



SCOR Proceedings
Volume 45

Beijing, China

October 2009

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October 2008 - October 2010

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ISSN 0253-2808

INTERNATIONAL COUNCIL FOR SCIENCE

**PROCEEDINGS
OF THE
SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH**

September 2010
Newark, DE USA

Support for SCOR activities (including international project offices) in 2009 came from the membership contributions of national SCOR committees and from the following organizations and agencies:

Alfred P. Sloan Foundation
British Oceanographic Data Centre
Brittany Region government (France)
Centre National de la Recherche Scientifique (France)
Institut de Recherche pour le Développement (France)
Institut Universitaire Européen de la Mer (France)
Intergovernmental Oceanographic Commission of UNESCO
International Geosphere-Biosphere Programme
National Aeronautics and Space Administration (USA)
National Science Foundation (USA)
 Division of Ocean Sciences
Natural Environment Research Council (UK)
University of East Anglia (UK)
University of Plymouth (UK)

Additional copies of this publication are available from:

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This report is available in pdf format at <http://www.scor-int.org>.

SCOR Proceedings, Volume 45
REPORT OF THE 39th SCOR EXECUTIVE COMMITTEE MEETING

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39th SCOR EXECUTIVE COMMITTEE MEETING¹

Beijing, China

20-22 October 2009

1.0 OPENING

1.1 Opening Remarks and Administrative Arrangements

Wolfgang Fennel opened the meeting by asking participants to introduce themselves. Huasheng Hong and Ed Urban made a few logistical announcements. A moment of silence was observed for individuals previously involved in SCOR who had died since last year's SCOR meeting: Wolfgang Krauss (Germany), Allan Robinson (USA), and Warren Wooster (USA).

1.2 Approval of the Agenda

There were no additions or modifications to the agenda.

1.3 Report of the SCOR President

Wolfgang Fennel briefly reviewed his activities since the SCOR Executive Committee Meeting in October 2008 in Woods Hole. He represented SCOR at two meetings during the past year, the IGBP-SC meeting in Japan and the Third SCOR Project Summit in Delaware at the end of March. Fennel also made contact with Croatia regarding a membership in SCOR, with the assistance of Bjørn Sundby.

1.4 Report of SCOR Executive Director

Ed Urban reported on his activities since the 2008 SCOR meeting, and on the financial health of SCOR. Membership dues were coming in more slowly than normal this year, possibly due to the worldwide economic conditions. However, SCOR's financial situation continued to be stable, thanks to conservative budgeting and good financial management.

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 reviewed the administration of 2008 and 2009 SCOR finances, and proposed a budget for 2010 activities. Johan Rodhe, Motoyoshi Ikeda, and Riitta Autio served on the Finance Committee. They received the annual audit report and other financial information in advance of the meeting and Johan Rodhe reported on behalf of the committee on the final day of the SCOR meeting (see section 8.3).

¹This Proceedings is based on notes taken by Lora Carter and Elizabeth Gross, which Ed Urban edited and supplemented with submitted documents and PowerPoint presentations from the meeting.

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 when the next request for working group proposals is distributed. Peter Burkill agreed before the meeting to chair the Disciplinary Balance Committee and Missy Feeley and Roberto Purini worked with Burkill and reported back at the end of the SCOR meeting (see section 8.4)

1.7 2010 Elections for SCOR Officers

Bjørn Sundby, as Past President, is responsible to chair the Nominating Committee for 2010 elections. By the end of the meeting, a nominating committee was assembled. This committee will solicit nominations for SCOR Officers according to the procedure described as an appendix to the SCOR Constitution. Sundby noted that he would need to identify two additional individuals to serve on the committee by the end of the meeting. All three Vice-President positions and the Secretary position are open, although Missy Feeley is eligible to serve another two-year term as Vice-President. The final composition of the Nominating Committee is giving under agenda item 8.1

2.0 WORKING GROUPS

2.1 Disbanded Working Groups

2.1.1 WG 78—Determination of Photosynthetic Pigments in Seawater

Ed Urban reported that the book *Phytoplankton Pigments: Updates on Characterization, Chemotaxonomy and Applications in Oceanography* is nearly completed, except for two chapters. Cambridge University Press has decided to publish the book and is awaiting the manuscript. Urban noted that the original book was a classic for biological oceanography, so there is good reason to expect that the next book will also be.

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 on actions to be taken. Meeting participants made preliminary decisions, based on the progress of working groups and the merits of the requests, about whether funding should be provided for 2010 activities of working groups that requested funds. The Finance Committee took into account the recommendations of the Executive Committee as it developed the 2010 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

Lawrence Mysak noted that the group is developing a book entitled *Coupled Coastal Wind-Wave-Current Dynamics*, which will be published by Cambridge University Press. One of the co-chairs, Chris Mooers, is taking responsibility for the book and is waiting for revisions to one

chapter. It is expected that the book will now be delivered to the publisher by January 2010. Mysak agreed to send an e-mail to Mooers to urge completion.

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

Bjørn Sundby reported that the group met for its final time on 23-27 September 2007 at the University of Colorado, Boulder, Colorado, USA. The meeting concentrated on completing the Terms of References of the group and defining the publication of its findings in a special issue of *Estuarine, Coastal and Shelf Sciences*.² Seven papers have been submitted for the special issue already and two more are expected. The papers should be available, at least online, by the end of 2009. The meeting approved disbanding the group when the publication is completed.

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

John Compton reported that the group met for the final time on 20–24 November 2006, in Delmenhorst, Germany. The group has downscaled its plans from 5 review papers to one review paper, based on Karin Lochte's presentation last year at the SCOR 50th Anniversary meeting and some of the texts already written by the members in preparation of the originally planned manuscripts. Dieter Wolf-Gladrow, Christine Klaas, and Lochte will prepare the outline of the review paper and seek input from working group members. They are creating the outline now, will seek input from November until March, and will finalize and submit the publication in June. John Compton will urge the group to finish and will contact working group members to suggest that Marie-Alexandrine Sicre take over as full chair to finish the review paper or suggest an alternate for approval by the Executive Committee.

2.2.4 WG 125—Global Comparisons of Zooplankton Time Series

Ed Urban reported that the group held its final meeting in May 2008 in Gijon, Spain, before the symposium on "Effects of Climate Change on the World's Oceans". The group presented one jointly authored summary paper in the symposium plenary session on "Impacts on Marine Ecosystems," and also held a one-day workshop session on zooplankton time series. Fourteen papers from the working group have been submitted for a special issue of *Progress in Oceanography* (editor-in-chief Cisco Werner has given pre-approval for a special issue, and Pierre Pepin has agreed to serve as "arms-length" guest editor for the issue). Publication is expected in early 2010. Papers will be available in pdf format on the Web before they are published in hard copy. Meeting participants approved some funding for color printing in the special issue and disbanding the group when its special issue is published.

2.2.5 WG 126—Role of Viruses in Marine Ecosystems

Jorma Kuparinen reported that the group held its final meeting on 14-16 May in Newark, Delaware (USA), as a community workshop (see http://www.scor-int.org/Working_Groups/WG126Symposium-2.pdf). Seventy-seven individuals participated. The workshop included a large number of young scientists. The group has been focusing on the production of an online, freely available publication currently entitled *Methods in Aquatic Virus Ecology*.³ The special volume (funded by the Gordon and Betty Moore Foundation) will be

²Mechanisms of Sediment Retention in Estuaries. Special issue of *Estuarine, Coastal and Shelf Science*, Volume 87(2):175-366.

³<http://aslo.org/books/mave/>

assembled and published by ASLO. Chapters have been identified, and papers submitted. Several chapters are in press and proofs are being made. Only a couple of chapters remain in the review revision pipeline, and the project should be completed by the end of 2009. The meeting approved disbanding the group when the publication is completed. Peter Burkill suggested a press release or some avenue to recognize SCOR's assistance with this project and another suggestion was for an article in *Oceanography* magazine.

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

Lawrence Mysak reported that the fourth and final meeting of the Working Group was held on 2-5 September 2009 in Arnhem, the Netherlands, funded by NOAA and IOC. Steffen Seitz (Germany) was added as an Associate Member because of his expertise and his contributions to the group. During the past year, the International Thermodynamic Equation of Seawater 2010 (TEOS-10) was adopted as the standard definition of seawater for engineering purposes by the International Association of the Properties of Water and Steam and by the Intergovernmental Oceanographic Commission (IOC) of UNESCO as the oceanographic definition of seawater. During this past year WG127 has also progressed many of its publications, including the creation of the TEOS-10 Web site (<http://www.teos-10.org>) and the writing of a comprehensive TEOS-10 manual. UNESCO/IOC plans to publish this TEOS-10 manual in 2010.⁴ The group has requested extension to 31 December 2010 so they can continue to serve as a source of advice regarding the introduction of the new standard. Mysak recommended that both SCOR and IAPSO encourage the use of TEOS-10. The meeting approved the group's request for an extension until 31 December 2010.

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

Peter Burkill reported that the group decided to publish its papers in a special issue of *Biogeosciences*.⁵ The deadline for submission was 31 August and 10 papers were submitted and are available for discussion. Since some of the papers are rather lengthy, the group requested permission from SCOR to pay for page charges in lieu of having a third meeting. SCOR agreed to this proposal last year. Meeting participants agreed to disband the group when its publication is completed.

2.2.8 SCOR/IAPSO WG 129 on Deep Ocean Exchanges with the Shelf

Lawrence Mysak reported that the papers from the group's 2008 workshop in Cape Town, South Africa will be published in *Ocean Science*; five have been submitted so far and 8 more are expected. Completion is expected in 2010.⁶ The group's final meeting and a special symposium were held in mid-2009, in conjunction with the MOCA'09 meeting in Montreal. The group has requested help from SCOR in finding funding for a student to help establish a database and maps. Meeting participants agreed to keep the group open for another year to try to help them achieve their goal of producing a World Shelf Atlas. Ed Urban will try to identify someone at the University of Delaware who could help with this task.

⁴http://www.teos-10.org/TEOS-10_Manual_08Aug10.pdf

⁵http://www.biogeosciences.net/special_issue34.html

⁶http://www.ocean-sci.net/special_issue18.html

2.2.9 SCOR WG 130 on Automatic Plankton Visual Identification

Peter Burkill reported that this group met for the third time (two times with SCOR funding) in May in Baton Rouge, Louisiana, USA. The group discussed the progress of its work, as well as papers for a special issue of the *Journal of Plankton Research*. A pre-meeting Zooscan workshop provided an opportunity for participants to learn how to use this instrument to process mesozooplankton samples. Plans were made to present progress in image classification at the next Zooplankton Production Symposium in Chile, at the ASLO Aquatic Sciences Meeting in Puerto Rico, and at the ICES Annual Scientific Conference in 2010. The group's final meeting will be held at one of these venues. Burkill will inform the group of funds for 2010 meeting and will ask for a clarification of the expected outcome of the meeting. He suggested a synthesis paper to wrap up the group's work.

2.2.10 SCOR WG 131 on The Legacy of in situ Iron Enrichment: Data Compilation and Modeling

Michael MacCracken reported that the group is still represented by two co-chairs, Philip Boyd (New Zealand) and Dorothee Bakker (UK). SCOR has postponed appointment of the remaining members of the group or analysis of the data compiled until the data compilation is completed. Until now, SCOR has provided partial funding for a post-doctoral fellow to gather data and metadata, and to work with the open-access Biological and Chemical Oceanography Data Management Office (BCO-DMO) at Woods Hole. The status of the input of each data set was shown in the meeting background papers. MacCracken will urge the group to get all data sets in before having a meeting. Ed Urban will get another report from Stephen Gregg (WHOI) to see what data are in hand before they meet. Participants suggested that SCOR give the group \$15,000 for a modeling workshop in 2010, then \$13,000 for a final meeting, to use the \$28,000 available. MacCracken added that the group should get the two available data sets for natural iron additions, as well, for comparison. The group also needs to provide the membership nominations. Urban will check with the co-chairs to see if old membership nominations are still appropriate for what they are planning to do.

2.2.11 SCOR/LOICZ WG 132 on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems

Jorma Kuparinen reported that this group is being co-funded by the Institute of Oceanology of the Chinese Academy of Sciences and the Land-Ocean Interactions in the Coastal Zone project, with some remaining funding added by SCOR. They have made good progress on their work, starting in mid-2008, and held their second meeting in October 2009, just before the SCOR Executive Committee meeting in Beijing, China. The group plans to hold its final meeting in Crete, Greece, in conjunction with the 14th International Conference on Harmful Algae. Ed Urban reported that he attended one day of the group's Beijing meeting. They have three papers submitted to peer-reviewed journals and three more planned by the end of the group's work, so they are making good progress. Funding was approved for the group's 2010 meeting.

2.2.12 SCOR/IAPSO WG 133: OceanScope

Missy Feeley reported that the OceanScope working group met for the first time in July in conjunction with the MOCA'09 meeting in Montreal. The meeting began with discussions of science, vessel, and instrumentation issues, to bring all of participants up to a common frame of

knowledge about the issues likely to define and constrain the development of the OceanScope paradigm. Participants worked through each of the terms of references (ToRs) and homework assignments were developed for each of the ToRs, determining if they covered all the relevant issues. The group will meet for the second time in April 2010 at the International Council for Shipping in London. Earlier in 2009, the SCOR Executive Committee approved addition of an 11th Full Member to the group to include expertise from the Continuous Plankton Recorder community. Funding was approved for the 2010 meeting. Lawrence Mysak commented that he attended the first meeting and the group got off to excellent start.

2.2.13 SCOR WG 134 on The Microbial Carbon Pump in the Ocean

Bjørn Sundby reported that this working group will meet for the first time in Xiamen, China, on 27-30 October, in the week after the SCOR Executive Committee meeting. The meeting will include presentations by participants around the theme of “Bridging biology and chemistry in ocean carbon sequestration”, relating how the expertise of each member can contribute to the group’s terms of reference. Detailed plans will be made for how the terms of reference will be achieved in the remainder of the group’s life. The group will not meet in 2010.

2.2.14 SCOR/InterRidge WG 135 on Hydrothermal energy transfer and its impact on the ocean carbon cycles

Missy Feeley reported that this group will meet for the first time in Woods Hole (USA) on 23-24 November 2009. Main points to be discussed will be the strategies to address the group’s terms of reference and the definition of a preliminary agenda for the next three years. This will include the definition of sub-groups (water column, deep-biosphere, seafloor ecosystems) and the links with initiatives like GEOTRACES, IODP, and any future programmes emerging from the Census of Marine Life (CoML) beyond 2010. The group also will develop the 2011 workshop organization committee and will discuss the venue of the workshop. The group will not meet in 2010.

As a general comment on SCOR working groups, Motoyoshi Ikeda commented that SCOR should spread more good publicity about successful groups.

2.3 New Working Group Proposals

Six working group proposals were received by the SCOR Secretariat; one was withdrawn before the meeting. SCOR agreed to fund two new working groups to begin in 2010.

2.3.1 Working Group on Evaluating the Ecological Status of the World's Fished Marine Ecosystems (INDISEAS)

Peter Burkill was the monitor for this proposal and summarized the input from the various SCOR national committees. The feeling was that the proposal is timely and highly international, which could make it appropriate for SCOR, but there seemed to be little opportunity for new science. The scope is too big to be accomplished. Two countries were positive about the proposal, but nine were not. In the end, meeting participants agreed not to fund the proposal.

2.3.2 Working Group on Coupled Climate-to-Fish-to-Fishers Models for Understanding Mechanisms Underlying Low-frequency Fluctuations in Small Pelagic Fish

Michael MacCracken was the monitor for this proposal. He noted that a lot has changed in the proposal from last year. Two strong letters of support were received, from PICES and IMBER. MacCracken suggested that maybe IMBER should sponsor the group, rather than SCOR. Lawrence Mysak added that the topic of the proposal is extremely important although cannot be accomplished globally. Ed Urban reported that the paper by Schwartzlose et al.⁷ is one of the two most cited papers from a SCOR working group, so this topic is of great interest. The meeting agreed not to fund the proposal, as advance comments from national SCOR committees and comments made at the meeting were not in favor of funding.

2.3.3 Working Group on Sea Ice Biogeochemistry

Bjørn Sundby noted that the proposal received two letters of support, from the SCAR Antarctica and the Global Climate System Steering Committee and from SOLAS. Sundby thought the proposal was important and interesting. One of the national SCOR committees noted that only three out of the nine proposed Full Members have expertise in sea ice research, although there is a lot of interest in this field. Ed Urban explained that SOLAS has identified seven topics for which they want to stimulate activity, although they do not have the funding to support all seven. Michael MacCracken commented that the topic is interesting, but needs to be broader than air-sea exchange in sea ice areas. As described in the proposal, it is more of a program than a working group. The proposal would need a lot of work before it is fundable. The proposal was not approved by meeting participants.

