many issues they raise are already being dealt with by other groups. There are some hot science issues to look into, but they are tough ones. There are already modeling groups active in the Indian Ocean, Caribbean Sea, etc.; it's difficult to coordinate them. Some problems are more engineering-related. For example, the topography of the last 50 meters traveled by the wave accounts for a large portion of the severity of a tsunami. There have been major reviews of tsunami science already. Tsunami warnings must have a high level of accuracy to make them believable. One issue not mentioned in the proposal is the high directionality of the energy distribution of the wave, which is a major problem for physics.

Frank Hall reported that the U.S. SCOR Committee ranked this proposal the highest. The kinds of data being collected are critical for models. However, some tasks described are too ambitious and their timetable may be too ambitious. Hall mentioned a forthcoming report on tsunamis on sheltered coasts from the U.S. National Research Council.

Bjørn Sundby summed up the discussion on this proposal. All agree that it is important as a topic, but looking at this proposal, it seems to have only medium support. Is this just another "me too" effort? There is a feeling that it would be useful to do a review. What should be SCOR's message to the group? Laurent Labeyrie responded that there are two aspects. As to science, IUGG is already helping tsunami science to progress. (The first proposed meeting of this working group would be at an IUGG tsunami meeting.) The other point is related to data. The proposal didn't consider all kinds of data available, for example, from satellites. It only includes tide gauge data. We should write and encourage the proponents to come back with a new proposal in a couple of years, building on work done by then and after the IUGG meeting referred to in the proposal. Robert Duce responded with his concern, from the discussion, that it seems impossible that they could put together a new proposal on tsunamis that SCOR could

support. The problems with the proposal may be more fundamental than waiting for the IUGG meeting results. Patricio Bernal added that ICSU has organized a meeting to start an effort on natural disasters in general. This may be relevant for SCOR. Sundby responded that SCOR needs to keep informed of such things as natural disasters and tsunamis. The consensus was that SCOR would not support this proposal.

2.3.5 Working Group on the Role of Lanternfish in the Ocean

Akira Taniguchi introduced the discussion of this proposal. He noted that the proposal had been submitted twice already in different forms. It had been substantially revised since last year. SCOR has recognized a need to have a working group on deep ocean ecology. This new proposal received strong support from several national SCOR committees, but others ranked the proposal as low or neutral, at best. Taniguchi reviewed the proposed terms of reference. The group would target myctophids since they are the dominant mesopelagic species. They are important prey for commercial pelagic fish, mammals, and seabirds. We need precise knowledge on their growth rates and productivity. The proposal does not deal with needs for future research. They are aware of their need to interact with IMBER and they should do this with other relevant programs and organizations (e.g., GLOBEC, PICES, ICES).

John Compton reported that the South African SCOR Committee ranked this proposal the lowest of the seven. They didn't feel that the proponents had responded to SCOR's 2005 comments, in that the proposal is still too taxonomic, indicated by the membership. Allyn Clarke reported that the Canadian SCOR Committee believes this is an important topic for a SCOR working group, but shares the South African concern that there is not yet enough ecology in it; it is still too focused on taxonomy. This concern could be removed by changing the membership. Canada ranked the proposal in the middle. Hein de Baar noted that the Netherlands SCOR Committee was quite positive about improvements over previous versions of the proposal. The argument for studying these non-commercial fish is strong, since they play an important role in ocean ecosystems. The proposed membership has good representation from scientists in developing countries. The Netherlands SCOR Committee ranked this proposal in their top three.

Peter Burkill reported that the UK SCOR Committee found the proposal to be timely, especially with regard to sustainability of mid-water populations. Some nations are now fishing mesopelagic fish. The proposed activity would also be important for understanding midwater dynamics and functioning of "twilight zone." However, the UK Committee felt that the proposal places too much emphasis on old-fashioned biology and taxonomy; they would like to see more emphasis on trophic dynamics and to redesign the proposal in terms of sensitivity of midwater populations to climate change. The UK SCOR Committee ranked the proposal sixth of the seven. Temel Oguz noted that he received conflicting comments on the proposal from different Turkish fisheries experts, so the Turkish SCOR Committee will remain neutral in its ranking of this proposal. Victor Akulich reported that the Russian SCOR Committee supports this proposal. Huasheng Hong agreed with the comments regarding the importance of studying how climate change will impact lanternfish and other mesopelagic organisms. The China-Beijing SCOR Committee ranked the proposal fourth. Catherine Jeandel reported that the French SCOR Committee noted the improvements in the proposal, although some aspects still are unanswered. Why didn't the proponents seek support from ICES or PICES? There is no publication defined. The expertise of the members is too narrow. The French SCOR Committee gave the proposal a

middle ranking. Marta Estrada noted that the specialist who reviewed the proposal for the Spanish SCOR Committee liked it and would like to be a member of the working group, if approved.

Julie Hall reported that the New Zealand SCOR Committee liked the proposal because it addresses issues of the twilight zone. There was a good session at the PICES meeting last week with papers on myctophids, so work is going on. The New Zealand committee did wonder why the ecologists proposed in the membership are invertebrate zoologists, rather than finfish ecologists. They felt that climate change and ecosystem dynamics should feature prominently in such a working group. The New Zealand SCOR Committee ranked this proposal third of the seven proposals. Toshitaka Gamo reported that the Japanese SCOR Committee gave this proposal a low ranking because it does not justify the need for a SCOR working group and why the same work could not be accomplished by e-mail. Annelies Pierrot-Bults reported for IABO that, although little is known about non-commercial mesopelagic fish, it is hard to see what can be done now from this proposal. Birger Larsen noted that the annual SCOR meetings have been working to improve this proposal. We need to recognize that some important parts of marine science are not at the cutting edge. The Danish SCOR Committee did not rank this proposal highly, but he did not receive comments from their fish specialists. A Chilean participant in the meeting noted that the first paragraph is very clearly stated, but then the work proposed is not so well stated. We really do need to clarify this “black box” if we are to make progress in this field. This proposal really needs more ecology. Kurt Hanselmann reported from the Swiss SCOR Committee that they ranked the proposal fifth out of seven. Their taxonomist expressed need for more emphasis on ecology and there is not enough coordination of ongoing research and proposal of future research in the proposal, but more a review of past research. Luis Icochea noted that the Peruvian SCOR Committee supports the proposal due to the importance of lanternfish in their fisheries, especially during and after El Niño events. Peruvian scientists found enormous schools of lanternfish after the 1997-1998 El Niño event. Squid feed heavily on them. So they like this proposal. Frank Hall reported that the U.S. SCOR Committee ranked the proposal fifth of seven. It is better than earlier versions but, as mentioned by other national committees, still emphasizes taxonomy too much, at the expense of ecosystem studies.

Bjørn Sundby summarized that SCOR has considered this proposal for three years and it still hasn't been rated highly by a majority of national committees. But, it is obvious that SCOR needs to do something on mesopelagic ecology. Can we find a way for SCOR to act top down and get out the message that we would welcome a proposal dealing with the ecology of mesopelagic fishes? Akira Taniguchi suggested that we give the proponents practical suggestions as to how to approach other organizations. Annelies Pierrot-Bults noted that ICES is probably not an appropriate sponsor, as it is focused on the North Atlantic Ocean. The Census of Marine Life (CoML) MAR-ECO program has relevant activities on myctophids and is expanding into the South Atlantic Ocean. Ed Urban added that the UN Food and Agriculture Organization has already said it is not interested in supporting this group. Sundby asked whether there is any point in asking for further revisions, and the consensus of meeting participants was that this should be the last time this proposal is considered.

2.3.6 Selection of Working Group Proposals for Start in 2007

Bjørn Sundby opened the discussion of ranking the working groups proposals and deciding which to fund. His impression was that there is no support for the working group on lanternfish. The working group on tsunamis was considered an important subject, but support for the working group was middle to low. The proposal on iron-enrichment experiments was thought very important, but perhaps not appropriate for a SCOR working group. That leaves two remaining working groups; the visual plankton identification proposal and proposal for a working group on Deep Ocean Exchanges with the Shelf were well received. We have two working groups we may wish to support and one (the iron group) that we think may be a bit premature. Sundby asked for comments on his perceptions. Mike MacCracken responded that he gathered comments on the Deep Ocean Exchanges with the Shelf proposal. We should assume that there will be some changes in the proposal to sharpen the focus and address the comments raised by national SCOR committees. Colin Devey agreed with Sundby's summation. In the plankton identification proposal, the last term of reference needs deletion of specific software. The Deep Ocean Exchanges with the Shelf proposal needs some focus, but can still be started. Julie Hall responded that we still need to resolve the issue of phytoplankton and/or zooplankton in the plankton identification proposal; just what will be included? As to the iron activity, what needs to happen is that they should get the data together first to prove they can work together and then come back to SCOR. That's a mechanical task that doesn't need a working group. Is a working group the right approach or should we offer to support a workshop or something else? SCOR could help it by giving this activity some sort of stamp of approval.

Hein de Baar reported that the plankton identification group was the first choice of the Netherlands SCOR Committee, so he is pleased with the outcome. Robert Duce echoed Julie Hall's comments. If we are going to recommend to the iron group that they put in a proposal for a workshop or some other activity, we may still have the same financial constraints next year. How can we help them make sure something happens before then? Colin Devey responded that funding isn't really the problem. The main concerns of the discussion were to encourage the proponents to get the data together, for which they said they didn't need money anyway. We should ask them to do this, then come back to SCOR when they know better what they can do with the data. John Compton asked if the iron group could come up with a proposal on how to proceed, whether a working group with a different focus, or something else? Or should SCOR advise them? Bjørn Sundby added that there are a large number of people involved, more than can be supported with SCOR funds for a working group. They are already looking for other funds, so an endorsement from SCOR might help them with leverage for other funds. Allyn Clarke added that their work plan may actually be longer than a regular working group; the timing is a bit vague in the proposal. Perhaps it should be thought of as a "mini-program" for which we might provide funds for a workshop every year or two. Colin Devey repeated his previous comment that we don't need to worry about a non-existent problem. There are no financial implications for 2007.

Hein de Baar responded that the iron community is performing very badly in assembling the data sets from past iron-addition experiments and making them available. This is noted in the proposal and the idea is to remedy the situation. De Baar agreed with Clarke that perhaps what's needed is not a working group. There may be other sources of funding; the proponents are really seeking endorsement from SCOR. They would be open to any suggestions as to appropriate

format, funds, etc. Ed Urban reiterated that SCOR has a lot of flexibility. The biggest issue is finances, but we can channel other funds through SCOR if that helps. De Baar responded that the most important thing is to get an endorsement and strong moral support from SCOR. Robert Duce stated that he was still concerned about the official message from SCOR; it seems we want to endorse the effort, but without money this year. Did Colin Devey mean to say that if the first term of reference is done separately, the idea could be revised into a working group proposal next year? Devey responded that it might be possible to make a working group out of the other terms of reference. If what they want is SCOR endorsement, then we are happy to do it. Once they have the data together, then we would be interested to hear from them again. Huasheng Hong agreed with Sundby's suggestion at the beginning of this discussion. She noted some overlap between the approved working group on plankton identification and the existing SCOR WG 115 on Standards for the Survey and Analysis of Plankton.

Bjørn Sundby asked if there was a consensus that two working groups should be accepted, the ones on Deep Ocean Exchanges with the Shelf and on Automatic Plankton Visual Identification and, if so, which of the two would be ranked first in case the Finance Committee says we can only fund one. Peter Burkill responded that the Deep Ocean Exchanges with the Shelf proposal seems to have fewer issues to work out. There was a slight preference to fund this proposal if only one can be funded. (The Finance Committee later recommended funding both groups and the meeting participants agreed.)

Bjørn Sundby returned to the issue of endorsing the iron activity. There was a general consensus that this should be done. Sundby will send a general endorsement letter and Robert Duce will draft a letter with the specifics of how the proposal should be changed if the proponents come back to SCOR next year. Hein de Baar agreed that if there is a strong message from SCOR supporting the activity, the group will work together to find the way forward, perhaps a new working group proposal, perhaps not, perhaps with funding support from SCOR for a workshop next year. A letter from SCOR at this point would be very helpful.

3.0 LARGE-SCALE SCIENTIFIC PROGRAMS

3.1 SCOR/IGBP/IOC Global Ocean Ecosystems Dynamics (GLOBEC) Project (see Annex 5)

GLOBEC held its 2006 SSC meeting in Honolulu, Hawaii, USA, in conjunction with a PICES/GLOBEC Symposium on "Climate variability and ecosystem impacts on the North Pacific: a basin-scale synthesis." The next GLOBEC SSC meeting will be held in May 2007 in Hiroshima, Japan, in conjunction with the 4th International Zooplankton Symposium. 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 2007 to identify aspects of GLOBEC that IMBER might take on after GLOBEC ends. Ed Urban attended the GLOBEC SSC meeting in April and they are making good progress in their integration and synthesis phase. Julie Hall added that the GLOBEC and IMBER executive committees meet together every year to coordinate the project activities. They will write an addendum to the *IMBER Science Plan* raising key issues coming out of the GLOBEC synthesis. Two GLOBEC regional projects will be incorporated into

IMBER after the end of GLOBEC. There are solid plans for the transition from GLOBEC to IMBER.

3.2 SCOR/IOC Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Program (see Annex 6)

Julie Hall reviewed the four GEOHAB open science meetings (OSMs) designed to create research plans for its four Core Research Project: (1) HABs in Upwelling Systems (in Lisbon, Portugal), (2) HABs in Fjords and Coastal Embayments (in Viña del Mar, Chile), (3) HABs and Eutrophication (Baltimore, Maryland, USA) and (4) HABs and Stratification (Paris, France). The research plans for the first and third of these Core Research Projects have been completed and subcommittees have been formed to advance them. NOAA will be providing funding for the Core Research Project on Eutrophied Systems. The next SSC meeting will be held in Tokyo, Japan in March 2007, in conjunction with a meeting of Asian HAB scientists designed to encourage their participation in GEOHAB. The SSC is still discussing how to move their modeling activities forward and the project still needs an International Program Office. Ed Urban added that he shares GEOHAB Executive Officer duties with Henrik Enevoldsen of IOC. GEOHAB has two major issues that have slowed project development. The first is that this community is not accustomed to working in the “big program” mode; they tend to work as isolated individual scientists or small teams. The Core Research Projects will serve as focal points for building support in the research community and bringing people into the project. The lack of an IPO is a real problem. Urban and Enevoldsen probably only provide about 25% of the time of a real IPO; they are still trying to arrange funding for one.

3.3 SCOR/IGBP Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project (see Annex 7)

The IMBER SSC met in May 2006 in Brest, France to discuss implementation activities. Robert Duce, the Reporter for IMBER, introduced Julie Hall, who reported on the IMBER’s activities since the 2005 SCOR meeting. First, Hall reported that the IMBER IPO was established in Brest, France with French support for three staff members. The existence of an IPO has made it possible for IMBER to make significant progress in developing the project and in promoting it, through a brochure, a Web site, and an electronic newsletter. IMBER has set up several special groups, (1) a task team on end-to-end food webs (with GLOBEC), (2) a working group on carbon (with SOLAS), (3) a Continental Margins Task Team (with LOICZ), (4) a Capacity Building Task Team, and (5) a Data Management Committee. Hall listed the projects that will contribute to IMBER and the projects that IMBER has endorsed, as well as regional and national activities that will contribute to IMBER. The Continental Margins Task Team is planning an open science meeting in Shanghai, China in September 2007 and have requested SCOR funding for scientists from developing countries and countries with economies in transition to attend.

3.4 SCOR/IGBP/WCRP/CACGP Surface Ocean-Lower Atmosphere Study (SOLAS) (see Annex 8)

Laurent Labeyrie made a presentation from the SOLAS IPO about the international SOLAS network progress and plans. SOLAS has three main focus areas:

- 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—This group is joint with IMBER and a Joint Implementation Plan has been completed and is available from the Web sites of both projects. The SOLAS-IMBER Carbon Group will meet in April at the IOCCP meeting in Paris on Surface pCO₂ and Ocean Vulnerability.

SOLAS has now completed detailed research plans for each of its focus areas. SOLAS has a Data Management Team, chaired by Juan Brown of the British Oceanographic Data Centre. SCOR approved the appointment of three new SSC members—Veronique Garcon, David Kieber, and Cliff Law—to replace three departing members. SOLAS is making linkages with other related projects, such as GEOTRACES, IMBER, and various SCOR working groups. There are SOLAS networks in 23 nations and substantial programs in Belgium, Canada, China, Germany, Japan, the United Kingdom, and the United States. For example, a German project called Surface Ocean Processes in the Anthropocene (SOPRAN) will start in January 2007. It is being led by Doug Wallace and will involve 43 investigators from 12 institutions in 23 sub-projects, at a cost of 6.5 million euros over 3 years. Another large national SOLAS effort is starting in Japan, where SOLAS scientists received (in July 2006) \$9.2 million for five years. SOLAS and the International Global Atmospheric Chemistry (IGAC) project are co-sponsoring an activity called Air-Ice Chemical Interactions (AICI), which conducted campaigns at the South Pole and Halley Bay (Antarctica) in 2004-2005 to study tropospheric ozone depletion, ice photochemistry, and halogen cycles. The Ocean-Atmosphere-Sea Ice-Snowpack (OASIS) project is focusing on similar processes in the Arctic for the next decade. SOLAS and the International Nitrogen Initiative (INI) are planning a meeting called “Review of Anthropogenic Nitrogen Impacts on the Open Ocean” at the University of East Anglia (UK) on 17-20 November 2006 (see section 4.3.3). The products of the meeting will be two to four papers for submission to journals such as *Deep-Sea Research* or *Global Biogeochemical Cycles*, and a review paper submitted to *Science* or *Nature*. SCOR is providing extra support to SOLAS for this meeting. SOLAS is planning its second open science meeting (OSM) in Xiamen, China on 6-9 March 2007, and also is planning its third summer school for 22 October-3 November 2007 (see <http://www.solas-int.org/>). Huasheng Hong welcomed SCOR meeting participants to attend the SOLAS OSM in Xiamen.

3.5 GEOTRACES (see Annex 9)

Robert Duce made a presentation about GEOTRACES. The revised *GEOTRACES Science Plan* was approved by SCOR and was published in September 2006. The GEOTRACES SSC has been approved by the Executive Committee. (Duce presented the list of approved SSC members.) The SSC plans to hold its first meeting in December 2006 after the American Geophysical Union meeting in San Francisco. Four of the GEOTRACES SSC members were in Concepción for the SCOR meeting or the oxygen minimum zone conference presented the details of the science plan, the motive, mission, timeliness, and goals of GEOTRACES. The project will have three phases: (1) Preparation phase (planning, preparation and distribution of standards, intercalibration, modeling to guide sections, establishment of data archiving protocols,

test stations), (2) main phase (series of 12-15 sections to cover all major ocean basins, chosen to address a maximum number of processes, run by various countries but with international representation, using compatible sampling and measurement protocols), and (3) parallel and follow-up process studies (e.g., coastal work in estuaries, shelf processes, etc., tied to the end of sections where possible, possibly run by countries with smaller research budgets). Since last year's SCOR meeting, GEOTRACES has convened a meeting of its Committee on Standards and Calibration (24-25 October 2005) to write a report for SSC consideration on how GEOTRACES will handle standards and intercalibration. IMBER has decided to follow GEOTRACES recommendations for trace metal standards. The GEOTRACES Data Management Committee met in late 2005 to write a report for the SSC on how to handle GEOTRACES data, from collection to archiving. Intercalibration and planning work will begin in 2007. The GEOTRACES Data Management System will be initiated in 2007. The first cruise contributing to GEOTRACES occurred in November 2005, while the *Polarstern* was en route from Germany to the Southern Ocean. This cruise initiated the process of developing analytical protocols and the intercalibration of methods.

A U.S. GEOTRACES Project Office has been funded and will assist the SCOR Secretariat with international GEOTRACES, as time and funding allow. Several national proposals have been submitted for cruises in both the Arctic and Southern oceans during the International Polar Year (IPY).

Catherine Jeandel noted that the first GEOTRACES IPY cruise will take place in the Southern Ocean in January 2008. A French ship will meet the German *Polarstern* there. Huasheng Hong spoke about GEOTRACES activities in China.

3.6 Land-Ocean Interactions in the Coastal Zone (LOICZ) Project

Julie Hall reported on the LOICZ project. The 2002 SCOR General Meeting agreed to co-sponsor the elements of LOICZ related to coastal ocean science, pending development of financial support for LOICZ. SCOR has not yet been able to develop funds to assist LOICZ, but has provided travel grants for two LOICZ meetings, and may provide funds for the IMBER/LOICZ continental margin research conference. The LOICZ IPO just moved to Germany and is making a transition from LOICZ 1 to LOICZ 2, which is a more integrated program. LOICZ is now sponsored by the International Human Dimensions of Global Change Programme (IHDP) as well as IGBP. It has three priority topics: (1) linking social and ecological systems in coastal zones, (2) predicting impacts of environmental change in coastal systems, and (3) linking natural and social sciences. Hall presented a list of LOICZ activities, highlighting a summer school on coastal management. LOICZ is trying to centralize its activities in the IPO with a set of central databases for contacts, budget modeling, coastal typology, etc. Allyn Clarke asked if SCOR is a cosponsor of LOICZ. Hall answered no, but SCOR has provided some support for developing country scientists to attend some LOICZ science meetings.

Bjørn Sundby made some general remarks on programs based on his experience in Canada, where the various projects are competing for many of the same individuals. Canada has no IMBER program, for example. It came along at same time as GEOTRACES. Are we seeing too much focus on the upper ocean? Do we need a project that goes to bottom of the ocean? Perhaps

SCOR needs to ask the same sort of questions that we ask now in relation to disciplinary balance of SCOR activities. Julie Hall responded that different countries fund projects in different ways. Some countries have combined efforts for several programs. Ed Urban noted that GEOTRACES (and IMBER) are going all the way to the seafloor, and some of the SCOR Affiliated Programs fill the gaps in seafloor science, such as InterRidge and IMAGES.

4.0 OCEAN CARBON AND OTHER ACTIVITIES

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

IOCCP was initiated in 2003 as a pilot project of the SCOR–IOC Advisory Panel on Ocean CO₂ and the Global Carbon Project because addressing global ocean CO₂ uptake and air-sea fluxes requires a sustained, coordinated international effort. There is an enormous amount of work being done at national, regional, and global levels. Ed Urban reported that IOCCP has been very active and has convened three workshops since the 2005 SCOR meeting, the International Repeat Hydrography and Carbon Meeting (November 2005), the North Atlantic Synthesis workshop (June 2006), and the Friends of Oxygen on Argo and workshop (June 2006). IOCCP is also assisting SOLAS and IMBER in putting together workshops related to their ocean carbon activities. NSF is funding 1+ positions at IOC for IOCCP and is providing activity funding through SCOR. Urban presented PowerPoint slides prepared by Maria Hood and Roger Dargaville of IOC. IOCCP’s activities fall into the following major categories:

- Common global research goals and strategies to achieve them
- A continuously updated global compilation of observation programs—examples of this activity include compiling and presenting maps on the Web of carbon measurements at time-series sites (with OceanSITES) and underway pCO₂ measurements
- An international forum to address compatibility/comparability issues to ensure that results from individual efforts can be combined
- Global and basin synthesis groups that compile data and produce “science”

IOCCP brings together the community to analyze information about existing observations to determine

- Is the coverage from the combined network sufficient to meet research needs for basin- and global-scale issues? If not, what needs to be done?
- Are data from individual activities comparable? (standards, reference materials, quality control/quality assurance procedures, best practices, etc.)
- Are the data management practices of each program compatible, and are there mechanisms in place to facilitate data sharing and data synthesis activities among programs?

Finally, IOCCP maintains an on-line information database and communications network for ocean carbon research and observations (see <http://www.ioccp.org>) and distributes an email bulletin to about 150 ocean carbon scientists on a regular basis.

Allyn Clarke stated that he was impressed by the report of this group. But, can we expect them to tell SCOR that there are too many overlapping groups in ocean carbon research? Ed Urban replied that the IOCCP focus is on observations. Julie Hall added that IOCCP meets jointly with the SOLAS/IMBER carbon group, providing a good link between research and observations. John Compton asked if IOCCP has a limited time frame and Urban answered that IOCCP's time frame is open ended. Patricio Bernal made a general comment from IOC. IOCCP is a good example of a division of labor between an intergovernmental organization and the research community. Bjørn Sundby added that this group is a good example of how the responsibilities can be sorted out between SCOR and IOC. Arthur Chen expressed his concern that most ship lines do not go into marginal seas or continental shelves; "most scientists start packing" as they approach the coast. Maybe IOCCP could encourage coastal and shelf measurements. Bernal pointed out that many countries limit research, and even observations, in their exclusive economic zones. IOC is trying to address this, but it is a really tough issue.

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

Robert Duce reviewed the final output from the first symposium on "The Ocean in a High-CO₂ World" as well as plans for the second symposium, in 2008. A special section of the *Journal of Geophysical Research—Oceans* was published with the papers from the first symposium in early 2006. SCOR, IOC, and IGBP have agreed to convene a second symposium, probably in 2008, and a planning committee is being formed. The planning committee will meet, in early 2007. Patricio Bernal added that planning is progressing well for the second symposium. IOC met with the UNESCO delegation from Monaco and they committed to support the second symposium. Prince Albert may be available to open it.

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 will be held in London, England on 7-9 Dec. 2006 and will be co-chaired by Peter Burkill and Bjørn Sundby. The meeting will be preceded by a one-half day session convened by CLIVAR as a planning session for a workshop focused on getting climate data (and scientists) from CLIVAR into other projects. Ed Urban reviewed the agenda for the upcoming summit. The planning is well advanced. This is an important service that SCOR is providing. In the future, the Sloan Foundation may provide half of funding, and SCOR and the projects would have to pay the other half.

4.3.2 Panel on New Technologies for Observing Marine Life

Annelies Pierrot-Bults began the presentation about this panel. The second meeting of the panel was held in Frankfurt, Germany in November 2006, in conjunction with the Census of Marine Life's All Program meeting there. The panel has established a Web site (www.scoml.org) and is working on improving interactions with Census of Marine Life (CoML) projects. It met in Kobe, Japan in conjunction with Techno-Ocean 2006 and an international conference of the CoML program's Natural Geography in Shore Areas (NaGISA) project, just before the SCOR meeting.

Ed Urban reported on the Panel's activities in Kobe. 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. In 2006, the SCOR Executive Committee approved Alex Rogers (UK) to be the panel's vice-chair. Allyn Clarke asked if the panel does work on technology beyond the needs of the Census of Marine Life (CoML). Urban responded that the Panel's prime task is to serve CoML, but that they hope their work can benefit scientists outside of CoML also.

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

Mike MacCracken reported that the International Nitrogen Initiative (INI) is an activity designed to develop a coordinated plan to understand nitrogen cycling for the world's continental regions and their coastal margins, and is a SCOPE activity. SCOR approved funding at its 2005 meeting for a joint INI-SOLAS workshop (17-20 November 2006 in Norwich, UK) 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 this workshop is 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 for *Science* or *Nature* and one or more additional papers for more specialized journals. Robert Duce and Julie la Roche (Germany) are co-chairing this activity. SCOR, SOLAS, and NOAA are providing financial support for this workshop. MacCracken described the format. Annelies Pierrot-Bults stated that she was pleased to see more links of SCOR with SCOPE.

5.0 CAPACITY-BUILDING ACTIVITIES

5.1 SCOR Committee on Capacity Building

Ed Urban opened the discussion on this item by reminding participants that SCOR has been involved in capacity building since SCOR's beginning. For example, the International Indian Ocean Expedition (IIOE) included funding for training Indian scientists. Urban reviewed SCOR capacity-building activities, including travel grants and the Regional Graduate Schools of Oceanography (RGSO) idea. Capacity building is coordinated in the SCOR Secretariat, but Urban asked whether it would be useful to set up a committee for capacity building. Such a committee could help us raise visibility, raise funds, link to partners like IOC, advance RGSOs, etc. The group could start work by e-mail until funds are available for it to meet.

Bjørn Sundby expressed that capacity building will be increasingly important in SCOR's future. Colin Devey asked what would be the terms of reference for a SCOR Committee on Capacity Building. What are our expectations from this group? Ed Urban showed the proposed terms of reference and responded that the main purpose of the group would be to provide a focus of advice and coordination of SCOR's capacity-building activities.

Julie Hall responded that she thought this is an excellent initiative. It should integrate with SCOR-sponsored research projects and provide help to them. Frank Hall noted that the U.S. National Research Council currently has an activity on capacity building related to ocean issues. How capacity building is defined is important. Do we have an effective definition? Urban responded that he could write one, but perhaps the committee should do this. The committee

would probably include 6 to 8 people. Carina Lange asked how this proposed activity would be different from POGO efforts. Urban responded that POGO has the Fellowship program for operational oceanography, which SCOR co-sponsors, and a Nippon-funded exchange program. POGO is not helping the research projects or most other SCOR-related activities with capacity building. What POGO does is focused on the mission of POGO. The applications to POGO and SCOR for the Fellowship program show that there is a large demand for research fellowships, which are not eligible for funding through this program.

Mike MacCracken asked how the proposed committee would fit with START (global change SysTem for Analysis, Research, and Training)? Urban responded that START is mostly non-marine; they operate a lot of conferences, but that's not SCOR's method of operation. Beatriz Balino agreed with this assessment of START interests. She asked whether SCOR has done any evaluation of its capacity-building activities so far to determine what would be most the most effective future activities. Urban agreed that this would be a good thing to do; SCOR has not done this yet. He sometimes wonders about the effectiveness of the travel grants, although we have anecdotal evidence that such support has helped entrain developing country scientists in SCOR activities.

Colin Devey noted that InterRidge and START are now working together. Arthur Chen added that the SARCS committee (of START) spends \$300K per year for two ocean-related activities, a training workshop and support of projects of scientists in Southeast Asia. START has been supporting projects relating to ocean carbon issues and training workshops have been held on similar topics. Patricio Bernal stated that an organization can do capacity building at the individual level, with regard to involving people in international projects, where SCOR operates. Capacity can also be built at a second level, where IOC is trying to concentrate, on institutional capacity building, in areas like leadership and science management. A third level is national capacity building, for example to facilitate tsunami warning systems in nations around the Indian Ocean. IOC has adapted principles of capacity building for itself, which are given on the IOC Web site. Sakhile Tsotsobe stated that the capacity building being discussed involves young scientists in developing countries traveling to developed countries. How about the opposite approach, to increase impact? Is it possible to send developed country scientists to developing countries? Urban replied that there are activities that do this, such as POGO's Nippon grant. This approach is not included in SCOR's current grant from NSF, but perhaps the next time we submit the NSF proposal, we should request funds for such activities. Carina Lange added that summer schools are a great way to use this approach. Frank Muller-Karger responded that this approach is really admirable, but he is concerned that there are fewer opportunities for people who have been trained to get research funding to carry out research.

5.2 Regional Graduate Schools of Oceanography and Marine Environmental Sciences

Jose Stuardo noted that he participated in SCOR's early planning on Regional Graduate Schools of Oceanography (RGSO) and he described the RGSO effort, which was kicked by a Team Residency that Jose Stuardo convened at the Bellagio Conference Center in Italy. The RGSO idea is powerful, as demonstrated by the fact that the oxygen minimum zone conference here included many of the doctoral students from the University of Concepción program. Stuardo described the spring and summer program and arrangements for international faculty visits.

COPAS (Centro de Investigación Oceanográfica en el Pacífico Sur-Oriental) at the University of Concepción resulted, in part, from the international courses.

Ed Urban added that the Bellagio meeting that Stuardo discussed defined four regions for which there should be RGSOs. We couldn't get funding for a world-wide effort, so we decided to try to start planning region by region. Urban described the concerns within regions. We do have access to funds from the Canadian International Development Agency for a meeting in Sri Lanka to plan a south Asian network, but it's not possible to go there now because of the warfare going on. Urban proposed funding for a regional meeting in Southeast Asia to advance plans for that region. The 2007 budget will not include funds for such a meeting, but this could be revisited in the middle of 2007, when we know better how the 2007 income and expenses are going.

Annelies Pierrot-Bults strongly supported the idea of SCOR funding scientists from developed countries to come to teach or train in developing countries. It is hard to find money for this kind of travel. John Compton added that ICSU has a strong component of capacity building in its strategic plan. He suggested looking to ICSU regional offices for outreach at regional levels in ocean sciences. SCOR should try to fit into existing structures, where possible. Bjørn Sundby expressed that SCOR must persist in its efforts to set up RGSOs. He discussed his experience in obtaining funding for a meeting in Sri Lanka. We have to find out what people in the regions want, not tell them what they should have. What are the concerns and priorities in developing countries? Some of the ICSU regions map very well onto regions recommended by the Bellagio group.

Carmen Morales stated that we need to define the needs for ocean science capacity development of the countries that are involved in SCOR. They still need more participation in working groups and projects. As to teaching, today there are huge resources for learning on the Internet. We should be making more materials available on the Web, as a result of summer schools, training programs, etc. Perhaps SCOR could do more to coordinate Web publishing of educational materials and push activities to make more material available. Colin Devey was worried to hear that RGSOs haven't yet borne fruit. He agreed with Compton that it will never work from the top down. The interest has to be from the regions. Ed Urban responded that SCOR's main role is to act as a catalyst to help stimulate grass roots interest. Allyn Clarke asked if we need the proposed committee. Have we demonstrated how such a committee would work? Perhaps we need a task team to create a white paper on capacity building that SCOR could look at in one to two years to see how to proceed. WCRP did this effectively; they were well integrated within the World Meteorology Organization capacity-building effort.

Huasheng Hong noted that it would be helpful to know what is going on in SCOR countries in terms of capacity building, such as the summer school in Xiamen, China. Their university is also thinking about a dual-degree program. We need to catalogue such ongoing activities. Hong offered Xiamen as a venue for an RGSO meeting. Kurt Hanselmann stated that he has been involved in capacity building and has helped to build up the program here in Concepción. It is so rewarding to see the progress and the growth in capabilities here. There is already an enormous network of young people from the summer courses who are staying in contact; they are starting a Web site. The SCOR Committee could look at what can be learned from all the activities worldwide that have worked well. How can we maintain high standards? David Karl just

received US\$500,000 from a foundation to start a Web-based course in marine microbiology. SCOR is a group that can gather all these experiences and share the results.

Patricio Bernal added that all capacity building must be country-driven or it will never be sustainable. We have a major duty to advocate for the needs of ocean science to be included in development efforts. But, we need to be careful that we don't take money from science to do development when there is so much development money available. You need to link with ongoing development activities. Hein de Baar added that SCOR has always been a bottom-up organization and this activity (RGSO) should be like that too. Let a few heroes in each region come up with ideas. Societies differ so much from one region to the other, as do their priorities.

Bjørn Sundby summarized. The proposed terms of reference for the committee include being an advisor to the Executive Director; they are not intended to tell people what to do and how to do it. We have had a great discussion with a lot of passion. SCOR is in a position to help and we need to make this known. Sundby expressed that a committee needs to be formed to advise the Executive Director. We should focus on what we are good at: science. One idea we will pursue is the engagement of retired scientists as capacity builders.

Allyn Clarke suggested that the chair of the Committee on Capacity Building should be a co-opted member of the SCOR Executive, or a Vice President could champion capacity building on the SCOR Executive Committee, if there is a Vice President who is really interested. But, it needs to be someone who is really passionate about capacity building on the Executive Committee so that the issue is in the forefront when activities of SCOR are discussed. Sundby agreed and there was consensus among meeting participants that the chair of the SCOR Committee on Capacity Building should be a Co-Opted Member of the SCOR Executive Committee.

5.3 POGO-SCOR Visiting Fellowships for Oceanographic Observations

A record number of applications (42) were received for this program in 2006. POGO and SCOR awarded 9 fellowships. Funding for 2007 was approved by the Executive Committee.

5.4 NSF Travel Support for Developing Country Scientists

SCOR is at the beginning of the second 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. The list of previous meetings supported was presented in the background book for the meeting and the following meetings were approved:

- PACKMEDS Conference on Dynamics of semi-enclosed marine systems: The integrated effects of changes in sediment and nutrient input from land
- SOLAS Science 2007
- Asian GEOHAB Workshop
- GLOBEC-PICES-ICES 4th International Zooplankton Production Symposium
- Atlantic Meridional Transect cruise training

- Workshop on Surface pCO₂ and Ocean Vulnerabilities (co-sponsored by IOCCP and SOLAS/IMBER)
- Polar Dynamics: Monitoring, Understanding, and Prediction—In conjunction with 2007 SCOR Executive Committee Meeting
- IMBER/LOICZ Open Science Meeting on Continental Margins
- 2007 SOLAS Summer School
- PICES XVI
- 1st GLOBEC-CLIOTOP symposium on “Climate Impacts on Oceanic Top Predators”
- ICES/PICES/IOC Symposium on the Effects of Climate Change in the World’s Oceans

Urban noted that there was one cancellation on the list of meetings he presented and he proposed to use the \$5,000 freed up to support the session at the 38th CIESM Congress in Turkey in memory of Ümit Ünlüata. The meetings are mostly linked to SCOR activities. Urban asked for comments on the list of proposed awards and there was general consensus to approve this list.

5.5 SCOR Reports to Developing Country Libraries

The SCOR Secretariat distributed four reports to developing country libraries since the 2005 SCOR meeting: (1) reprint of *Phytoplankton Pigments in Oceanography*, (2) the IMBER *Science Plan and Implementation Strategy*, (3) the GEOHAB Core Research Project on Harmful Algal Blooms in Upwelling Systems, and (4) the special section of the *Journal of Geophysical Research—Oceans* on The Ocean in a High-CO₂ World. Some participants questioned some of the institutions on the list of libraries receiving SCOR publications; perhaps some of these libraries can afford to buy the publications?

5.6 ICSU Priority Area Assessment on Capacity Building

The committee conducting the ICSU Priority Area Assessment on Capacity Building issued a final report in 2006. Copies of this report were available at the meeting. It also is available at http://www.icsu.org/Gestion/img/ICSU_DOC_DOWNLOAD/928_DD_FILE_ICSU_PAA_Cap_Building.pdf.

6.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS

6.1 Intergovernmental Oceanographic Commission

Bjørn Sundby and Ed Urban attended the IOC Executive Council in June 2006 to represent SCOR. SCOR and IOC cooperate on several different activities, and Sundby invited Patricio Bernal, the Executive Secretary of IOC and Assistant Director General of UNESCO, to make some comments on behalf of IOC. Bernal started by noting the main point that the links between IOC and SCOR are being strengthened. IOC has relied on the work of SCOR for a long time to get governments interested in research programs and provide support for them. IOC does other things. GOOS is a significant one, aimed to provide a permanent system of observations that will provide products and services for many kinds of users. Bernal continued by stating that he is very satisfied with the work of IOCCP.

IOC has conducted many activities related to tsunami observations in the past two years. Many oceanic services exist already. This is an area that is an application of science, not research. It is run by a different community that is maturing to understand its role in relation to science. Prior to the Indian Ocean tsunami in December 2004, this field was very poorly funded, but that has changed and many nations now support it. A tsunami unit in IOC is independently funded, with 7 professionals involved. It is helping to create warning systems in the Indian Ocean and Caribbean Sea, and strengthening the Pacific Ocean warning system. This is a good example of an ocean service being identified as critical by society. Other services are benefiting from the new-found interest in tsunamis, such as sea-level monitoring. A major challenge is that most countries do not have institutions involved with operational observations of the ocean; some don't even understand the questions involved. It is a major challenge to help build up these institutions. The tsunami effort will mature and evolve and we have to be left with the infrastructure to sustain a useful observing system that will include tsunami warnings in its products. There is a lot of capacity building associated with all of this. Thus, capacity building is a major effort of IOC; it is related to all that they do.

Bjørn Sundby responded that, from the perspective of SCOR, it is clear that IOC's task is enormous and he is glad that SCOR does not have such a wide range of responsibilities. Of course, SCOR is always ready to help. The relationship between SCOR and IOC was not clear to Sundby when he started his term as SCOR President and he has been trying to clarify this. Much progress has been made in the SCOR-IOC relationship. The levels of the organizations are different, with SCOR working mostly with individual scientists and IOC working mostly with governments. ICSU has agreed that SCOR is the point within ICSU with ocean expertise, and SCOR will act for ICSU on issues relating to the ocean, for example, at IOC meetings and GOOS meetings. Birger Larsen asked what happened to the working group proposal from last year related to bathymetry (it was critical for tsunamis); SCOR passed it over to IOC. Patricio Bernal replied that they have been looking at this issue. They have had discussions with governments for each of the ocean basins.

Bernal expressed his appreciation of all that SCOR is doing and his willingness to work to keep the relationship very active. He also expressed his gratefulness that SCOR will help support the special session for Ümit Ünlüata at the CIESM meeting. He also noted that Ünlüata's post will be advertised soon.

6.1.1 Global Ocean Observing System (GOOS)

Bjørn Sundby attended the GOOS Scientific Steering Committee meeting in 2006 and discussed the role of SCOR in GOOS management with ICSU representatives. The project summit discussed in Section 4.3.1 will include a discussion of the interactions between GOOS and the major international ocean research projects. Patricio Bernal reported that the climate component of GOOS is about 50% implemented. Challenges remain for the remainder of the program. The coastal GOOS strategy needs development; it must respond to local interests and users. It will have a much more distributed implementation than the climate portion of GOOS. IOC is working on pilot projects to prove the concept. One big challenge is that the Global Earth Observing System of Systems (GEOSS) has developed its own identity and is not recognizing the work of other observing systems. IOC is trying to correct this by working closely with GEOSS. There are limited resources and the overlap of GEOSS and GOOS is causing a problem. GOOS has lost

momentum in the last year or two. Budgetary constraints all over the world are impacting science. We need to make better presentations and improve our communications with funding agencies. Sundby responded that SCOR would like to help the scientific committee for GOOS, but cannot provide financial support at this time.

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

Significant steps were made in the last year toward implementing the recently developed strategic vision for the “New GESAMP”. GESAMP’s sponsoring organizations (UN, UNEP, FAO, UNESCO-IOC, WMO, IMO, and IAEA) have not yet signed a revised Memorandum of Understanding (MOU) to implement the strategic vision, but have agreed that many elements of the new GESAMP can be implemented under the existing MOU. Robert Duce introduced Michael Huber, the chair of GESAMP. Huber started by noting that this is first time for a formal representation and report from GESAMP at a SCOR annual meeting (Duce has done this informally in the past.)

The new GESAMP is focused on “Science for Sustainable Oceans”, partially as a result of the review in which SCOR assisted. It is a joint group presently sponsored by 8 UN agencies. GESAMP’s mission is “to provide authoritative, independent, interdisciplinary scientific advice to organizations and governments to support the protection and sustainable use of the marine environment.” GESAMP is a multi-disciplinary scientific advisory body. The members of its governing committee and project committees are experts acting in their individual capacities. GESAMP was established in 1969. Since then, it has produced nearly 50 scientific reports on a range of issues, such as studies/reviews of individual contaminants; impacts/management of specific human activities; air-sea and land-sea interaction/exchange; guidelines, criteria, and methodologies, and State of the Marine Environment Assessments. Current GESAMP working groups are focused on the topics of

- hazard evaluation of substances carried by ships,
- environmental risk assessments and communication in aquaculture,
- evaluation of active substances for ballast water treatment,
- review of the UNEP-WCMC marine assessments report,
- deep-water fisheries, and
- ecosystem approaches to mariculture.

GESAMP is looking for new partners to implement their strategic vision, which is one reason why Huber came to the SCOR meeting. The GESAMP strategic vision is a proactive strategy for credibility, engagement, and professionalism. “Engagement” is being pursued by a revitalized Web site, better products, a pool of experts, new partnerships (with governments, regional bodies, scientific unions, intergovernmental organizations, non-governmental organizations), and increased regional participation. GESAMP is funded by UN agency contributions (US\$120,000/yr + in kind) and funding from Sweden (US\$1,100,000 for 2006-2008 + in kind). The topic of capacity building might be “fertile ground” for cooperation with SCOR.

Robert Duce stated that he was pleased to see this first formal presentation from GESAMP. There are many common interests between GESAMP and SCOR. For example, both are interested in capacity building and both have working groups. There are many opportunities for interactions between SCOR and the new GESAMP. Julie Hall suggested that GESAMP link to the Pacific Islands Applied Geoscience Commission (SOPAC). Jose Stuardo asked about GESAMP's working group on ecosystem-based approaches to mariculture; there are no clear rules governing salmon farming in Chile. Huber responded that governments will receive advice from this working group via the UN Food and Agriculture Organization. Laurent Labeyrie asked if GESAMP reports are open access on the Web. Huber responded that they will be as soon as possible. Patricio Bernal stated that it is important that advice from GESAMP and other bodies be in the context of a specific mandate. For example, the global marine assessment was specifically requested by governments at the World Summit on Sustainable Development, to put in place a regular process to assess the status of the ocean. Such assessments must feed into a body that can take action. Temel Oguz stated that GESAMP needs a bottom-up approach (e.g., responding to requests from nations), but most government agencies don't know about GESAMP. Turkey could benefit from GESAMP, but they don't know about it; they must create new links, perhaps through national representatives.

6.3 North Pacific Marine Science Organization (PICES)

Victor Akulich reported that PICES conducts several activities that are relevant to SCOR interests and that implement SCOR activities in the North Pacific region. He noted the good connections between the SCOR and PICES. Julie Hall represented SCOR at the October 2006 PICES meeting in Japan, which has a theme of climate variability. 2007 is their 15th anniversary. Julie Hall reported that she gave a presentation on SCOR at the PICES Governing Council and they were very positive about PICES' links to SCOR. They expressed their thanks for the travel support for developing country scientists received from SCOR over the years. PICES has strong links to GEOHAB and GLOBEC and is seeking to build links with SOLAS and IMBER.

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 so far. SCOR sent a representative (John Compton) to the Second Regional Consultative Forum of the African region, in September 2006. SCOR also was invited to send representatives to other regional meetings, but did not do so. The SCOR Executive Committee is discussing what level of involvement to pursue in relation to the regional centers. Bjørn Sundby reported that it has been an interesting year in relation to ICSU, as the SCOR relationship with ICSU has been clarified. ICSU plans to make better use of SCOR for the ocean-related issues. SCOR will represent ICSU at future IOC meetings.

Ed Urban reported on ICSU activities more generally. ICSU is celebrating its 75th anniversary in 2006, having been formed in 1931. A few landmarks since then include

- International Geophysical Year (1957-1958)
- International Biological Programme (1964-1974)
- Freedom in the conduct of science (1963-)
- Four global change programmes (1980-)
- ASCEND 21 and the Rio Earth Summit (1991,1992)
- World Summit on Sustainable Development (WSSD, 2002)
- Summit on the information Society (WSIS, 2003, 2005)
- Regional Offices (2005-)
- International Polar Year (2007-2008)

ICSU has three inter-related strategic themes: (1) international research collaboration, (2) science for policy, and (3) universality of science. In international research collaboration, ICSU's major activities relate to linking research, monitoring, and assessments with focus on global environmental change; the International Polar Year 2007-2008; natural and human-induced environmental hazards and disasters; science for sustainable development; science for human health; and sustainable energy. ICSU's activities in relation to science for policy are designed to ensure that international research programmes address key policy issues, participate in major international assessments, produce authoritative statements, and speak as the voice of international science in policy fora, for example, at meetings of the Convention on Sustainable Development. ICSU promotes the principle of the universality of science, which encompasses freedom and responsibility in science. ICSU also promotes the universality of science by reaching out to all countries by promoting free and open access to data and information and by setting up regional offices. The aim of the regional offices is to ensure that the voice of developing countries influences the international agenda setting and that scientists from the South are fully involved in the research. Progress in the regions includes

- The ICSU Regional Office for Africa was inaugurated in September 2005.
- Agreement has been reached with Malaysia for an office for the Asia and Pacific region.
- Additional offices are to follow soon in Latin America/Caribbean (Brazil) and Arab regions.

John Compton reported on the meeting of the ICSU Africa region that he attended on behalf of SCOR in Johannesburg in September 2006. ICSU has made capacity building a huge issue in their strategic plan and have taken quite a bit of action on this topic. Of the regional ICSU offices, the ICSU office for Africa is furthest along in its development. The meeting was very diverse. Two things stood out; yes, they need training, they also need it to be sustainable. People trained in science have to be retained in African countries and institutions need to be developed to retain them. This is a big challenge for SCOR as well. Ocean science was not well represented at the ICSU Africa meeting. Compton participated in a global change working group. They need input from social science. There is a lot room for optimism, but there is no question that scientific capacity building in Africa is a big challenge. The establishment of the ICSU office for Africa is a good start, to facilitate collaboration with other groups and projects.

7.1.1 International Geosphere-Biosphere Program (IGBP)

Ed Urban attended the IGBP Science Committee meeting in Pune, India in March 2006 to represent SCOR. Julie Hall also attended at IGBP's expense as the IMBER SSC chair and Bob Duce attended as the IGBP Treasurer. SCOR and IGBP staff members have ongoing discussions in relation to co-sponsored projects. The PAGES project of IGBP is leading an IGBP/SCOR Fast-Track Initiative on "Atmospheric CO₂ and ocean biogeochemistry: modern observations and past experiences", which held its first meeting in Palisades, New York, USA on Sept. 28-30, 2006.

Beatriz Balino made a presentation on behalf of Wendy Broadgate, who is on maternity leave. Balino reported that, in the past year, the IGBP II Science Plan and Implementation Strategy was published, outlining IGBP's program for the next decade. Also, IGBP has a new chair, Carlos Nobre (Brazil). Two important IGBP meetings were highlighted, the IGBP Congress in Cape Town, South Africa in May 2008, and the IGBP 20th Anniversary meeting in Stockholm, Sweden in September 2007. IGBP sponsors nine different projects, some with other organizations, including three with SCOR. In addition, IGBP supports two integrative activities. The first is Analysis, Integration and Modelling of the Earth System (AIMES). A major challenge for AIMES is to include the human dimension in Earth System modelling. AIMES is in the process of preparing its Science Plan. Current AIMES activities include the Coupled Carbon Cycle Model Intercomparison Project (C4MIP; with the World Climate Research Programme), the Integrated History of People on Earth (IHOPE) project (a book is in preparation), and the AIMES Young Scientist Network. Another integrative IGBP activity is PAGES (Past Global Changes). The new structure of PAGES focuses on past climate forcings, regional climates and variability, land/ocean/cryosphere dynamics, and the past human/climate/environment. PAGES is implementing its new structure and preparing its new Science and Implementation Plan. Its activities include two PAGES/CLIVAR workshops and the ocean acidification workshop with SCOR. IGBP has completed Fast-Initiatives on iron (with SCOR) and nitrogen (with SCOPE), has the ongoing one on ocean acidification, and has two in planning on "Refining plant functional classification for Earth System modelling" (w/DIVERSITAS) and "The planet Earth in 2050: An ESSP integrative project"

Ed Urban added that, regarding ocean acidification, this is a very interesting activity. It was the first time that paleo-CO₂ people and modelers met in a workshop setting. A scholarly paper will result from the meeting at Lamont-Doherty Earth Observatory. They originally planned two meetings, but they may not have another after the Lamont meeting a few weeks ago. Several organizers of the Lamont meeting are being proposed for the planning committee of the Second Symposium on The Ocean in a High-CO₂ World.

Laurent Labeyrie stated that he has been involved in IMAGES for years and really sees problems in terms of it being isolated from the rest of PAGES and from IGBP. This is a serious concern. Perhaps IMAGES should have stronger links to SCOR because its links to PAGES have never developed properly. Beatriz Balino said that she will take the message back. The IGBP Congress might be a good forum to expose the connections.

7.1.2 World Climate Research Programme (WCRP)

Mike MacCracken attended the WCRP meeting in Pune, India in March 2006 and reported on that meeting and WCRP's activities more generally. WCRP is co-sponsoring the SOLAS project and SCOR projects are working well with CLIVAR, the part of WCRP most relevant to SCOR. CLIVAR is one of the projects invited to the SCOR Project Summit in December 2006, and CLIVAR will take advantage of this meeting to hold a planning meeting on Applications of Climate Information to Marine Research Projects (the title is still being discussed). MacCracken noted that WCRP has a new Executive Director, Ann Henderson-Sellers. WCRP is working on a new strategy—"seamless prediction"—which involves linkages from prediction of weather on short time scales all the way to long-term climate. A major research effort, THORPEX, is coming out of the weather prediction field and getting integrated into WCRP, particularly in relation to prediction of extreme events. Another interesting initiative is a major effort to compare attempts at seasonal predictions through coupled global climate models and ensemble simulations. CLIVAR continues its work in studying ocean-climate interactions.