2.3.4 Working Group on Climatic Importance of the Greater Agulhas System

John Compton, the monitor for this group, summarized the comments from national SCOR committees, which were generally positive. IMAGES submitted a support letter for this proposal and WCRP has agreed to provide some financial support for the group, if approved. Lawrence Mysak added that IAPSO is very much in favor of this proposal and that it falls in the “must fund” category. Compton added that there is strong interest in this proposal from the paleoceanography community and IMAGES has offered its support. Ed Urban responded that the IMAGES support is morale support only, as far as he knows, because there has been no offer of co-funding yet. They believe the project would be scientifically important. Meeting participants agreed to fund the group.

2.3.5 Working Group on Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observation

Jorma Kuparinen reported that the SCOR national committees overall ranked this proposal second, and that PICES and the UNESCO regional office in Perth, Australia submitted a letter supporting this proposal. It was approved by meeting participants.

2.3.6 Wrap-up Discussion

Wolfgang Fennel summarized that the sense of the meeting was that the Agulhas current and phytoplankton time series proposals were most favored for funding, and the sea ice

⁷Schwartzlose, R.A., J. Alheit, A. Bakun. 1999. Worldwide large-scale fluctuations of sardine and anchovy populations. *South African Journal of Marine Science* 21:289-347.

biogeochemistry and Climate to Fishers proposals were in the “might fund” category. It seemed to be a consensus not to fund the INDISEAS proposal. Ed Urban noted that the draft budget for 2010 includes two new groups, but the Finance Committee will need to discuss this. Fennel added that there was not enough funding promised from outside SCOR to make it possible to approve three groups, as was possible last year. The Executive Committee will develop comments to respond to each proposal.

The first discussion concerned what advice to send back to the proponents regarding the proposals that were not accepted, but in the “might fund” category, which SCOR did not have sufficient funding to approve. Michael MacCracken noted that the science included in the sea ice proposal was probably not right and they didn’t have the right people in their proposed membership. Missy Feeley added that the issue of sea ice is an important one, it just wasn’t an appropriate proposal. Many comments on this proposal referred to the need for additional expertise on various aspects of the problem. Corina Brussaard noted that the chair proposed for the sea ice group is a very good organizer. Bjørn Sundby asked about appointing a co-chair. Wendy Broadgate stated that she knows some of the members proposed and thinks they are the right ones. Steffels would be good as a co-chair; she is a member of the SOLAS SSC. Some participants thought that dynamical aspects of the sea ice system were missing. Marie-Alexandrine Sicre pointed out that the climate-to-fishers topic could be dealt with in a large program like IMBER, whereas there is no simple home for the sea ice topic. Although SOLAS could handle this and has identified sea ice as a priority topic, they don’t have funding to do everything they have identified as important.

Turning to the climate-to-fishers proposal, does SCOR still need to do something about this topic? There was extensive discussion about how many times a proposal can be revised and resubmitted, without resolution of the issue. Why wasn’t this topic handled in GLOBEC SPACC? What about the IMBER end-to-end modeling effort as a home for this topic? Ed Urban asked whether SCOR should encourage the two fish-related proposals (climate-to-fishers and INDISEAS) to be resubmitted. John Compton suggested that, for declined proposals, SCOR should send positive and negative comments on all proposals, but stay neutral about resubmitting. SCOR should not encourage resubmission because it would be setting the proponents up for potential disappointment and we don’t know what new topics might be submitted in the next year. Let the proponents decide whether to re-submit. Motoyoshi Ikeda cautioned that SCOR should be careful with proposals coming in for a second time to make sure that comments have really been addressed.

Turning to “Must Fund” group, Wolfgang Fennel stated that both require some revisions regarding scientific and membership issues. The reporters should write to proponents and get responses within a certain time, and re-circulate to the Executive Committee for approval. In terms of the phytoplankton time series proposal, Corina Brussaard noted that they must demonstrate that they can get the data sets submitted within one year before SCOR funds them beyond the first year. They need to demonstrate that they can assemble the data. Meeting participants agreed with this requirement and that continued funding should be reconsidered after one year. Jorma Kuparinen reminded participants that tracking the progress of working groups is the responsibility of their Reporters on the Executive Committee.

Michael MacCracken agreed to write to the climate to fishers group, Bjorn Sundby to the sea-ice group, and Peter Burkill to the INDISEAS group.

3.0 LARGE-SCALE SCIENTIFIC PROGRAMS

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

Peter Burkill reported that GLOBEC held its Third Open Science Meeting in Victoria, Canada in June 2009, which he attended, as well as several other very successful meetings aimed at GLOBEC synthesis. Burkill made remarks at the OSM on behalf of SCOR and Elizabeth Gross made a presentation with Roger Harris about the history of GLOBEC. SCOR issued a declaration of congratulations to GLOBEC for its OSM (see http://www.scor-int.org/2009EC/SCOR_Resolution_on_GLOBEC.pdf). The final GLOBEC SSC meeting will be held near Plymouth, UK in November 2009. (Ed Urban will attend.) Burkill added that GLOBEC is officially ending at the end of 2009. The project lasted more than 10 years. They are putting together a synthesis book to be published in February 2010. The main issue that the SSC needs to be concerned with is the IPO closure process. IGBP is providing GLOBEC with additional funding. GLOBEC also received extra funds from NSF through SCOR to finish outreach items and close properly. There are no particular actions to recommend. SCOR will receive the final project report at next year's meeting. They will need to figure out what to do with the Web site and files, transfer of information, and archiving of financial files. They will make sure there are three copies of important documents in different parts of the world. Urban will suggest that GLOBEC transfer its documents for North American to the libraries at the Woods Hole Oceanographic Institution or the Scripps Institution of Oceanography because they have can handle such historical documents.

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

Huasheng Hong reported that GEOHAB continues to develop its Core Research Projects (CRPs). Reports for the Core Research Project on HABs in Fjords and Coastal Embayments and for Asian GEOHAB are nearing completion. GEOHAB held a successful Modeling Workshop in Galway, Ireland, just after the 2009 SSC meeting. The next SSC meeting is not yet scheduled, but may be held in Hawaii in conjunction with the Open Science Meeting on HABs in Benthic Systems. It took awhile to find the right people to lead this activity, even though it had been discussed for several years. The SSC is working on nominations for new SSC members, starting in 2010. There was no action required for this project. Ed Urban noted that the project does not have an IPO, but the decision has been made to not seek one. Some GEOHAB activities will probably be carried on beyond the end of the project in 2013.

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

Bjørn Sundby reported that the IMBER SSC met most recently in June 2009 at IOC Headquarters in Paris, France. They named a new Executive Officer in the past year, Lisa Maddison (South Africa). IMBER will hold its second Imbizo open science meeting in 2010 in

Crete, Greece. Publications have begun to appear from the first Imbizo.⁸ A major task of the IMBER SSC in the coming year will be to determine how to implement the recommendations of the Transition Task Team, which was formed by SCOR and IGBP to advise IMBER about how to respond to the completion of GLOBEC (which has some unfinished projects), as well as other issues related to mid-life adjustments for IMBER.

3.4 GEOTRACES Project

Bjørn Sundby introduced the discussion of the GEOTRACES project and Ed Urban reported that the GEOTRACES Scientific Steering Committee held its third meeting in Toyama, Japan in November 2008. One of the two GEOTRACES intercalibration cruises (in the Atlantic Ocean) was conducted in mid-2008 and the second took place this year in the Pacific Ocean.

GEOTRACES has established an international GEOTRACES Data Management Office at the British Oceanographic Data Centre (BODC) in Liverpool, UK, and a full-time Data Liaison Officer has been hired. The U.S. National Science Foundation (NSF), BODC, and the UK Natural Environment Research Council are co-funding the position. NSF and several European sources are co-funding the first full-time position for a GEOTRACES International Project Office in Toulouse, France and interviews for the position were held on 7 and 21 September; and an offer had been made. The GEOTRACES SSC and Data Management Committee will meet next in Washington, D.C. in November 2009 to update U.S. agency program managers. The SSC will establish a rotation scheme in 2010. GEOTRACES-related cruises have been carried out as part of IPY, but cruises resulting from the Atlantic, Pacific and Indian ocean planning meetings will begin this year. A GEOTRACES-related COST Action (ES0801) was approved in Europe, based on the SOLAS experience with its COST Action. The GEOTRACES COST Action includes working groups on cruise planning, intercalibration, data management and training. There was a meeting in June 2009 to develop plans for GEOTRACES cruises in the Arctic Ocean. Process studies are expected to be developed throughout the life of the project. Some are already emerging, others will be obvious as the ocean sections find new geochemical features. The final intercalibration workshop will be held in April 2010.

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

Huasheng Hong reported that SOLAS is planning its third open science meeting for Barcelona, Spain in November and completed its fourth summer school in August. SOLAS and IMBER have created a cooperative research activity related to ocean carbon and have formed a working group to guide the activity and to interact with the International Ocean Carbon Coordination Project (IOCCP). SOLAS is reviewing its progress and potentially revising its plans at mid-project. SCOR and other co-sponsors are considering new members for the SOLAS SSC. The SSC met in March 2009 in Washington, D.C. to interact with U.S. program managers and had a good turnout for that meeting.

⁸St. John, M.A., I. Grigorov, J. Ruiz and P. Monfray. 2010. Parameterisation of Trophic Interactions in Ecosystem Modelling. Special Issue of *Progress in Oceanography* 84:1-138.

4.0 OCEAN CARBON AND OTHER ACTIVITIES

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

Wolfgang Fennel and Ed Urban reported that IOCCP has continued to be very productive in the past year. NSF is funding 1+ positions at IOC for IOCCP and is providing activity funding through SCOR. A new IOCCP director, Kathy Tedesco (USA), was hired since last year's SCOR meeting. Maria Hood, the former director, has moved to part-time status as an NSF-funded consultant to the project. The group's major activity this year has been the continued work of a panel to revise the WOCE/CLIVAR hydrography manual, follow-up on a workshop on biogeochemical measurements at time-series stations, and an activity on standards for ocean acidification experiments (with the EU EPOCA project and others). SCOR and IOC work together to spend their resources from NSF and IOC. The major IOCCP activities in 2009 include

- The global ocean ship-based hydrographic investigations panel (GO-SHIP) – GO-SHIP brings together scientists with interests in physical oceanography, the carbon cycle, marine biogeochemistry and ecosystems, and other users and collectors of hydrographic data to develop guidelines for a globally coordinated network of hydrographic sections. The two activities of GO-SHIP are (1) revision of WOCE manual and (2) development of strategy for the global survey. See www.ioccp.org > hydrography > GO-SHIP
- The Surface Ocean CO₂ Atlas Project (SOCAT)—This is a long-term project to develop a global common format surface ocean CO₂ data set with well-documented quality control and no interpolation. The SOCAT dataset now includes more than 7 million measurements from more than 2100 cruises from 1968 to 2007 and will be published in 2009 and made available via Live-Access Server. Plans are being developed to sustain this activity.
- Changing Times Inventory— IOCCP's activity involves creating a multi-platform inventory of carbon and biogeochemistry time-series measurements. IOCCP is working with the OceanSITES program to generate an inventory of open ocean fixed-point stations and carbon and biogeochemistry time-series stations.

4.2 Symposia on The Ocean in a High-CO₂ World

Ed Urban reminded participants that SCOR, IOC, IAEA and IGBP held the second symposium on The Ocean in a High-CO₂ World on 6-9 October 2008, at the Oceanography Museum in Monaco, immediately before last year's SCOR meeting. Several documents have been produced from the symposium and the special issue of *Biogeosciences* is now closed, including 20 papers.⁹ Fundraising has started for the third symposium, in 2012. The chair of planning committee is under discussion by co-sponsors, but should be approved by the end of 2009. The planning committee for the symposium should be approved by spring 2010 and will probably meet in late 2010. NSF and IOC have committed partial funding for the third symposium, but the organizers will need to raise US\$50,000-75,000 in additional funds. Michael MacCracken suggested that the title of the symposium series should be adjusted to better reflect that it is primarily about ocean acidification, not all aspects of the ocean in a high-CO₂ world (e.g., increasing

⁹ http://www.biogeosciences.net/special_issue44.html

temperature, freshening of polar areas, rising sea level, etc.) Wendy Broadgate agreed. Urban promised to raise this issue with the planning committee.

4.3 Other Activities

4.3.1 Third SCOR Summit of International Marine Research Projects

Wolfgang Fennel reported on this activity, which was co-chaired by him and Bjørn Sundby. SCOR obtained funding from the Alfred P. Sloan Foundation to convene a third meeting of representatives of the major large-scale ocean research projects, both SCOR-sponsored and others. The meeting was held at the University of Delaware, Newark, Delaware (USA) on 30 March-1 April 2009. The major discussion items included data management/data publication/project data legacy, capacity building, observing technology/ocean biology observatories, project visibility/publicity, modeling, and interactions with intergovernmental organizations. The SCOR Executive Committee will discuss additional support to the projects that was recommended by meeting participants. This was the final summit supported by the Sloan Foundation, so the projects and SCOR will need to determine whether to support a fourth summit in 2011. The SCOR Secretariat will pursue the possibility of focused online discussions among the projects. Ed Urban reported that the Executive Committee agreed to purchase access to “GoToMeeting” to use for various projects.

4.3.2 Panel on New Technologies for Observing Marine Life

Missy Feeley reported on this panel. The Sloan Foundation allocated new funding for the Panel for 2008-2010. The fifth meeting of the panel was held in Newark, Delaware (USA) in December 2008. The Panel’s primary task is to create a CoML technology synthesis as part of the overall CoML synthesis, as the program comes to an end in 2010. The Panel will also oversee two cross-project synthesis activities on electronic tagging and will convene a meeting on ocean biology observatories in conjunction with OceanObs09 in Venice, Italy in September 2009. CoML Phase 2 is looking for funding. The movie, “The Oceans” will be released in January.

4.3.3 SCOR/IODE Data Publication Activity

SCOR and IOC’s International Oceanographic Data and Information Exchange (IODE) have been working together for the past 18 months on a project to promote getting data associated with research papers, as well as stand-alone data sets, into national and international data management systems. Activities since the 2008 SCOR meeting include a presentation by Ed Urban at the Fall American Geophysical Union meeting on the activity and the recent acceptance of a publication in *EOS*.¹⁰ A small group of people met in Oostende, Belgium earlier this year to scope out some pilot projects to test various aspects of data publication. The same individuals may convene later this year to assess the progress on these pilot projects, and activity will continue at least through 2010.

¹⁰Lowry, R., E. Urban, and P. Pissierssens. 2009. A new approach to data publication in ocean sciences. *EOS: Transactions of the American Geophysical Union* 90:484.

5.0 CAPACITY-BUILDING ACTIVITIES

5.1 SCOR Committee on Capacity Building

Venu Ittekkot reported on the activities of the SCOR Committee on Capacity Building, including a meeting just prior to the SCOR Executive Committee meeting, on 17-18 October in Shanghai. The participants discussed the status and progress of ongoing SCOR capacity-building activities, with a focus on activities in Asia and Africa. Some actions recommended by the committee and the SCOR Executive Committee include

- Evaluate and revise guidelines for organizers of meetings for travel grants
- Encourage projects to set up mentoring at open science meetings
- Set up subcommittee for Southern and Eastern Africa
- Identify new members from the Middle East and eastern Europe

Funding was budgeted for 2010 activities of the committee.

5.2 Regional Graduate Networks of Oceanography and Marine Environmental Sciences

Venu Ittekkot also reported that Regional Graduate Networks of Oceanography activity is still unfunded, but the Committee on Capacity Building discussed the potential for RGNOs in Africa and Asia. There is still interest among members in trying to convene regional meetings to discuss RGNOs.

5.3 POGO-SCOR Visiting Fellowships for Oceanographic Observations

Ed Urban reported that this POGO-led program continues to be a success and presented the list of names of the 2009 fellows.

5.4 NSF Travel Support for Developing Country Scientists

Ed Urban reported that SCOR received the second year of its grant 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. Urban showed the list of meetings recommended for funding by the Committee on Capacity Building and the list was approved.

5.5 SCOR Reports to Developing Country Libraries

Ed Urban reported that the SCOR Secretariat had arranged for distribution of one report to developing country libraries since the 2008 SCOR meeting, the JGOFS/LOICZ Continental Margins Task Team synthesis: *Carbon and Nutrient Fluxes in Continental Margins: A Global Synthesis*, after the report is published.