7.1.3 Scientific Committee on Antarctic Research (SCAR)

SCAR and SCOR are co-sponsoring a joint Expert Group on Oceanography, which met in conjunction with the 2006 SCAR Annual Meeting in Hobart, Tasmania, Australia in July 2006. Julie Hall reported that she attended both the SCAR meeting and the Expert Group meeting. There was a lot of interesting science presented. Hall gave a presentation to SCAR about SCOR that generated a lot of interest. SCAR has a much more political focus. They are keen to develop interactions with SCOR via the joint Expert Group, which had a very productive meeting in Hobart. The group has a high proportion of physicists due to the focus of SCAR, but they are taking a number of interdisciplinary initiatives with their Web site and links to other programs. SCOR should continue to support the group; it is raising the profile of SCOR on Southern Ocean science. SCOR needs to push SCAR to make the group more interdisciplinary, since they want to get involved in coordinating ocean observations in the Southern Ocean, which will be a theme for their next meeting. Allyn Clarke asked why SCOR, as a cosponsor, can't demand changes in the Expert Group's membership. Ed Urban responded that the membership was decided by SCAR before SCOR was fully involved. SCAR has been told that in the future this needs to be a more bilateral process and we should tell them that future funding is conditional on more consultation.

7.1.4 Scientific Committee on Problems of the Environment (SCOPE)

Bjørn Sundby and Annelies Pierrot-Bults represented SCOR at the October 2006 SCOPE Executive Committee meeting. (Pierrot-Bults is an officer of SCOPE, so SCOR does not pay her travel expenses to the meeting.) SCOR will participate with SCOPE and IAPSO in the PACKMEDS activity. SCOPE is in a difficult financial situation, which makes it hard for them to set up new working groups. Sundby added that he attended the SCOPE meeting as a complete outsider. SCOPE does assessments and recognizes the need to identify customers for these assessments. SCOR could learn from SCOPE how to make very readable books that reach out to the community. They want to work with SCOR and we should make an effort to find new areas for joint activities.

7.2 Affiliated Organizations

7.2.1 International Association for Biological Oceanography (IABO)

Annelies Pierrot-Bults, the IABO President, reported that IABO is still implementing the actions decided at the 2005 IABO Business Meeting in Cairns, Australia. It has been difficult to complete these tasks due to the lack of funding and paid secretariat staff. The secretary, Mark Costello, is attempting to develop a small amount of funding for this purpose. IABO will participate in two joint sessions at the IUGG meeting in Perugia, Italy in July 2007, on (1) Environmental Controls on Marine Biota and (2) Life in Icy Environments: Interactions Between the Biology and Chemistry of Ice. IABO will also convene a special session at the CoML All Program meeting next year with OBIS, on marine biogeographic data analysis.

7.2.2 International Association for Meteorology and Atmospheric Sciences (IAMAS)

IAMAS, as an association of IUGG, will meet next at the IUGG General Assembly in Perugia, Italy. Mike MacCracken, the IAMAS President, noted that an International Association of Cryospheric Sciences will be added at the Perugia meeting. There are many possibilities for SCOR to collaborate with IUGG, especially in relation to capacity building in Africa, for which IUGG has significant funds. IAMAS has a Commission on Climate, which is seeking interactions with IAPSO. The Perugia meeting should be excellent, as the university there is having its 700th anniversary, three IPCC chairs are speaking, and posters will be presented in tunnels under the town.

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

Shiro Imawaki, the IAPSO President, reported that SCOR and IAPSO are currently co-sponsoring WG 121 on Ocean Mixing, WG 122 on Estuarine Sediment Dynamics (with LOICZ), and WG 127 on Thermodynamics and Equation of State of Seawater. The joint IAG/IAPSO/IABO Assembly in Cairns, Australia was the major IAPSO activity for 2005-2006. The Assembly drew a total of 724 participants from 62 countries. Work of the Permanent Service for Mean Sea Level (PSMSL) and the associated IAPSO Commission on Mean Sea Level and Tides continued during 2005. A report on the complete activities of PSMSL was received. One significant activity was the planning, in cooperation with other organizations, of the WCRP Workshop, "Understanding Sea Level Rise and Variability," held during the summer 2006 in Paris, France. IAPSO was a co-sponsor of the workshop. In administrative actions, the IAPSO Executive Committee approved holding a Joint Assembly with IAMAS in July 19–29, 2009 in Montreal, Canada. The IAPSO Executive Committee also approved discontinuing the Commission on Groundwater-Seawater Interaction (CGSI) with a recommendation to CGSI that they continue activities in a different organizational format.

7.3 Affiliated Programs

The benefit of continued affiliation to SCOR is evaluated at each General Meeting. All SCOR-affiliated programs have been 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

Laurent Labeyrie reviewed the history of this affiliation discussion. 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. InterMARGINS replied that there is a token fee, but it doesn't give developing countries full rights in the program. 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 this developing country member to attend steering committee meetings. SCOR should invite a speaker from InterMARGINS to the next General Meeting.

7.3.2 Census of Marine Life (CoML)

The Census of Marine Life is progressing rapidly and now has 14 field projects underway. SCOR's Panel on New Measurement Technologies for Observing Marine Life is a scientific advisor to the CoML projects. Victor Gallardo, one of the CoML Vice Presidents, presented a report. He started by reviewing the history of CoML. Fred Grassle and Jesse Ausubel were instrumental in the founding of CoML. The Sloan Foundation sponsored a series of meetings from 1997 to 2000 to explore the CoML concept and later to plan the program. The goal of CoML is to assess and explain the diversity, distribution, and abundance of marine life in the ocean—past, present, and future. This is addressed in the form of three focal questions:

- What did live in the oceans?
- What does live in the oceans?
- What will live in the oceans?

Each CoML project begins by identifying the known, unknown, and unknowable within their realm, to help focus their explorations. The History of Marine Animal Populations (HMAP) project focuses on what lived in the ocean in the past and the Future of Marine Animal Populations (FMAP) project will make predictions of what the future marine biodiversity is likely to be, based on analysis of directional trends. In the present, 14 field projects are studying the diversity, distribution, and abundance of marine organisms from the ocean surface to the deep seafloor. Gallardo presented details about HMAP, FMAP, and each field project. He also briefed meeting participants about the Ocean Biographic Information System (OBIS), which is collecting geographically referenced species data from all sources, not just CoML projects. OBIS will provide the ability to synthesize CoML and other data, and to test hypotheses about what controls species' diversity, distribution, and abundance. CoML is managed by an international SSC, but has also developed a strong set of national and regional implementation committees (NRICs). CoML is beginning planning for its 2010 document and to look beyond to what might supersede CoML after 2010, when Sloan Foundation funding will be completed.

Akira Taniguchi noted that more environmental data should be included in OBIS. Maybe SCOR can help? Sloan Foundation funding for CoML will run out in 2010. The second phase of CoML may have problems with funding, but they do seem to having some success in broadening their international funding base. SCOR may be able to help with its moral support. Therefore, Taniguchi recommended continuation of affiliation of CoML with SCOR, and meeting

participants agreed.

7.3.3 International Antarctic Zone (iAnZone) Program

Ed Urban reported that iAnZone is a loose affiliation of physical oceanographers working in the Southern Ocean. Its primary mission to advance our understanding of climate-relevant processes in the Southern Ocean region poleward of the Antarctic Circumpolar Current. iAnZone objectives are (1) to provide an active forum for Antarctic oceanographers to exchange ideas, plans, results, and data; (2) to identify, develop, and coordinate research projects; (3) to facilitate coordination among Antarctic and global climate programmes, and among other Southern Ocean programmes; and (4) to advise on the development of appropriate observing systems, datasets and modelling strategies needed to assess the scales and mechanisms of climate variability in the Antarctic Zone.

One of iAnZone's new projects is the Synoptic Antarctic Shelf-Slope Interactions Study (SASSI), which is a lead project in IPY. iAnZone was requested to make a presentation at the SCOR General Meeting in Chile, but their limited funding made this impossible. (Travel of iAnZone scientists to their biennial meetings is funded by individual participants.) iAnZone will, however, meet in Bergen in August 2007, so iAnZone will be able to make a presentation to SCOR next year. It was agreed that iAnZone should continue to be affiliated to SCOR.

7.3.4 International Marine Global Changes Study (IMAGES)

SCOR and IMAGES are co-sponsoring WG 123 on Reconstruction of Past Ocean Circulation and WG 124 on Analyzing the Links Between Present Oceanic Processes and Paleo-Records. Marie-Alexandrine Sicre gave a PowerPoint presentation on behalf of Ralph Schneider, the IMAGES Director. IMAGES has two primary aims:

1. To quantify the role of ocean circulation in climate change:
 - a. the time relationships between variability in different parts of the ocean-climate system,
 - b. the impact of perturbations in the freshwater cycle on ocean circulation, and
 - c. the relative roles of high- and low-latitude processes in rapid climate change.
2. To quantify changes in the oceanic nutrient and carbon cycles:
 - a. changes in deep-water carbon storage as a function of circulation,
 - b. changes in biological productivity related to new supply or redistribution of nutrients, and
 - c. implications for the net CO₂ flux into or out of surface waters.

The foundation of IMAGES was SCOR/PAGES WG 100 on Sediment Coring for International Global Change Research (see <http://www.images-pages.org/outreach/science-plan.pdf> for the report of SCOR WG 100, the IMAGES Science Plan). IMAGES conducts its work through collection of cores throughout the world and through working groups focused in specific paleoceanographic issues. Current research projects include

- MARCO POLO II
- PACHIDERME
- GALOPER
- ISOLAT

There are 9 active IMAGES working groups, including two with SCOR: IMAGES WG10 (SCOR WG 123) on Reconstruction of Past Ocean Circulation (PACE) and IMAGES WG11 (SCOR WG 124) on Links between Present Oceanic Processes and Paleo-records (LINKS). Laurent Labeyrie added that the driving force of IMAGES is science, not just taking cores. John Compton reported that IMAGES has been very active in involving participants from countries where they go for cruises. It has been invaluable around southern Africa. Labeyrie responded that, in fact, capacity building is a major concern of IMAGES. Jeandel asked whether there is participation from Brazil. Sicre responded that there are no future plans for cruises in the South Atlantic Ocean. Labeyrie recommended continuation of affiliation to SCOR and the consensus was that this recommendation should be accepted.

7.3.5 InterRidge - International, Interdisciplinary Ridge Studies

Laurent Labeyrie asked that InterRidge consider forming a working group with SCOR. Colin Devey, the current InterRidge chair, responded that this is unlikely, although InterRidge is now making its working groups more like SCOR's, based on Devey's experiences at SCOR meetings; they should now have shorter lifetimes, more focus, etc. Ed Urban published an article about SCOR in *InterRidge News*, which is only on-line now, but will be published in hard copy later. There was consensus that InterRidge's affiliation to SCOR should continue.

7.3.6 International Ocean Colour Coordinating Group (IOCCG)

IOCCG appointed a new chair, James Yoder (USA), at the end of 2005. Over the past year, two IOCCG scientific working groups have completed their deliberations, and submitted monographs for publication by IOCCG. Bjørn Sundby noted IOCCG's concern at the loss of their IOC support and its impact on their capacity-building activities. Meeting participants agreed that IOCCG's affiliation to SCOR should continue.

7.4 Other Organizations

7.4.1 Partnership for Observation of the Global Ocean (POGO)

Ed Urban reported that the next POGO meeting will be held in Qingdao, China on 17-19 January 2007. POGO and SCOR are participating together on the POGO-SCOR Visiting Fellowships for Oceanographic Observations and on developing new capacity-building activities. POGO has put out a request for proposals for a research cruise database and Urban is assisting in reviewing the proposals received. He noted the continuing cooperation on fellowships.

8.0 ORGANIZATION AND FINANCE

8.1 Membership

8.1.1 National Committees

Bjørn Sundby and Ed Urban met with the French SCOR Committee in June 2006, in conjunction with the IOC Executive Council meeting. The changes in Nominated Members since the 2005 Executive Committee Meeting were reported. Robert Duce noted that China-Beijing will increase from Membership Category II to III in 2007.

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 2004, Bangladesh was moved to suspended status. At the end of 2005, Egypt was moved to suspended status. There was activity in the Philippines to pay their dues at the time of the 2005 SCOR meeting, so they were given another year, but no payment has been received, and so they are subject to transfer to suspended status, and there was agreement that they should be changed to suspended status. No other countries are more than one year in arrears. The suspended countries are listed on the SCOR Web site as “Observer Nations”, to avoid stigmatizing these nations. They will still receive SCOR documents and notifications of meetings, but cannot name people for working group, nominate SCOR Officers, or participate in SCOR elections.

Possibilities for new members are always explored, but there is nothing imminent. Laurent Labeyrie responded that we are talking about capacity building, but we are pushing out a member that needs capacity-building help. Perhaps we should focus some attention on capacity building in the Philippines and other countries that have already been suspended (Bangladesh, Egypt). The new capacity-building committee should look at this issue carefully.

8.2 Publications Arising from SCOR Activities

Ed Urban reported on SCOR publications from the past year, and asked if any changes were needed to the SCOR Web page and/or Newsletter.

Publications from Working Groups and Major Projects—Three major publications from SCOR activities were produced since the 2005 SCOR meeting: (1) the special section of the *Journal of Geophysical Research—Oceans* that resulted from the SCOR/IOC Symposium on The Ocean in a High-CO₂ World (published as a stand-alone document), (2) the final publication from the SCOR/IUPAC WG 109 on The Biogeochemistry of Iron in Seawater, and (3) a special issue of *Deep-Sea Research* from IAPSO/SCOR WG 121 on Ocean Mixing.

2005 SCOR Proceedings—The *Proceedings* was printed and distributed in July 2006.

SCOR Brochure—The SCOR brochure is updated occasionally and given to potential sponsors, potential member nations, and others. The brochure is available in English, Spanish, and French.

SCOR Web site—The SCOR Web site is updated and checked for dead links regularly. Robert Duce noted that the SCOR Web site is “functional and accurate” but not “dynamic or exciting.”

Urban responded that he has to do what he can with limited time and within his capabilities to maintain the site. Hein de Baar and Ken Bruland requested that *The Biogeochemistry of Iron in Seawater* paper to be available via the SCOR Web site. Urban responded that he will discuss this request with the publishers. Kurt Hanselmann stated that it would be useful if one could go into the SCOR Web site and find colorful, useful material for talks. Also, could we have a capability for people to sign up to get automatic notifications when new material is posted? Urban responded that the latter is easy. The former is complicated by getting permissions to use figures and Urban does not think this is a priority use of his time. We need to be careful about not infringing copyright. Julie Hall mentioned software packages like FrontPage that can easily improve the look of Web sites. Also Google Analytics will quickly give reports on many aspects of Web site usage. Urban will work in the coming year on improving the SCOR Website and tracking its use.

SCOR Newsletter—Six issues have been distributed so far. (All are available on the SCOR Web site.) The SCOR Secretariat will issue three newsletters each year. In 2006, Issue #5 was produced in time for the IGBP-SC meeting and distributed in hard copy there and Issue #6 was produced in time for the IOC Executive Council and distributed there. The SCOR Secretariat will work on improving the layout and design of the Newsletter in 2007 and will continue to have it printed in hard copy for limited distribution. The next newsletter will be issued shortly after the Concepción meeting.

SCOR Poster—The SCOR poster is still available in A0 and A3 size.

8.3 Finances

The annual audit was completed in mid-July. Elizabeth Gross and Havelly Taylor worked to prepare information for the auditors. The financial records and financial controls were found to follow accepted standards. SCOR's science grant from the National Science Foundation was renewed for three years. Other new funds were obtained for other SCOR activities. Colin Devey chaired the ad hoc Finance Committee and presented the list of tasks for the committee and what the committee did in relation to each of these tasks:

- Review auditor's report of 2005 finances—The auditor found no accounting discrepancies and the Finance Committee recommended acceptance of the 2005 statements. The end-of-year net assets were US\$237,000 and SCOR had agreed previously to reduce this amount because it does not look good to national committees. The budget for 2006 was intended to reduce the net assets.
- Consider approval of revised 2006 budget—The Finance Committee did not spend time on the grants and contracts columns ("flow-through funding") because the income and expenses are equal, by definition. Instead, the committee focused on discretionary funds. The revised 2006 budget shows a reduction of assets from \$237,000 to \$180,000. The Finance Committee recommended approval of 2006 budget revisions.
- Consider approval of 2007 draft budget—Devey presented highlights of the 2007 draft budget. The net assets are projected to come down at the end of 2007 to \$137,000. The budget includes \$107,000 for working groups. At \$15,000 each, this equals 7.1 working groups. Our aim is to have six working groups running all the time. The \$43,000 projected deficit is more than needed to account for the 1.1 additional working groups;

therefore, the money is being used for other things, such as non-working group science activities, salary increases, etc. Therefore, we need to think about raising the dues. A 1% increase would raise only \$2,500 more in dues. A 3% increase would account for inflation in the United States, amounting to increased income of \$7,500. Changes in categories of dues have a much larger positive impact. Devey asked members to look at the list of dues for different countries and challenged national committees to consider whether their dues adequately reflect their participation in marine science. Rodrigo Nuñez requested that SCOR not make a formal request for countries to move levels. He had a hard time to make the arguments for paying the Chilean dues, but was able to get a lot of statistics from Ed Urban to help with his funding agency that pays their dues. Devey agreed that it would not be necessary to make a blanket request to all countries, but that it should be possible to pick specific ones to approach. The Finance Committee recommended acceptance of the proposed budget for 2007.

- Determine dues increase for 2008—The Finance Committee recommended a 3% increase in dues for 2008.

Bjørn Sundby thanked Colin Devey and the other Finance Committee members. Robert Duce asked if SCOR can even maintain six working group meetings in any given year. Devey answered that it is hard to say; all it takes is for one working group to postpone its meeting and the deficit is reduced (as happened in 2006 budget revisions). Some current working groups are half-funded from IMAGES and some have outside funding. Devey continued by saying that there is adequate funding to start two new working groups in 2007. Annelies Pierrot-Bults asked why SCOR grants do not include overhead. Ed Urban responded that NSF doesn't allow it on SCOR's science grant. We do receive some overhead from the NSF developing country travel grant and some grants from the Sloan Foundation. Laurent Labeyrie stated that working groups are the heart of SCOR. Perhaps we should be stricter and disband working groups that are not performing. At each General Assembly we should be much more rigorous on review of working groups and put more pressure on them. Urban responded that, with the exception of WG 111, each current group has met once in the past two years. WG 122 is a little delayed. It's hard to abandon a working group that we have already invested in and the working group process is much faster, on average, than it used to be. Not all of them can proceed at exactly the same pace. Labeyrie responded that we need to require forward planning of schedules for approval of working groups. Julie Hall clarified the difference between working groups on the books that are just finishing their work and those for which we have financial commitments. There are only six of the latter for 2006.

Devey brought up the issue of registration fees and what the left-over fees are used for. Should they have to be related to similar activities? SCOR sets registration fees to cover the costs of the meeting. We don't expect to have unspent registration fees after any meeting. In cases where this happened, more people than planned attended the meeting, or we obtained additional funds for it. In such cases, the leftover money should go back into a related activity, or be used for SCOR salaries, since the SCOR Executive Director and Administrative Assistant tend to devote a lot of time to these meetings. Hein de Baar responded that SCOR takes the risk of a loss on a meeting, so it should be valid to use some excess fees for the Secretariat.

All recommendations of the Finance Committee were accepted, including a 3% dues increase in 2008.

8.4 The Disciplinary Balance among SCOR Working Groups

Laurent Labeyrie presented the analysis and recommendations of the ad hoc disciplinary balance committee. They examined both working groups and other SCOR activities. The category of “general tools” is disappearing. The committee recommended that SCOR encourage multidisciplinary approaches, at the limits between existing large programs. In biology, we need some activities on the benthic boundary interface with chemistry, physics, and sedimentology, including exported fluxes from the surface ocean. (Earlier discussions at the meeting identified ecology of the mesopelagic zone as a potential area of SCOR interest.) In the area of physical oceanography, we need some integrative activities and perhaps something on sea ice. In chemistry/biogeochemistry, we need something on remote sensing and clathrate dynamics. Labeyrie made a strong recommendation that we need to have capacity building across the whole range of SCOR activities. Last year we made a recommendation on shelf-break science and we did get a proposal. How did that happen? Ed Urban responded that when the call for working group proposals goes out each year he includes the recommendations from the disciplinary balance committee. The call for proposals is widely distributed and available on the SCOR Web site. Temel Oguz asked if modeling is missing. Urban responded that WG 111, 122 and the new DOES working group are all modeling. Allyn Clarke added that the climate category would be much bigger if you added program activities. Bjørn Sundby summarized that SCOR activities seem to be pretty well balanced now, so there is no need for drastic changes.

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 2006 General Meeting – Concepción, Chile

Bjørn Sundby opened this last session by thanking our Chilean hosts for all the terrific arrangements. Rodrigo Nuñez thanked José Stuardo for efforts to convince the president of the university to host the meeting.

9.1.2 2007 Executive Committee Meeting – Bergen, Norway

A tentative invitation has been received from the Norwegian SCOR Committee to hold the 2007 Executive Committee Meeting in Bergen, Norway. Beatriz Balino stated that she was asked by Peter Haugan to reiterate the invitation. SCOR meeting participants will be welcome to participate in the associated meeting (Polar Dynamics: Monitoring, Understanding, and Prediction) and will be invited to social activities. Ed Urban asked if people want to have the two meetings scheduled back to back so that SCOR members can attend the entire science event. Bjørn Sundby urged that this be done. Urban responded that this would mean at least one day of

the SCOR meeting will be on a weekend; it will be before or after the other meeting. The science conference is 29-31 August 2007. The SCOR meeting has been set for 26-28 August.

9.1.3 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 planning committee (chaired by Robert Duce, USA) reported on plans for the 2008 meeting. Robert Duce introduced the current status of the draft program on the first day of the SCOR meeting. He stated that the Planning Committee is finished with its work and recommended that a Program Committee should be formed. Duce requested comments and inputs on the program.

Duce described the meeting arrangements. The tentative dates are 20-21 October. We have a formal invitation from the Woods Hole Oceanographic Institution and from the U.S. SCOR Committee to host a reception. Duce received many comments on the rough draft of the symposium program. Bjørn Sundby added that Laurent Labeyrie has agreed to chair the Program Committee. We want to strive to have an occasion that catapults SCOR into the next 50 years. Labeyrie responded that he hesitated, but accepted the challenge. He spoke about his admiration for SCOR as a "human organization". He will count on Duce, Sundby, Urban and Gross for help.

9.1.4 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.

9.2 Other Meetings of Interest to SCOR

A list of SCOR-related meetings is maintained on the SCOR Web site at <http://www.jhu.edu/scor/calendar.htm>.

Bjorn Sundby closed the meeting by thanking all the participants. Gifts were presented from SCOR to departing SCOR Executive Committee members Julie Hall, Akira Taniguchi, and Shiro Imawaki, and to Monica Sorondo and Carmen Morales for their local logistical help.

ACRONYMS

ACCENT	Atmospheric Composition Change European Network of Excellence
ADIAC	Automatic Diatom Identification and Classification System
AGU	American Geophysical Union
AICI	Air-Ice Chemical Interactions (SOLAS and IGAC)
AIMES	Analysis, Integration and Modelling of the Earth System (IGBP)
AMEMR	Advances in Marine Ecosystem Modeling
APN	Asia Pacific Network for Global Change Research
AMT	Atlantic Meridional Transect (UK)
ASLO	American Society for Limnology and Oceanography
BELSPO	Belgian Federal Science Policy
BENEFIT	Benguela Environment Fisheries Interaction and Training
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)
CliC	Climate in the Cryosphere (WCRP)
CLIOTOP	Climate Impacts on Ocean TOP Predators (GLOBEC)
CLIVAR	Climate Variability and Prediction project (WCRP)
CNRS	Centre national de la recherche scientifique (France)
CoML	Census of Marine Life
COPAS	Centro de Investigación Oceanográfica en el Pacifico Sur-Oriental (Chile)
CPR	Continuous Plankton Recorder
CRP	Core Research Project (GEOHAB)
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
DEEP	Deep-Sea Ecosystem and Exploitation Programme (Japan)
DFO	Department of Fisheries and Oceans (DFO)
DiCANN	Dinoflagellate Identification by Artificial Neural Network
DIVERSITAS	An international program of biodiversity science
DMS	dimethylsulfide
DOES	Deep Ocean Exchanges with the Shelf
EGU	European Geophysical Union
EO	Executive Officer
ESSAS	Ecosystem Studies of Sub-Arctic Seas (GLOBEC)
ESSP	Earth System Science Partnership (IGBP, WCRP, IHDP, and DIVERSITAS)
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)
GEF	Global Environment Facility
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)
GLOBEC	Global Ocean Ecosystem Dynamics project (SCOR, IGBP, and IOC)
GOOS	Global Ocean Observing System
HAB	harmful algal bloom
HAMSOM	Hamburg Shelf Ocean Model
HIiT	Halogens in the Troposphere (SOLAS and IGAC)
HMAP	History of Marine Animal Populations (CoML)
HYCOM	Hybrid Coordinate Ocean Model
IABO	International Association of Biological Oceanography (IUBS)
IAEA	International Atomic Energy Agency
IAG	International Association of Geodesy (IUGG)
IAI	Inter-American Institute for Global Change Research
IAMAS	International Association of Meteorology and Atmospheric Sciences (IUGG)
iAnZone	International Antarctic Zone program
IAPSO	International Association for the Physical Sciences of the Oceans (IUGG)
ICED	Integrated analyses of circumpolar Climate interactions and Ecosystem Dynamics in the Southern Ocean
ICES	International Council for the Exploration of the Seas
ICOM	Imperial College Ocean Model
ICSU	International Council for Science
IGAC	International Global Atmospheric Chemistry project (IGBP and CACGP)
IGBP	International Geosphere-Biosphere Programme (ICSU)
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)
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
IPO	international project office
IPY	International Polar Year
IRD	Institut de Recherche pour le Développement (France)
IUBS	International Union of Biological Sciences (ICSU)
IUGG	International Union of Geodesy and Geophysics (ICSU)
IUPAC	International Union of Pure and Applied Chemistry (ICSU)
JAMSTEC	Japan Agency for Marine-Earth Science and Technology
JGOFS	Joint Global Ocean Flux Study (SCOR and IGBP)
KORDI	Korean Ocean Research and Development Institute
LINKS	WG 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-ECO	Mid-Atlantic Ridge project (CoML)
MEAD	Marine Effects of Atmospheric Deposition (EU)
MOST	Ministry of Science and Technology (China-Beijing)
MOU	Memorandum of Understanding
NaGISA	Natural Geography In Shore Areas project (CoML)
NASA	National Aeronautics and Space Administration (USA)
NEMO	Nucleus for European Modelling of the Ocean
NERC	Natural Environmental Research Council (UK)
NIO	National Institute of Oceanography (India)
NIWA	National Institute of Water & Atmospheric Research Ltd. (New Zealand)
NOAA	National Oceanic and Atmospheric Administration (USA)
NSF	National Science Foundation (USA)
OASIS	Ocean-Atmosphere-Sea Ice-Snow project
OBIS	Ocean Biogeographic Information System (CoML)
OCB	Ocean Carbon Biogeochemistry (U.S.)
OSCC	Ocean Carbon and Climate Change (U.S.)
OECOS	Ecodynamics Comparison in the Oceanic Subarctic Pacific
OFCCP	Oceanic Fisheries and Climate Change Project
ONR	Office of Naval Research (U.S.)
OSM	open science meeting

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)
PICES	North Pacific Marine Science Organization
POGO	Partnership for Observations of the Global Oceans
PRIMO	Formation and dynamics of the Oxygen Minimum Zone in the Peru-Chile Current system
PROOF	French acronym for biogeochemical processes in the ocean and fluxes
RAPID	Research into Automatic Plankton Identification
RGSO	Regional Graduate Schools of Oceanography
ROMS	Regional Ocean Model System
SAGE	SOLAS-ANZ Dual Tracer Gas Exchange Experiment
SASSI	Synoptic Antarctic Shelf-Slope Interactions Study (iAnZone)
SCAR	Scientific Committee on Antarctic Research (ICSU)
SCJ	Science Council of Japan
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)
SIBER	Sustained Indian Ocean Biogeochemical and Ecological Research
SIC	SOLAS/IMBER Carbon Research Implementation group
SIPPER	Shadow Image Particle Profiling Evaluation Recorder
SNIFFS	Subtropical Nitrogen Fixation Flux Study (Japan)
SOLAS	Surface Ocean-Lower Atmosphere Study (SCOR, IGBP, WCRP, and CACGP)
SOPAC	South Pacific Applied Geoscience Convention
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
STAGE	Studies on Antarctic Ocean and Global Environment (Japan)
SVM	Support Vector Machine
SWEET	Straight Watch on the Environment and Ecosystem with Telemetry (China-Taipei)
TNO	The Netherlands Institute for Applied Geoscience
TOS	The Oceanography Society

UEA	University of East Anglia (UK)
ULB	Université Libre de Bruxelles
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific, and Cultural Organization
VAMOS	Variability of American Monsoon Systems (CLIVAR)
VMAP	Variability of Marine Aerosol Properties (Japan)
VOCALS	VAMOS Ocean Cloud Atmosphere Land Study
VOM	Vector Ocean Model
VPR	Video Plankton Recorder
WCRP	World Climate Research Programme (WMO, IOC, and ICSU)
WG	working group
WMO	World Meteorological Organization

Annex 1 - AGENDA

1.0 OPENING

- | | | |
|-------|--|----------------------|
| 1.1 | Opening Remarks and Administrative Arrangements | <i>Sundby, Urban</i> |
| 1.1.1 | Memorials for Scientists Involved With SCOR | |
| 1.2 | Approval of the Agenda | <i>Sundby</i> |
| 1.3 | Report of the SCOR President | <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 | Appointment of an ad hoc Committee to Review the Disciplinary Balance of SCOR's Activities | <i>Sundby</i> |
| 1.7 | Results of 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>Urban</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>Taniguchi</i> | |
| 2.2.5 | WG 120—Marine Phytoplankton and Global Climate Regulation: The <i>Phaeocystis</i> Species Cluster As Model | <i>Hall</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>Labeyrie</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>Urban</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>Hall</i> |
| 2.2.12 | SCOR/IAPSO WG 127 on Thermodynamics and Equation of State of Seawater | <i>Imawaki</i> |
| 2.2.13 | WG 128 on Natural and Human-Induced Hypoxia and Consequences for Coastal Areas | <i>Duce</i> |
| 2.3 | New Working Group Proposals | |
| 2.3.1 | Working Group on Deep Ocean Exchanges with the Shelf | <i>Urban</i> |
| 2.3.2 | Working Group on Automatic Plankton Visual Identification | <i>Hall</i> |
| 2.3.3 | Working Group on The Legacy of in situ Iron Enrichments: Data Compilation and Modelling | <i>Duce</i> |
| 2.3.4 | Working Group on Tsunamis: Examination, Modeling and Risk Estimation (2007-2010) | <i>Labeyrie</i> |
| 2.3.5 | Working Group on the Role of Lanternfish in the Ocean | <i>Taniguchi</i> |

3.0 LARGE-SCALE SCIENTIFIC PROGRAMS

- 3.1 SCOR/IGBP/IOC Global Ocean Ecosystems Dynamics (GLOBEC) Project *Sundby*
- 3.2 SCOR/IOC Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Program *Hall*
- 3.3 SCOR/IGBP Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project *Hall, Duce*
- 3.4 GEOTRACES Project *Duce*
- 3.5 SCOR/IGBP/WCRP/CACGP Surface Ocean-Lower Atmosphere Study *Labeyrie*
- 3.6 Land Interactions in the Coastal Zone (LOICZ) Project *Hall*

4.0 OCEAN CARBON AND OTHER ACTIVITIES

- 4.1 IOC/SCOR International Ocean Carbon Coordination Project (IOCCP) *Urban*
- 4.2 SCOR-IOC International Symposium on “The Ocean in a High-CO₂ World” *Duce*
- 4.3 Other Activities
 - 4.3.1 SCOR Summit of International Marine Research Projects *Burkill, Sundby, Urban*
 - 4.3.2 Panel on New Technologies for Observing Marine Life *Pierrot-Bults*
 - 4.3.3 SOLAS/INI Workshop on Anthropogenic Nitrogen Impacts on the Open Ocean *Duce*

5.0 CAPACITY-BUILDING ACTIVITIES

- 5.1 SCOR Committee on Capacity Building *Urban*
- 5.2 Regional Graduate Schools of Oceanography and Marine Environmental Sciences *Urban*
- 5.3 POGO-SCOR Visiting Fellowships for Oceanographic Observations *Urban*
- 5.4 NSF Travel Support for Developing Country Scientists *Urban*
- 5.5 SCOR Reports to Developing Country Libraries *Urban*
- 5.6 ICSU Priority Area Assessment on Capacity Building *Urban*

6.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS

- 6.1 Intergovernmental Oceanographic Commission *Sundby, Bernal*
 - 6.1.1 Global Ocean Observing System (GOOS) *Sundby, Hall*
- 6.2 Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) *Duce, Huber*
- 6.3 North Pacific Marine Science Organization (PICES) *Akulichev*

7.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

- 7.1 International Council for Science *Sundby, Urban*
- 7.1.1 International Geosphere-Biosphere Program (IGBP) *Balino*
- 7.1.2 World Climate Research Programme (WCRP) *MacCracken*
- 7.1.3 Scientific Committee on Antarctic Research (SCAR) *Hall*
- 7.1.4 Scientific Committee on Problems of the Environment (SCOPE) *Sundby, Pierrot-Bults*
- 7.2 Affiliated Organizations
- 7.2.1 International Association for Biological Oceanography (IABO) *Pierrot-Bults*
- 7.2.2 International Association for Meteorology and Atmospheric Sciences (IAMAS) *MacCracken*
- 7.2.3 International Association for the Physical Sciences of the Oceans (IAPSO) *Imawaki*
- 7.3 Affiliated Programs
- 7.3.1 Applications for New Affiliated Programs: InterMARGINS *Labeyrie*
- 7.3.2 Census of Marine Life (CoML) *Taniguchi, Gallardo*
- 7.3.3 International Antarctic Zone (iAnZone) Program *Urban*
- 7.3.4 International Marine Global Changes Study (IMAGES) *Schneider, Labeyrie*
- 7.3.5 InterRidge - International, Interdisciplinary Ridge Studies *Devey, Labeyrie*
- 7.3.6 International Ocean Colour Coordinating Group (IOCCG) *Sundby*
- 7.4 Other Organizations
- 7.4.1 Partnership for Observation of the Global Ocean (POGO) *Hall, Urban*

8.0 ORGANIZATION AND FINANCE

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

9.0 SCOR-RELATED MEETINGS

- 9.1 SCOR Annual Meetings
- 9.1.1 2006 General Meeting – Concepción, Chile *Sundby*
- 9.1.2 2007 Executive Committee Meeting – Bergen, Norway *Sundby*
- 9.1.3 2008 General Meeting -- SCOR 50th Anniversary— Woods Hole, USA *Duce*
- 9.1.4 2009 Executive Committee Meeting *Sundby*
- 9.2 Other meetings of interest to SCOR *Urban*

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Annex 3 - Proposal for a Joint IAPSO/SCOR Working Group on Deep Ocean Exchanges with the Shelf (revised 6 December 2006)

Background

As part of its strategy for the 21st century, the International Association for the Physical Sciences of the Oceans (IAPSO) has proposed a new scientific focus area on Deep Ocean Exchanges with the Shelf (DOES). The primary goal of DOES is to understand the physical and chemical interactions taking place at the shelf break between the deep ocean circulation and the shelf currents, and their impact on marine life and biogeochemical cycles. SCOR has identified interdisciplinary work focussed on the shelf break as a priority area for new working groups. IAPSO is thus proposing this joint working group.

The joint WG will consist of a mixture of physical, chemical and biological oceanographers, including both theoretical and observational experts. Although much of the work of the group will be concerned with planning better physical models of the shelf break region, an important aim is to include the requirements of chemical and biological oceanographers for output from such models. The involvement of scientists from developing countries will help to meet the capacity-building goals of both organisations.

The support of IAPSO and SCOR will enable the members of the working group to hold a first meeting to push forward the research required on this topic, to arrange a DOES workshop for all interested scientists, and to hold a final meeting to complete the final publication of the working group. Although much preliminary work can be conducted by email, it is vital to have face-to-face meetings to make significant progress.

Rationale - Deep Ocean Exchanges with the Shelf

The shelf break is a region of steep slopes, strong narrow currents, internal tides, shelf waves and significant vertical motion. With the advent of much finer resolution in ocean models, it is a good time to address the links between the shelf circulation and the deep ocean circulation at the shelf break. Improved understanding of the exchanges between the shelf and the deep ocean will be useful for more realistic models for studying climate, the carbon cycle, sedimentation and marine ecosystems. The increased detail in the improved models often leads to prediction of features that have not yet been observed. This can lead observational oceanographers to include fieldwork in their cruise plans that will either establish the existence of these new features or test the validity of the models.

Even as ocean models become more realistic by having much finer resolution in space and time, there are still significant problems in resolving the high variability that occurs around the shelf break between the deep ocean and continental shelves. Modellers have often regarded the shelf break as the nominal seaward boundary of shelf models or the coastal boundary of deep ocean models. Even with the finest resolutions in ocean general circulation models, the shelf region is poorly resolved with only a few grid points. Ocean observers have had difficulty in securing measurements at the edge of the shelf due to the narrowness of the currents and steep slopes. However, new technologies are now enabling measurements in such challenging environments. For example, swath bathymetry gives accurate bottom topography, the ship's dynamic positioning allows precise placing of moorings and acoustic Doppler current profilers allow measurements throughout the water column, even in strong currents. At the same time, fine-scale (1km or less) coastal models such as the Regional Ocean Model System (ROMS) with multiple depth layers are now being used to model the movement of water, chemical species and sediments on the shelf, and are being connected to biogeochemical models of the local ecosystem. Meshing these models into larger-scale deep ocean models offers the chance to resolve some of the unknowns.

The exchanges and fluxes that occur near the shelf break are important parts of the global ocean circulation. These fluxes include sediments and biomass as well as seawater. Coupled ocean-atmosphere general circulation models require, for example, the input of freshwater outflow from rivers. These inputs are generally added at the location of the river. But, in reality, the fresher water flows along the shelf, sometimes for considerable distances, before it crosses the shelf break and enters the deep ocean (for example, along the Oregon coast, as has been modelled by Baptista et al. (2005)). Similarly, the formation of Antarctic Bottom Water and other dense water masses often occurs over continental shelves before they flow offshore. An example of a biological flux is the movement of patches of krill on and off the Antarctic shelf, as described by Murphy et al. (2004).

Strong tidal mixing at the shelf break and over variable topography is an important feature in the energy balance of the Earth's oceans (see, for example, Jayne and St. Laurent (2001), Wunsch and Ferrari (2004)). Internal and surface tides are built into shelf models but are usually absent from deep ocean general circulation models. Strong mixing associated with significant topography is an important component in the theories of the global thermohaline circulation. Coastal models often use terrain-following coordinate systems (sometimes called sigma coordinates). Although this method deals better with the changes in shelf slopes compared with models using standard grid boxes, they introduce significant problems due to pressure gradient force error as described in Berntsen and Furnes (2005).

A new generation of high-resolution models is under development including, for example, (i) the Nucleus for European Modelling of the Ocean (NEMO) begun in France but now forming the basis of a wider European project and using interactive nesting (see www.lodyc.jussieu.fr/NEMO/), (ii) the next generation of the Hamburg Shelf Ocean Model (HAMSOM), called the Vector Ocean-Model (VOM), including biological and physical coupling on an unstructured adaptive grid (see Harms et al. (2003)), (iii) the Imperial College Ocean Model (ICOM) using an unstructured mesh (see Gorman et al. (2006)) and (iv) the Hybrid Coordinate Ocean Model (HYCOM) a data-assimilative hybrid isopycnal-sigma-pressure coordinate ocean model (see Chassignet et al. (2006)). The WG will monitor the progress of these new models, and encourage the use of such models for looking at the details of processes near the shelf edge and for the inclusion of biogeochemical fields. The WG will also encourage further observations in regions that can validate and enhance the understanding of the model output.

With the advent of the new observational technologies and the new generation of ocean models, this is an appropriate time to set up this working group. Improved models and observations leading to a better understanding of the processes that occur between the shelf and the deep ocean will be of benefit in maintaining fish stocks and dealing with threats of pollution from oil and gas wells, and for studying river runoff and sedimentation. Coastal areas are often regions of enhanced primary production due to coastal upwelling. Understanding the carbon cycle in such ecosystems is relevant to climate studies.

Interaction with other programmes

Two existing SCOR WGs have links with this proposed WG. The published output from WG 111 on Coupling Waves, Currents, and Winds in Coastal Models will form part of the current knowledge of shelf oceanography. The ongoing IAPSO/SCOR WG 121 on Ocean Mixing will provide useful input about deep ocean mixing to the proposed WG.

The ongoing international Antarctic Zone (iAnZone) project (an affiliated programme of SCOR) is concerned with modelling and observations in the Southern Ocean, including strategies to understand climate variability in the Antarctic Zone. It includes the Synoptic Antarctic Shelf-Slope Interactions Study (SASSI); a programme of observations over the Antarctic shelf and slope as part of the International Polar Year (see <http://roughy.tamu.edu/sassi/sassi.html>).

The carbon cycle in the shelf and upwelling zones is an important component of the modelling by the Climate Variability and Predictability (CLIVAR) programme. The discussion of applications on chemical and biological fluxes needs to be in collaboration with projects such as the International Geosphere-Biosphere Programme (IGBP) Land-Ocean Interactions in the Coastal Zone (LOICZ) project and the SCOR/IGBP Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) project. IMBER is particularly concerned with how long-term global change (including changes to the deep ocean/shelf fluxes) will affect biogeochemical cycles and ecosystems. Members of the WG would interact with scientists involved in these programmes to determine the mutual benefit that can be derived from collaboration and to avoid unnecessary duplication.

Other important collaborators are (i) the Surface-Ocean-Lower Atmosphere Study (SOLAS) for their interest in biogeochemical interactions and feedbacks between ocean and atmosphere, and (ii) GEOTRACES, the international study of global marine biogeochemical cycles of trace elements and their isotopes, where the proposed WG can help with the understanding of the processes in the ocean that affect the concentrations of these tracers. Links between

the proposed working group and SOLAS and GEOTRACES will be straightforward as members of their steering committees work in the same building as the proposed chairman of the proposed WG.

The leadership of the GEOTRACES and CLIVAR programs see real possibilities of cooperation with the DOES WG; GEOTRACES through their interest in shelf/ocean exchange of metals and other tracers, including via sediments and groundwater, CLIVAR through physical aspects such as the effects of tropical waves on eastern boundary shelves and tracer work, particularly that associated with the carbon cycle. Additionally, both programs have major modeling activities that will provide information on the exchange processes of interest, including also aspects such as mixing in deep overflow regions and interactions between deep ocean eddies and the shelf. The latter, for example, have been implicated in the dispersal of fresh water from the Mississippi (Belabbassi et al., 2005) and in large-scale losses of fish eggs and larvae in the Benguela (Duncombe Rae et al, 1992). The leadership of SOLAS sees potential links with the DOES WG through fluxes across the shelf break. The input of nitrogen onto the shelf from the deep ocean is greater than the input from rivers, and is converted to N₂O which is a greenhouse gas. There is high production of N₂O along the western seaboard of India, which is being studied as part of a joint SOLAS/IMBER project (Naqvi et al., 2000).

Statement of Work / Terms of reference

IAPSO proposes the formation of an international joint working group with SCOR to advance modelling and observations of deep ocean exchanges with continental shelves. IAPSO wishes to foster research work on the links between shelf and deep-sea oceanography by using the working group to generate ideas and encouragement for future research by the wider oceanographic community with funding from national and international bodies.

The working group will complete the following tasks, over a period of four years:

(1) Establish the current state of knowledge and make recommendations for future research related to the following topics:

- Processes due to shelf waves, internal tides, shelf break upwelling, storms and extreme events that produce effects over time scales of weeks to one or two years;
- Transport over the shelf and shelf break of riverine and estuarine input of sediment and fresh water (this aspect includes the Arctic and Antarctic coastal zones, but does not include investigating the sources of sediment and fresh water on the shelves);
- Dissipation of tidal motion along the continental margins on time scales of hours to days;
- The physical controls of chemical and biological fluxes between the shelf and the open ocean that can affect the ecology of such regions; and
- Coupled physical-chemical-biological models, generally at local to regional scales, that have a more realistic description of the exchanges at the shelf edge;

(2) Determine where further observational programmes (using improved technology) are needed to improve understanding of shelf break processes and to provide help with the formulation of more realistic models of the fluxes between the shelf and the deep ocean;

(3) Serve as an international forum for oceanographers to discuss current research on the interaction between the coastal zone and the deep ocean, by using the services and membership database provided by IAPSO;

(4) Foster collaboration between developed and developing countries that have interest in the shelf zone (limited-area models are required to help scientists in countries that do not have access to large computers); and

(5) Produce a comprehensive, published final report incorporating the latest results on the above topics. This report will be in a form of a special issue of a peer-reviewed journal or a book by a major publisher.

Timetable: If approved by SCOR, the following three working group meetings will be held:

1. The proposed first formal meeting of the WG will take place in July 2007 in association with the International Union of Geodesy and Geophysics meeting in Perugia, Italy. Preliminary work prior to this meeting (conducted by email) will lead to identification of additional Associate WG members, and the creation of an agenda for the meeting.
2. The second meeting will occur at the time of the proposed Workshop on Deep Ocean Exchange with the Shelf to involve a wider group of experts from many countries. To support delegates from developing countries, other sources of funding will be sought (including ONR, the EU and SCOR). A venue in 2008 in a developing country would be ideal, for example Cape Town, South Africa.
3. The third and final meeting will be held in July 2009 in association with the IAPSO/IAMAS Joint Assembly to be held in Montreal, Canada. This meeting will be for final discussions to input into the final report of the working group.

The first task of the WG is to establish a bibliography of existing publications relevant to DOES. There has been some research by European groups as part of projects MORENA, OMEX, CANIGO, ECOMARGE (part of French JGOFS), SES (the UK part of LOISZ). North American research includes COAST (part of the CoOP project). Each of these projects has a group publication, for example ECOMARGE in Monaco et al. (1999) and COAST in Barth & Wheeler (2005). Having established this bibliography, the task of the first meeting of the WG is to identify the gaps and uncertainties in these past studies that most urgently need to be addressed.

After the first meeting it is proposed that the initial report takes the form of an annotated bibliography of the information assembled by the members of the WG from their individual interests in Deep Ocean Exchange with the Shelf. It would be made available for use by other oceanographers by placing it on the DOES website and advertising it using the IAPSO database.

It is planned that the keynote lectures at the DOES workshop and other lectures of note will be published as a special issue of a scientific journal, preferably one that allows open access to its publications. After the final WG meeting, a similar open-access publication is planned with contributions from members of the WG.

Membership

Working group membership is proposed to consist of scientists from various countries with expertise in both modelling and observations of the oceans and in biological, chemical and physical oceanography. If approved, there are 10 proposed Full Members and 2 Additional Members whose travel will be funded by IAPSO. Further Associate Members may be identified to widen the WG expertise.

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Annex 4 - Proposal for a Working Group on Automatic Visual Plankton Identification

Background and Rationale

One of the main problems confronting plankton research is low sampling resolution, both spatial and temporal. Although it is widely recognized that the relevant scales for plankton are much smaller than those usually sampled, the work involved in plankton sample analysis has made it impossible to sample at very high resolution in most programs. To some extent the lack of sampling capability has been resolved using simplified measurements such as Chl a, total biovolume, biomass (wet or dry weight), or more sophisticated systems providing size and number of particles (e.g., OPC). However, these methods lack the ability to distinguish between different functional groups of plankton known to have very different roles in the ecosystem (e.g., diatoms vs flagellates, marine snow, or copepods vs appendicularians).

In recent years several *in situ* and laboratory imaging systems have been developed. These systems are capable of obtaining relatively good-resolution images at high sampling rates that would, in theory, allow quantification of the abundance of taxonomically well-resolved groups in the appropriate spatial and temporal scales (Wiebe & Benfield 2003). Development of these systems has presented a new problem: the manual analysis of images from such systems is impractical due to the huge amount of information and quantities of images they produce. New image analysis systems offer a potentially advantageous solution compared to manual methods of counting and sizing. With the aid of image analysis and classification software and hardware, the images can be identified to at least major groups. Many sophisticated automatic recognition algorithms exist, and research in this area is very active. There is a very real potential of using image analysis techniques to obtain more refined taxonomic classification in the near term.

In the future, if marine science is to achieve any progress in addressing biological diversity of plankton in the ocean then it needs to sponsor development of new technology to image and identify specimens in plankton samples, acting as an adjunct to existing (and increasingly scarce) taxonomists and marine ecologists (Culverhouse et al. 2006). We propose to focus on the automation of plankton identification. Drawing from recent progress in object recognition in the wider machine vision community, marine scientists and engineers have had some significant successes in demonstrating automated recognition of plankton taxa.

A training set of objects is used to establish the pool of features and their prior distributions. Statistical and other pattern classification methods are then used to cluster the feature occurrences in test specimens and hence derive identification. Thus, in the Automatic Diatom Identification and Classification (ADIAC) system (DuBuf and Bayer, 2000) a large set of morphological measurements (e.g., specimen length, width, aspect ratio) is made of each specimen placed under the microscope. Some of these measurements are similar to those made by taxonomic experts and is similar to ZooSCAN (Grosjean et al., 2004), used for zooplankton recognition and counting where a “forest” of classifiers is used. DiCANN (Dinoflagellate Identification by Artificial Neural Network; Culverhouse et al., 1996), a tool for dinoflagellate phytoplankton species recognition, analyses low-resolution shape, texture, and size characteristics, but uses the machine to discover how these features correlate with object classes through Support Vector Machine (SVM) clustering. Recently SIPPER (Shadow Image Particle Profiling Evaluation Recorder; Samson et al., 2001; Remsen et al. 2004) has employed SVM categorisers fed from shape moments, granulometric and domain-specific features to recognise five classes of plankton. The Video Plankton Recorder (VPR), developed at the Woods Hole Oceanographic Institution, has been used as a test bed for a number of analysis protocols (Tang et al., 1998; Hu and Davis, 2005). The most recent VPR system demonstrated recognition through texture analysis and categorisation.

Using automation to assist experts in visual plankton identification is relatively new. Engineers and scientists developing these instruments usually assess machine performance through cycles of training and testing. Most systems in development at the moment rely on images of plankton collected from the field or from culture samples. The experimenter labels each specimen image, which is then processed by the machine. The machine-given label is then compared to the human-given label to assess machine performance. Once performance is at an acceptable level the machine is ‘released’ for more routine application. An important step in the evaluation, and subsequent widespread scientific use, of these identification machines is the validation of their labelling abilities. It must also be recognised that people are biased and can make mistakes whilst labelling specimens. These errors must be removed

from reference data sets used for training machines (Culverhouse et al 2003). A factor governing the widespread adoption of these new machines is the level of confidence the community has in their performance, and the quality of their results. Existing manual methods are, in a sense, rigorously quality controlled. The same must be established for automatic methods.

A recent GLOBEC/SPACC-sponsored workshop held at San Sebastian, Spain, in November 2005, concluded that it was imperative to co-operate and not compete in the development of machine vision solutions for automatic labelling of plankton. The RAPID (Research into Automatic Plankton Identification) group arose from this, formed initially by members of the workshop. This group is ideally placed to support the development of standards and foster the spirit of co-operation. A team from the organising members of RAPID has liaised with SCOR WG115 on Standards for the Survey and Analysis of Plankton and produced this proposal for a new working group.

GLOBEC, IMBER, Census of Marine Life, and Census of Marine Zooplankton are some of the global initiatives that will benefit from the outputs of this working group. This is reason enough for an international approach to this work. However, it is also important from several other perspectives: plankton identification is an international problem, and a global approach will increase the visibility of local solutions to identification and perhaps also adoption of solutions from outside marine science. A common platform will make it quicker to integrate new software into applications that are immediately useable by marine scientists.

Relevance to Other SCOR Activities

This working group would be highly relevant to the future of the Continuous Plankton Recorder (CPR) and other time-series biological surveys as significant increases in throughput could be achieved by automation supporting manual analysis of samples. Automatic identification of common taxa will free taxonomists to focus on the more difficult identifications and deeper questions. This could also encourage ‘new blood’ into taxonomy and systematics. The outcome of the proposed group could make collection of future data for worldwide comparisons of zooplankton populations easier (WG 125). The proposed group will consult regularly with the SCOR Panel for New Technologies for Observing Marine Life (two associate members of the proposed WG are members of the Panel—Gaby Gorsky and Sun Song), particularly on collaborative workshops.

An order of magnitude increase in existing analysis throughput is required to address the needs of global monitoring and research programmes such as GOOS, GLOBEC, and IMBER. Automation will help achieve this increase and the new working group would assist through the following terms of reference.

Terms of Reference

The RAPID group has identified an urgent need for a common software toolbox for plankton image classification, which is robust and flexible, allows data post-processing for ecology modelling and other applications and is fast for *in situ* real-time processing. It is accepted that open source software, supported by the community, is a reliable way of generating robust code that is tailored to the needs of the community. These terms of reference are designed to foster and grow that community for automated visual identification of marine plankton, together with reviewing practices and establishing the necessary standards to ensure widespread uptake of these new technologies across biological oceanography. The working group will attempt to foster a confidence in marine scientists, who may feel threatened by the adoption of this technology. It will define standards for image data validation for use in training machines and people.