6.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS

6.1 Intergovernmental Oceanographic Commission

Bjørn Sundby attended the IOC General Assembly in June 2009 to represent SCOR. As usual, SCOR represented ICSU at the meeting. SCOR received a lot of visibility at the meeting, as Trevor McDougall, chair of SCOR/IAPSO WG 127 gave the Bruun Memorial Lecture and Venu Ittekkot gave the Pannikaar Memorial Lecture. Both lectures were well received. IOC adopted

the new equation of state of seawater (TEOS-10) and will publish the manual that describes its use. SCOR and IOC cooperate on several different activities, as discussed in other sections.

GOOS is working with the Global Earth Observation System of Systems (GEOSS) on implementing an ocean observation system. GOOS is promoting the Chlorophyll Global Integrated Network (ChloroGIN) project which aims to increase the *in situ* measurement of chlorophyll in the ocean and to combine these data with satellite-derived estimates. Trevor McDougall made a presentation at the GOOS Scientific Steering Committee on SCOR/IAPSO WG 127's work and Missy Feeley made a presentation about the work of the SCOR/IAPSO OceanScope (WG 133).

6.2 North Pacific Marine Science Organization (PICES)

Huasheng Hong reported that PICES conducts several activities that are relevant to SCOR interests and that implement SCOR activities in the North Pacific region. The 2009 PICES annual meeting will be held in Korea immediately after the SCOR meeting, and Wolfgang Fennel and Ed Urban will attend the meeting to represent SCOR and to meet with the new Korean SCOR Committee. PICES submitted letters of support for two of the working group proposals. Hong also mentioned the PICES FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Ecosystems) program. The travel support for developing country and Russian scientists to attend PICES-related meetings was approved.

6.3 International Council for Exploration of the Seas

Ed Urban reported that ICES was involved in the SCOR Project Summit and has expressed an interest in increased interactions with SCOR. Adi Kellerman's participation in the summit continued interactions that SCOR has had with ICES in recent years. Wolfgang Fennel volunteered to make contact with ICES on behalf of SCOR. Corina Brussaard added that ICES has a new working group on phytoplankton time series, which should link closely with the new SCOR working group on this topic. Urban asked whether there is any cross-membership between the groups, but no one knew.

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

SCOR provided support for one meeting of GESAMP Working Group 38 on The Atmospheric Input of Chemicals to the Ocean. Ed Urban noted that SCOR and GESAMP cooperated in recent years, especially on the statement on iron fertilization. Should SCOR continue to interact with GESAMP? Michael MacCracken thought that SCOR should continue the relationship because governments turn to GESAMP, and SCOR is in a position to help link good science to GESAMP. Their current working groups include one on atmospheric inputs of nutrients to the ocean. Urban replied that SCOR should make sure that GESAMP is informed about what SCOR is doing and see if they express interest in specific SCOR activities. He noted that the GESAMP contribution to the Assessments of Assessments was one of the best. Bjørn Sundby offered to be liaison between SCOR and GESAMP.

7.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

7.1 International Council for Science

ICSU has continued its development of regional offices in Africa, Southeast Asia, and South America. ICSU has designated SCOR its representative at IOC annual meetings. Wolfgang Fennel reported that he met with Deliang Chen, the new ICSU Executive Director, at the 2009 IGBP SC meeting. Chen assured him that SCOR is the primary ICSU body for ocean science.

7.1.1 International Geosphere-Biosphere Program (IGBP)

Wolfgang Fennel attended the 2009 IGBP Science Committee meeting in Japan to represent SCOR. SCOR and IGBP staff members have ongoing discussions in relation to co-sponsored projects. Wendy Broadgate gave a presentation on the structure and current activities of IGBP. She gave some details on the second Symposium on The Ocean in a High-CO₂ World and the outputs from it: the Monaco Declaration, the Summary for Policymakers, etc. She discussed research priorities of ocean acidification. SOLAS and IMBER have set up a joint group on ocean acidification to encourage international cooperation, led by Jean-Pierre Gattuso.

IGBP Fast-Track Initiatives (FTIs) are similar to SCOR working groups. They are intended to encourage integration across IGBP, and collaboration with partners like SCOR. Broadgate discussed two FTIs in detail:

- Upper Ocean Nutrient Limitation, processes patterns and potential for change—Led by Mark Moore (UK), Matt Mills (USA), Doug Wallace (SOLAS) and Emily Breviere (SOLAS)
- Megacities and the coastal zone—led by Roland von Glasow (UK), Tim Jickells (UK), Sarah Doherty (NOAA), Tong Zhu (China-Beijing), Ramesh Ramachandran (India) and Josef Pacyna (Norway).

IGBP has started its second synthesis and integration process. Instead of the single large process undertaken the first time, IGBP will conduct ongoing synthesis in staggered phases. They will focus on high-profile peer-reviewed articles, rather than books, with outreach products like summary documents to make the outcomes more accessible to policymakers. There are articles underway on megacities, the cryosphere, and some others. An IGBP Open Science Conference in 2012 will bring all these together. Lawrence Mysak commented that one important topic is sea-level rise due to melting of ice. Does IGBP interact with IUGG's new association on the cryosphere? Wendy noted his mention of this group and will try to get them in touch. Peter Burkill asked about perturbation experiments and their usefulness for understanding long-term changes in the Earth system. Broadgate responded that they may help to understand the differences between natural and artificial processes. She agreed that this is a tough question. John Compton asked about the decision to move away from synthesis books; he thinks the change makes sense, but wants to know why this decision was made. With the new focus on review papers, will an important aspect of the integrative process be lost? Broadgate responded that books are too expensive, so are not accessible to everyone. A review paper is a slimmed down version of the material. She didn't agree that depth is necessarily lost. Compton suggested that an alternative would be to self publish, so that they could easily make PDF files available without waiting for release of copyright from the publishers.

7.1.2 World Climate Research Programme (WCRP)

Michael MacCracken reported that WCRP is co-sponsoring the SOLAS project and SCOR projects are working well with CLIVAR, the part of WCRP most relevant to SCOR. WCRP has offered to co-sponsor the proposed working group on the Agulhas current, if approved, although the funding level they would provide had not been specified. MacCracken was not able to attend the recent WCRP JSC meeting because they had space limitations. The major focus of the WCRP JSC was World Climate Conferences, which would provide a global framework for climate services. They established a panel to determine how to implement this. Motoyoshi Ikeda asked Wendy Broadgate about the discussion of merger between IGBP and WCRP. Broadgate responded that the idea is no longer being discussed, but ICSU is looking at the current structures on global change research and whether they are adequate. She predicted that the landscape among the programs will be different in five years' time.

7.1.3 Scientific Committee on Antarctic Research (SCAR)

Jorma Kuparinen reported that SCAR and SCOR are co-sponsoring a joint Expert Group on Oceanography. The major focus for this group in 2009 was continued work on a plan for a Southern Ocean Observing System (SOOS). The Expert Group held an opportunistic meeting on 26 Sept., after OceanObs'09 in Venice, to discuss the status of the planning document and plans for SOOS implementation. There was a meeting in September, in which Ed Urban participated, to discuss SOOS implementation. Kuparinen stated his view that SCOR and SCAR should continue to co-fund the Expert Group. Urban reported that the SOOS implementation plan is not finished but they have a November 15 deadline for some portions of it. Discussion is ongoing about how to proceed with implementation after the plan is published.

7.1.4 Scientific Committee on Problems of the Environment (SCOPE)

Ed Urban reported that SCOPE will become independent of ICSU in 2010 and is developing a new mode of operation and a funding plan. Last year, ICSU approved the movement of SCOPE to an independent body. SCOPE had been struggling financially, especially after new organizations took on some of its interests. They are looking at various options, such as moving the office, but being independent of ICSU. The action agreed was for SCOR to watch to see what happens in the future before developing new areas of cooperation.

7.2 Affiliated Organizations

7.2.1 International Association for Biological Oceanography (IABO)

Ed Urban reported that IABO does not get funding from its parent organization, the International Union of Biological Sciences. Yet, they do their best to maintain a Web site and meetings.

7.2.2 International Association for Meteorology and Atmospheric Sciences (IAMAS)

Michael MacCracken, as IAMAS past-president, continues as IUGG/IAMAS liaison to SCOR, and reported on the status and activities of IAMAS. IAMAS works with other IUGG associations and is planning in anticipation of the joint assembly in Melbourne, Australia in 2011. IAMAS will hold a joint scientific assembly with the International Association for Cryospheric Sciences (IACS) in 2013 in Switzerland. IUGG gives half of its income from member nations to its associations. Virtually all the money that IAMAS receives is devoted to

travel of developing country scientists to IAMAS-related meetings. MacCracken is concerned about the issue of the thermal expansion and melting of ice sheets, a topic that IPCC missed in 2007. A presentation by MacCracken showed the enormous error in the IPCC report (underestimating negative effects). In relation to these terms, the term for ice movement is actually very large.

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

SCOR and IAPSO are currently co-sponsoring WG 122 on Estuarine Sediment Dynamics (with LOICZ), WG 127 on Thermodynamics and Equation of State of Seawater, WG 129 on Deep Ocean Exchanges with the Shelf, and OceanScope (WG 133). Lawrence Mysak discussed the IAPSO collaboration with IABO and the IAPSO relationship with IUGG. IAPSO and IABO have had joint sessions in Sapporo, Mar del Plata, and Perugia. Mysak has invited IABO to join IAPSO in organizing joint sessions at the next IUGG Assembly in Melbourne (2011). Plans for Melbourne are moving along, so Mysak hopes to hear from IABO soon. The big event in 2009 for IAPSO was MOCA'09. The theme was the warming planet. WGs 129 and 133 met there and WG 129 organized a symposium. Trevor McDougall made a presentation regarding WG 127 there. Harry Bryden from the University of Southampton (UK) received the Prince Albert medal for his observational work on the role of the oceans in climate. The Eugene LaFond medal, which is based on a presentation by a developing country scientist, was awarded to Bamol A. Sow, a scientist from Senegal. One role of IAPSO that distinguishes it from SCOR is to bring together scientists from around the world to meetings every two years. Mysak would like to see IAPSO move towards interdisciplinary studies to bring in biology and biogeochemistry. He thanked Johan Rodhe for his work as an active Secretary General of IAPSO. Ed Urban added that collaboration with IAPSO has been good, especially the joint working groups. SCOR can bring more resources to the table and help advance topics that interest both organizations.

7.3 Affiliated Programs

The benefit of continued affiliation to SCOR is evaluated at each General Meeting. These programs were invited to send representatives to the project summit sponsored by SCOR in 2009. 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 Census of Marine Life (CoML)

Peter Burkill reported that, in 2010, this international research program will release its first report on the status of knowledge of marine biodiversity. To meet this deadline, CoML has begun implementing plans for integration, synthesis and visualization of marine biodiversity information, as well as the management needs to achieve them. The final CoML conference will be held in London in October 2010 and SCOR will be represented there by Peter Burkill, Ed Urban, and the chair of the SCOR Panel on New Technologies for Observing Marine Life (Alex Rogers). Burkill noted that SCOR could learn from CoML, which is superb in education and outreach. Magazines like *Discover* and *Time* have ranked them very highly as one of the top scientific endeavors in the world.

7.3.2 International Antarctic Zone (iAnZone) Program

Jorma Kuparinen reported that iAnZone met in conjunction with the MOCA'09 Assembly in Montreal in July 2009. They are discussing the future of the program. Ed Urban reported that there was discussion whether to close down iAnZone and it looks like they will move in that direction.

7.3.3 International Marine Global Changes Study (IMAGES)

John Compton reported that SCOR and IMAGES are currently co-sponsoring WG 124 on Analyzing the Links Between Present Oceanic Processes and Paleo-Records. IMAGES submitted a letter of support on the Agulhas Current working group proposal. They are considering the future of their program. They have also had a time of reduced activity, in part because of the International Polar Year. IMAGES scientists are very active in the Integrated Ocean Drilling Program (IODP). The IMAGES science and implementation plan is still being revised. Compton hoped that the new SCOR working group on the Agulhas Current would include people active in IMAGES for the paleoceanography component, and that they could re-energize IMAGES in some ways.

7.3.4 InterRidge - International, Interdisciplinary Ridge Studies

John Compton reported that InterRidge has an active program of working groups and scientific meetings, as well as significant education and outreach activities. SCOR and InterRidge are co-sponsoring WG 135 on Hydrothermal Energy Transfer and its Impact on the Ocean Carbon Cycle. The InterRidge office will move to the National Oceanography Centre in Southampton, UK, in 2010. Compton believes that InterRidge is doing very well with many active groups, specifically SCOR WG 135 and others not related to SCOR.

7.3.5 International Ocean Colour Coordinating Group (IOCCG)

Jorma Kuparinen reported that several monographs are in progress by IOCCG scientific working groups over the past year and seven have been published in the IOCCG Report series so far (see http://www.ioccg.org/reports_ioccg.html#Reports). Two additional reports are expected to be published by the end of 2009. This is a very active and large group. They operate like SCOR, forming relatively small working groups to produce reports. They have been very active in capacity building and training courses. All their activities are listed on their Web site. They may be so active due to a large list of sponsors. Ed Urban added that GEOHAB is proposing a working group on remote sensing of HABS to IOCCG. (It was approved.) Also, SCOR assists IOCCG by handling their NASA grant for them.

7.3.6 Ocean Mixing Processes

This group is an outgrowth of WG 121 on Ocean Mixing, but we have received no information from them since they had a session at the MOCA'09 meeting in July. Ed Urban was asked to encourage them to liaise better with SCOR. Their affiliation to SCOR will be dropped if they do not report in 2010.

7.4 Other Organizations

7.4.1 Partnership for Observation of the Global Ocean (POGO)

Peter Burkill reported that the 2009 POGO meeting was held in Concepcion, Chile in January and the 2010 meeting will be held in Moscow. POGO and SCOR are participating together on the POGO-SCOR Visiting Fellowships for Oceanographic Observations. POGO devotes much effort to capacity building and to ocean input to the Global Earth Observing System of Systems (GEOSS). The main interaction between SCOR and POGO relates to the fellowships and the SCOR Committee on Capacity Building.

7.4.2 Arctic Ocean Sciences Board (AOSB)

Jorma Kuparinen reported that the AOSB re-established contact with SCOR in 2007 and is interested in expanding its role in the global ocean programs and will be looking to new linkages with various international marine science organizations such as SCOR and GOOS. AOSB merged with the International Arctic Science Committee (IASC) in 2009, but will maintain a discrete profile within IASC. Kuparinen suggested that SCOR should think about links with AOSB if a revised sea ice working group proposal is submitted next year.

8.0 ORGANIZATION AND FINANCE

8.1 Membership

Wolfgang Fennel reported that Bjørn Sundby proposed a nominations committee consisting of himself, Mingyuan Zhu (China-Beijing), Roberto Purini (Italy), and Lynn Shannon (South Africa). This group was approved.

8.1.1 National Committees

Ed Urban reported that Korea re-entered SCOR in 2009 at a Category II member. Urban and Wolfgang Fennel will be having a meeting with the Korean SCOR Committee after the SCOR meeting to see how they can be more involved.

8.2 Publications Arising from SCOR Activities

Ed Urban briefly discussed publications from SCOR-funded activities that have appeared in the past year:

- 2008 *SCOR Proceedings*—The *Proceedings* will be printed and distributed in electronic form in October. A limited number of hard copies may be printed.
- SCOR Web site—The SCOR Web site is updated and checked for dead links regularly. Work continues on re-designing the site and the SCOR Executive Committee will discuss re-design options.
- *SCOR Newsletter*—The SCOR Newsletter was started late in 2004, to provide more frequent updates about SCOR activities between annual meetings. Fourteen issues have been distributed so far. (All are available on the SCOR Web site.) The SCOR Secretariat issues three newsletters each year. The SCOR Secretariat improved the layout and design

of the Newsletter in 2007 and will continue to have it printed in hard copy occasionally for limited distribution.

Urban asked if any additional changes are needed to the Web site and/or the *SCOR Newsletter*. There were no suggestions in the open meeting, but the Executive Committee requested in its closed session that a profession be consulted about re-designing the site.

8.3 Finances

The annual audit was completed in August. Elizabeth Gross worked to prepare information for the auditors. The financial records and financial controls were found to follow accepted standards. New U.S. government requirements resulted in a more expensive audit and more work for SCOR staff to prepare reports for the U.S. government. SCOR received the following new or renewal grants since the 2008 SCOR meeting:

- Second year of NSF grant for travel of scientists from developing countries to ocean science meetings
- Approval of a new 3-year science grant from NSF.

Ed Urban referred to dues in arrears. Payments are behind the normal schedule in coming in. Johan Rodhe reported for the Finance Committee. He first went over the finances for 2008. The Finance Committee went over the auditor's report of 2008 finances. The auditor found no accounting discrepancies and the Finance Committee recommended acceptance of the 2008 statements. Elizabeth Gross presented the 2009 budget revisions worksheet and Johan Rodhe presented the Finance Committee's summary of 2009 SCOR finances. The income for SCOR activities was budgeted at \$360,354. The proposed revised budget is \$370,714. The expenses were budgeted to \$393,465, while in the revised budget are \$383,028. The end-of-year cash balance for 2009 was budgeted to \$182,501 and in the revised budget it is \$167,504. Elizabeth Gross presented the 2010 budget for SCOR discretionary accounts and Rodhe asked participants to consider approval of the budget. The cash balance is estimated to come down at the end of 2010 to \$152,137 from \$167,504 in 2009. This is consistent with the recommendation of previous Finance Committees to reduce the cash balance.

8.4 The Disciplinary Balance among SCOR Working Groups

Peter Burkill led a group to consider the disciplinary balance among SCOR working groups and to make recommendations on any specific topics for the 2010 call for working group proposals. Burkill went through the working group spreadsheet and disciplinary balance worksheet. A question was raised about whether SCOR should solicit ideas for proposals from other intergovernmental and non-governmental organizations, like IGBP, WCRP, etc., recognizing that the working groups should remain driven by bottom-up proposals. Michael MacCracken asked whether the biology category be broken down more finely and, if so, how to do it. Burkill responded that this effort is primarily a means to check that one discipline doesn't completely dominate the set of working groups. John Compton asked how SCOR disseminates the topics identified as desirable. Ed Urban responded that the topics are included in the request for

proposals, but he could put it more prominently on the SCOR Web site. Bjørn Sundby added that there is a big difference between trying to balance the disciplines and trying to balance in terms of societal relevance. If we get an idea from other organizations, unless we can find a strong scientist so lead it, it won't fly. Urban responded that we might not fund a proposal directly from another organization, but we could put their suggestions out to see if scientists take them up. Corina Brussaard responded that asking other organizations for topics might interfere with the bottom-up process. Wendy Broadgate added that the review process is a good place for input from other organizations, like IGBP. Sundby added that “if it ain't broke, don't fix it!” Sundby recalled the discussion about five years ago regarding the working group process, in terms of what makes groups successful. SCOR acted on the recommendations and the results are clear in more efficient groups with better products. Missy Feeley changed the subject slightly to ask why more proposals aren't submitted. Ed Urban responded that we purposely don't encourage a large number of proposals due to limited resources to handle the review. We would have to add new review processes if we received a much larger number of proposals. Michael MacCracken added that there are a lot of organizations that form working groups; maybe the proposals are spread among them. John Compton added that all SCOR members should use meetings as opportunities to encourage groups working on exciting topics to submit proposals for SCOR working groups. Wolfgang Fennel stated that the discussion led him to conclude that SCOR should not ask other organizations for working group ideas. Sundby suggested that we should make it explicit on the SCOR Web site that anyone can submit proposals; they do not have to come from SCOR members.

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 2009 Executive Committee Meeting – Beijing, China

Wolfgang Fennel expressed gratitude to the China-Beijing SCOR Committee for hosting a wonderful annual meeting. Ed Urban presented gifts to Mingyuan Zhu and Huasheng Hong on behalf of the SCOR Executive Committee.

9.1.2 2010 General Meeting – Toulouse, France

The SCOR Executive Committee has accepted an offer from the French SCOR Committee to hold the 2010 General Meeting in September in Toulouse, France. Ed Urban noted that Toulouse will be the site of the new GEOTRACES IPO. Catherine Jeandel will be the local host and she suggested that the group stay in town and come up to LEGOS for the meetings. There were suggestions that it would be better to meet at a site in town and hold the meeting in mid-September. Jeandel suggested a tentative agenda of a 1.5-day symposium on French ocean science and 3.5 days of SCOR meetings. Some meeting participants felt that would make too long a meeting at that time of year, and asked that the French meeting be before or after the SCOR meeting and not in the middle. Suggestions were made that the symposium be only one day and that there be a poster session to encourage younger scientists.

9.1.3 2011 Executive Committee Meeting - Finland

Ed Urban reported that there was a tentative invitation for the 2011 SCOR Executive Committee meeting to be held in Finland. Jorma Kuparinen confirmed that the invitation was solid and that the venue will be Helsinki. The hosts will arrange a 1-day excursion. The dates need to be discussed later. A late September date is preferable.

9.1.4 2012 General Meeting – Canada

Bjørn Sundby reported that the Canadian National Committee for SCOR has invited SCOR to hold its 2012 General Meeting in Canada. The location is not certain, but it will possibly be in Halifax.

9.1.5 2013 Executive Committee Meeting

Ed Urban noted that SCOR needs an invitation for 2013 and it should be in the Southern Hemisphere or a developing country. Perhaps SCOR should meet in a country that's not a member of SCOR, possibly in Africa or South America. People should think about this.

9.1.6 2014 General Meeting - Germany

Wolfgang Fennel announced a possible German invitation for the General Meeting in 2014 to be held in Bremen.

9.2 Gifts of Appreciation

Wolfgang Fennel thanked the Chinese SCOR Committee again for hosting the meeting and thanked all the participants for their contributions to the meeting. Gifts were presented to the local hosts. Lawrence Mysak thanked the Executive Committee and Secretariat for their work on the meeting.

ACRONYMS

ADOES	Asian Dust and Ocean Ecosystems
AFOBi	Atmospheric Forcing on Ocean Biogeochemistry (China-Taipei)
AGU	American Geophysical Union
AMOC	Atlantic Meridional Overturning Circulation
AMT	Atlantic Meridional Transect (UK)
AOSB	Arctic Ocean Sciences Board
ASCLME	Agulhas-Somali Current Large Marine Ecosystem
ASLO	American Society for Limnology and Oceanography
BCO-DMO	Biological and Chemical Oceanography Data Management Office
BELSPO	Belgian Federal Science Policy
BENEFIT	Benguela Environment Fisheries Interaction and Training
BODC	British Oceanographic Data Centre
CACGP	Commission on Atmospheric Chemistry and Global Pollution (IAMAS)
CARBOOCEAN	Marine carbon sources and sinks assessment (EU Integrated Project)
CARINA	CARbon dioxide In the North Atlantic project
CCC	Cod and Climate Change (ICES and GLOBEC)
CCCC	Climate Change and Carrying Capacity (PICES and GLOBEC)
ChloroGIN	Chlorophyll Global Integrated Network
CHOICE-C	Carbon cycling in China Seas – budget, controls and ocean acidification (China-Beijing)
CLIMECO	Climate driving of marine ecosystem changes (CLIVAR, GLOBEC, IMBER)
CLIOTOP	Climate Impacts on Ocean TOp Predators (GLOBEC)
CLIVAR	Climate Variability and Prediction project (WCRP)
CMTT	Continental Margins Task Team (IMBER, LOICZ)
CNRS	Centre national de la recherche scientifique (France)
CoML	Census of Marine Life
COST	European Cooperation in the Field of Science and Technical Research
CRP	Core Research Project (GEOHAB)
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
CYBER	CYcles Biogéochimiques, Ecosystèmes et Ressources (France)
DFO	Department of Fisheries and Oceans
DMC	data management committee
DMS	dimethylsulfide
DMSP	dimethylsulfide/dimethylsulfoniopropionate
EGU	European Geophysical Union
EPOCA	European Project on Ocean Acidification (EU)
ESSAS	Ecosystem Studies of Sub-Arctic Seas (GLOBEC)
ESF	European Science Foundation
EU	European Union
EUROCEANS	European Network of Excellence for Ocean Ecosystem Analysis
FAO	Food and Agriculture Organization (UN)
FP	Framework Programme (EU)
FTI	Fast-Track Initiative (IGBP)
FUTURE	Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems (PICES)
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)
GHG	greenhouse gas
GLOBEC	Global Ocean Ecosystem Dynamics project (SCOR, IGBP, and IOC)
GODAE	Global Ocean Data Assimilation Experiment
GOOS	Global Ocean Observing System
GO_SHIP	Global Ocean Ship-based Hydrographic Investigations Panel
GOV	GODAE Ocean-View
HAB	harmful algal bloom
IABO	International Association of Biological Oceanography (IUBS)
IACS	International Association for Cryospheric Sciences (IUGG)
IAEA	International Atomic Energy Agency
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)
IASC	International Arctic Science Committee
ICED	Integrated analyses of circumpolar Climate interactions and Ecosystem Dynamics in the Southern Ocean
ICES	International Council for the Exploration of the Seas
ICSU	International Council for Science
IFREMER	Institut français de recherche pour l'exploitation de la mer (French Research Institute for Exploitation of the Sea)
IGBP	International Geosphere-Biosphere Programme (ICSU)
IMAGES	International Marine Global Changes Study (IGBP/PAGES)
IMBER	Integrated Marine Biogeochemistry and Ecosystem Research project (SCOR and IGBP)
INATEX	INDian-ATLantic EXchange in present and past climate (Netherlands)
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)
IODE	International Oceanographic Data and Information Exchange (IOC)
IODP	Integrated Ocean Drilling Program
IPCC	Intergovernmental Panel on Climate Change
IPO	international project office
IPY	International Polar Year
IR	InterRidge
IRD	Institut de Recherche pour le Développement (France)
ISSN	International Standard Serial Number
IUBS	International Union of Biological Sciences (ICSU)
IUEM	Institut Universitaire Européen de la Mer
IUGG	International Union of Geodesy and Geophysics (ICSU)
JGOFS	Joint Global Ocean Flux Study (SCOR and IGBP)
LDEO	Lamont-Doherty Earth Observatory (US)
LEFE	Fluid Envelopes and Environment project
LEGOS	Laboratoire d'Etudes en Géophysique et océanographie Spatiale (France)
LINKS	WG 124 on Analyzing the Links Between Present Oceanic Processes and Paleo-Records (SCOR and IMAGES)
LOICZ	Land-Ocean Interactions in the Coastal Zone project (IGBP and IHDP)
LORECS	Long-term Observation and Research of the East China Sea (China-Taipei)
MOIN	Minimalist OceanSITES Interdisciplinary Network

NASA	National Aeronautics and Space Administration (US)
NERC	Natural Environmental Research Council (UK)
NM	Nominated Member (SCOR)
NOAA	National Oceanic and Atmospheric Administration (US)
NOC	National Oceanography Centre (UK)
NSF	National Science Foundation (US)
NSFC	National Natural Science Foundation of China
OCB	Ocean Carbon and Biogeochemistry program (US)
OceanSITES	a worldwide system of long-term, deepwater reference stations
OECD	Organisation for Economic Co-operation and Development
OMZ	oxygen minimum zone
OSC	open science conference
OSM	open science meeting
PACKMEDS	Dynamics of semi-enclosed marine systems: the integrated effects of changes in sediment and nutrient input from land (SCOPE, IAPSO, and SCOR)
PaFCA	Partnership for Climate, Fisheries and Aquaculture
PAGES	Past Global Changes project (IGBP)
PICES	North Pacific Marine Science Organization
POC	particulate organic carbon
POGO	Partnership for Observations of the Global Oceans
POMAL	Population Outbreak of Marine Life (Japan)
SAEON	South African Environmental Observation Network
SCAR	Scientific Committee on Antarctic Research (ICSU)
SCOPE	Scientific Committee on Problems of the Environment (ICSU)
SCOR	Scientific Committee on Oceanic Research (ICSU)
SEATS	South East Asia Time-Series Station (China-Taipei)
SESAME	Southern European Seas: Assessing and Modelling Ecosystem changes (EU)
SIBER	Sustained Indian Ocean Biogeochemical and Ecological Research
SIC	SOLAS/IMBER Carbon Research Implementation group
SO	Southern Ocean
SOCAT	Surface Ocean CO ₂ Atlas
SOLAS	Surface Ocean-Lower Atmosphere Study (SCOR, IGBP, WCRP, and CACGP)
SOOS	Southern Ocean Observing System
SOPRAN	Surface Ocean Processes in the Anthropocene (Germany)
SPACC	Small Pelagic fish and Climate Change project (GLOBEC)
SPC	South Pacific Commission
SPEEDS	Subarctic Pacific Experiment for Ecosystem Dynamics Study (Japan)
SSC	scientific steering committee
SSG	scientific steering group
SSS	SOLAS Summer School
STAGE	Studies on the Antarctic Ocean and Global Environment (Japan)
TEIs	trace elements and isotopes
TENATSO	Tropical Eastern North Atlantic Time-Series Observatory
TEOS-10	The Equation of State of Seawater 2010
ToRs	terms of reference
TTT	Transition Task Team (GLOBEC, IMBER)
UBO	Université de Bretagne Occidentale
UEA	University of East Anglia (UK)
ULB	Université Libre de Bruxelles

UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNISDR	United Nations International Strategy for Disaster Reduction
USP	University of São Paulo (Brazil)
WCRP	World Climate Research Programme (WMO, IOC, and ICSU)
WG	working group
WHOI	Woods Hole Oceanographic Institution (US)
WMO	World Meteorological Organization
W-PASS	Western Pacific Air-Sea Interaction Study

Annex 1 – AGENDA

39th SCOR EXECUTIVE COMMITTEE MEETING
Beijing, China

20-22 October 2009

1.0 OPENING

1.1	Opening Remarks and Administrative Arrangements	<i>Fennel, Urban, Hong</i>
1.2	Approval of the Agenda	<i>Fennel</i>
1.3	Report of the President of SCOR	<i>Fennel</i>
1.4	Report of SCOR Executive Director	<i>Urban</i>
1.5	Appointment of an <i>ad hoc</i> Finance Committee	<i>Fennel</i>
1.6	<i>Ad hoc</i> Committee to Review the Disciplinary Balance of SCOR's Activities	<i>Burkill</i>
1.7	2010 Elections for SCOR Officers	<i>Sundby</i>

2.0 WORKING GROUPS

2.1	Disbanded Working Groups	
2.1.1	WG 78—Determination of Photosynthetic Pigments in Seawater	<i>Urban</i>
2.2	Current Working Groups	
2.2.1	WG 111—Coupling Winds, Waves and Currents in Coastal Models	<i>Mysak</i>
2.2.2	SCOR/LOICZ/IAPSO WG 122—Estuarine Sediment Dynamics	<i>Sundby</i>
2.2.3	SCOR/IMAGES WG 124— Analyzing the Links Between Present Oceanic Processes and Paleo-records (LINKS)	<i>Compton</i>
2.2.4	WG 125—Global Comparisons of Zooplankton Time Series	<i>Urban</i>
2.2.5	WG 126—Role of Viruses in Marine Ecosystems	<i>Kuparinen</i>
2.2.6	SCOR/IAPSO WG 127 on Thermodynamics and Equation of State of Seawater	<i>Mysak</i>
2.2.7	WG 128 on Natural and Human-Induced Hypoxia and Consequences for Coastal Areas	<i>Burkill</i>
2.2.8	SCOR/IAPSO WG 129 on Deep Ocean Exchanges with the Shelf	<i>Mysak</i>
2.2.9	SCOR WG 130 on Automatic Plankton Visual Identification	<i>Burkill</i>
2.2.10	SCOR WG 131 on The Legacy of in situ Iron Enrichment: Data Compilation and Modeling	<i>MacCracken</i>
2.2.11	SCOR/LOICZ WG 132 on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems	<i>Kuparinen</i>
2.1.12	SCOR/IAPSO WG 133: OceanScope	<i>Feeley</i>
2.1.13	SCOR WG 134 on The Microbial Carbon Pump in the Ocean	<i>Sundby</i>
2.1.14	SCOR/InterRidge WG 135 on Hydrothermal energy transfer and its impact on the ocean carbon cycles	<i>Feeley</i>

- 2.3 New Working Group Proposals
- 2.3.1 Working Group on Evaluating the ecological status of the world's fished marine ecosystems
- 2.3.2 Working Group on Coupled climate-to-fish-to-fishers models for understanding mechanisms underlying
- 2.3.3 Working Group on Sea Ice Biogeochemistry
- 2.3.4 Working Group on Climatic Importance of the Greater Agulhas System
- 2.3.5 Working Group on Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of

3.0 LARGE-SCALE SCIENTIFIC PROGRAMS

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

4 OCEAN CARBON AND OTHER ACTIVITIES

- 4.1 IOC/SCOR International Ocean Carbon Coordination Project (IOCCP) *Fennel, Urban*
- 4.2 Symposia on The Ocean in a High-CO₂ World *Urban*
- 4.3 Other Activities
- 4.3.1 Third SCOR Summit of International Marine Research Projects *Fennel, Sundby, Urban*
- 4.3.2 Panel on New Technologies for Observing Marine Life *Feeley*
- 4.3.3 SCOR/IODE Data Publication Activity *Urban*