The proposed terms of reference are

- *To encourage the international co-operation of software developers and marine scientists to use and enhance the open-source development platform, so that a common toolset can be built up over time that is of value to the community.*

Rationale: This SCOR Working Group could achieve support through both dissemination activities and through the review of function and leading the debate of developer and end-user issues. The opportunity of an open source platform for specimen identification is extremely important, as it gives all developers and users an easy way of extending and enhancing function with a low cost of effort. This is particularly important in developing nations where large repositories of taxonomic expertise exist, but financial resources for acquisition of

commercial software and hardware are frequently limiting. This activity will best be addressed through a working group meeting to discuss dissemination and then through the Internet and academic/conference papers.

- *To evaluate the limits of taxonomic resolution possible from image-based classifiers and develop means of improving the taxonomic resolution that can be achieved from plankton images. The working group will establish a basis for standards in taxonomic reporting by automatic labelling instruments.*

Rationale: The goal of image-based classifiers is prediction of the taxonomic composition of the plankton assemblage in a sample. There are obvious current limits to the amount of information present in an image compared with a physical specimen of the same organism. If image-based classification is to succeed, we need to understand what the taxonomic limits are, if we are to avoid errors caused by attempts to classify organisms to levels beyond those known to be reasonably possible. At the same time, by linking high-resolution images from plankton with genetic- or morphologic-derived taxonomic information, it may be possible to identify image features that may provide a means of obtaining greater taxonomic resolution.

- *To review existing practices and establish standards in the use of reference image data used for training automation machines and in training people.*

Rationale: A global database of specimens and images is needed for training machines and also for training experts. A pilot web site to address this aim is being set up at both Plymouth University and Louisiana State University. However, the exact nature and function of the database should be defined by the biodiversity, ecology and taxonomy communities as well as the software developers. This working group would be well placed to stimulate discussion and establish international operational standards for the reference system, through the Internet, working group meetings and academic/conference papers.

- *To establish a methodology for inter-comparison/calibration of different visual analysis systems.*

Rationale: wide availability of computer-based plankton recognition systems will cause difficulty for potential customers as systems performances are compared. A common set of benchmark measurements will simplify the comparisons and strengthen both the developer community and the end-user confidence in these systems. Such benchmarks are commonplace in the computing industry. They need to be created for this new domain.

- *To develop open-source software for application by the marine ecology, taxonomy and systems developers. Publish the products of reviews by members of the Working Group, selected presented papers and workshop reports in an internationally recognised, peer-reviewed journal or a book by a major publisher.*

The proposed working group will extend the dissemination activities to special sessions at existing international conferences, to raise the profile of progress and solutions. Funding for these activities will be sought from other agencies and foundations.

Sponsorship by SCOR would focus the international community on the working group's terms of reference, which will facilitate global debate and hopefully mark rapid progress in automatic plankton identification.

Timetable

It is suggested that the working group meet at least once a year for four years. The first meeting could coincide with ICES/PICES/GLOBEC "The 4th International Zooplankton Production Symposium" Japan meeting May 2007.

The issues for discussion in the first meeting are as follows:

- (a) Review available image analysis platforms & report
- (b) Review taxonomic standards and report
- (c) Review existing practices (manual and current automations) & report
- (d) Review current and propose future inter-calibrations, inter-operability for automatic labelling
- (e) Plan and establish dissemination and promotion of common platform, standards and other resources.
- (f) Establish website

It is proposed that (a) and (b) are addressed in year 1, (c) and (d) in year 2, and (e) and (f) in years 3 and 4 with additional effort at (e) and (f) perhaps in the form of international symposia to simulate debate, interest and uptake.

Deliverables

Items in timetable (a-f) above are deliverable reports to SCOR following the appropriate meeting. It is expected that published products are available also following the meetings. These will comprise reviews by members of the Working Group, selected presented papers and workshop reports in an internationally recognised, peer-reviewed journal or a book by a major publisher.

Working Group Composition

The working group will have two co-chairs, Mark Benfield (USA) and Phil Culverhouse (UK). Benfield is a marine scientist, but has worked on plankton recognition software for some years. Culverhouse is an electronics engineer with a background in biology and experimental psychology; he has been developing plankton identification techniques since 1989.

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Annex 5 - Global Ocean Ecosystem Dynamics (GLOBEC) Project

Report of the SCOR/IOC/IGBP GLOBEC International Project for 2005/ 2006 to the SCOR General Assembly. Concepción, Chile, 23-26 October 2006

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1. RECENT PROGRESS: Symposia and Workshops

1.1. GLOBEC-sponsored symposia

Most symposia activities 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 synthesis symposia planned or conducted along this regional scale:

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) and symposium TBC 2008
SOUTHERN OCEAN GLOBEC	TBC
ESSAS	1 st OSM Victoria, Canada, 16-20 May 2005
CLIOTOP	1 st OSM La Paz, Mexico, 3-7 December 2007
FINAL GLOBEC OSM	Late 2009

GLOBEC symposia during this reporting period are

- ***GLOBEC symposium on Climate Variability and Sub-Arctic Marine Ecosystems, Victoria, Canada, May 16-20, 2005***

This successful symposium was used to integrate GLOBEC's research in sub-Arctic regions, and to launch the new GLOBEC regional programme ESSAS (Ecosystem Studies of Sub-Arctic Seas). It was attended by over 240 participants from 16 countries. Two implementation workshops were also held, each drawing over 100 participants. Prof. R.T. Barber (Duke, USA) delivered the invited keynote speech, on "How will ocean warming in the next 50 years affect sub-Arctic marine ecosystems". Prof. V. Smetacek (AWI, Germany) provided a symposium summary. Some of the presentations and the full programme of talks are available at www.globec.org. The proceedings of the symposium will be published as a special issue of *Deep-Sea Research II* and will include 30-40 papers.

- ***PICES/GLOBEC symposium on 'Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis', Honolulu, April 19-21, 2006.***

This symposium was designed to continue the programme of GLOBEC symposia along regional lines by synthesising the knowledge acquired as part of the PICES-GLOBEC Climate Change and Carrying Capacity in the North Pacific (CCCC). The programme of the symposium was being drafted by the steering committee, chaired by Dr. Harold Batchelder (Corvallis, USA) and Prof. Suam Kim (Pusan, Korea). The themes were

1. Regime shifts, especially examination of the ocean and ecosystem responses to known strong, infrequent changes in the North Pacific, such as those that occurred in 1977, 1989, and 1998;
2. Ecosystem productivity and structural responses to physical forcing, with an emphasis on shorter than inter-decadal time scales-interannual (El Niño-La Niña), seasonal and event scales; and
3. Pan-Pacific comparisons, with an emphasis on comparisons of similar species or processes from multiple coastal ecosystems and of open ocean-coastal linkages and climate connections.

The Proceedings are to be published as a special volume of *Progress in Oceanography*. The GLOBEC Scientific Steering Committee met in Honolulu in 2006, to facilitate their engagement in the symposium.

- **PICES XIV meeting, Vladivostok, Russia, 30 September - 8 October 2005**, including the following GLOBEC/PICES CCC sessions:

- The comparative response of differing life history strategists to climate shifts
- Modeling climate and fishing impacts on fish recruitment
- Evidence of distributional shifts in demersal fish in relation to short- and long-term changes in oceanographic conditions.

- **AMEMR: Advances in Marine Ecosystem Modelling Research, Plymouth, UK, 27-29 June 2005**

This GLOBEC-endorsed symposium, which included 5 members of the GLOBEC SSC in its Steering Committee, was designed to discuss recent advances in model-based marine ecosystem understanding and predictive capability. A special issue in the *Journal of Marine Systems* is currently in preparation. AMEMR will have a follow-on in 2007.

- **6th International Crustacean Congress, 18-22 July 2005, Glasgow, Scotland.**

This symposium hosted a GLOBEC session on "The scope for ecophysiological and behavioural adaptation to environmental change in mero- and holoplanktonic Crustacea"

- **AGU Ocean Science Meeting, 20-24 February 2006, Honolulu, Hawaii.**

This popular symposium had two special GLOBEC sessions in the programme:

- Toward a Synthesis of Understanding of Zooplankton Population Variability Across Ocean Basins (synthesis of Southern Ocean, Georges Bank, Northeast Pacific GLOBEC programmes)
- GLOBEC-CLIOTOP (Climate Impacts on Oceanic Top Predators) Special Session on this Regional programme

- **PICES XV meeting, Yokohama, Japan, 13 - 22 October 2006**, including the following GLOBEC/PICES CCC sessions:

1. Modelling and historical data analysis of pelagic fish, with special focus on sardine and anchovy (Conveners S-I Ito, M Kishi, B Megrey and F Werner)
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

Plus a pre-meeting workshop 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 is the 2nd Open Science Conference of the Earth System Science Partnership (IGBP, WCRP, IHDP and DIVERSITAS). It includes the GLOBEC session "**Marine ecosystems: trends, feedbacks and predicting future states**", co-convened by Francisco Werner and Manuel Barange), contributing 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 has 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 predator and fishers, and back

5. Adaptive strategies of fish and other key species in a highly variable ecosystem
6. Adaptive management

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 Norway/Barents Sea under the GLOBEC umbrella. These include the ADAPT, CLIMAR and NESSAS projects, and the new GLOBEC regional program, Ecosystem Studies of Sub-Arctic Seas (ESSAS), together with the upcoming International Polar Year (IPY). Common for these activities are that they are focusing on fundamental research on Arctic and sub-Arctic Seas. The symposium offers an opportunity to present the results and findings from these programs. <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.**

This will be the first CLIOTOP symposium, following from 3 years of intense workshops to implement the synthesis objectives of CLIOTOP. The symposium has special interest in presenting comparative studies between regions or species and papers dealing with an integrated approach, combining observation/experiments and modelling. GLOBEC has submitted a request to SCOR to support developing country scientists wishing to attend this symposium (see Appendix 1).

- **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. This symposium follows on the very successful 3rd IZPS held in Gijon, Spain, May 2003, with identical sponsors. Several sessions are tailored to GLOBEC's synthesis: http://www.pices.int/meetings/international_symposia/2007_symposia/4th_Zooplankton/4th_Zoopl.aspx. GLOBEC and PICES have submitted a request to SCOR to support developing country scientists wishing to attend this symposium (see Appendix 2).

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/ICES CCC-WGZE Workshop on the Impact of Zooplankton on Cod Abundance and Production. Copenhagen, Denmark, June 2005.**

This workshop, attended by 18 scientists from the ICES area, met to a) determine the zooplankton species in the diets of cod, and their temporal and spatial changes; b) determine the variability in zooplankton populations and their relationships to cod; c) examine the vital rates of zooplankton that are relevant to cod life histories; d) determine how the timing of zooplankton production and spatial dynamics of nauplii relates to the spawning, distribution and survival of early stages of cod; e) establish the links between zooplankton and later stages of cod; and f) study long-term changes in phenology, abundance and size composition of zooplankton and possible consequences for cod. An ICES Cooperative Report is expected. This was a synthesis workshop of the GLOBEC-CCC programme.

- **GLOBEC/IOC Study Group on Regime Shifts, 4-5 June 2005 (Rome, Italy) and 28-29 October 2005 (Brest, France).**

This study group met twice to put together a review paper for a major journal (*Nature/Science*) that would exemplify the process of identifying, detecting and preventing regime shifts, and applying the knowledge to management and governance of marine resources. The examples used (corals, upwelling systems, NE Pacific and Newfoundland coast) are used to design observational systems that would operationalize the process. The group is co-funded by IOC and GLOBEC and is a GLOBEC I+S effort.

- ***GLOBEC-SPACC workshop on "Image analysis to count and identify zooplankton", San Sebastian, Spain, 1-3 November 2005.***

To understand fish biomass fluctuations we need appropriate biological information on the prey field. The difficulty is to extract the information from the thousands of samples collected routinely. However, new systems based on image analysis have become available, allowing quick counting and sizing of zooplankton. The workshop is intended to evaluate these new systems and provide feedback for the manufacturers. The final objective is to have a network of laboratories using the same approach to count and identify zooplankton. A group publication is expected.

- ***GLOBEC-CLIOTOP Working Group 4 (Synthesis and Modeling) workshop, La Jolla, USA, 8-10 November 2005.***

This workshop was held at the Southwest Fisheries Science Center's (U.S. National Marine Fisheries Service) La Jolla Laboratory. The ToR of the meeting were specifically geared toward:

1. Review inter-sessional work conducted by participants
2. Develop research ideas that could support the future work of the group and provide collaborative opportunities for its participants
3. Agree on specifications for global data sets of catch and effort statistics and environmental data.

- ***GLOBEC-SPACC workshop on "Fluctuations of sardines and anchovies and impact on coastal fishing communities", Tokyo, Japan, 14-17 November 2005.***

The workshop was used to fit the NEMURO-FISH ecosystem model (an NPZ model with compartments for pelagic fish) to data from several areas that have large populations of anchovy and sardine, with the objective to ascertain if the replacement between both species could be explained as driven by decadal-scale climate variability that permeates through the food web. The workshop is an APN/IAI/PICES/GLOBEC/JFA activity. This activity is to be followed up during PICES XV, through a specific session and a short meeting to continue homogenising data and procedures.

- ***Workshop on Indices of meso-scale structures. Nantes, France, 22-24 February 2006.***
- ***Advancements in modeling physical-biological interactions in fish early-life history: recommended practices and future directions. Nantes, France, 3-5 April 2006:***

These two workshops have received GLOBEC endorsement, but are not organised or funded by GLOBEC. The first intended to review numerical methodologies for the construction of indices of meso-scale structures such as fronts, eddies, transport, upwelling and vertical hydrographic changes. It plans to disseminate available tools and software for the automatic detection of such structures and construct time series of them. The second workshop intended to evaluate the present state and next steps in the developing field of modelling physical-biological interactions in lake, estuarine, shelf and ocean ecosystems. Both workshops will be used to present ongoing GLOBEC research and place it in a broader context. As such, these workshops contribute to GLOBEC's I+S phase.

- ***GLOBEC workshop on Mathematical modelling of zooplankton dynamics, Marseille, France. 2-5 May 2006:***

This workshop is a joint activity of two GLOBEC Working Groups, Focus 2 WG (Process Studies) and Focus 3 WG (Predictive and Modelling Capabilities). The thematic target of the workshop is "Key issues in the parameterization of zooplankton models" and we hope it is a significant contribution to the GLOBEC Integration and Synthesis effort. During the workshop, 25 GLOBEC scientists

1. synthesized current knowledge on key processes for major zooplanktonic taxa,
2. discussed the validity of known mathematical formulations and parameterization commonly used in zooplankton models, and
3. defined approaches and guide research to implement the mathematical formulation of key processes for key species.

A multi-authored paper is being drafted.

- ***GLOBEC CCC Workshop on the Decline and Recovery of Cod Stocks throughout the North Atlantic including tropho-dynamic effects. St John's, Canada, 8-11 May 2006:***

This workshop was hosted by the Northwest Atlantic Fisheries Centre, Fisheries and Oceans, Canada, in St. John's from May 9-12, 2006, co-convened by Brian Rothschild (USA), Svein Sundby (Norway), George Lilly (Canada) and Kai Wieland (Greenland). The CCC programme has for some time noticed the similarity in the abundance trends of many of the stocks, from high values in the 1960s that in some cases persisted through into the 1970s and 1980s, followed by a decline to relatively low levels. This workshop compared the changes that have occurred in all of the cod stocks around the Atlantic to assess the relative importance of climate-induced ecosystem changes and fishing as causes of the observed declines. (<http://www.ices.dk/globec/workshops/Decline/WKDRC.htm>).

- ***GLOBEC ESSAS/PICES Workshop to compare four Sub-Arctic marine ecosystems St Petersburg, Russia, 12-14 June 2006:***

PICES and GLOBEC will jointly sponsor a workshop to compare the marine ecosystems of the Okhotsk Sea/Oyashio region, the Bering Sea, the Newfoundland/Labrador Shelf and the Barents Sea. The workshop will provide a foundation for the new GLOBEC regional program, Ecosystem Studies of Sub-Arctic Seas (ESSAS). PICES and ESSAS share the goal of developing comparative studies of the sub-Arctic Seas and understanding how climate variability will affect their productivity and ability to support sustainable commercial and subsistence harvests. The goals of the workshop will be to

1. lay the groundwork for developing the data sets needed to achieve the appropriate comparisons, and
2. commence developing the teams necessary to synthesize available data and develop models for predicting the effects of climate variability on these ecosystems.

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

This workshop, a major I+S effort for GLOBEC, has a working title of "Climate variability of large exploited fish populations and their ecosystems". The workshop will be held at the Museum for Natural History in Berlin, Germany, and the papers (which MUST be delivered before the workshop commences, 'Dahlem Conference style') will be published in a special issue of the *Journal of Marine Systems*. The workshop is structured in four groups:

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

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

This is a new working group of ICES, chaired by J. Alheit, M.F. Borges, A. Lavin and A. Uriarte, set up with the objective to rescue, collate and jointly analyze 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 are to identify possible links to climate variability and to look for possible telecommunication patterns with European and other marine ecosystems.

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

This workshop is 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. The authors would circulate their draft chapters in preparation for the meeting, so that areas of overlap, knowledge gaps and style differences can be ironed out. The book is expected to be ready for publication in June 2007.

In addition, GLOBEC has/will host the following SSC/working group meetings in 2005/2006:

- ***31 August - 2 September 2005: GLOBEC Focus 4 Working Group meeting. Victoria, Canada***
- ***25-26 September 2005: GLOBEC Focus 3 WG meeting. Aberdeen, Scotland***
- ***17-20 October 2005: GLOBEC Focus 2 WG meeting. Dartington, UK***

- *14-15 December 2005: GLOBEC-IMBER End to End Foodweb Task Team meeting, Hamburg, Germany (see below)*
- *27 February - 1 March 2006: GLOBEC-CLIOTOP SSC meeting. Hawaii, USA*
- *23-25 April 2006: GLOBEC SSC meeting. Honolulu, Hawaii, USA.*
- *15-16 June 2006: GLOBEC-ESSAS SSC meeting, St Petersburg, Russia*
- *26-29 September 2006: GLOBEC-IMBER Executive Committees Meeting. UK*
- *September 2006: GLOBEC CLIOTOP WG3 workshop on "comparing trophic models "workshop. Noumea, New Caledonia.*
- *July 2007. CLIOTOP WG5 (Socio-economic aspects and management activities) workshop. NCAR, Boulder, USA*

More information is available on the GLOBEC website.

2. RECENT DEVELOPMENTS AND PUBLICATIONS

2.1. Links with IMBER

The GLOBEC and IMBER Executive Committees had their 1st joint meeting in Brest, France, 25-27 October 2005, with a view to implement IGBP-SCOR agreements in relation to the "IGBP Oceans Box", summarized as follows:

- GLOBEC will continue to completion of the project in December 2009 as specified in its Implementation Plan.
- IMBER will develop research activities with a ten-year life, with its scientific emphases thus extending until 2014. The project will be allowed to develop its own identity.
- IMBER and GLOBEC will be encouraged to begin to develop joint activities starting in 2003. The two SSCs will be encouraged to hold back-to-back or overlapping meetings.
- The extent and speed of development of joint activities and project integration will be at the discretion of the SSCs for the two projects.
- There will be a single integrated ocean project, including scientific aspects of GLOBEC and IMBER, in place by 2009.

The main agreements on interactions between both programmes were:

1. Executive meetings will be co-located to allow a joint session of both Executive Committees on an annual basis.
2. Sections will be established in the IMBER and GLOBEC Newsletters to highlight joint activities.
3. In the case of combined activities (e.g., ICED) the IPOs will coordinate the publication of reports. Each report will have dual numbering to reflect the report series of both programmes.
4. Joint session of GLOBEC-IMBER SSCs will be held at the IGBP Congress (2008).
5. At the 2007 joint Executive meeting, a Transition Task Team will be appointed to develop the scientific content of the addendum to the IMBER Science Plan, to reflect the science of the second phase of IMBER, including
 - Outstanding questions identified during the GLOBEC synthesis
 - Ongoing research in GLOBEC's CLIOTOP and ESSAS regional programmes
 - Results of the first phase of IMBER
6. GLOBEC and IMBER agree that co-endorsement of national projects can occur if requested.

The following are common activities between IMBER and GLOBEC:

- **GLOBEC-IMBER End to End Foodweb Task Team meeting
Hamburg, Germany, 14-15 December 2005:**

Members of the TT include Ken Denman (Canada), Dave Karl (USA), Fritz Köster (Denmark), Coleen Moloney (South Africa, co-chair), Mike St John (Germany, co-chair), Svein Sundby (Norway), Rory Wilson (UK). The life

span of the task team will end with the publication of a paper, after which the GLOBEC and IMBER SSCs will jointly appoint members of an e2e working group.

- **Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics in the Southern Ocean (ICED)**

ICED is a continuation of the still running GLOBEC Southern Ocean Programme, co-sponsored by SCAR, SCOR, GLOBEC and IMBER. ICED will bring together climatologists, oceanographers, biogeochemists, ecosystem and fisheries scientists to generate unique circumpolar databases and models to address three globally important questions:

1. how do climate processes affect the dynamics of circumpolar ecosystems?
2. how does ecosystem structure affect circumpolar ocean biogeochemical cycles?
3. how should ecosystem structure and dynamics be included in the development of sustainable approaches to managing exploitation?

- **Chinese GLOBEC/IMBER programme**

The China GLOBEC programme has reached its third phase after nearly 10 years of endeavour of China GLOBEC I (BoSEC, 1997-2000) and China GLOBEC II (EYSEC, 1999-2004). A new 5-year programme on GLOBEC and IMBER has been approved by the Ministry of Science and Technology of China (MOST) with a total funding of US\$4.0 million from 2006 to 2010. Prof. Qisheng Tang is the chief scientist and nearly 70 scientists will be involved in the programme, entitled "Key Processes and Sustainable Mechanisms of Ecosystem Food Production in the Coastal Ocean of China".

- **EUROCEANS**

EUROCEANS (European Network of Excellence for Ocean Ecosystems Analysis) is a network of excellence co-funded by the Sixth Framework Programme for Research and Technological Development of the European Communities (FP6). The network gathers more than 60 research institutes and universities from 25 countries. Its activities started in January 2005, running for 4 years until December 2008. EUROCEANS is set up as a contributor to GLOBEC and IMBER at European level. In addition, the GLOBEC IPO hosts the EUR-OCEANS Knowledge Transfer Unit, designed to transfer the advancements of the network to advisory, policy and socio-economic users.

2.2. International Polar Year (IPY)

The 2007-2009 International Polar Year is under planning. GLOBEC's role in fostering and coordinating international research on marine ecosystems has been recognised by having two regional programmes, ESSAS (Ecosystem studies of Sub-Arctic Seas) and ICED (Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics in the Southern Ocean), as LEAD PROJECTS for IPY.

2.3. Publications



The GLOBEC publication list can be interactively searched at www.globec.org. Since 2000 the list includes a **total of 1,647 publications** (1466 refereed, 181 non-refereed), with a substantial and escalating increase in output over the period 2000-2005.

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 and IPO publications printed in 2004/2005/2006:

1. **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

2. **Castro, LR, P. Fréon , C.D. van der Lingen, and A Uriarte (Eds.)** 2005. Report of the SPACC Meeting on Small Pelagic Fish Spawning Habitat Dynamics and the Daily Egg Production Method (DEPM). GLOBEC Report 22: xiv, 107 p.
3. **Drinkwater, K.F., H. Loeng, B.A. Megrey, N. Bailey and R.M. Cook (Eds.)** 2005. The influence of climate change on North Atlantic Fish stocks. ICES Journal of Marine Science 67: 1203-1542.
4. **Hanesson, R., M. Barange and S. Herrick Jr. 2006. (Eds.)** 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.
5. **Hunt, G.L., Jr and K.F. Drinkwater (Eds.)**. 2005. Ecosystem Studies of Sub-Arctic Seas (ESSAS) Science Plan. GLOBEC Report No.19, viii, 60pp.
6. **Hunt, G.L., Jr and K.F. Drinkwater (Eds.)**. 2005. Background on the Climatology, Physical Oceanography and Ecosystems of the Sub-Arctic Seas. Appendix to the ESSAS Science Plan. GLOBEC Report No.20, viii, 96pp.
7. **Maurry, O. and P. Lehodey (Eds.)**. 2005. Climate Impacts on Oceanic TOP Predators (CLIOTOP). Science Plan and Implementation Strategy. GLOBEC Report No.18, ii, 42pp.
8. **van der Lingen, C.D., Castro, L., Drapeau, L. and D. Checkley, Jr. (Eds.)**. 2005. Report of a GLOBEC-SPACC Workshop on Characterizing and Comparing the Spawning Habitats of Small Pelagic Fish. GLOBEC Report 21: xii, 33p.
9. *GLOBEC Newsletter 11.1 and 11.2 April/ October 2005*
10. *GLOBEC Newsletter 12.1 April 2006*

2.4. GLOBEC/EUROCEANS Summer School



GLOBEC has teamed up with EUROCEANS to organize a summer school entitled “*Towards ecosystem oceanography: Identification and modelling of controls in marine ecosystems*”. The school took place on 19-28 June 2006 and was attended by 30 students and practitioners. The venue was the Drägerup field station in Denmark. The lecturers were Pilippe Cury (France), Volger Grimm (Germany), Niels Stenseth (Norway) and Christian Mullon (France).

2.5. GLOBEC IPO

Following the successful bid to renew the funding of the GLOBEC IPO until March 2010 through the UK's Natural Environment Research Council and the Plymouth Marine Laboratory, the IPO and SCOR have submitted a proposal to renew our funding bid through the USA-NSF. If this bid is successful GLOBEC will be supported to tackle the extensive programme of workshops outlined above. This is in addition to long-standing funding agreements with IGBP and IOC.

In addition, as part of the GLOBEC IPO involvement in the European network of Excellence EUROCEANS the Office has grown to incorporate an additional project officer to focus on Knowledge Transfer.

2.6. 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 to request 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). The draft structure of the book is as follows.

**DRAFT GLOBEC International Synthesis Book Outline
Global Change and Marine Ecosystems**

- Chapter 1: Introduction (short)
- Chapter 2: Historical
- Chapter 3: Dynamics of Marine Systems
- Chapter 4: Marine Ecosystems under the influence of humans
- Chapter 5: Marine Systems as Part of the Earth System
- Chapter 6: Human Dimension
- Chapter 7: Projection and future scenarios
- Chapter 8: Responsible management
- Chapter 9: Summary and next steps toward sustainability

The GLOBEC Executive Committee (Werner, Field, Harris, Hofmann, Perry, Barange) will meet in Plymouth, September 2006 to flesh out the contents of the volume and discuss drafting issues.