5.0 CAPACITY-BUILDING ACTIVITIES

- 5.1 SCOR Committee on Capacity Building *Ittekkot*
- 5.1.1 Regional Graduate Networks of Oceanography and Marine Environmental Sciences *Ittekkot*
- 5.1.2 POGO-SCOR Visiting Fellowships for Oceanographic Observations *Urban*
- 5.1.3 NSF Travel Support for Developing Country Scientists *Urban*
- 5.1.4 SCOR Reports to Developing Country Libraries *Urban*

6.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS

- 6.1 Intergovernmental Oceanographic Commission *Sundby*
- 6.2 North Pacific Marine Science Organization (PICES) *Hong*
- 6.3 International Council for Exploration of the Seas *Urban*
- 6.4 Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) *Urban*

7.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

7.1	International Council for Science	<i>Fennel, Urban</i>
7.1.1	International Geosphere-Biosphere Program (IGBP)	<i>Fennel, Broadgate</i>
7.1.2	World Climate Research Programme (WCRP)	<i>MacCracken</i>
7.1.3	Scientific Committee on Antarctic Research (SCAR)	<i>Kuparinen</i>
7.1.4	Scientific Committee on Problems of the Environment (SCOPE)	<i>Urban</i>
7.2	Affiliated Organizations	
7.2.1	International Association for Biological Oceanography (IABO)	<i>Urban</i>
7.2.2	International Association for Meteorology and Atmospheric Sciences (IAMAS)	<i>MacCracken</i>
7.2.3	International Association for the Physical Sciences of the Oceans (IAPSO)	<i>Mysak</i>
7.3	Affiliated Programs	
7.3.1	Census of Marine Life (CoML)	<i>Burkill</i>
7.3.2	International Antarctic Zone (iAnZone) Program	<i>Kuparinen</i>
7.3.3	International Marine Global Changes Study (IMAGES)	<i>Compton</i>
7.3.4	InterRidge - International, Interdisciplinary Ridge Studies	<i>Compton</i>
7.3.5	International Ocean Colour Coordinating Group (IOCCG)	<i>Kuparinen</i>
7.3.6	Ocean Mixing Processes	<i>Fennel</i>
7.4	Other Organizations	
7.4.1	Partnership for Observation of the Global Ocean (POGO)	<i>Burkill</i>
7.4.2	Arctic Ocean Sciences Board (AOSB)	<i>Kuparinen</i>

8.0 ORGANIZATION AND FINANCE

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

9.0 SCOR-RELATED MEETINGS

9.1	SCOR Annual Meetings	
9.1.1	2009 Executive Committee Meeting – Beijing, China	<i>Fennel</i>
9.1.2	2010 General Meeting – Toulouse, France	<i>Sicre</i>
9.1.3	2011 Executive Committee Meeting - Finland	<i>Kuparinen</i>
9.1.4	2012 General Meeting – Canada	<i>Sundby</i>
9.2	Gifts of Appreciation	<i>Urban</i>

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Annex 3 – Proposal for a Working Group on the Climatic Importance of the Greater Agulhas System

Proposal for a SCOR-WCRP sponsored Working Group on the *Climatic Importance of the Greater Agulhas System*

Abstract

The overarching goal of this SCOR working group is to improve understanding and awareness of the global climate impacts of the greater Agulhas Current system. Although this system is, by nature, regional, our thrust is about understanding changes in the Atlantic Meridional Overturning Circulation (AMOC) and climate that are forced from the southern hemisphere - i.e. by Agulhas leakage - hence the implications are of truly global significance. Moreover, our working group membership is distributed globally. We plan to achieve our goals through the enhancement of collaboration and cooperation within our small, yet global scientific community, and by promoting enlargement of the community. We will hold regular planning meetings to produce a review publication and a steering report that raise the profile of this important region, both in terms of its climatic significance and in terms of the representation it deserves as part of the Global Ocean Observing System. Finally, we will organise a Chapman Conference. WCRP provided comments on this proposal and has agreed to co-fund our group, if approved by SCOR.

Rationale

Mounting evidence from palaeoceanographic and modeling studies suggest that the Agulhas Current and its interocean flux are drivers of global climate change (see Background). For example, through their southern influence on the AMOC, changes in the flux of warm, salty waters from the Indian Ocean may have triggered the end of ice ages, as well as effecting shorter-term climate variability. This puts the importance of the greater Agulhas Current system on a par with Heinrich (land-ice release) Events and deep convection, in terms of northern hemisphere climate. Yet, owing to the relative isolation of the region from the US and Europe, few modern observations and even fewer palaeoceanographic time series exist over the region and it is substantially underrepresented in international monitoring efforts.

It is important that this SCOR working group begin work as soon as possible, to facilitate collaborations to build the best possible research programs in the region and pass on recommendations for future sustained observations as part of IndOOS. The need for such an activity is well identified by our community, as demonstrated by good attendance at a recent unfunded workshop in Kiel, Germany. Ideas and outcomes from this workshop have been used to produce this document. Now is a time of heightened research activity in the region, that will provide unprecedented coverage, new data, and insight into dynamical and climatic mechanisms. There are several Africa-based initiatives (e.g. Agulhas-Somali Current Large Marine Ecosystem project, ASCLME; South African Environmental Observation Network, SAEON), a Dutch program (INdian-ATlantic EXchange in present and past climate, INATEX), a US experiment (Agulhas Current Time-series, ACT), a German program with a hierarchy of models, a recently-funded Japanese climate modeling project (Prediction of Climate Variations and Its Application in the Southern African Region), and two European palaeoclimate programs (Agulhas Warm Water Transports: Climatic Dimension for Southern Africa and Europe, and GATEWAYS - Multi-level assessment of ocean-climate dynamics: a gateway to interdisciplinary training and analysis). There is an urgent need for better linkages between these groups and others in our community, to share resources, data, and even ship-time and to identify collaborations that will maximize the opportunities for data collection in the region while these programs are ongoing. For example, floats, coral coring, coastal altimetry, and air-sea interaction programs were identified as missing important elements for an observational program. Better collaborations between field scientists and modelers, and between modeling groups are also called for.

Our rationale is aligned with the SCOR call for working group proposals for 2009, which encourages topics related to ocean dynamics and heat transfers, both of which strongly characterize the Agulhas and its inter-ocean exchange. Moreover, SCOR is the best vehicle for our endeavor given that our international community is widespread and that we would seek input from SCOR's Committee on Capacity Building. Many scientists find

themselves the sole person or group at their institutions pursuing research in the region and scientists from African countries which abut the Agulhas Current system lack the resources to participate in international meetings and workshops. A truly international and multi-disciplinary approach is needed to strengthen collaborations and identify the questions that will lead to a faster advancement of understanding with respect to the significance of the region as a southern-hemisphere driver of climate change. Our needs fit squarely into the remit of SCOR as a non-governmental organization for the promotion and coordination of international oceanographic activities.

Scientific Background

The greater Agulhas Current system forms a key component of the global thermohaline circulation (Lutjeharms, 2006) and its dynamics are somewhat different from other major western boundary currents, both because of the presence of Madagascar and because the continental boundary ends equatorward of the large-scale wind forcing (Figure 1). Warm, salty waters from the Red Sea, Indonesian Throughflow, and the tropical Indian Ocean are fed into the Agulhas Current from the north and east (Gordon, 1986). Through large air-sea fluxes (Figure 1, left panel), the Current's variability is strongly linked to patterns of rainfall over eastern Africa (e.g. Reason and Godfred-Spenning, 1998). At the southern tip of the African continent the Agulhas Current retroflects, with most of its water being returned into the South Indian Ocean as the Agulhas Return Current. At the retroflection, large Agulhas Rings are formed by a process of loop occlusion (Lutjeharms and Gordon, 1987). This process leads to a significant portion of Agulhas water, carrying anomalous amounts of heat and salt, being leaked into the South Atlantic Ocean. Palaeoceanographic studies suggest (Peeters et al., 2004) that changes in this leakage are intimately linked to the end of each global glaciation.

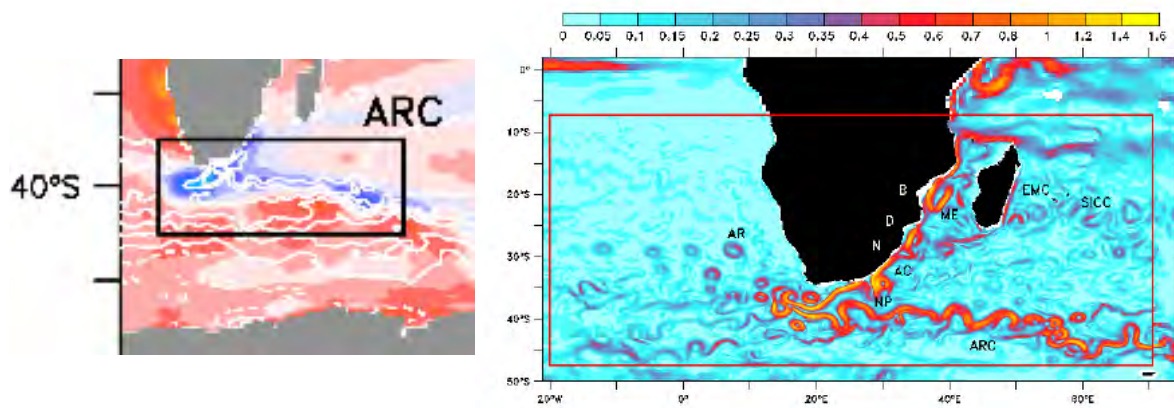


Figure 1: Left panel shows mean air-sea heat flux (Wm^{-2}) over the Agulhas Current, Retroflection, and Return Current region (ARC). This region exhibits the largest surface heat fluxes in the southern hemisphere. Right panel shows 5-day mean speeds (ms^{-1}) at 100 m depth from a nested, high resolution model (from Biastoch et al., 2008b). The features of the greater Agulhas system are clear, as is the exchange of waters with the Atlantic.

In model simulations, variations in the Agulhas leakage are on a par with that of deep water formation in the North Atlantic, in terms of making a comparable contribution to variations in the strength of the Atlantic meridional overturning circulation (Biastoch et al., 2008a), an important element of the global climate system. We fully expect further research to find evidence of links to Southern Ocean overturning also, linked to high eddy heat diffusivity across the meandering Agulhas Return Current (Sallee et al., 2006). Yet, how the Agulhas and its interocean leakage varies is not well understood. There is evidence for control by mesoscale disturbances, such as Mozambique eddies and Rossby waves (Biastoch et al., 2008b; Schouten et al., 2002). These can trigger solitary meanders in the trajectory of the Current which can cause upstream retroflections – preventing inter-ocean leakage – and set the rate of formation of Agulhas Rings. The strength of the Agulhas

transport also exerts a control through inertial processes (de Ruijter et al., 1999; van Sebille et al., 2009), whereby a weaker transport appears to lead to a stronger leakage. Shifts and intensity changes of the large-scale wind field also effect the leakage and its properties (Oke and England, 2004), although exactly how is not yet clear.

On a global basis, this region remains one of the poorest understood. Even limited oceanic investigations here have made major and basic discoveries over the past few years. It has, for instance, been shown that no continuous Mozambique Current exists, instead there is a train of eddies (de Ruijter et al., 2002). A new current, the South Indian Ocean Countercurrent, has been discovered to carry water eastward across the subtropical gyre (Siedler, 2006; Palastanga et al., 2007). An undercurrent to the Agulhas has been detected (Beal and Bryden, 1997) substantially modifying the thinking on the volume flux of the Agulhas Current. This is indicative of the pioneering nature of much research in the system. In order to bring an understanding of the key elements of this circulation and its impact on climate to the same cognitive level as other systems, it is highly desirable and urgent that significant resources and well-planned research programs be targeted to the region.

Terms of Reference

The specific goals of our proposed working group are to:

1. Facilitate collaboration between existing and planned (observational and modeling) studies in the greater Agulhas Current system, such that we minimize the gaps in the research, maximize the scientific outcome, and encourage estimates on the robustness of key findings (e.g. multiple model ensembles).
2. Write a review paper (for publication in a peer-reviewed journal) that highlights the importance of the greater Agulhas system in terms of global climate, reviewing the current levels of both understanding and uncertainty as to how changes in the system come about, how they effect climate, and vice versa.
3. Identify key components of the circulation which deserve further study through physical/palaeo observations and/or models, some of which may act as indices/proxies (through sustained observation) that can help describe the state of the Agulhas system on decadal to climate time scales. Communicate these findings to regional and international strategic planning committees, such as CLIVAR, GOOS, GEOSS, GO-SHIP etc.
4. Write a proposal for, and organize, a Chapman Conference on the “Climatic Importance of the Greater Agulhas System”, to be held in 2012.

List of Products

1. Kick-off article in EOS.
2. Review paper in a peer-reviewed journal.
3. Report on recommendations for future research programs and sustained observations, for dissemination to CLIVAR, GOOS, GEOSS, GO-SHIP etc
4. Chapman Conference on the “Climatic Importance of the Greater Agulhas System”.

Collaboration and Capacity building

We will enlist the help of the SCOR’s Committee on Capacity Building for ways in which our group and its activities can help build scientific capacity in East African nations, such as Mozambique, Tanzania, and Kenya. More resources in these nations would greatly increase the feasibility of sustained observations over the region in the future. We note that two of our members (Juliet Hermes and Johann Lutjeharms) are involved in the Agulhas-Somali Current Large Marine Ecosystem (ASCLME) project, funded by the United Nations Development Program, which shares some of our goals. We will seek a collaboration with ASCLME for a joint planning meeting/workshop and for in-kind support for attendance of these scientists at our SCOR meetings. Communication with International CLIVAR VACS (Variability of the African Climate System) and US CLIVAR WBC (Western Boundary Current ocean-atmosphere interaction) groups will also be sought to identify common ground and establish possible collaborations. We note that committee member Meghan Cronin is on the WBC panel.

Timeline

Once funded, our new SCOR working group will announce itself in an EOS article, in order to reach other scientists conducting related research, encourage their participation, and facilitate their interaction with members of the community.

Our first working group meeting will be held in conjunction with the Ocean Sciences meeting in Portland, Oregon, in February 2010. This meeting will focus on (1) putting together the review article, as described in our terms of reference, (2) encouraging working group members to participate in regional and international strategic panels, and (3) discussing strategies for identifying key components of the Agulhas system for further study / sustained observations.

Our second working group meeting will be in early 2011, possibly in South Africa in conjunction with ASCLME to facilitate capacity building efforts. Here we will focus on (1) a final discussion and submission of review article, (2) initiating a Chapman Conference proposal and identifying a lead convener and (3) outlining a report which will include recommendations on the direction of future research and the requirement for sustained observations in the region. The Conference proposal will be submitted within a few months of this meeting. Finally, a third working group meeting, potentially also in an African nation, but perhaps at EGU, will aim to (1) have a final discussion about the report on future directions for the region, with dissemination shortly afterwards, and (2) follow up on planning for, and organization of, the Chapman Conference, which should be held within six months of this meeting.

Our final product is to hold a Chapman Conference for the community. (AGU guidelines specify a timeline of 12 to 15 months between proposal acceptance and the actual event.) Such a conference will allow for plenty of scientific discussion, an increase and strengthening of collaborative ties – particularly with African colleagues, and ultimately a more productive outlook for future research, resources, and observation programs, that will accelerate our understanding of the Agulhas and its role in climate.

Chairs and Working Group Members

Our proposed working group has two enthusiastic co-Chairs, representing observations and modeling: Lisa Beal at the Rosenstiel School of Marine and Atmospheric Science at the University of Miami, and Arne Biastoch at the Leibniz-Institut für Meereswissenschaften. Plus seven other full members, representing a good balance of expertise, nationality, seniority, and gender (see Table). Each member volunteered their time and ideas at our recent workshop, in which we discussed and initiated this SCOR proposal. The exception is Meghan Cronin whom we recruited after the workshop to fulfill an identified need for expertise in ocean-atmosphere processes.

The group seeks one more member, preferably from the field of fisheries/ecosystems or meteorology/climate, and from a developing African nation. We have identified David Obura (ecosystems, Kenya) or Alberto Mavume (ocean/atmosphere, Mozambique) as possible members, subject to advice from SCOR.