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

2.7. 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.

2.8. 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 Escribano	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 W. 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 2006 one member rotates off (Rosemary Ommer). GLOBEC does not plan to replace her at this stage, but will include Prof Brad de Young (Canada, Chair GLOBEC Focus 3 working group) as ex-officio member. This is in recognition that this working group (Predictive and modelling capabilities) needs to be represented at the SSC meetings during our I+S phase.

3. RESEARCH HIGHLIGHTS 2006

The GLOBEC IPO produces an annual research highlights brochure, which is available for download from the GLOBEC website (see <http://www.globec.org/products/highlights/highlights.htm>).

Appendix 1



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www.globec.org

Dr Ed Urban
Executive Director
SCOR
The John Hopkins University
USA

25 June 2004

Dear Ed:

As you know GLOBEC is teaming with PICES and ICES in co-sponsoring and organising the **4th International Zooplankton Production Symposium: Human forcing of zooplankton populations**, to be held in Hiroshima, Japan, May 28 – June 1, 2007.

This symposium follows on the successful 3rd IZPS, held in Gijon, Spain, May 2003, with identical set of sponsors.

GLOBEC and PICES would like to request a contribution from SCOR to cover the expenses of 3-5 scientists from developing countries to attend this important symposium. The amount would range between \$6,000 (3 scientists supported) and \$10,000 (5 scientists supported). SCOR would be adequately acknowledged in the book of abstracts and Proceedings.

We would be grateful if you could bring this request to the attention of the SCOR General Assembly at their meeting in Concepcion in October 2006.

Thanks you in advance for your consideration. Regards,

Manuel Barange
Director GLOBEC International Project Office
and
Alex Bychkov
Executive Secretary PICES

A core project of the International Geosphere-Biosphere Programme, co-sponsored by the Scientific Committee on Oceanic Research (SCOR) and the Intergovernmental Oceanographic Commission of UNESCO (IOC)



Appendix 2



Dr Ed Urban
Executive Director
SCOR
The John Hopkins University
USA

25 June 2004

Dear Ed:

GLOBEC is sponsoring and organising the 1st CLIOTOP Symposium, “**Climate Impacts on Oceanic Top Predators**” in La Paz, Mexico, 3-7 December 2007.

This symposium is part of the implementation strategy of CLIOTOP, which as you know is one of GLOBEC’s regional programmes. CLIOTOP is aimed at identifying, characterising and modelling the key processes involved in the dynamics of oceanic pelagic ecosystems.

This symposium follows on the series of synthesis GLOBEC regional symposia that started in 2004 with the ICES/GLOBEC Symposium on “**The Influence of Climate Change on North Atlantic Fish Stocks**” (Bergen, May 2004, no SCOR support requested), continued with the successful GLOBEC Symposium on “**Climate Variability and Sub-Arctic Marine Ecosystems**” (Victoria, Canada, May 2005, SCOR-supported), and the PICES/GLOBEC Symposium on “**Climate variability and ecosystem impacts on the North Pacific: A basinscale synthesis**” (Honolulu, USA, April 2006, SCOR-supported). Regional symposia have been identified by GLOBEC as one of its main strategies for integration and synthesis.

GLOBEC would like to request a contribution from SCOR to cover the expenses of 3-5 scientists from developing countries to attend this important symposium. The amount would range between \$6,000 (3 scientists supported) and \$10,000 (5 scientists supported). SCOR would be adequately acknowledged in the book of abstracts and Proceedings.

We would be grateful if you could bring this request to the attention of the SCOR General Assembly at their meeting in Concepcion in October 2006.

Thanks you in advance for your consideration. Regards,

Manuel Barange
Director GLOBEC International Project Office

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A core project of the International Geosphere-Biosphere Programme, co-sponsored by the Scientific Committee on Oceanic Research (SCOR) and the Intergovernmental Oceanographic Commission of UNESCO (IOC)

Appendix 3. GLOBEC National, Multinational and Regional Programmes (Shaded are completed projects)

National

Country	Duration	Name-code	Funding	Contact
Brazil	1998-2002	DEPROAS	Conselho Nacional de Desenvolvimento Cientifico e Tecnologico	B. M. de Castro
Canada	1996-1999	GLOBEC Canada	Natural Sciences and Engineering Research Council, Fisheries and Oceans Canada	B. de Young
Chile	1997-ongoing	FONDAP-COPAS	Chilean National Commission for Science and Technology	R Escribano
China	1997-ongoing	China GLOBEC	National Natural Science Foundation of China, Ministry of Science and Technology	Q. Tang
France	1999-ongoing	PNEC	Call for proposals, funded for 1 year. Proposals can be resubmitted each year. Mean duration ~4 years.	F. Carlotti
Germany	2000-ongoing	GLOBEC Germany	Federal Ministry for Education, Science, Research and Technology plus participating institutions	J. Alheit
Italy	2000-ongoing	SINAPSI	Ministero dell'Universita' e della Ricerca Scientifica e Tecnologica	M. Zavatarelli
Japan	1997-ongoing	Japan GLOBEC	One project funded by Japanese Government, others seem to be institute/university funded	Y. Sakurai
Korea	1999-ongoing	Korea GLOBEC	Korea Science and Engineering Foundation, Ministry of Maritime Affairs and Fisheries, NFR&D Institute	I. Sang Oh
Mexico	1997-ongoing	IMECOCAL	Consejo Nacional de Ciencia y Tecnologia, IAI	T. Baumgartner
Netherlands	1993-2002	Several	Various loosely affiliated projects, various funding agencies	M Baars
Norway	1993-2001 2003-2006	MARE COGNITUM ECOBIE, CLIMAR, ADAPT	EU funding, Norwegian Research Council, Norwegian Institutes and Institute of Marine Research	W. Melle/ S Sundby
Portugal	1999-ongoing	GLOBEC Portugal	Portuguese Foundation for Science and Technology, IPIMAR	M. Santos
Peru	2004-ongoing	GLOBEC-IMARPE	Instituto del Mar del Peru (IMARPE)	R. Guevara
Spain	2001-ongoing	GLOBEC Spain	Ministerio de Ciencia, IEO, CSIC, CYCIT, etc.	F. Echevarria
Turkey	1997-ongoing	Black Sea GLOBEC	Turkish scientific and technical research council (TUBITAK)	T. Oguz
Ukraine	1997-2004	Ukraine GLOBEC	INTAS, UK DETR Darwin Initiative + others	V. Zaika
UK	2000-2005	Marine Productivity (largest)	NERC Thematic money – individual projects by proposal	P. Williamson
USA	1994-ongoing	U.S. GLOBEC	NSF and NOAA – individual projects by submitted proposals	D. Haidvogel

Multi-National and Regional

Start Year	Countries	Funding	Contact
1997- 2007	BENEFIT: South Africa, Namibia, Angola, Norway, Germany	Norwegian and German donor agencies, Governments of Angola, Namibia, South Africa	N. Sweijd
2000-2003	LIFECO: Norway, Germany, UK, Denmark	EU FP 5	M. St John

Start Year	Countries	Funding	Contact
1996-1999	TASC: Norway, UK, Denmark, Iceland, Germany, France, ICES	EU MAST	K. Tande
1999-2001	ENVIFISH: EU countries, Angola, Namibia, South Africa	EU INCO	L. Nykjaer
1997-2000	VIBES: France, South Africa	IRD (ORSTOM)	P. Freon
2001-ongoing	IDYLE1 and 2/ ECO-UP: France, South Africa	IRD (ORSTOM)	P. Freon
2002- 2004	NATFISH: Norway, Morocco, Mauritania, Senegal, Italy	EU INCO	L. Nykjaer
2001-ongoing	OFCCP: USA, New Caledonia, Mexico, Australia, France, New Zealand, Japan, IATTC	National funding agencies of participating countries, GEF	P. Lehodey
1993-ongoing	SPACC: Spain, France, Germany, Japan, Chile, Peru, Senegal, Mauritania, Portugal, USA, Mexico, and others	National, GLOBEC	D. Checkley and C. Roy
1993-ongoing	CCC: ICES countries	National, ICES	G. Ottersen and K. Wieland
Ongoing	CCCC: Japan, China, Korea, Russia, Canada, USA	National, PICES	S. Kim and H. Batchelder
Ongoing	SO GLOBEC: USA, Australia, UK, Germany, IWC, and others.	National	E. Hofmann
2005-ongoing	ESSAS	National, GLOBEC, PICES	G. Hunt
2004-ongoing	CLIOTOP	National, GLOBEC	O. Maury and P. Lehodey

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

ACTIVITIES 2005-2006
(submitted by Robin Raine and Ed Urban)

1. Implementation of Core Research Projects

The GEOHAB *Implementation Plan*¹, 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 2005 SCOR Executive Committee Meeting.

A. Core Research Project: HABs in Upwelling Systems

A report of the Open Science Meeting on HABs in Upwelling Systems, hosted at the Instituto Nacional de Investigação Agrária e das Pescas, in Lisbon, Portugal on 17-20 November 2003, has been completed and published.² The Open Science Meeting served to identify interested participants and research regions and to bring together the international community to design core research. The meeting report provides a general overview of HABs in the designated upwelling systems (California Current System, Iberian Upwelling System and Benguela Upwelling System) and details 8 high-priority research activities to be addressed in understanding the ecology and oceanography of HABs in upwelling systems. Much of the content of the Open Science Meeting report was included in a paper published in *Oceanography*.³

A Core Research Project Committee for Upwelling Systems includes Grant Pitcher (South Africa, chair), Teresa Moita (Portugal), Francisco Figueiras (Spain), Raphael Kudela (USA), Trevor Probyn (South Africa), Sonia Sanchez (Peru), and Vera Trainer (USA) and is responsible for implementation of this CRP. The Upwelling CRP Subcommittee met prior to the 2006 GEOHAB SSC meeting. The group published a report of the OSM in *Harmful Algae News*, inviting participation in the CRP. There has been some response to the article in *Harmful Algae News* and with the progress now made in planning of the CRP, the committee will interact with those who have shown interest. The subcommittee meeting in January developed projects based on the key questions developed at the OSM and described in the Upwelling report. The second purpose of the meeting was to develop a practical mode of operation of the CRP. One development from the meeting is that the Humboldt Current system will be incorporated in the CRP. Not all key questions will be addressed immediately. The CRP Subcommittee has assigned responsibility for each CRP component and compiled a listing of potential collaborators. Objectives and work plans for each CRP component have been drafted. Vera Trainer drafted an article about this CRP for *Harmful Algae News*, to summarize progress on this CRP and to point to the Web site. Implementation activities were discussed and international coordinators were identified. Subcommittee members will ensure that this document gets distributed to the people on the list. The Upwelling Subcommittee will develop a Web page. They will attempt to write review papers on each of the six topics to compare previous research in the various upwelling systems, as a useful starting point for each project. In terms of capacity building, the CRP will try to make it possible to have students travel among the regions.

Two members of the CRP Committee are members of the international GEOHAB SSC, to ensure a strong linkage between the Committee and the SSC. It is intended that much of the work of the CRP Committee will be conducted by means of the GEOHAB Web site and through the establishment of a CRP mailing list. Periodic meetings of the Committee may be organized and combined with GEOHAB SSC meetings, for example, in conjunction with the

¹GEOHAB. 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.

²GEOHAB 2005. *Global Ecology and Oceanography of Harmful Algal Blooms, GEOHAB Core Research Project: HABs in Upwelling Systems*. G. Pitcher, T. Moita, V. Trainer, R. Kudela, P. Figueiras, T. Probyn (Eds.) IOC and SCOR, Paris and Baltimore. 82 pp.

³Kudela, R, G Pitcher, T Probyn, F Figueiras, M Moita and V Trainer. 2005. Harmful algal blooms in coastal upwelling systems. *Oceanography* 18(2):184-197.

GEOHAB SSC meeting in January 2006 (the meeting report is available at <http://ioc.unesco.org/hab/Upwelling%20IP-2006%20Final.pdf>).

An invitation to participate in the Core Research Project: HABS in Upwelling Systems has recently been sent to all participants of the Open Science Meeting. A “town hall” meeting has been scheduled for one evening during the 12th International Conference on Harmful Algae, to be held in Copenhagen, Denmark on 4-8 September 2006 (see <http://www.bi.ku.dk/hab/>).

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

The Open Science Meeting on Harmful Algal Blooms in Fjords and Coastal Embayments took place in Viña del Mar, Chile from 26-29 April 2004 under the co-direction of Allan Cembella (Alfred Wegener Institute, Germany) and Leonardo Guzmán (IFOP, Chile). More than 60 participants attended at least part of the meeting, which featured 11 key lectures, more than 25 posters presented by participants and an extensive and lively discussion and question periods following each theme.

On the day following the completion of the open meeting, the co-convenors met with the GEOHAB Chairman, the international Core Project Coordinating committee, and representatives of the GEOHAB SSC to plan the research agenda and to prepare a research plan from the meeting. Specific issues addressed included: (1) identification of processes and mechanisms that must be studied in such ecosystems to define HAB dynamics; (2) determination of the most important questions and working hypotheses; (3) consideration of opportunities, differences and commonalities to be addressed in studies of coastal embayments; (4) discussion of potential field study sites where research could be implemented; and (5) possibilities and constraints for national and international funding support for research initiatives.

Invited speakers were asked to prepare a manuscript based upon their presentations, subject to peer review, for publication in a special issue of the Elsevier journal *Harmful Algae*. A CRP subcommittee will be formed and may meet soon after the report is published.

C. Core Research Project: HABS and Eutrophication

The Open Science Meeting on HABS and Eutrophication was held on 7-10 March 2005 in Baltimore, Maryland, USA, under the leadership of Patricia Glibert, assisted by a Steering Committee of Don Anderson (USA), Edna Graneli (Sweden), Mingjiang Zhou (China-Beijing), Icarus Allen (UK) and Michele Burford (Australia). This meeting served to obtain community input for the development of a detailed research plan for the Core Research Project – Harmful Algal Blooms in Eutrophied Systems. The plan was drafted by the Steering Committee based on the input of the approximately 120 participants at the meeting, and has been printed by IOC and distributed to meeting participants, sponsors, and other interested scientists. The steering committee for this CRP met in conjunction with the June 2006 meeting of the American Society of Limnology and Oceanography in Victoria, B.C., Canada.

D. Core Research Project: HABS and Stratification

The fourth Open Science Meeting, on HABS and Stratification, was held on 5-8 December 2005, at the UNESCO Headquarters in Paris, France, under the leadership of Patrick Gentien. This meeting was designed to bring experts together to review the state of knowledge of the physical and chemical processes related to stratification, and their interaction with microscopic algae. As profiling techniques have improved, persistent and spatially coherent plankton patches have been described at scales smaller than those of standard sampling. These patches are recurrent in coastal systems and their study is essential to understanding the development of HABS. The meeting addressed topics relating to the physical processes relevant to stratification, the maintenance of HAB populations in thin layers, the selection of assemblages by different turbulent regimes, the influence of phytoplankton communities on small-scale physical properties, the implications for sampling, monitoring and operational oceanography, and the required detection systems. The report from the meeting is in preparation.

2. GEOHAB Modelling

The 2006 GEOHAB SSC meeting featured an extended discussion on modelling, particularly on the content of a potential modelling workshop. The aim is to identify modellers and to get them involved in the CRPs. HAB modelling is not very different from biogeochemical models or particle-tracking models of low-density species. The specific HAB aspects will require species-specific and site-specific modifications. There is no HAB-specific modelling community, but there are modellers who are interested in HAB problems. In most cases, modellers are physical oceanographers and mathematicians, and HAB biologists need to talk with modellers to ask and answer the right questions. Options for the workshop include

1. Model intercomparisons—This would involve modellers talking to each other
2. Dialogue meeting of HAB researchers and modellers. Model representations, introduction to models relevant for the CRPs, including tutorials
3. HAB modelling sessions at conferences (ICES, AMEMR)
4. Summer school

The SSC stressed the need for modelling workshops to get down to a practical level. Species-of-interest models are required for GEOHAB. Also, models should include forecasts as well as models for numerical experimentation. The dialogue between modellers and biologists may be easier if the participants understand what each other are talking about (i.e., the main workshop would be preceded by a tutorial for biologists). They don't need to go into the nuts and bolts of models. Not how to solve differential equations, but why we use them. The biologists don't need to know the details of the physics, but the scales on which they work. The SSC agreed on attempting a shorter, practical meeting, rather than a larger teaching meeting. Also the SSC agreed that it will require a practical implementation meeting to integrate models into the CRPs. The SSC will scale the meeting to the funding available. The meeting will focus on developing roadmaps of how prediction through modelling and monitoring can be achieved and to give a pattern for how models can be developed for each CRP.

It was agreed to have a student component of the meeting as GEOHAB will have students involved in the CRPs. Summer 2008 was considered the earliest for the meeting/workshop.

3. Second SCOR Summit of International Marine Projects

GEOHAB will participate in the second SCOR Summit of International Research Projects, to be held in London, UK in December 2006 (see www.jhu.edu/scor/ProjCoord2.htm). GEOHAB will be represented by Robin Raine and Henrik Enevoldsen.

4. XI International Conference on Harmful Algae

A GEOHAB display will be constructed for the 12th International Conference on Harmful Algae held in Copenhagen, Denmark, on 4-8 September 2006, to promote the strategy, mission and achievements of GEOHAB. The display will provide a focal point for distribution of GEOHAB documents. Also, as noted above, the Upwelling CRP will host an informal "town hall" meeting one evening to discuss how new individuals can get involved in this CRP.

5. SSC Meeting: Villefranche, France, January 2006

A Scientific Steering Committee meeting was held on 23-25 January 2006 in Villefranche, France. The following issues were discussed at the meeting:

- a. GEOHAB Terms of Reference—The SSC agreed that it should stay focused on coordination of GEOHAB research to ensure that success of GEOHAB as a research program and not divert its focus to a broader set of related activities. However, an important point of the discussion is that GEOHAB must make more effort to publicize GEOHAB progress to the worldwide HAB community, and to be more of a leader and catalyst in international HAB research. Since the meeting, a Microsoft Access database of all past SSC members and participants of all GEOHAB meetings was prepared by the SCOR Secretariat for future mailings.
- b. Status of Core Research Projects (see above)
- c. Framework Activities—A summer school on observing systems was discussed briefly, but more discussion was devoted to modelling activities (see above).

- d. Changes needed for the GEOHAB Web site.
- e. GEOHAB representation, presentations, and special sessions at relevant scientific meetings, and meetings of other research projects.
- f. GEOHAB data management and protocols—The CRPs need to allocate significant resources for data management and there would be synergies if the CRPs could share a person to manage data. The SSC recalled that it previously had agreed that GEOHAB CRPs will not compile primary data, only metadata. On each CRP Web page there will be a listing of where data are located. It was agreed to develop or use existing structures to maintain metadata.
- g. GEOHAB endorsement mechanism
- h. Potential new SSC members—New nominations for SSC members will be presented at the SCOR meeting in Chile.
- i. The time and place of the next SSC meeting.

6. SSC Meeting: Tokyo, Japan, March 2007

The 2007 GEOHAB SSC meeting will be held at the University of Tokyo, hosted by SSC member Ken Furuya, who has obtained special funding to convene an Asian GEOHAB meeting, to stimulate involvement of Asian scientists in GEOHAB. The SSC meeting will focus on implementation of GEOHAB Core Research Projects.

7. 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 overseeing programme progress, as one of their many tasks. Despite consideration of the location of the IPO in Norway, China, United Kingdom and Germany, none of these options have materialized. This situation is unsatisfactory for the long-term progress and success of the programme.

GEOHAB Finances

Income	2005	2006	2007
Carry-over from previous year (NSF grant)	\$15,485.04	\$30,647.57	(1) \$52,595.45
NOAA	\$24,000.00		
NSF (through SCOR)	\$30,000.00	\$17,500.00	(2) 30000
IOC	\$21,134.00	\$20,000.00	20000
IFREMER	\$2,250.00		(3)
SCOR Support for LDC Travel	\$1,508.64		
Other sources (, DNR, CRC)	\$3,000.00		
NOAA Funding for Eutrophication CRP (for 2 years)		\$32,000.00	
Registration Fees	\$26,292.00		
Total	\$123,669.68	\$100,147.57	\$102,595.45
Expenses			
Publications (formatting, printing, mailing, copyrights)	\$30.00		(4)
Advertising			
SCOR Administrative Expenses	\$316.03		
SCOR LDC Travel Support	\$1,508.64		
IOC Expenses (airfares)	\$7,268.00		
Other Meetings			
SSC Meeting		\$14,433	\$34,784
HABs in Upwelling Systems		\$9,156.62	\$12,000.00
HABs in Fjords and Coastal Embayments		\$6,000.00	\$12,000.00
HABs and Stratification	\$27,534.22	\$12,000.00	\$12,000.00
HABs and Eutrophication	\$56,365.22	\$5,963.00	\$16,000.00
Modelling Committee			
Booth at Copenhagen Meeting			
Observation Systems and Instrumentation Committee			
Total	\$93,022.11	\$47,552.12	\$86,784.00
Remaining	\$30,647.57	\$52,595.45	\$15,811.45

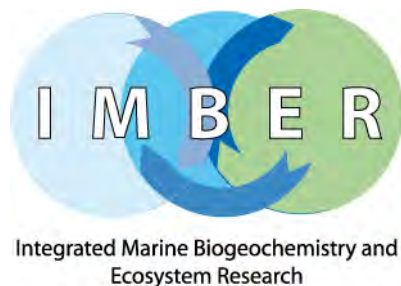
(1) Includes first 5 months in 2006

(2) 7 months from June 1, 2006

(3) IFREMER provided 15,000 euros in 2005 toward building "GEOHAB Europe"

(4) Does not yet include some publication costs for 2006

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



Annual Report 2006
Submitted by Sylvie Roy
On behalf of the IMBER Scientific Steering Committee

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Establishment of the IMBER International Project Office

The official opening of the IMBER IPO was held on October 25, 2005 at the European Institute for Marine Studies (IUEM) in Brest. The IPO 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 now 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. The IMBER IPO is actively working on the implementation and promotion of IMBER.

SSC and Executive Meetings

2005 Executive Meeting

The Second IMBER Executive Committee meeting was held in Brest on October 25-27. This meeting was jointly held with the GLOBEC Executive Committee. The focus was to continue work on the Implementation plans for IMBER over the next 6 to 12 months and to develop a plan for moving the relationship between IMBER and GLOBEC forward. A framework for interactions between IMBER and GLOBEC was drafted and circulated to the respective SSCs for approval.

2006 SSC Meeting

The Third IMBER Scientific Steering Committee Meeting was held on May 10-12, 2006, at the European Institute for Marine Studies in Brest (France) home of the IMBER International Project Office. The meeting focused on reviewing the implementation of IMBER to date and identifying future priorities including interactions with other projects.

Plans for 2006-2007

The next IMBER Executive meeting will be held jointly with GLOBEC in Plymouth (UK on September 27-29, 2006.

Implementation of IMBER

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

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 team met in Hamburg (Germany) in December and is preparing a review for publication in 2006, which lays out i) why we need to tackle end-to-end food webs in our studies at this time, ii) what the key challenges are and how we can meet them, and iii) how we can make headway in the experimental, observational and modelling components of marine end-to-end food webs. The manuscript entitled "Newton and Kelvin meet Darwin in the complex sea of global change: Unravelling marine food webs end to end", with authorship (St John et al.) was submitted to *Science* in early July. The task team will be disbanded when the paper is published. However, the task team recommended the formation of a new IMBER/GLOBEC activity: an End-to-end Food Webs working group to be jointly appointed by the IMBER and GLOBEC SSCs. Some continuity in membership is preferred, but a new group composition is probably needed. The task team will make recommendations regarding scientific issues and refine the terms of reference for this group for the next IMBER/GLOBEC Executive meeting in September 2006. A budget of 10K USD was approved for the activities of this group in 2007.

In conjunction with this activity IMBER will co-sponsor the International Symposium on "Parameterization of Trophic Interactions in Ecosystem Modeling" that EUR-OCEANS is organising in early 2007. This symposium will provide a review, synthesis, and forum for discussion of the present understanding of trophic interactions at key interfaces and provide a vision for the development of future modelling strategies. IMBER has agreed to support five participants to attend this symposium.

IMBER/SOLAS Carbon Working Group

Recognizing the need for scientific discussion and coordination of marine carbon research within IMBER and SOLAS, the two projects have established a joint carbon implementation group. The group is co-chaired by Truls Johannessen (Norway) and Arne Körtzinger (Germany) and works closely with the IOCCP (International Ocean Carbon Coordination Project). It is understood that the joint SOLAS/IMBER Carbon (S.I.C.) group will oversee all scientific aspects of marine carbon process studies. A Joint SOLAS/IMBER Carbon Research implementation plan has been published electronically and is considered to be a living document that will be updated regularly (http://www.imber.info/products/Carbon_Plan_final.pdf). The S.I.C. group met in September 2005 in Broomfield, Colorado, (USA). One major outcome of this meeting was the creation of three sub-groups to move forward the implementation of the carbon research.

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

This group is focused on synthesis, instrumentation and technology development, VOS and mixed layer sampling strategy. Their first major action is to organize with IOCCP an International Workshop on Volunteer Observation Ships Network Design and Data Synthesis (UNESCO, Paris, 11-13 April 2007). The Co-chairs of the organizing committee are Nicolas Metzl and Bronte Tillbrook.

Sub-Group 2 Interior ocean carbon storage (Chair: Nicolas Gruber, Switzerland). This group will cover inventory and observations, natural variability, transformation, designing a strategy for leverage for the Argo program, and interaction with modeling. They took the lead on the initiative "Friends of Oxygen on Argo". Their objective is to submit a white paper suggesting the addition of oxygen sensors on Argo buoys to the Argo SSC by the end of 2006. The group met on June 28-30 at the North Atlantic Synthesis meeting in Iceland organized by CARBOOCEAN. This group is also involved with the International Repeat Hydrography Carbon Advisory Group. It was suggested that this group take the lead on a new activity aimed at broadening the Repeat Hydrography Strategy and identifying the most important questions. This activity could start in 2007 and involve CLIVAR.

Sub-Group 3 Carbon cycle climate sensitivities and feedbacks (Chair: Kitack Lee, Korea). This group has not yet been formed. It will focus on the response of ecosystems and biogeochemical cycle to natural and anthropogenic changes, feedbacks to the Earth System, and future perspective (prediction). Email discussion has been initiated between this group and IOCCP to identify the science issues and develop guidelines and protocols for mesocosm experiments. It was suggested to link Kitack Lee with the IGBP/SCOR Fast Track Initiative on Ocean Acidification.