<i>Name</i>	<i>Seniority</i>	<i>Affiliation</i>	<i>Expertise</i>
Lisa Beal (co-Chair)	jr/mid	University of Miami, USA	physical oceanography
Arne Biastoch (co-Chair)	jr/mid	IFM-Geomar, Germany	ocean modeling
Johann Lutjeharms	sr	University of Cape Town, South Africa	physical oceanography
Rainer Zahn	sr	Univ. Autònoma de Barcelona, Spain	palaeoclimatology
Will de Ruijter	sr	Universiteit Utrecht, The Netherlands	theory / physical oceanography
Juliet Hermes	jr	South African Environmental Observation Network, South Africa	regional ocean modeling / coastal observations

Tomoki Tozuka	jr	University of Tokyo, Japan	coupled climate modeling
Graham Quartly	mid	National Oceanography Centre, UK	bio-physical satellite oceanography
Meghan Cronin	mid	NOAA-PMEL, USA	air-sea interaction

In addition, we have a roster of eleven volunteer Associate members: Herman Ridderinkhof (physical oceanography, NIOZ, The Netherlands), Alan Meyer (satellite oceanography, CSIR, South Africa), Jens Zinke (marine geology, U. Amsterdam, The Netherlands), Frank Peeters (palaeoceanography, U. Amsterdam, The Netherlands), Deirdre Byrne (physical oceanography, U. Maine, USA), Shekeela Baker-Yeboah (dynamical theory, MIT, USA), Paolo Cipollini (coastal altimetry, NOC, UK), Ian Hall (palaeoclimatology, Cardiff U., UK), Veronique Garcon (biophysics, LEGOS, France), Wonsun Park (climate modeling, IFM-Geomar, Germany), and Pierrick Penven (regional ocean modeling, IRD, France). Once again, all these associate members attended the recent workshop, at which they shared ideas for this proposal and asked to be involved.

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Annex 4 – Proposal for a Working Group on Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observation

A Proposal for Forming a SCOR WG: Global Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observations

1. Introduction

Background & Rationale

Marine ecosystems are changing rapidly in response to natural processes, human activities, and climate change. These drivers of change have become the subject of an increasingly intense focus from both research and management perspectives. There are important scientific questions that need to be addressed with regard to natural vs human-induced changes including: 1) the qualitative characters of the ecosystem responses (“what changes?”), 2) their amplitudes (“by how much?”), and 3) their timing and spatial and temporal scales (“when and where are rates of change most profound?”). Phytoplankton are excellent indicators of marine ecosystem change. They are ecologically and biogeochemically important and relevant indicators, since they conduct a large share of system-scale primary production and hence C cycling and they are highly sensitive to a suite of environmental stressors. There is much accumulated evidence that diverse ocean regions undergo strong and sometimes abrupt changes in phytoplankton composition, and productivity at roughly decadal intervals (i.e. regime shifts). This variability is associated with corresponding changes in atmospheric, hydrologic, chemical, and higher trophic-level biological processes and state variables. However, our understanding of global change is incomplete because we have not adequately explored, inventoried, nor compared available observational data. Nor do we know how to anticipate the timing and direction of the next major shifts.

The understanding of climate change vs anthropogenic influence in coastal ecosystems is important in sustainable management of coasts. A recent example of a climate change-induced shift in biological communities was reported by Cloern et al. (2007) for San Francisco Bay. The abrupt change in the biological communities was first detected as increasing phytoplankton biomass and the occurrences of new seasonal blooms that began in 1999, overriding the influence of changes in the input of nutrients. There were coincidental higher level biotic changes, including sharp declines in the abundance of bivalve molluscs, the key phytoplankton consumers in this estuary, and record high abundances of several bivalve predators: Bay shrimp, English sole, and Dungeness crab. The phytoplankton increase is consistent with a trophic cascade resulting from heightened predation on bivalves and suppression of their filtration control on phytoplankton growth. These community changes in San Francisco Bay across three trophic levels followed a state change in the California Current System in the form of sudden increased upwelling intensity, amplified primary production, and strengthened southerly water flows. These diagnostic features of the East Pacific “cold phase” led to strong recruitment and immigration of juvenile flatfish and crustaceans into estuaries where they feed and develop. This study utilized three decades of observations to reveal a previously unrecognized mechanism of ocean–estuary connectivity. This shows that interdecadal oceanic regime shifts can propagate into estuaries and coastal waters, altering their community structure and efficiency of transforming land-derived nutrients into algal biomass.

In October 2007, nearly 100 phytoplankton ecologists gathered in Rovinj, Croatia and attended the AGU Chapman Conference: “Long Time-Series Observations in Coastal Ecosystems: Comparative Analyses of Phytoplankton Dynamics on Regional to Global Scales” (<http://www.agu.org/meetings/chapman>). They initiated an analysis of phytoplankton changes in many different coastal marine ecosystems around the world, but the comparison and synthesis of the differences between those ecosystems are a huge task, it could not be completed during the 5 day conference and therefore a smaller working group that works over a longer period, is needed to continue the analysis of these valuable data sets not only in science, but also for management needs.

Proposed SCOR Working Group

We are proposing to form a SCOR Working Group to focus on coastal ecosystems (estuaries, fjords, bays, sounds, open waters of the continental shelf, etc.) where perturbations from terrestrial, atmospheric, oceanic sources and human activities converge to cause changes that ramify across local and global scales. Human pressure on coastal regions and continental margins is increasing with expanding urbanization and the conflicting demands of tourism, agriculture and aquaculture, water diversions, wind parks and other developments. Our proposal to develop a SCOR Working Group grew out of the recent AGU Chapman Conference: “Long Time-Series Observations in Coastal Ecosystems: Comparative Analyses of Phytoplankton Dynamics on Regional to Global Scales” (convened by James Cloern and Nenad Smodlaka, October 8-12, 2008, Rovinj, Croatia). This conference convened over 150 researchers, managers and agency representatives from many countries and provided an excellent opportunity to identify and compare long-term coastal phytoplankton data sets broadly distributed throughout the northern and southern hemispheres.

There was a strong consensus at this conference that a more detailed, global comparison of phytoplankton time series would be timely, technically feasible, and an extremely valuable next step to more fully understand commonalities and contrasts with regard to ecological responses to natural and man-made changes captured by our global network of coastal phytoplankton time series.

Such an analysis must be an international cooperative effort. The relevant data sets are in many places and have been collected by many independent researchers, agencies and nations. Many of the necessary data are available now, and the Working Group can begin immediately. Endorsement and sponsorship by SCOR will help us attract and retain approvals and financial support from national agencies.

The Chapman Conference was a meeting organized by individual scientists and managers; not by an organization. The WG formation would carry forward the momentum by helping set up the platform to work with scientists in various regions on a continuing basis for several years and also possibly to take a lead in promoting a second Chapman conference in the near future (as yet, there is no actual activity for organizing the second Chapman conference). Without an organizational approach in the form of a SCOR WG, there will be no platform to gather scientists to more fully analyze and synthesize these valuable data sets.

2. The Nature of the Scientific Opportunity and Management Needs

Phytoplankton

Phytoplankton are dominant marine primary producers; they mediate nutrient flux and cycling as well as transfer of organic matter to higher trophic levels, including invertebrate grazers, planktivorous fish, and carnivores. Hence, they are a key link between nutrients and secondary production. As key primary producers, phytoplankton reflect immediate effects of changes in the input of nutrients in coastal ecosystems. Because different phytoplankton groups require different nutrient ratios, their composition responds to changes in the ratios of ambient nutrients. For example, diatoms require silicate and their relative abundance may be regulated by Si concentrations relative to other nutrients. Phytoplankton productivity and floristic composition are subject to physical forcings such as horizontal exchange between estuaries and the open sea (Cloern et al. 2007) and vertical mixing regimes, and they are also regulated by light fluctuations, and temperature. Changes in phytoplankton productivity and composition can be driven by climatic forcing and variability such as monsoons (Yin 2002), typhoons or hurricanes (Paerl et al. 2001, 2006) and rainfall (Paerl 1995; Adolf et al. 2006). In addition, phytoplankton are broadly distributed and abundant, and can be quantified by relatively simple and intercomparable sampling methods. Finally, demographic traits of phytoplankton make them particularly suitable for comparative analysis of ecosystem changes across regional to global scales.

Regional and Global Comparisons

We believe that large-scale (between-region and between-ocean) comparisons of phytoplankton time series are the essential next step. Local- and regional-scale observational programs are maintained in coastal marine waters of all continents, but their data remain largely isolated. Our goal is to locate, assemble, and synthesize multi-decadal observations to obtain quantitative and descriptive depictions of phytoplankton variability as an

indicator of environmental change. We envision a global phenology of phytoplankton at the land-sea margin and a conceptual model from which coastal ocean observing systems can be built. As a logical outgrowth of (and next step following) the Chapman Conference, the working group will focus on a comparative analysis of ecosystems to address three guiding questions:

1. *What are the dominant scales of variability in phytoplankton biomass, abundance, floristic composition, species composition, and/or species diversity? Is there evidence for secular trends or regime shifts? With which criteria can we best differentiate long-term from episodic, seasonal and interannual signals?*
2. *Is there evidence for external forcings of variability and change (e.g., effects of climate change, basin scale oscillations, land-based inputs, atmospheric deposition, alien species)? Are changes coherent in space and/or time?*
3. *Are there consistent patterns among ecosystems in terms of relationships between environmental drivers, responses in phytoplankton biomass and changes in species/floristic composition?*

To date, relatively few between-region comparisons of phytoplankton time series have been completed. All previous comparisons have been at smaller scales (within an individual current system, or at one ocean basin), compared to the global scale that include inter-regional comparisons that we are proposing.

The Chapman Conference was focused on the land-sea interface where changes are driven by complex interactions between human disturbance and climate variability. This proposed working group will continue to focus on coastal ecosystems influenced by connectivity to land: estuaries, river plumes, mangroves, bays, lagoons, inland seas.

Existing time series data of phytoplankton

Many researchers and governmental agencies around the world have relied on phytoplankton as a key indicator of water quality monitoring programs and many data sets have been presented in the Croatia AGU Chapman conference. Those data sets are included in Table 1 (attached at the end of this document).

Data availability for the proposed WG

We already have a number of data sets with excellent global representation of coastal systems that are available for the WG. They will be contributed by the members and associate members, as shown in Table 2.

Table 2. Data available from participants of the proposed WG members and associate members.

Name	Country	Ecosystem	Series
Susan Blackburn	Australia	South Pacific Ocean	1993-2007
Robert Le Borgne	New Caledonia, France	West Coast of South Africa SW Pacific	1993-2007
Jacob Carstensen	Denmark	Kattegat, Atlantic	1993-2007
James E. Cloern	U.S.	North & South San Francisco Bay, Western Pacific	1969-2007
Lawrence W. Harding, Jr.	U.S.	Chesapeake Bay, North Atlantic	1989-2007
Snejana P. Moncheva	Bulgaria	Black Sea	1954-2003

McQuatters-Gollop, Abigail	UK	CPR (North-East Atlantic including European shelf; North Sea, Irish Sea, English Channel, North-West Atlantic including Scotian Shelf, Grand Banks; North Pacific)	1948-2007
N. Ramaiah	India	Bay of Bengal, Indian Ocean	1962-1965, 2001-2006
Clarisse Odebrecht	Brazil	Patos Lagoon estuary and Cassino Beach surf-zone, South America (32° S)	1986, 1988-1990, 1992-2009
Hans W. Paerl	U.S.	Neuse River-Pamlico Sound, Atlantic	1993-2006
Elgin S. Perry	U.S	Chesapeake Bay, Atlantic	1985-2004
C J M Philippart	The Netherlands	Wadden Sea, North Sea	1995-2004
Ted Smayda	U.S.	Narragansett Bay, Atlantic	1974-2007
Kedong YIN, Paul J. Harrison	China (Hong Kong)	Subtropical South China Sea	1991-2004
A. Zingone	Italy	Gulf of Naples, Mediterranean Sea	1984-1991, 1995-2009

We will consult with other individuals (in Table 1) about their willingness to participate in our WG analysis and synthesis. Scientists and managers are willing to contribute their data sets for specific purposes such as synthesis, correlations, and comparisons in general, which has been demonstrated in Cloern and Jassby (2008) who received over 100 data sets (the condition was that the data would only be used for this specific purpose). In addition, we hope to have a second Chapman conference in the near future under the SCOR WG leadership, which would provide the opportunity for identification of more data sets and to conduct a more thorough regional and global time series synthesis.

The analysis and synthesis of many datasets are crucial to achieve the WG objectives. The WG members and associate members have the necessary skills to complete the tasks proposed in this WG since they have all conducted analysis and synthesis of their data for regional ecosystems. For example, Cloern and Jassby (2008) have synthesized many data sets in the paper “Complex seasonal patterns of primary producers at the land-sea interface”. The WG participants have two statisticians, Carstensen and Perry. The WG participants not only have skills in manipulation of large databases, but also have comprehensive knowledge of phytoplankton ecology in the context of environmental change, anthropogenic influence and climate change. Lastly, they have contributed numerous publications emphasizing the importance of synthesizing human and climatic drivers of phytoplankton community structure and function.

The data sets listed above are by no means complete (they were from the Chapman Conference only). The CPR dataset, although not included in the original proposal, is included here as the CPR has comprehensively sampled phytoplankton biomass as well as the abundance of nearly 200 phytoplankton taxa in coastal ecosystems including the North Sea, Irish Sea, English Channel, European Shelf, North Pacific, Grand Banks,

and Scotian Shelf as well as the open ocean since 1948. No other ecological datasets have sampled marine and coastal plankton at this comprehensive spatial and temporal scale.

Data Archiving and Database Centre

There is certainly a need for compiling and archiving those data sets into a mega database. We will facilitate migration of individual datasets to a permanent and secure electronic archive based on the scientist's willingness of participation and data accessibility. Requirements for development of a fully-stocked phytoplankton data-base greatly exceed the resources of this WG. However, we expect to produce a small working proto-type, based on some existing archive (to be identified) to demonstrate the value of sharing data through an international database, as demonstrated by SCOR WG125: Global Comparisons of Zooplankton Time Series.

Methodological opportunities and issues

Several methodological issues affect the analysis of phytoplankton time series and only a brief summary is given here. However, even though these issues will complicate our work, we can still obtain a meaningful global comparison.

The first issue is diversity of the sampling methodology. No phytoplankton sampling method is perfect, and there have been differences in sampling methodology both within and between data sets, particularly for earlier data. However, we do not expect these differences to be a serious technical barrier to between-region comparisons. A key reason for this is that our analysis focuses on comparisons of anomaly time series rather than of regional climatology. Hence, we are primarily interested in the temporal variability of relative abundance, not the spatial variability of absolute abundance. Several of the proposed WG members have expertise in evaluating effects of changes in sampling methodology within individual time series.

A second issue is consistency of taxonomic identification within and among data sets. Again, we are primarily comparing anomalies relative to local norms, and looking for when, where, and how long the community changes. We also expect that all or most of our analyses will be weighted on the better-known taxa that dominate the community in each region.

A third issue is the volume, accessibility, and diversity of data. The situation here is much improved over even a few years ago. Good computer tools for dealing with the diverse origin and moderately large data sets are now more available, cheaper, more flexible and user-friendly. We anticipate that this trend will continue. Although data management work will be necessary, we do not expect that electronic assembly and consolidation of the phytoplankton data sets will be a major technical problem. In fact, we have already assembled several key data sets as part of the Chapman Conference.

The final issue is the use of statistical tools. During the Chapman Conference, several statistical experts were invited to help participants to perform statistical analyses on their own data set. They demonstrated how to deal with temporal and spatial autocorrelation, and with data gaps. This knowledge will be utilized by our SCOR WG in the next phase of global time series analysis. Application, evaluation, and bundling of these statistical tools for distribution/publication will be another important WG product.

3. Proposed Terms of Reference

- Identify existing long time series of phytoplankton data in coastal oceans around the world
- Facilitate migration of individual data sets to a permanent and secure electronic archive (Requirements for development of a fully-stocked phytoplankton data-base greatly exceed the resources of this WG. However, we expect to produce a small working proto-type, based on the existing archive (to be identified) to demonstrate the value of sharing data through an international database.)
- Develop the methodology for global comparisons for within-region and within-time-period data summarization (e.g. spatial, seasonal and annual averaging, summation within taxonomic and functional group categories). The goal is to clarify what level of detail provides the optimal tradeoff (i.e. information gain vs. processing effort).

- Based on the above, develop priorities and recommendations for future monitoring efforts and for more detailed re-analysis of existing data sets.
- We will carry out a global comparison of phytoplankton time series using (in parallel) a diverse suite of numerical methods. We will examine:
 - Synchronies in timing of major fluctuations, of whatever form.
 - Correlation structure (scale and spatial pattern) for particular modes of phytoplankton variability (e.g. changes in total biomass, species composition shifts, among different geographic distribution).
 - Amplitude of variability, both for total biomass and for individual dominant species, and a comparison to the amplitude of population fluctuations.
 - Likely causal mechanisms and consequences for the phytoplankton variability, based on spatial and temporal coherence with water quality time series.
- Through comparative analysis, we will address the 3 guiding questions.

4. Time Frame and Expected Products

We will begin work in 2010 and will continue for three years. We will convene annual WG meetings (each about 4-5 days), and a larger open attendance workshop or conference in the final or penultimate year. For each year, expected activities and products include:

Year 1: Summarize and evaluate methods, results, and questions arising from the phytoplankton time series analyses that have been completed to date. For the proposed new comparative analyses, select and prioritize the set of regional time series, and the suite of variables from each time series that will be compared (e.g. total phytoplankton biomass, major groups and/or species-level phytoplankton taxonomic composition, phenology, and physical and biological environmental indices). Identify and address obstacles to pooled analyses (e.g. incomplete processing, differences in formatting, differences in resolution). Develop the “best practice” recommendations for data sampling and analysis methodologies.

Year 2: Begin comparative analyses. Evaluate sensitivity and specificity of data analysis (statistical) tools, and improve their availability and “user-friendliness”. Identify time scales and time intervals of particular interest. Post selected tools and data on a web or ftp site (initially closed, and eventually public).

Year 3: Complete comparative analyses of phytoplankton and environmental time series, incorporating any new data that have become available during years 1-3. Identify synchronies (if any) in timing of fluctuations, and quantify correlation time and space scales. Prepare interpretive paper(s) for symposium presentation and publication. Prepare recommendations for “best practice” time series sampling and analysis methodologies.

5. Proposed Working Group membership

Our primary selection will be based on a broad experience with phytoplankton time series, combined with geographic representation and local knowledge of the content for each regional data set. Our suggested list of full members (total 10) includes the following candidates:

Co-Chair, **Kedong Yin**, Australian Rivers Institute, Griffith University, Brisbane, Queensland, Australia, k.yin@griffith.edu.au

His data set will cover subtropical coastal waters in the South China Sea, which receives the outflow of the 2nd largest river (Pearl River) in China.

Yin’s research interests include: coastal dynamics of nutrients; eutrophication processes; ecology and oceanographic processes of harmful algal blooms, in coupling processes with environmental variability, and climate changes; and a plenary speaker on “the dynamics of phytoplankton species composition in subtropical waters of south China during the last 15 years”.

Co-Chair, **Hans W. Paerl**, Institute of Marine Sciences, University of North Carolina at Chapel Hill, Morehead City, North Carolina, USA, hpaerl@email.unc.edu

His interest is to examine how phytoplankton composition change responds to natural disasters. Paerl is the Kenan Professor of Marine and Environmental Sciences and his research interests include; microbially-mediated nutrient cycling and primary production dynamics of aquatic ecosystems, environmental controls of harmful algal blooms, and assessing the causes and consequences of man-made and climatic (storms, floods) nutrient enrichment and hydrologic alterations of inland, estuarine and coastal waters. His studies have identified the importance and ecological impacts of atmospheric nitrogen deposition as a new nitrogen source supporting estuarine and coastal eutrophication. In 2003, he was awarded the G. Evelyn Hutchinson Award by the American Society of Limnology and Oceanography for his work in these fields and their application to interdisciplinary research, teaching and management of aquatic ecosystems.

Susan I. Blackburn (female), CSIRO Marine and Atmospheric Research and the Aquafin CRC, Hobart, 7001, Australia; susan.blackburn@csiro.au

Her data represent temperate waters in the south Pacific Ocean.

Dr Susan Blackburn is a Principal Research Scientist with CSIRO Marine and Atmospheric Research and Head of the CSIRO Collection of Living Microalgae. Her research spans phytoplankton environmental issues and bioapplications of microalgae. Working with harmful algal bloom (HAB) species for over 20 years, Dr Blackburn has combined ecophysiological studies in culture with field studies to elucidate regulation of HABs and interrogate life history details, toxin production, molecular characterization and processes, and trophic interactions, particularly of HAB species in south eastern Australian waters. Within CSIRO, nationally and internationally Dr Blackburn research informs system-wide environmental management and prediction of phytoplankton dynamics and algal blooms through biogeochemical modelling.

Jacob Carstensen, National Environmental Research Institute, Denmark, jac@dmu.dk

His data set represents a temperate inland sea (Kattegat) of the Atlantic Ocean.

Carstensen is a statistician working within marine ecology, in particular long-term trends of ecosystem quality indicators in response to anthropogenic pressures. Particular scientific fields of interests are: biogeochemical processes, phytoplankton community structure and bloom mechanisms, hypoxia, and nutrient management for marine ecosystems.

James E. Cloern, U.S. Geological Survey, Menlo Park, California, USA, jecloern@usgs.gov

His data are from San Francisco Bay and represent many phenomena associated with anthropogenic influence vs climate change.

Cloern has strong expertise in phytoplankton ecology, particularly phytoplankton response to eutrophication and climate changes. He is very experienced in the synthesis of long term data set, and wrote "Phytoplankton bloom dynamics in coastal ecosystems: a review with some general lessons from sustained investigation of San Francisco Bay, California" in 1996. In 2001, he comprehensively reviewed global data in coastal waters and wrote a conceptual review that was published in Mar Ecol Prog Series, "Our evolving conceptual model of the coastal eutrophication problem", which has greatly stimulated coastal eutrophication research. The paper has been cited 373 times.

Paul J. Harrison, Atmospheric, Marine and Coastal Environment Program, Hong Kong University of Science and Technology, Hong Kong SAR, China Harrison@ust.hk

Harrison is a biological oceanographer with expertise in nutrient dynamics and phytoplankton ecology and recent interest in eutrophication, harmful algal blooms and hypoxia. He is a member of SCOR WG 132 "Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems" and will coordinate activities between the two WGs if this WG is funded.

McQuatters-Gollop, Abigail (female), Sir Alister Hardy Foundation for Ocean Science, Citadel Hill, Plymouth, PL1 2PB, United Kingdom, abiqua@sahfos.ac.uk

Working on the CPR data set which includes a measure of phytoplankton biomass as well as the identification and abundance of nearly 200 phytoplankton taxa in the North Sea, Irish Sea, English Channel, European Shelf, North Pacific, Grand Banks, and Scotian Shelf as well as the open ocean since 1948.

Clarisse Odebrecht (female), Institute of Oceanography, Federal University of Rio Grande-FURG, Cx.P. 474, 96201-900 Rio Grande, RS, Brazil, doclar@furg.br

Her data are from South America coastal temperate waters (Patos Lagoon estuary and sandy beach surf-zone).

She is a Professor and leader of the research group: Ecology of Marine Phytoplankton and Microorganisms at the Federal University of Rio Grande-FURG, Brazil. Her main research topics include: taxonomy and ecology of marine phytoplankton, harmful algal blooms, coastal eutrophication and studies on microalgae in marine aquaculture.

N. Ramaiah, National Institute of Oceanography, Dona Paula, Goa 403 004, India; telephone: +91 832 2450515; fax: +91 832 2450602; email: ramaiah@nio.org

His data represent coastal tropical waters in the India Ocean.

Katja Philippart (female), Royal Netherlands Institute for Sea Research (The Netherlands), Texel, The Netherlands, katja@nioz.nl

Her data are from the Wadden Sea, another example where major engineering works have occurred along the coast.

Philippart is a marine ecologist and her research combines laboratory experiments, field studies, statistical analysis of long-term field observations and modeling techniques to investigate the underlying mechanisms of long-term dynamics within shallow marine coastal communities. Her emphasis is on understanding the role of human influences (eutrophication, fisheries and global warming) within these ecosystems in regulating primary and secondary producers, within the North Sea, Venice Lagoon and the Banc d'Arguin. At present, she coordinates relevant research projects, viz. JetSET (long-term field observations in the western Wadden Sea), and the recently funded national research project (2008-2013) dedicated to monitoring primary production in the western Wadden Sea as a baseline for management of human activities in coastal waters (IN PLACE). She is the Editor-in-Chief of the Journal of Sea Research since 2000, co-author of Marine Coastal Dimension of Climate Change in Europe (EU-IES, 2006, Ispra), and the leading author of Climate Change Impacts on the European Marine and Coastal Environment (ESF-Marine Board, 2007, Strasbourg).

Adriana Zingone (female), Stazione Zoologica A. Dohrn, Villa Comunale, Italy, zingone@szn.it

Her data set are in the Gulf of Naples, Mediterranean Sea

Zingone is an expert in taxonomic and morphological studies on marine microalgae, and spatial distribution of phytoplankton diversity in marine waters. Her research findings based on biological time series data contributed to revising paradigms and myths of phytoplankton ecology. She also reviewed seasonal patterns in plankton communities in a pluri-annual time series at a coastal Mediterranean site (Gulf of Naples): an attempt to discern recurrences and trends.

Potential Candidates for Associate Members include:

Borgne, Robert Le, Centre IRD de Noumea, B.P. A5, 98848 Nouméa Cédex, New Caledonia,
leborgne@noumea.ird.nc

His data are from coastal waters off Abidjan, Western Africa and Noumea, SW Pacific in New Caledonia

Elgin, Perry, USA, eperry@chesapeake.net

Perry has worked with Harding on the Chesapeake Bay long time series data set.

Dr. Perry is a statistics consultant providing experimental design and data analysis expertise to researchers involved with environmental research and regulation. Dr. Perry was trained in applied mathematics at the Univ. of Maryland in an interdisciplinary program that included course work and research in mathematical statistics, numerical analysis, and zoology. The majority of Dr. Perry's consulting experience involves collaboration with clients who are conducting research and monitoring of Chesapeake Bay. These clients include: the U.S Geological Survey, USEPA Chesapeake Bay Program, Maryland Sea Grant, Maryland Department of Natural resources, Horn Point Laboratory, Chesapeake Biological Laboratory, Wye Research and Education Center, Virginia Department of Environmental Quality, and U.S. Army Corps of Engineers.

Malone, Thomas C., Ocean US Office for Integrated and Sustained Ocean Observations (US),
Washington, DC, USA, t.malone@ocean.us

He is working with GOOS and his participation will be helpful for coastal observation systems that plan to incorporate phytoplankton into their monitoring program in the future.

Malone has published over 100 peer-reviewed papers on phytoplankton and coastal ecosystem dynamics, science and policy, and integrated ocean observing systems. Chair, IOC-WMO-UNEP-ICSU Coastal Global Ocean Observing System Panel (1998-2000), and Co-Chair, IOC-WMO-UNEP-ICSU Coastal Ocean Observations Panel (2002-2005)

Moncheva, Snejana P. (female), Institute of Oceanography, BAS, Bulgaria, snejanam@abv.bg

Her data set is an extremely long time series (1954-2003) from the Black Sea. Perry,

Picher, Grant, Marine and Coastal Management, Private Bag X2, Rogge Bay 8012, South Africa
gpitcher@sfri2.wacpe.gov.za.

He has access to a 20 yr time series of dinoflagellate abundance from the South African coastal upwelling zone.

Smayda, Theodore J., Graduate School of Oceanography University of Rhode Island Kingston, RI 02881
USA tsmayda@gso.uri.edu

Smayda has a rare long term data set for Narragansett Bay during 1974-2007, another case study for temperate waters.

Smayda is a well known phytoplankton ecologist. His major research themes include seminal works on phytoplankton suspension, species succession in marine environments and population dynamics related to diatom and harmful algal blooms. Armed with the skills of knowing the major marine species, an enviable knowledge of the international literature and a constantly inquisitive mind, Smayda continues to delve into insights related to the dynamics that drive phytoplankton blooms. His recent collaborations with the freshwater phytoplankton ecologist Colin Reynolds in generating his present concepts on species strategies, community assembly and development of blooms offer another

cornerstone from which to examine the HAB paradigm. His first comments on the importance of life cycles, nutrients and eutrophication in driving the spreading of the bloom phenomena on a global basis were quickly adopted by others and presented or reiterated in colleague's publications. In this regard, he has been a trend setter of ideas that have stimulated others to explore further. In 2002, he received **XHAB2002/ISSHA Yasumoto Lifetime Achievement Awards.**

Yoo, Sinjae, Korea Ocean Res. & Dev. Inst. Sa-Dong 1270, Ansan, South Korea sjyoo@kordi.re.kr

His data set from satellite images represents temperate coastal waters in Pacific Ocean where anthropogenic influence from land runoff is increasing.

Yoo has been studying interannual variation of chlorophyll *a* in the North Pacific ecosystems using satellite image data. He also has been studying primary productivity of the Yellow Sea and East Sea by using ship-board and satellite observations.

6. Funding

We will contact various organizations such as LOICZ, IMBER, GEOHAB, PICES, IOC, ICES and Census of Marine Life and expect to attract co-sponsorship and additional financial support in the form of travel funding for associate WG members, especially from the developing countries.

Full members from developed countries will be asked to cover part of the cost of their own travel and accommodation from other sources, if SCOR has a budget limitation to fully support our proposed WG. Our proposal has been strongly supported by PICES and PICES will fully support an associate member, Sinjae Yoo.

7. Interactions with other organizations or programs.

We will maintain our interactions with organizations such as IMBER, LOICZ, GEOHAB, PICES, IOC and CoML during the WG's active period. For example, we will send them our annual meeting notices before meetings and our annual reports for their feedback.

We will try to establish a strong interaction and working relationship with the SCOR WG 125 on zooplankton time series and SCOR WG 132 on HABs. This interaction will be very beneficial as they are dealing with the similar challenge of analyzing global time series data sets.

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Table 1. Data sets presented at the Chapman Conference in 2007, Croatia.

Theme 1: dominant scales of variability in phytoplankton biomass, abundance, floristic composition, species composition, and/or species diversity			
Name	Country	Ecosystem	Series
Paulo C. Abreu	Brazil	Patos Lagoon Estuary	1986-1990, 1993-2007
Susan I. Blackburn	Australia	Huon Estuary, Tasmania	1996-2005
H. O. Briceño	U.S.	Biscayne Bay, Florida Bay, Florida Shelf	1989-2007
Francisco.P. Chavez	U.S.	Monterey Bay	1988-2007
James E. Cloern	U.S.	North & South San Francisco Bay	1969-2007
Valerie David	France	Gironde Estuary	1978-2003
S. Fonda Umani	Italy	Gulf of Trieste	1986-2005
Miles Furnas	Australia	Great Barrier Reef Lagoon	1992-2007
S.A. Gaeta	Brazil	Brazil Coastal Waters	2004-2007
Charles L. Gallegos	U.S.	Rhode River Estuary	1969-2007
Amatzia Genin	Israel	N Gulf of Aqaba	1988-2007
Rita A. Horner	U.S.	Washington Coast	1997-2007
Arantza Iriarte	Spain	Bilbao & Urdaibai . Estuary	1997-2007
Jacco C. Kromkamp	The Netherlands	Oosterschelde/Westerschelde	1987-2006
Robert Le Borgne	France	Ivory Coast, New Caledonia	1969-1979, 1979-1989
WKW Li	Canada	Bedford Basin	1967-2007
Michael W. Lomas	U.S.	Bermuda Atlantic Series	1989-2007
Emma Orive	Spain	Nervion River Estuary	2000-2006
Elgin S. Perry	U.S	Chesapeake Bay	1985-2004
N. Ramaiah	India	Bay of Bengal	1962-1965, 2001-2006
Diana Sarno	Italy	Gulf of Naples	1984-1991, 1995-2008
Dietmar Straile	Germany	Lake Constance	1980-2006
Sanna Suikkanen	Finland	Northern Baltic Sea	1979-2003
Alexander Vershinin	Russia	NE Black Sea	2001-2006
Hidekatsu Yamazaki	Japan	Tokyo Bay	1996-2006

Theme 2: evidence for external forcings of variability and change

Name	Country	Ecosystem	Series
Ana B. Barbosa	Portugal	Ria Formasa Lagoon	1991-1993
Vanda Brotas	Portugal	Tagus Estuary	1999-2007
Rita B Domingues	Portugal	Guadiana River Estuary	1999-2005
Naomi Greenwood	U.K.	Liverpool Bay	1989-2006
Malcolm S. Robb	Australia	Swan Canning Estuary	
Bradley Eyre	Australia	Moreton Bay & Brunswick Estuary	1984-1991; 1995-2007
David G. Borkman	U.S.	Narragansett Bay	1959-1997; 1999-2006
Jonathan H. Sharp	U.S.	Delaware Bay	1980-2003; 1950s – present
Larry W. Harding, Jr.	U.S.	Chesapeake Bay	1989-2007
Hans W. Paerl	U.S.	Neuse River-Pamlico Sound	1993-2006
Clarisse Odebrecht	Brazil	Patos Lagoon Estuary, Cassino Beach	1987, 1989-1990, 1992-2006
M Ribera d'Alcalà	Italy	Gulf of Naples	1979-2006
Alina Tunin-Ley	France	Ligurian & Tyrrhenian Seas	1908-1914, 1929-1931, 1969-1970, 1984, 1988, 2002-2005
Nenad Smodlaka	Croatia		1987-2007
Jacob Carstensen	Denmark	Kattegat	1993-2007
Daniel Conley	Sweden		
Hans Christian Eilertsen	Norway	Norwegian Coast/Barents Sea	1974-2007
Karen Helen Wiltshire	Germany	North Sea Helogland	10 years
Xavier Desmit	The Netherlands	North Sea	1975-2003 ; 1990-2006 (Phyto)
Martina Loebel	Germany	Belgian, Dutch, German Coastal	1990-2005