Continental Margins Task Team

LOICZ and IMBER have agreed to form a joint LOICZ/IMBER Continental Margin Task Team. The task team consists of 10 members. The task of this group is to organize, by email and perhaps a short logistic meeting by a few, a small Open Science Conference in the second half of 2007 in Shanghai on the biogeochemistry and ecosystems for continental margins. As part of fund raising for this activity, IMBER plans on submitting a proposal to SCOR for travel funds for scientists from developing countries and countries with economies in transition. Based on the outcome of this conference, the task team will recommend to the IMBER and LOICZ SSCs a strategy for implementation of continental margins research in the two projects and suggest a group of people identified from the OSC to take the implementation forward.

Capacity Building Task Team

The Capacity Building Task Team chaired by Wajih Naqvi is composed of 8 members. The task team developed a capacity-building strategy and implementation plan to be used by IMBER to guide capacity-building issues. 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. The aim is also to strengthen graduate education in ocean sciences. The task team is now developing the approach that should be taken to ensure that the strategy is implemented, and may recommend the formation of a longer term working group.

In relation to its capacity-building activities, IMBER is trying to develop a floating university program. This could potentially be accomplished in collaboration with EUR-OCEANS.

Data Management Task Team

IMBER has decided to focus on metadata management. A Data Management Task Team chaired by Raymond Pollard was appointed to develop and implement a data management plan, and develop metadata guidelines for IMBER projects. The IMBER Deputy Executive Officer, Sophie Beauvais, was appointed as the IMBER Data Liaison Officer at the IPO to support the Data Management task team. Raymond and Sophie are planning a meeting with Roy Lowry at the British Oceanographic Data Centre to determine the best strategy for 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.

Promotion of IMBER in the science community

Communication Plan

An IMBER communication plan has been developed and made available on the IMBER website. The critical audiences targeted by this plan over the ten-year duration of the program are the scientific community, funding agencies, decision makers, and the broader public. It is proposed that the IMBER Communication Plan take a staggered multiphase approach to target these key audiences at the appropriate phase of the program. Thus, the first three years should focus on building awareness and involvement of the scientific community and promoting IMBER to the potential funding agencies. From year 4, outreach of science results should still include scientists and funding agencies, but also be more proactive to decision makers and the broader public. This second phase should start slowly after year 3 and last until year 10.

Website

The IPO has developed a new IMBER website which was made publicly available in March 2006 (see www.imber.info)

Newsletter

The three issues of the IMBER electronic "*IMBER update*" have been published in December 2005, March and June 2006. The IPO plans to publish the newsletter quarterly.

Brochure and poster

A brochure giving an overview of the IMBER project is being produced and will be sent out to scientists and institutions. A poster is being produced for use at conferences.

IMBER activities

Sponsored meetings

- Advances in Marine Ecosystem Modeling Research Symposium (AMEMR), June 27-29th 2005, Plymouth, UK.
- Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER) workshop. October 3-6, 2006, Goa, India.
- PICES/IMBER session at the PICES XV Annual Meeting "Boundary Current Ecosystems" October 13-21, 2006 Yokohama, Japan.
- International Conference on the Humboldt Current System: Climate, ocean dynamics, ecosystem processes, and fisheries. Nov 27-Dec 1, 2006, Lima, Peru.
- Symposium on Parameterisation of trophic interactions in Ecosystem Modeling. March 7-9, 2007, Cadiz, Spain.

Regional Activities

ICED (Integrated analysis of Circumpolar Climate interactions and Ecosystem Dynamics in the Southern Ocean) ICED is a joint initiative between IMBER, GLOBEC, SCAR and EUR-OCEANS. The ICED initiative will develop a coordinated circumpolar approach to understand climate interactions in the Southern Ocean, the implications for ecosystem dynamics, the impacts on biogeochemical cycles and development of management procedures. The first Science Planning Workshop for ICED was held 24-26 May 2005 at the British Antarctic Survey, Cambridge, UK. ICED directly addresses the questions put forward as a science focus for IMBER such as: 1) how do climate processes affect the dynamics of circumpolar ecosystems? 2) how does ecosystem structure affect circumpolar ocean biogeochemical cycles? 3) how should ecosystem structure and dynamics be included in the development of sustainable approaches to managing exploitation? A Science Plan for the ICED project was developed and will be submitted to both IMBER and GLOBEC for approval. ICED is also preparing a special session at the XXIX SCAR meeting in Hobart on July 9-19, 2006.

OECOS (Ecodynamics Comparison in the Oceanic Subarctic Pacific)

Oregon State University (OSU, Corvallis) was the site of an international workshop sponsored by PICES (with assistance from the OSU Research Office and the OSU College of Oceanic and Atmospheric Sciences) on May 23-24, 2005. Japanese (OECOS-west) and North American (OECOS-east) scientists discussed the fundamental questions and observational details of proposed comparative studies of ecological processes in the upper waters of the oceanic subarctic Pacific. The questions addressed by the project will serve to improve our understanding of the range of ecosystem function within HNLC regions; specifically those areas with tight control on biomass accumulation, such as the eastern subarctic Pacific. IMBER is working to develop a strong relationship with OECOS.

PRIMO (Formation and dynamics of the Oxygen Minimum Zone in the Peru-Chile Current system)

Chile, Peru and France have proposed a multi-national project to study the Oxygen Minimum Zone in the Peru-Chile current system. The main objectives are to understand what physical and biogeochemical processes are involved in the formation and variability of the OMZ of the SE Pacific on time scales of a few days to the interannual time scales for the present ocean, and to assess the impacts of its variability on productivity and biological processes in the water and sedimentation.

SIBER (Sustained Indian Ocean Biogeochemical and Ecological Research)

The workshop on Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER) will be held at the National Institute of Oceanography in Goa, India on October 3-6, 2006. The goals of the SIBER Workshop will be to 1) review the state of our knowledge and scientific understanding of the biogeochemical and ecological dynamics of the Indian Ocean in relation to physical oceanographic variability; 2) identify prominent gaps in our understanding, especially as they pertain to the role of physical and ecological processes in regulating biogeochemical cycles and the carbon cycle in particular; and 3) formulate a plan for the implementation of a biogeochemical and ecological observational and modelling research program that leverages and substantially enhances the planned CLIVAR/GOOS Indian Ocean observing system. At this workshop the development of an IMBER Indian Ocean regional activity will be discussed.

Contributing projects

EUR-OCEANS (European Network of Excellence for Ocean Ecosystems Analysis)

The European Network of Excellence EUR-OCEANS is a key contributing project in Europe as a Network of Excellence funded by the European Union. The overall networking objective of EUR-OCEANS is to achieve lasting integration of European research organizations on global change and pelagic marine ecosystems and the relevant scientific disciplines. EUR-OCEANS brings together 160 Principal Investigators (from 66 member organisations in 25 countries). An overview of the different work packages of EUR-OCEANS was presented during the last IMBER SSC meeting. This year, EUR-OCEANS and IMBER signed a memorandum of understanding (MOU) to formalize collaboration and are investigating areas where the two projects can work together. One clear example is the IMBER co-sponsorship of the International Symposium on "Parameterisation of trophic Interactions in Ecosystem Modeling" that EUR-OCEANS is organising in early 2007.

CARBO-OCEAN

CARBOOCEAN is a European integrated project aimed at an accurate scientific assessment of marine carbon sources and sinks, with special emphasis on the Atlantic and Southern Oceans on a time scale -200 to +200 years from now. An MOU was signed between IMBER and CARBO-OCEAN, which will focus on Themes 1 and 2 of IMBER. Forty-seven partners and associated collaborators are participating in the implementation. The second annual CARBOOCEAN meeting will be held 4-8 December 2006 in Las Palmas, Canary Islands.

National Activities

Canada

In Canada, the main initiative will come from funding for the IPY. A GEOTRACES/IMBER initiative has been submitted by Roger François; for the Canadian Arctic Margin Experiment.

Venus and Neptune observation: The cables are in the water for VENUS and the data are being collected. Neptune needs funding for instruments.

A meeting on the Line P Time-series organized by PICES will be held in Victoria (July 2006).

Chile

COPAS (Center for Oceanographic Research in the eastern South Pacific) was established in March 2002 at the University of Concepción in Chile. The COPAS Center is devoted to advanced basic scientific research on the circulation, biogeochemical cycling, ecology and paleoceanography of the Eastern South Pacific Ocean. The Center also provides advanced training opportunities to young scientists for research careers in oceanography and related areas. Three scientific questions have been identified and are being addressed from a multidisciplinary and synergistic point of view through six initial research programs. This multi- and inter-disciplinary research is based on direct observations, retrospective analyses, experimental work, and modelling.

China-Beijing

A new 5-year IMBER/GLOBEC programme has been approved by the Ministry of Science and Technology of China (MOST). Prof. Qisheng Tang and nearly 70 scientists are involved in the programme entitled "Key Processes and Sustainable Mechanisms of Ecosystem Food Production in the Coastal Ocean of China". The scientific focus of the programme will be on coupling mechanisms of the marine biogeochemical cycles and the end-to-end food web

interactions in the China seas to promote sustainable food production and ecosystem-based management in coastal ocean ecosystems from the perspectives of both anthropogenic impacts and natural changes. A kickoff meeting was held in Qingdao (China) in January 2006. During this meeting, the group leaders started developing the implementation strategy of the programme. Sylvie Roy attended this meeting at the invitation of the Chinese organizers.

Finland

The Finnish SCOR Committee expressed their interest in the IMBER programme. They decided to make actions to join IMBER by participating with researchers in international IMBER-oriented cruises and organizing international research cruises on the *R/V Aranda* in the Baltic Sea and elsewhere in near future.

France

The new French ocean program CYBER (CYcles Biogéochimiques, Ecosystèmes et Ressources, French acronym for “Biogeochemical Cycles, Ecosystems and Resources”) is a program that takes over the former PROOF program that was essentially dedicated to the study of ocean fluxes. Scientific activity within CYBER is now structured around four major themes, each of them being the French counterpart of international initiatives:

- Theme 1: Ecosystem structure, functional diversity and biogeochemical cycles (IMBER);
- Theme 2: Biogeochemical cycles of trace elements and isotopes (GEOTRACES);
- Theme 3: Biological and biogeochemical processes within continental margins (LOICZ-IMBER-GLOBEC);
- Theme 4: Biological and biogeochemical processes at air-sea interface (SOLAS).

Two major French campaigns have been successful recently: BIOSOPE (Oct-Dec 2004, South Pacific) and KEOPS (Jan-Feb 2005, Kerguelen Plateau). BIOSOPE focuses on the biogeochemical and optical characteristics of different trophic regimes in the southeast Pacific Ocean, and especially the oligotrophic area associated to the central part of South Pacific Gyre. This program has been endorsed by IMBER. 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 effect 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.

Germany

Three IMBER-related initiatives are under way in Germany:

1. A German IMBER project proposal has been submitted to a German funding body with 2008 as a starting date and a planned duration of 2 to 3 years. The goal of the project is to understand how shelf ecosystems will react to global change and to develop predictive capacities for these reactions. The studies will focus on the North Sea and Northern Benguela Upwelling.
2. A new project focused on the determination of seasonal-to-decadal time changes in sub-surface oceanic oxygen storage and transport is being developed.
3. The University of Kiel (IFM-GEOMAR) has submitted a proposal entitled “The Future Ocean” to the Excellence Cluster initiative of the German Research Ministry. This project includes two main research topics: "Greenhouse Oceans" and "Resources and Risks". The funding decision will be made at the end of October 2006.

IMBER has also provided a letter of interest to support a national proposal to establish an open-access off-shore mesocosm facility administered by IFM-GEOMAR in Kiel. The purpose of the proposal is to set up a research platform dedicated to studying the consequences of ocean change (such as ocean warming, ocean acidification, changes in ocean redox state, and loss of species diversity ...) on an ecosystem level. The proposed facility will be comprised of two components: (1) an infrastructure component centered around a mobile, off-shore mesocosm and (2) a network component that coordinates and operates off-shore mesocosm activities.

India

The Council of Scientific and Industrial Research has approved a project entitled “Impact of anthropogenic perturbations on oceanographic – atmospheric processes in and around India in the context of Global Change”. This project is coordinated by the National Institute of Oceanography (NIO), Goa and comprises three activities of interest to IMBER:

- Transports and transformations of nitrogenous fertilizers from agricultural fields to the ocean: Impact on coastal ecosystem and exchanges with atmosphere;
- Reconstruction of upwelling intensity/anoxia on seasonal to centennial time scales from coral and sedimentary records; and
- Long-term times-series measurements including calibration of critical atmospheric and oceanographic parameters.

Japan

The Japanese IMBER National Committee was set up under the Global Environmental Research Liaison Committee of the Science Council of Japan (SCJ) in January 2005 in Nagoya (Japan). This group is developing a research strategy and funding proposal for an IMBER-related study, as well as developing relationships with SOLAS-Japan and Japan-GLOBEC. IMBER-Japan proposed a North-South transect cruise in the western North Pacific, and obtained 52 days ship time in 2008 with Japan-SOLAS. IMBER-related scientists also got ship time in 2009 for the subarctic Pacific and for the subtropical North Pacific.

DEEP (Deep-Sea Ecosystem and Exploitation Programme) is an ongoing GLOBEC-related research programme focusing on the interaction between epipelagic and mesopelagic ecosystems. The Agriculture, Forestry and Fisheries Research Council, the Japanese funding agency for agriculture, forestry and fisheries sciences, is planning a new research programme on the marine ecosystem regime shift after DEEP. If it takes off successfully (from 2007), the programme would be an IMBER-Japan activity with GLOBEC.

There are also several ongoing research programmes in Japan that will contribute to the IMBER project including the biological pump study in the NW North Pacific Ocean (JAMSTEC); carbon sequestration to the deep sea and the Subtropical Nitrogen Fixation Flux Study (SNIFFS); and the EAST-WEST comparison of the subarctic Pacific ecosystems (OECOS).

Netherlands

IMBER was presented to 140 scientist during a meeting held in April 2005. Following this meeting, a firm plan for a national oceanographic expedition in the Indian Ocean, including SOLAS and IMBER, have been made for 2007. Funding plans have been delayed for one year and there was a very recent SOLAS/IMBER/GEOTRACES joint meeting in Amsterdam to discuss future research plans.

New Zealand

An ocean ecosystem project has been funded for 12 years. Two cruises in the permanently oligotrophic region to the northeast of New Zealand investigating the nitrogen cycle will be contributions to the IMBER project. In 2008-2009, a cruise on the east coast of New Zealand will focus on mesopelagic processes and will link to a strong modeling component in the project.

South Africa

There is no national IMBER project in South Africa. The Benguela region is the focus of most ecosystem research, but there is little open ocean research undertaken. Marine ecosystem research is embedded in regional studies in Somali and Benguela currents and largely focused on continental margins. There is also a South African Marine Research program: "Society, Ecosystems and Changes" involving social and natural scientists.

USA

IMBER organized an evening informational session at the 2005 annual meeting of ASLO, held on Feb. 22, 2005, in Salt Lake City, Utah. The title of the session was “U.S. National and International Projects on Carbon, Ecosystems, and Global Change: Status and Discussion.” The session was intended to highlight IMBER in the context of other

international ocean projects that the United States was developing or involved with, such as GLOBEC, SOLAS and the U.S. Ocean Carbon and Climate Change (OCCC) project. The OCCC scientific steering group (SSG) is chaired by Scott Doney. The recently formed Ocean Carbon Biogeochemistry (OCB) activity is also chaired by Scott Doney and is composed of the OCCC SSG (8) and 8 additional members with a variety of expertise. An Ocean Carbon Cycle science workshop will be held at WHOI on July 10-13, 2006.

IMBER Scientific Steering Committee in 2005.

Name	Expertise	Institution	Gender	Country
Ann Bucklin	Biology and Ecosystems	University of Connecticut	F	United States
Jay T. Cullen	Chemistry	University of Victoria	M	Canada
Julie Hall (Chair)	Biology and Ecosystems	NIWA	F	New Zealand
Dennis A. Hansell (Vice Chair)	Carbon	University of Miami - RSMAS	M	United States
Wilco Hazeleger	Physics and Climate	Royal Netherlands Meteorological Institute	M	The Netherlands
David Hutchins	Biology and Ecosystems	University of Delaware Graduate College of Marine Studies	M	United States
Arne Körtzinger	Carbon	Institute of Marine Research University of Kiel	M	Germany
Carina Lange	Paleoceanography	University of Concepción - COPAS	F	Chile
Jack Middleburg	Sediment-Water Interface	NIOO-KNAW - CEME	M	Netherlands
Coleen Moloney	Sediment-Water Interface	University of Cape Town	F	South Africa
Patrick Monfray (Vice Chair)	Modeling and Integration	OMP/LEGOS	M	France
S. Wajih Ahmad Naqvi	Biogeochemistry	National Institute of Oceanography	M	India
Raymond Pollard	Physics and Climate	National Oceanography Centre, Southampton	M	United Kingdom
Hiroaki Saito	Biology and Ecosystems	Tohoku National Fisheries Research Institute	M	Japan
Carol Turley	Biology and Ecosystems	Plymouth Marine Laboratory	F	United Kingdom
Jing Zhang	Biogeochemistry	East China Normal University State Key Laboratory of Estuarine and Coastal Research	M	China-Beijing

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

*SOLAS International Project Office
Annual Report to SCOR 2005/2006*

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SOLAS Implementation Plans

The Surface Ocean – Lower Atmosphere Studies (SOLAS) Science Plan and Implementation Strategy was published on the Web and in hardcopy in late-2003 to early-2004, and this posting marked the start-up phase of international SOLAS.

The next critical stage of the program was undertaken in mid- to late-2004, with meetings of three Implementation Groups (IMPs) representing the three foci of SOLAS:

- 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

It was decided that the Implementation Plan for Focus 3 would be developed jointly with the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) project. As of October 2006, the IMPs successfully completed the task of development of the three Implementation Plans, and these are posted on the SOLAS Web site (<http://www.solas-int.org>). Now that these are posted, the role of the IMPs shifts toward execution of the science within the plans. The Implementation Plans are meant to be ‘living documents’ and will periodically, but judiciously, be subject to review and modification.

SOLAS Scientific Steering Committee (SSC)

The SOLAS SSC met in Tokyo, Japan at the end of May 2005 and met in Amsterdam Netherlands in early May 2006. Coincident with the meeting in Japan, the SOLAS-Asia network met for a 2-day workshop. Similarly, a workshop was held in Amsterdam for the Netherlands SOLAS/IMBER/GEOTRACES network, and the SSC was invited to participate.

Original membership of the SSC (2001-2003):

Peter Liss (Chair), UK, Microlayer/Air-Sea Overview
Ilana Wainer, Brazil, Ocean Boundary Layer Physics
Peter Schlosser, USA, Air-Sea Exchange (WCRP member)
Bill Miller, Canada, Marine/Atmospheric Photochemistry
Katherine Richardson, Denmark, Biological Oceanography

Phil Boyd, New Zealand, Marine Biogeochemistry
 Truls Johannessen, Norway, Ocean Carbon
 Doug Wallace, Germany, Air-Sea Exchange of Greenhouse Gases
 Patricia Matrai (Vice-Chair), USA, Air-Sea Sulfur Exchange
 Ullrich Platt, Germany, Air-Sea Halogen Exchange
 Barry Huebert, USA, Atmospheric Aerosols
 Mitsuo Uematsu, Japan, Atmospheric Aerosols
 Elsa Cortijo, France, Palaeo Studies
 Ken Denman, Canada, Biogeochemical Modeling (WCRP member)
 Dileep Kumar, India, Coastal Studies
 Gerbrand Komen, Netherlands, Atmospheric Boundary Layer
 Tim Jickells, UK, Air-Sea Exchange of Nutrients

Changes to the membership of the SSC:

Jan 2004:	Departed - Replacement-	Ilana Wainer, Brazil, Ocean Boundary Layer Physics Wade McGillis, USA, Ocean Boundary Layer Physics
	Departed - Replacement-	Katherine Richardson, Denmark, Biological Oceanogr. Osvaldo Ulloa, Chile, Biological Oceanography Christiane Lancelot, Belgium, Biological Oceanography
	Departed - Replacement-	Phil Boyd, New Zealand, Marine Biogeochemistry Shigenobu Takeda, Japan, Marine Biogeochemistry
	Departed - Replacement-	Gerbrand Komen, Netherlands, Atmos. Boundary Layer Gerrit DeLeeuw, Netherlands, Atmos. Boundary Layer
Jan 2005:	Departed - Replacement-	Dileep Kumar, India, Coastal Studies Guang-Yu Shi, China, Coastal Studies
Jan 2006:	Departed - Replacement-	Elsa Cortijo, France, Palaeo Studies Isabel Cacho Lascorz, France, Palaeo Studies
	Departed - Replacement-	Peter Schlosser, USA, Air-Sea Exchange (WCRP member) Sergey Gulev, Russia, Air-Sea Exchange (WCRP member)
Jan 2007:	To Depart - Nominee-	Bill Miller, USA, Photochemistry David Kieber, USA, Photochemistry
	To Depart - Nominee-	Doug Wallace, Germany, Greenhouse gases, Air-sea exchange Cliff Law, New Zealand, Trace gas exchange and nutrients
	To Depart - Nominee-	Ken Denman, Canada, Biogeochemical modeling Veronique Garcon, France, Ecosys. dynamics, biogeochemistry

Significant change in SSC composition is anticipated at the end of 2007 (the timing coincides with two terms of the original members), including the need for selection of a new Chair. This turnover will present new challenges and opportunities for SOLAS.

SOLAS International Project Office

The SOLAS International Project Office (IPO) was established at the University of East Anglia (UEA) in Norwich UK, with five-year funding by the U.K. National Environmental Research Council (NERC).

In June 2005, Dr. Jeffrey Hare was appointed as Executive Officer (EO) of the IPO. Jeff comes to the office from the University of Colorado, where he worked for nearly 10 years as a research marine micrometeorologist in the NOAA Environmental Technology Laboratory in Boulder. In September 2005, Dr. Emily Breviere, formerly of the Centre de Calcul Recherché et Réseau Jussieu at the University of Pierre and Marie Curie in Paris, was appointed as IPO Project Officer. Ms. Georgia Bayliss-Brown recently received her BS degree in Environmental Sciences from UEA and is now working part-time in the IPO as a Research Assistant.

National Networks

A number of 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. Activity within the nation should accelerate if the proposed national joint Land-Ocean Interaction in the Coastal Zone (LOICZ) / SOLAS office is realized. Australian scientists led and executed the SOLAS-endorsed project, Precursors to Particles (P2P), at the Cape Grim Baseline Air Pollution Station in January 2006.
- **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 fills that role from the Université Libre de Bruxelles (ULB). This agency has also provided funding for research groups within the nation to consolidate SOLAS research activities into a Cluster. The funding will establish a communications office at ULB, establish a database management strategy, help to coordinate modeling efforts, and assist in the set up of a national website. In May 2005, the 37th Liege Colloquium on Ocean Dynamics focused on Gas Transfer at Water Surfaces (SOLAS Focus 2) and was hosted by Dr. Alberto Borges of the Université Liege. In December 2006, ULB will organize and host a DMS model intercomparison workshop (SOLAS Focus 1). A SOLAS-related expression of intent has been submitted for the International Polar Year (IPY). Christiane Lancelot, of ULB, is a member of the SOLAS SSC.
- **Brazil** – There are four major experimental efforts listed on the SOLAS-BR Web site: (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.
- **Canada** – The C-SOLAS program is the first funded national program within SOLAS, and their five-year funding cycle is now complete. The science program was structured into three inter-related 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) over 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 50) 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. Ken Denman of Fisheries and Oceans Canada (DFO) is a member of the SOLAS SSC.

- **Chile** – A significant amount of SOLAS work in Chile is conducted at the COPAS (Centro de Investigación Oceanográfica en el Pacifico Sur-Oriental) institute in Concepción, with 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 2007, and this collaboration involves significant participation by Chilean SOLAS researchers. Osvaldo Ulloa, of the Universidad de Concepcion, is a member of the SOLAS SSC.
- **China (Beijing)** – China SOLAS has obtained over 1 million US dollars to conduct SOLAS research from 2003-2007, 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. An Asian-SOLAS meeting was conducted in May 2005 in Tokyo, coincident with the SOLAS SSC meeting, and presentations were conducted by scientists from India, Japan, China (Beijing), China (Taipei), and Korea. 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 are planned or 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, and a second ADOES workshop is planned for August 2006. Finally, China will host the next International SOLAS Open Science Conference in Xiamen, on 6-9 March 2007. Guang-Yu Shi of the Institute of Atmospheric Physics in Beijing is a member of the SOLAS SSC.
- **China (Taipei)** – National scientists continue to participate in three major SOLAS activities: 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), the Straight Watch on the Environment and Ecosystem with Telemetry (SWEET), and 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, from the National Central University, has been invited to speak at the 2007 SOLAS Open Science Meeting in Xiamen, China.
- **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. Studies are planned for investigation of the air-sea exchange of aerosols, toward making improvement to existing parameterizations. Lise Lotte Sorensen of the Riso National Laboratory is an invited speaker at the 2007 SOLAS Open Science Meeting in China.
- **France** – Although France has not consolidated their SOLAS research efforts, a SOLAS meeting in Paris in September 2005 has helped to establish a network. French scientists are very active in SOLAS-related research, so the assembly of a national network is an important step. In the past, the French program operated under the moniker of PROOF (acronym for biogeochemical processes in the ocean and fluxes). This program had three main themes: 1) interaction between climatic changes and biogeochemical cycles through the ocean/atmosphere interface, 2) effects of climate change and natural variability on the functional structure of marine ecosystems and on biogeochemical cycles, and 3) calibration of palaeo proxies in the ocean. Eight national SOLAS projects were sponsored by PROOF:

1. ACTION (quantifying seasonal and interannual variations of the air-sea carbon dioxide flux in the Mediterranean Sea),
2. BIOSOPE (biogeochemical and optical properties of trophic regimes in the South East Pacific Gyre during the austral summer),
3. FLEMENCO₂ (estimation of regional air-sea fluxes of carbon dioxide),
4. KEOPS (prediction and response of the Southern Ocean to climate change),
5. OCEVAR (interactions between climate variability and marine biogeochemical cycles on a global scale),
6. POMME (understanding subduction mechanisms in the northeast Atlantic),
7. UVECO (effect of UV radiation on bacterial and phytoplanktonic communities), and
8. DYFAMED (long time-series measurement station with addition of carbon dioxide and other fluxes).

Veronique Garcon, of the Centre National de la Recherche Scientifique (CNRS) has been nominated for membership on the SOLAS SSC.

- **Germany** – German scientists are very active in the SOLAS research regimes, combining institutional (the Max Planck Institutes) and university researchers. The D-SOLAS effort has focused on dust deposition, iron chemistry in aerosols and the sea, biogeochemistry, sulfur and halogen-chemical transformations in the atmosphere, and the air-sea fluxes of nitrogen and carbon compounds. Some efforts have been placed into developing the network, and a proposal has been submitted to the national science agency for consideration. Although the funding level has not been established, this proposal has been successfully accepted. This largely oceanographic program is named Surface Ocean Processes in the Anthropocene (SOPRAN), and it 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. Significantly, 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 are planned for Cape Verde with researchers in the USA. An atmospheric-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 (Institute for Marine Research, Kiel) and Uli Platt (University of Heidelberg) are members of the SOLAS SSC.
- **India** – SOLAS and IMBER collaborate strongly in India, but resources within the nation are limited. Dileep Kumar, from the National Institute of Oceanography, 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 April 2005. Recently, scientists at the University of Galway led a cruise and experimental effort under the Marine Aerosol Production (MAP) moniker.
- **Japan** – Significant progress in the SOLAS-JP network was demonstrated during the mid-2005 Asian SOLAS Workshop, held coincident with the Tokyo meeting of the SOLAS SSC. Research results were presented from the two Sub-Arctic Ocean Enrichment and Ecosystem Dynamics Study (SEEDS) iron enrichment cruises, measurements of bromomethanes and radical molecules in the atmosphere, time-series measurements, modeling of ecosystems, and results from the Studies on Antarctic Ocean and Global Environment (STAGE) experiment. The goals of the SEEDS

experiments were to evaluate iron enrichment as a way of carbon dioxide sequestration and to evaluate the effects of iron enrichment to marine ecosystems, while STAGE is a 5-year series of cruises into Antarctic waters which is in its final year of funding. Other SOLAS activities include the Variability of Marine Aerosol Properties (VMAP) program, which seeks to exploit natural and man-made releases of sulfur compounds for studies of nutrient enrichment, and the Subtropical Nitrogen Fixation Flux Study (SNIFFS) which is due to occur from May to August 2006 in the subtropical North Pacific Ocean. A Joint Japan SOLAS/IMBER workshop was held at Nagoya University in March 2006. SOLAS-JP was recently informed that a major SOLAS/IMBER proposal is funded, although the final level of support is not yet apparent. Shigenobu Takeda and Mitsuo Uematsu, both at the University of Tokyo, are on 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. Kitack Lee, from Pohang University, is a member of the SOLAS-IMBER Carbon Group.
- **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. 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 the SSC was invited to participate. Gerrit DeLeeuw, from the Netherlands Institute for Applied Geoscience (TNO) is a member of the SOLAS SSC.
- **New Zealand** – Scientists from New Zealand, Australia, the United States, Canada, and the United Kingdom participated in the 2004 SOLAS Air-Sea Gas Exchange Experiment (SAGE) to investigate the biological response to iron enrichment and gas transfer with a dual-tracer injection. From this experiment, the New Zealand network has gained strength and is led by scientists from the National Institute for Water and Atmospheric Research (NIWA). 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. Clifford Law of NIWA has been nominated for membership on the SOLAS SSC.
- **Norway** – Norwegian SOLAS at present does not have direct national funding for SOLAS science, but several 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 (EU-CAVASSOO, which includes scientists from the UK, Germany, France, Spain, and Norway). 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. Truls Johanessen, of the University of Bergen and the Bjerknes Centre for Climate Research, is on the SOLAS SSC.
- **Russian Federation** – A national climate program exists, and SOLAS-related studies here include atmospheric anthropogenic gases and chemical components of the Earth climate. The national network has not fully developed, although many researchers are working within SOLAS fields. Sergey Gulev, of the Russian Academy of Sciences, is a member of the SOLAS SSC.
- **Spain** – Specific funding for SOLAS research is not available at the national level, but a working group has been established within the general structure of IGBP-Spain. 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. Isabel Cacho Lascorz, from the University of Barcelona, is a member of the SOLAS SSC.

- **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 National Environmental Research Council (NERC) programme UK-SOLAS was initiated in early 2004 with £11M over 5 years. Eleven Round One projects were selected for funding, and the first annual meeting was held in July 2006. A call for proposals for research in halogen dynamics resulted in two funded projects, and an additional project received funding under Knowledge Transfer. Funding has also been approved for the installation of a 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. Peter Liss (Chair) and Tim Jickells, both of the University of East Anglia, are members of the SOLAS SSC.
- **United States** – The U.S. program is in the final stages of science and implementation plan development and network solidification. There are plans for a process-study oriented cruise in the Southern Ocean for early 2008. Funding for US-SOLAS is expected to come from the 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. SSC members from the United States include Wade McGillis (Lamont-Doherty Earth Observatory), Bill Miller (University of Georgia), Paty Matrai (Bigelow Laboratory for Ocean Sciences), and Barry Huebert (University of Hawaii).
- **Europe** – SOLAS research is very strong across the continent, with over 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. 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.

Other Activities

SOLAS International Summer School

Seventy-five students and 24 lecturers attended the first SOLAS International Summer School, which was held in June 2003. Corinne LeQuere (UK), Veronique Garcon (France), and the IPO are responsible for planning and operation of the Summer School, which is held biennially at the Institut d'Etudes Scientifiques de Cargese in Corsica, France. The site provides a unique environment for the Summer School, with academic classrooms, laboratory facilities, and a nearby port. For example, collaborators from France have been able to secure a research vessel for ship-based practical workshops during the Summer School. The 2nd Summer School was held in September 2005, and plans are underway for the 3rd Summer School, scheduled for 22 October – 3 November 2007. The Summer School is highly successful, as self-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 the SSC to be of fundamental importance to the long-term legacy of SOLAS.

Open Science Meeting

Before the establishment of the International SOLAS structure, an Open Science Meeting (OSM) was held in Damp, Germany in the spring of 2001. This conference was largely concentrated on the establishment of the SOLAS Science Plan and on the development of the programme.

The 2004 SOLAS OSM was held in Halifax, Nova Scotia Canada, from 13-16 October. This meeting for all international science contributors was organized by the Canadian SOLAS Secretariat and provided a unique forum for networking. Twenty plenary presentations and more than 175 posters were presented, and the meeting was attended by over 250 scientists and students from 24 countries. The SOLAS SSC made a subsequent decision to follow the format of the Halifax meeting for other OSMs. The unique opportunities to network and establish collaborations are felt to be incredibly useful.

The 2007 SOLAS OSM is planned for 6-9 March in Xiamen, China, and is being organized by local hosts at the University of Xiamen and the IPO. This OSM will again include a relatively small number of plenary talks (21), long poster sessions (posters will be displayed over the duration of the conference), and afternoon discussion and synthesis sessions on topics determined to be of importance by the community. We are looking forward to this exciting event, and the IPO has requested \$8k from SCOR to help bring scientists and students from less developed nations to the conference.

Other Projects

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 Implementation Plan for ocean carbon research (SOLAS IMP3). With the International Global Atmospheric Chemistry (IGAC) project, 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) project, including projects to investigate air-sea fluxes of gases in nearshore regions.

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

The Atmosphere-Ice Chemical Interactions (AICI) Task Team is a jointly endorsed venture under IGAC and SOLAS and has issued a science plan and is strategically positioned for the International Polar Year (IPY; March 2007 - March 2009).

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.

In conjunction with the International Nitrogen Initiative (INI), SOLAS has endorsed a review of anthropogenic nitrogen impacts on the open ocean. This review will generate a published paper explaining the state of the science and the outstanding scientific issues that must be addressed. A four-day workshop is planned for UEA in Norwich (UK) for November 2006, and SCOR is generously providing funds for this activity.

SOLAS is sponsoring a dimethylsulfide (DMS) model intercomparison workshop for over 20 scientists at the Université Libre de Bruxelles (ULB) in December 2006. The development of this workshop is a direct result of the afternoon discussion sessions during the 2004 OSM in Halifax.

Special SOLAS sessions were conducted at the February 2006 American Geophysical Union / American Society of Limnology and Oceanography / The Oceanography Society (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 is scheduled for the 2007 Fall AGU Meeting in San Francisco, and a joint IMBER/SOLAS special session will be held at the 2007 EGU General Assembly in Vienna.

SOLAS is sponsoring a workshop entitled "Modeling iron biogeochemistry and ocean ecosystems" at the October

2006 North Pacific Marine Science Organization (PICES) Annual Meeting in Yokohama, Japan.

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 20 scientists 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, and the final draft of the synthesis paper is expected very soon.

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.

The SOLAS SSC Executive Committee and the three SOLAS Implementation Groups met during the February 2006 AGU/ASLO/TOS Ocean Sciences Meeting in Honolulu. The next meeting of the full SSC will take place on 4-5 March 2007 in Xiamen, China, before the SOLAS OSM in the same city.

Capacity Building and Inclusion of Less Developed 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. Without this support, SOLAS would not be able to pursue the capacity building engendered by this activity.

The SOLAS IPO is developing the lectures from the summer school into an online learning tool and to develop 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 one.

With our Open Science Meeting to occur in March 2007, SOLAS has made a request to SCOR to support the participation of scientists and students from less developed economies. SOLAS has also requested funds for participation in the OSM from the Chinese government agencies, U.S. funding agencies (NASA, NOAA, and NSF), APN, IAI, PICES, ACCENT, etc.

Jeffrey Hare
Emily Breviere

Annex 9 – GEOTRACES Project

GEOTRACES PLANNING GROUP
ANNUAL REPORT TO SCOR 2005/2006
July 2006

SCOR planning group for GEOTRACES

Co-Chairs

Robert F. Anderson, USA
Gideon M. Henderson, UK

Other Full Members

Martin Frank, Germany
Toshitaka Gamo, Japan
Catherine Jeandel, France
William J. Jenkins, USA
Tim Jickells, UK
Seth Krishnaswami, India
Denis Mackey, Australia
J. Keith Moore, USA
Raymond Pollard, UK
Reiner Schlitzer, Germany

Associate Members

Jess Adkins, USA
Per Andersson, Sweden
Edward A. Boyle, USA
Greg Cutter, USA
Minhan Dai, China
Hein de Baar, Netherlands
Anton Eisenhauer, Germany
Roger Francois, Canada
Chris German, UK (moving to USA)
Pere Masque, Spain
Chris Measures, USA
Jim Moffett, USA
Kristin Orians, Canada
Andreas Oschlies, UK
Mukul Sharma, USA
Karen von Damm, USA
Michiel Rutgers van der Loeff, Germany
Jing Zhang, Japan

Development of Science Plan for GEOTRACES

The primary goal of GEOTRACES SCOR planning group activity over the last year has been to complete our Science Plan. A draft of the Science Plan was sent out for review by SCOR in July 2005. Substantial reviews were received from nine anonymous referees. The planning group drafted a comprehensive response to these reviews. That response was presented to SCOR and, following approval from SCOR, it was used as a basis for revising the Science Plan. The revised Science Plan was approved by SCOR in January 2006.

Members of the planning group made further revisions to the text and figures in February and March, after which the document was forwarded to the printers (Clyvedon Press, UK). During the two months leading up to the writing of this report, members of the planning group, with tremendous help from Ed Urban, have reviewed and revised three drafts of the galley proofs. We anticipate that the final changes will be implemented in early August, and that printed copies will soon be available for distribution.

SCOR meetings

- The full SCOR Planning Group did not meet during the past year. Business has been handled via e-mail.
 - Two subcommittees established by the planning group met during the past year, with travel support provided by SCOR:
- i) *Standardisation and Intercalibration*: During the meeting of the full planning group held in Vienna, Austria (May 2005), Greg Cutter (Old Dominion University, USA) was asked to lead a subcommittee on Standards and Intercalibration. That committee met at the IAEA laboratory in Monaco (24-25 October 2005) and produced a set of recommendations that have been embodied in a report that was circulated among planning group members for comments. The report was revised based on those comments, and is now posted on the GEOTRACES web site (www.geotraces.org) for review by the broader community. Building on the recommendations from that report, Cutter and colleagues are preparing a proposal to the U.S.

NSF to be submitted 15 August 2006, to secure ship time and major infrastructure (e.g., trace metal-clean rosette systems) to host an international intercalibration cruise. The format of the cruise is planned to follow that used during the intercalibration for iron that was conducted as part of the SAFE program.

- ii) *Data Management*: During the meeting of the full planning group held in Vienna, Austria (May 2005), Raymond Pollard (National Oceanography Centre, UK) and Chris Measures (University of Hawaii, USA) were asked to lead a subcommittee on Data Management. That committee met at the British Oceanographic Data Centre, Liverpool, UK (30 Nov. – 2 Dec., 2005) and produced a set of recommendations that have been embodied in a report that was circulated among planning group members for comments. The report was revised based on those comments, and is now posted on the GEOTRACES Web site (www.geotraces.org) for review by the broader community.

Future issues

The GEOTRACES Planning Group has nearly completed its mission of creating a Science Plan. GEOTRACES is in the process of replacing the planning group with a Scientific Steering Committee. At the time of the writing of this report, 17 of the 19 individuals who were invited to serve on the SSC have either agreed, or have recommended an alternate. As soon as we have a decision from the last 2 people, a list of names will be forwarded to SCOR for review, comment, and approval.

Links with other programmes

Throughout the planning of GEOTRACES we have maintained close linkages to other programmes in order to maintain synergies and to avoid replication. Major links have been established with

- *SOLAS*, was represented on the GEOTRACES planning group by Tim Jickells (University of East Anglia, UK). Jickells has chosen not to serve on the GEOTRACES SSC, but rather to continue serving in a non-SSC capacity as a liaison between GEOTRACES and SOLAS.
- *IMBER*. Raymond Pollard is a member of both the GEOTRACES Planning Group and the IMBER SSC. The IMBER SSC and the GEOTRACES planning group have agreed that, in the future, Jay Cullen (University of Victoria, Canada) will serve as the liaison between IMBER and GEOTRACES. Continuing with the tradition started in 2004, Gideon Henderson (co-chair of the GEOTRACES Planning Group) attended the 2006 IMBER SSC Meeting (Brest, France, May 2006).

Developments at national and international levels

During the transition between the planning group and the SSC, we do not have a complete report of national and regional activities. Following is a partial list:

- A combined GEOTRACES planning meeting for China and for the western Pacific region was held in Xiamen, China during the last week of August 2005 (Minhan Dai, host and contact). More than 40 scientists participated, primarily from China, but with representatives as well from Taiwan, Hong Kong, South Korea and Japan.
- Several national proposals have been submitted for cruises in both the Arctic and Southern oceans during the International Polar Year (IPY). Hein de Baar (The Netherlands) is coordinating GEOTRACES IPY activities.
- The first GEOTRACES cruise occurred in November 2005, while the *Polarstern* was en route from Germany to the Southern Ocean. This cruise initiated the process of developing analytical protocols and the intercalibration of methods that will be essential to the generation of internally consistent data throughout the GEOTRACES program (contact person Michiel Rutgers van der Loeff, AWI, Germany).
- A major proposal was submitted to NERC (UK) on 1 July 2006 for a Consortium Award to repeat the Atlantic Meridional Transect as a GEOTRACES cruise (contact Gideon Henderson, The University of Oxford).
- A proposal to the U.S. NSF to establish a U.S. GEOTRACES project office has been recommended for funding. To the extent permitted by available resources, the 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).

GEOTRACES: Spreading the word

We have strived to engage the wider research community through publications, special sessions, and open meetings at international research conferences.

Publications:

- Anderson, R.F., and G.M. Henderson. 2005. GEOTRACES: A global study of the marine biogeochemical cycles of trace elements and their isotopes. *Oceanography* 18(3):76-79.

Conferences:

- An open “town meeting” will be held during the Fall meeting of the American Geophysical Union (11 December 2006, San Francisco). The general purpose of the meeting will be 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 planning and implementation of the GEOTRACES program. A specific mission for this meeting will be to encourage people to participate in the intercalibration effort that is being launched at this time. We believe that the intercalibration of sampling and analytical methods used to measure trace elements and their isotopes in seawater will be of great value to the oceanographic community, regardless of the level to which participants in the intercalibration are involved later in GEOTRACES cruises.
- A special session entitled “Marine Biogeochemical Cycles of Trace Elements and Isotopes: From Regional to International Networks” was held at the Western Pacific Geophysical Meeting, Beijing, China, on 24-27 July 2006. The session was well attended, and the strong showing has reportedly helped convince NSF-China to begin supporting GEOTRACES planning activities.
- A special session entitled “Evolution of ocean chemistry: Past, present and future” will be held at the 2006 Goldschmidt Conference, Melbourne, Australia, 27 August - 1 September 2006.

Acknowledgements

We offer our special thanks to Ed Urban, who has made a heroic effort to help finalize the GEOTRACES Science Plan while also providing excellent organization and logistics support for the GEOTRACES committee meetings.

Budget for GEOTRACES

	2005	2006	2007
Carry-over	\$28,508	\$27,839	\$25,839
Income			
<hr/>			
SCOR			
NSF	\$29,167	\$50,000	\$50,000
Other nations?			
LDEO (Boston Meeting)			
IAEA			
Total Income	\$57,675	\$77,839	\$75,839
Expenses			
<hr/>			
Publications	\$10,000		
Representation at meetings		5000	8000
Oxford Meeting			
Boston-LDEO			
Boston-SCOR			
Vienna Meeting	\$0		
SSC Meeting		\$25,000	\$25,000
Exec. Comm. Meeting?			
DM Comm. Meeting	\$8,887	\$10,000	\$10,000
Stds/Protocol Meeting	\$10,949	\$12,000	\$12,000
Cruise Planning Meeting?		??	??
Other?		??	??
Total Expenses	\$29,836	\$52,000	\$55,000
Balance	\$27,839	\$25,839	\$20,839

Annex 10 – Post-Audit Financial Statement for 2005

	Discretionary Funds	Grants & Contracts	Total
Income			
Membership Contributions	\$256,680		\$258,680
IOC Contracts - SOLAS		\$7,000	\$7,000
IOC Contracts - IOCCP		\$5,500	\$5,500
Sloan - Ocean Technology	\$6,000	\$38,137	\$44,137
IGBP Contribution to IMBER		\$19,480	\$19,480
IGBP Contribution to SOLAS		\$39,664	\$39,664
NOAA support for GEOHAB		\$24,000	\$24,000
NSF Grants - Travel	\$5,000	\$52,115	\$57,115
NSF Grants - Geosciences	\$40,000	\$295,711	\$335,711
Registration Fees:			
GEOHAB OSM	\$3,039	\$23,887	\$26,925
Ocean in High CO2 World	\$8,487	\$500	\$8,987
Ocean Mixing	\$6,216	\$256	\$6,472
SOLAS Summer School		\$27,958	\$27,958
WG 119	\$11,016	\$23,619	\$34,635
WG 123		\$2,805	\$2,805
SOLAS Misc. Income		\$13,755	\$13,755
Miscellaneous & Interest Income	\$4,794		\$4,794
Total Income	\$343,232	\$574,388	\$917,620
Expenses			
WG 78 reprint	\$3,000		\$3,000
WG 116 - Sediment Traps	\$14,156		\$14,156
WG 119 Symp. publication		\$23,619	\$23,619
WG 120 - Phaeocystis	\$12,371		\$12,371
WG 121 - Ocean Mixing		\$256	\$256
WG 122 – Sed. Retention	\$5,981		\$5,981
WG 123 - PACE	\$15,632	\$2,805	\$18,437
WG 124 - LINKS	\$15		\$15
WG 125 - Zooplankton	\$8,798		\$8,798
GEOHAB		\$68,258	\$68,258
GEOTRACES		\$50,102	\$50,102
GLOBEC		\$106,567	\$106,567
IMBER		\$63,470	\$63,470
SOLAS		\$115,070	\$115,070
C02 Panel / IOCCP		\$27,322	\$27,322
Carbon Sequestration		\$16,463	\$16,463
Sloan Project Coord. Mtg.		\$14	\$14
Sloan Ocean Tech. Panel	\$6,000	\$38,123	\$44,123
SCOR-SCAR joint activities:			
Expert Group	\$3,779		\$3,779
Joint Session at IAPSO/IABO	\$2,178		\$2,178
SCOR Annual Meetings	\$37,148		\$37,148
Representation	\$9,847		\$9,847
NSF Travel Grants	\$5,000	\$52,115	\$57,115
Publications	\$10,617		\$10,617
Advertising	\$610		\$610
Office Equipment	\$3,360		\$3,360
Salaries & Benefits	\$129,644		\$129,644
Less Sals Allocated to Programs	(\$11,000)		(\$11,000)
Outside Services	\$15,488		\$15,488
Accounting Services	\$2,200		\$2,200
Audit and tax return	\$8,273		\$8,273
Bank Charges/Bad Debt Exp.	\$1,245	\$205	\$1,450
Miscellaneous	\$3,462		\$3,462
Meeting Management System	\$1,796		\$1,796
Communications	\$4,474		\$4,474
JHU - Indirect Expenses	\$23,520		\$23,520
Total Expense	\$317,593	\$564,389	\$881,981

Beg. Unrestricted Net Assets	\$211,098	
Income - Expenses	\$25,639	
Ending Unrestricted Net Assets	\$236,737	agrees with 2005 audit report

Annex 11 – SCOR-Related Meetings (2005-2007)

2005

February 14-16	Panel on New Technologies for Observing Marine Life	Goa, India
March 7-11	GEOHAB OSM on HABs and Eutrophication	Baltimore, Maryland, USA
March 20-23	SCOR/IMAGES WG 123 Workshop on Past Ocean Circulation	Atlanta, Georgia, USA
April 18-21	WG 116 on Sediment Trap and Th-234 Methods for Carbon Export Flux Determination	Xiamen, China
April 18-22	IMBER Scientific Steering Committee Meeting	Shanghai, China
May 1-3	GEOTRACES Planning Committee	Vienna, Austria
May 30-June 1	SOLAS Scientific Steering Committee	Tokyo, Japan
June 1-3	GLOBEC Scientific Steering Committee Meeting	Rome, Italy
June 20	WG 126 on Role of Viruses in Marine Ecosystems	Santiago de Compostela, Spain
June 23-25	WG 122 on Mechanisms of Sediment Retention in Estuaries	Texel, The Netherlands
Aug. 29-Sept. 1	SCOR Executive Committee Meeting	Cairns, Queensland, Australia
30 Aug.-Sept. 4	WG 120 Conference on <i>Phaeocystis</i> : Major Link in the Biogeochemical Cycling of Climate-Relevant Elements	Haren, The Netherlands
October 24-25	GEOTRACES Standards Committee	Monaco
November 6	SCOR Panel on New Technologies for Observing Marine Life	Frankfurt, Germany
November 7-9	WG 125 on Global Comparisons of Zooplankton Time Series	Silver Spring, Maryland, USA
Nov. 30-Dec. 2	GEOTRACES Data Management Committee	Liverpool, UK
December 5-8	GEOHAB OSM on Harmful Algal Blooms and Stratification	Paris, France
December 13	POGO/SCOR Meeting on Research Vessel Database	Silver Spring, Maryland, USA
December 5-6	WG 124 on Analyzing the Links Between Present Oceanic Processes and Paleo-records	San Francisco, California, USA

2006

18-21 January	GEOHAB Core Research Project Subcommittee on HABs in Upwelling Systems	Villefranche, France
23-25 January	GEOHAB Scientific Steering Committee	Villefranche, France
6-7 April	WG 128 on Natural and Human-Induced Hypoxia and Consequences for Coastal Areas	Vienna, Austria
8-12 April	Workshop on Phytoplankton Pigments in Oceanography	Monaco
25-27 April	GLOBEC Scientific Steering Committee	Honolulu, Hawaii, USA
2-5 May	Working Group 127 on the Equation of State of Seawater	Warnemünde, Germany
8-10 May	SOLAS Scientific Steering Committee	Amsterdam, Netherlands
10-12 May	IMBER Scientific Steering Committee	Brest, France
19-20 May	WG 115 on Standards for the Survey and Analysis of Plankton	Plymouth, UK
1-3 June	Virus Ecology in Marine Systems: A Workshop on Methods	Victoria, B.C., Canada
10-11 July	SCAR/SCOR Group on Experts on Oceanography	Hobart, Australia
28-30 September	IGBP-SCOR Fast Track Initiative Meeting on Atmospheric CO ₂ and Ocean Biogeochemistry: Modern Observations and Past Experiences	Palisades, NY, USA
18-20 October	SCOR Panel on New Technologies for Observing Marine Life	Kobe, Japan
23-26 October	SCOR General Meeting	Concepción, Chile
24-26 October	Workshop on Oxygen Minimum Systems in the Ocean: Distribution, Diversity and Dynamics	Concepción, Chile
17-20 November	SOLAS/INI Workshop on Anthropogenic Nitrogen Impacts on the Open Ocean	Norwich, UK

21-24 November	SCOR/IMAGES WG 124 on Analysing the Links Between Present Oceanic Processes and Paleorecords (LINKS)	Delmenhorst, Germany
4-7 December	WG 125 on Global Comparisons of Zooplankton Time Series	Lima, Peru
7-9 December	SCOR Summit of International Marine Research Projects	London, UK
16-18 December	GEOTRACES Scientific Steering Committee Meeting	San Francisco, CA., USA

2007

26-27 February	Planning Committee for Second Symposium on The Ocean in a High-CO ₂ World	Monte Carlo, Monaco
4-5 March	SOLAS SSC Meeting	Xiamen, China
6-9 March	SOLAS Science 2007	Xiamen, China
12-14 March	GEOHAB SSC Meeting	Tokyo, Japan
15-16 March	Asian GEOHAB Meeting	Tokyo, Japan
11-14 April	Surface Ocean CO ₂ Variability and Vulnerabilities	Paris, France
7-11 May	SCOR/IAPSO Working Group 127 on Thermodynamics and Equation of State of Seawater	Reggio Calabria, Italy
7-12 May	WG 126 on The Role of Viruses in Marine Ecosystems	Bergen, Norway
24-26 May	GLOBEC SSC Meeting	Hiroshima, Japan
26 May	WG 125 on Global Comparisons of Zooplankton Time Series	Hiroshima, Japan
2-3 June	WG 130 on Automatic Plankton Visual Identification	Hiroshima, Japan
14-15 June	IMBER SSC Meeting	Victoria, B.C., Canada
26-29 June	GEOTRACES Pacific Basin Cruise Planning Meeting	Honolulu, Hawaii, USA
7 July	WG 121 on Ocean Mixing	Perugia, Italy
10-11 July	WG 129 on Deep Ocean Circulation with the Shelf	Perugia, Italy
26-28 August	SCOR Executive Committee Meeting	Bergen, Norway
10-12 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
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