C J M Philippart	The Netherlands	Wadden Sea	1995-2004
Jennifer L. Martin	Canada	Bay of Fundy	1980-2007
Michael L. Parsons	US	N Gulf of Mexico	
Trevor Platt	Canada	NW Atlantic, remote sensing	1990-2005
Theme 3: consistent patterns among ecosystems in terms of relationships between environmental parameters, phytoplankton biomass and changes in species/floristic composition			
Name	Country	Ecosystem	Series
Malcolm C. Baptie	U.K.	North Sea, UK NE coast	1969-2007
Mauro Bastianini	U.K.	Gulf of Venice	1986-2007
Suncica Bosak	Croatia	N Adriatic Sea	1998-2006
Eileen Bresnan	Scotland	NE Scotland Coastal	1997-2007
Maria Degerlund	Norway	Norwegian coast/Barents Sea	3 decades
R. H. Freije	Argentina	Bahía Blanca Estuary	1978-2006
Inga Hense	Germany	Baltic Sea	1975-2006
Carlton D. Hunt	U.S.	Boston Harbor, Cape Cod Bay, Massachusetts Bay	1992-2008
Tapan Kumar Jana	India	Sundarban Mangrove Forest	1988-2001
R. Kraus	Croatia	Northern Adriatic	1972-2006
Dongyan Liu	China	Jiaozhou Bay	
A. Lincoln MacKenzie	New Zealand	Marlborough Sound, Tasman & Golden Bays	1993-2007
Ivona Marasović	Croatia	Northern Adriatic	1962-1982
Snejana P. Moncheva	Bulgaria	Black Sea	1954-2003
Patricija Mozetic	Slovenia	Gulf of Trieste	1984-2006
Tatyana Osadchaya	Ukraine	Black Sea	1998
Edward J. Phelps	U.S.	Indian River Lagoon	1997-2007

Igor G Polikarpov	Ukraine	Sevastopol Bay	1937-1938, 1960-1968, 2001-2007
Kevin G. Sellner	U.S.	Chesapeake Bay	1984-2007
Ted Smayda	U.S.	Narragansett Bay	1974-2007
Kuninao Tada	Japan	Seto Inland Sea	1991-2006, 1973-2005
Norbert Wasmund	Germany	Baltic Sea, Mecklenburg Bight	1979-2006
Kedong YIN	Hong Kong	Hong Kong Coastal	1991-2004
A. Zingone	Italy	Gulf of Naples	1984-1991, 1995-2009

GLOBEC: Global Ocean Ecosystem Dynamics

Report of the SCOR/IOC/IGBP GLOBEC International Project for 2008/2009
to the SCOR Executive Committee Meeting, Beijing, P.R. China, 20-22 October
2009

Manuel Barange, Director GLOBEC International Project Office
Plymouth Marine Laboratory, UK, m.barange@pml.ac.uk

1. RECENT PROGRESS: Symposia and Workshops

1.1. GLOBEC-sponsored international symposia

- *GLOBEC-IMBER-SOLAS-EUROCEANS symposium on “Dynamics of Eastern Boundary Upwelling Ecosystems: integrative and comparative approaches”*. Las Palmas, Spain, 2-6 June 2008. This was the first symposium co-sponsored by all three SCOR marine projects, receiving generous support from SCOR to developing country scientists. The symposium considered most aspects of the dynamics, structure and functioning of the four major eastern boundary upwelling ecosystems linked to the Benguela, California, Canary (African Canary and Iberian Peninsula) and Humboldt Current systems. These aspects include climate and ocean dynamics, climate change, physics of the ocean and atmosphere, biogeochemistry, ecosystem production, ecology (including behavioural ecology), food-web structure and dynamics, trophic interactions, fisheries assessment and management. The symposium was convened by Pierre Fréon, IRD (France), Javier Aristegui, ULPGC (Spain) and Manuel Barange, PML (UK) and was a clear success. More than 350 scientists attended the symposium, with very even representation from each of the four regions. The Proceedings are in press with the following reference: *Progress in Oceanography*, vol. 83 (nos. 1-4), 2009, and contains approximately 45 papers.
- *GLOBEC-FAO-EUROCEANS symposium on “Coping with global change in marine social-ecological systems”*. Rome, Italy, 8-11 July 2008. This symposium was the culmination of the GLOBEC Focus 4 working group activity. It was highly successful and was attended by more than 200 scientists from both natural and social science disciplines. Social-ecological systems have marine (including physical-biological sub-systems) and human (including cultural, management, economic, and socio-political sub-systems) components which are highly inter-connected and interactive. The central goals of this symposium were to share experiences across disciplines and to identify key next steps and common elements and approaches that promote resilience of marine social-ecological systems in the face of global changes. The meeting was convened by Ian Perry (Fisheries & Oceans Canada, Nanaimo, Canada), Rosemary Ommer (University of Victoria, Victoria, Canada) and Philippe Cury (IRD/CRH, Sète, France). The proceedings of the symposium appear in two separate outlets: A commissioned book: *World Fisheries: A Social-ecological Analysis*, to be published by Wiley-Blackwells, and a special issue in the journal *Marine Policy* (papers in the final stages of approval). Both publications are expected to appear in early 2010.
- *GLOBEC 3rd Open Science Meeting*. Victoria, British Columbia, Canada, 22-26 June 2009. The 3rd OSM was entitled “Marine ecosystems: from function to prediction” to focus the meeting towards the overall objective of GLOBEC of “providing a new mechanistic understanding of the functioning of the marine ecosystem, in order to develop predictive capabilities and propose a framework for the management of marine ecosystems in the era of global change”. The GLOBEC OSM was planned to

culminate the integration and synthesis activities of the international GLOBEC programme by providing a new mechanistic understanding of the functioning of the marine ecosystem, in order to develop predictive capabilities and propose a framework for the management of marine ecosystems in the era of global change. When the GLOBEC programme was being developed in the late 1980s the scientific view of the ocean was very different from what it is today—collaboration between oceanographers and fisheries scientists was limited, the major forcings on the ocean were seen to be climate variability (by oceanographers) and fishing (by fisheries scientists); and the Internet and email did not exist. Today, the marine world looks very different—satellites provide coverage of an array of ocean properties, huge amounts of data are instantly available over the Internet and the main drivers of change in marine ecosystems are realised to be climate, humans and their interactions. GLOBEC has played a large role in effecting these changes, as shown in the presentations at the OSM. The first two days of the conference were devoted to ten specific workshops:

- Modelling ecosystems and ocean processes. Chairs: Enrique Curchitser, Alejandro Gallego, Michio Kishi and Emanuele Di Lorenzo
- Comparisons of processes and climate impacts in sub-Arctic and Antarctic marine ecosystems. Chairs: Eileen Hofmann, George Hunt, Bernard A. Megrey, Eugene Murphy, Sei-ichi Saitoh and Hyoung-Chul Shin
- Worldwide large-scale fluctuations of sardine and anchovy. Chairs: Jürgen Alheit, Salvador Lluch-Cota and Carl van der Lingen
- Krill biology and ecology in the world's oceans. Chairs: Angus Atkinson, Jaime Gómez-Gutiérrez, Bettina Meyer and William Peterson
- Biogeochemistry of the oceans in a changing climate. Chairs: Francis Chan and Debby Ianson
- Continuous Plankton Recorder surveys of the global ocean. Chairs: Sonia Batten and Peter Burkill
- Cod and climate change: the past, the present and future. Chairs: Øyvind Fiksen, Jeff Runge and Fritz Köster
- Plankton phenology and life history in a changing climate: observation and modelling Chairs: Rubao Ji, Dave Mackas and Martin Edwards.
- Climate impact on ecosystem dynamics of marginal seas. Chairs: Yasunori Sakurai and Christian Möllmann
- Socio-economic dynamics and ecosystems, governance Implications. Chairs: Kathleen Miller and Anthony Charles
- There then followed three days of plenary sessions along the following themes:
- GLOBEC achievements. Chairs: Manuel Barange and Ian Perry
- Ecosystem structure, function and forcing. Chairs: Salvador Lluch-Cota, Yasunori Sakurai, George Hunt and Qisheng Tang
- Ecosystem observation, modelling and prediction. Chairs: Harold Batchelder, Roger Harris and Dale Haidvogel
- Workshops feedback. Chair: Manuel Barange
- Ecosystem approach to management. Chairs: Dave Checkley, Keith Brander and Astrid Jarre
- Each of these sessions (except #4) consisted of a number of invited and contributed presentations, plus an adjacent poster session. Session 4 was devoted to providing feedback on the follow-ups to the workshops. In this context, GLOBEC intends to partially fund selected follow-up activities that contribute to the synthesis of the programme. The OSM was attended by more than 300 delegates from 34 countries. Thanks to the contribution of the sponsors (such as SCOR), the organisation was able to invite and offer financial support to 20 scientists from many countries including Peru, India, Lebanon and Namibia. The proceedings of the conference will be published in a special issue of *Progress in Oceanography* and edited by Manuel Barange (UK), Ian Perry (Canada), Eileen Hofmann (USA), Coleen Moloney (South Africa), Yasunori Sakurai (Japan) and Geir Ottersen (Norway). The Proceedings complement the GLOBEC synthesis book ("Marine ecosystems and global change", Ed. By Barange et al., Oxford University Press, in press).
- 26-29 April 2010: Climate change effects on fish and fisheries: forecasting impacts, assessing ecosystems responses, and evaluating management strategies. Sendai, Japan. While this symposium is

to take place after the official closure of the GLOBEC programme, it is listed in this report because it has emanated from the work conducted by GLOBEC programmes in different ocean basins. The symposium will provide a forum for scientists and policymakers to discuss the potential impacts of climate change on marine ecosystems and our uses of these ecosystems, and to consider the strategies that society can take to be prepared for anticipated impacts. Quantitative studies of the potential impact of climate change on fish and fisheries throughout the world will be featured. The symposium is co-sponsored by ICES, PICES and the FAO, and convened by Anne Hollowed (NOAA, USA), Manuel Barange (PML, UK), Harald Loeng (IMR, Norway), Suam Kim (PKNU, Korea) and Shin-Ichi Ito (FRA, Japan). The list of sessions is as follows:

- Plenary Session 1 Forecasting impacts: from Climate to Fish. Ken Drinkwater (Norway), Harald Loeng (Norway) and Yasuhiro Yamanaka (Japan)
- Plenary Session 2 Forecasting impacts: from fish to markets. Co-convenors: Jacquelynne King (Canada) and Manuel Barange (United Kingdom)
- Plenary Session 3: Sustainable strategies in a warming climate. Co-convenors: Anne Hollowed (USA) and Michael Schirripa (USA)
- Parallel Session A1: Downscaling variables from global models. Co-convenors: Michael Foreman (Canada) and Jason Holt (United Kingdom)
- P. Session A2: Species-specific responses: changes in growth, reproductive success, mortality, spatial distribution, and adaptation. Co-convenors: Myron A. Peck (Germany) & Richard J. Beamish (Canada)
- P. Session B1: Assessing ecosystem responses: impacts on community structure, biodiversity, energy flow, and carrying capacity. Co-convenors: Akihiko Yatsu (Japan) and Thomas Okey (Canada)
- P. Session B2: Comparing responses to climate variability in nearshore, shelf and oceanic regions. Co-convenors: Jürgen Alheit (Germany) and Vladimir Radchenko (Russia)
- P. Session C1: Impacts on fisheries and coastal communities. Co-convenors: Keith Brander (United Kingdom) and Suam Kim (Korea)
- P. Session C2: Evaluating Human Responses, Management Strategies, and Economic Implications. Co-convenors: Jake Rice (Canada) and Kevren Cochrane (Italy)
- P. Session D1: Measuring uncertainty, identifying key unknowns and communicating risk. Co-convenors: Chairs: Franz Mueter and Carl O'Brien
- P. Session D2 Session: Contemporary and next generation climate and oceanographic models, technical advances and new approaches. Co-Convenors: Jonathan Hare (USA), Shin-Ichi Ito (Japan)

Additional information on this symposium is available at www.pices.int.

1.2 GLOBEC workshops, regional and national symposia

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

- ICES-GLOBEC Workshop on Cod and Future Climate Change. 16-17 June 2008, Copenhagen, Denmark. This was the 2008 annual workshop of the Cod and Climate Change programme of ICES and GLOBEC, which follows on the strategy of the CCC. The project will conclude at the end of 2009.
- GLOBEC-ESSAS 2008 Science Meeting. Halifax, Canada, 15-19 September 2008. A series of ESSAS workshops is planned in Halifax, Nova Scotia. The workshops included a follow-up 1-day session on predicting future climates in the ESSAS regions, a 1-day workshop devoted to presentations and discussions from the 2008 Science meeting in Hakodate, a half-day session on advective processes and a 1-day workshop on assessing the best approaches to using models for comparing the ESSAS regions and their responses to climate change.

- 18-20 September 2008: GLOBEC synthesis book editors meeting. Halifax, Canada. This meeting was used to make final decisions regarding the structure and contents of the GLOBEC synthesis book, which is now in press (see below).
- PICES XVII Annual Meeting. Dalian, China, 23 October-2 November 2008. The meeting included the following GLOBEC sessions:
 - GLOBEC CCCC Topic Session - Marine system forecast models: Moving forward to the FUTURE.
 - GLOBEC ESSAS Workshop - Status of marine ecosystems in the sub-arctic and arctic seas - Preliminary results of IPY field monitoring in 2007 and 2008
 - GLOBEC CCCC - Climate scenarios for ecosystem modelling (II)
- GLOBEC/ICES/PICES workshop on changes in distribution and abundance of clupeiform small pelagic fish in relation to climate variability. Kiel, Germany, 3-7 November 2008. This workshop follows on a series of similar initiatives conducted over the last few years in the Americas, Africa, Asia and Europe under the banner of SPACC. A report of this meeting is still being prepared.
- 18-19 June 2009: ESSAS Annual Science Meeting. Seattle, Washington, USA. The annual ESSAS science meeting included three workshops and three working group sessions:
 - Gadoid-crustacean interactions in Sub Arctic Seas (Franz Mueter & Earl Dawe)
 - Advection and Its Effects in Sub-Arctic Ecosystems (Ken Drinkwater)
 - Comparisons of Approaches to End-to-End Modeling of Marine Ecosystems (Conveners: Bernard Megrey, Kenneth Rose, and Shin-Ichi Ito)
 - ESSAS Working Group 1 — Regional Climate Prediction
 - ESSAS Working Group 2 — Bio-Physical Coupling: Hotspots and Thresholds
 - ESSAS Working Group 3 — Modeling Ecosystem Response
- *CLIOTOP-WG3 Workshop: Inter-ocean comparisons of oceanic food webs. Sete, France, 6-10 July 2009.* This five-day workshop in Sète conducted analysis of stomach content data of a common subset of predators (especially tunas) from the Indian, Atlantic, and Pacific Oceans to examine similarities and differences in their trophic ecology in relation to differences in regional oceanography (Fig. 2). The approach, which has been applied recently by WG3 scientists during a one-day meeting in Hawaii to a combined data set covering three distinct regions in the Pacific Ocean, revealed a number of important differences suggesting that large-scale comparisons would be useful to interpret future responses to ocean warming. The workshop in Sète was designed to investigate how to incorporate food web data (both stomach and stable isotope data) from the three oceans into an interoperable database from which the global inter-oceanic comparative analysis will be based.
- *CLIOTOP-WG2 Workshop: Development of new electronic devices to monitor animal behaviour and physiology.* Swansea, UK, 28-30 July 2009. The primary purpose of the workshop is to identify how we might best proceed in order to be able to model the movement and incidence of space-dependent behaviours of oceanic top predators. The aspiration is to produce a strategy for studying top predator movement with a truly global perspective.
- Summer colloquium: Ecosystems and climate: modelling and analysis of observed variability in marine ecosystems. Boulder, USA, 3-14 August 2009. This colloquium will provide climate and marine ecosystem graduate students with a comprehensive introduction to issues surrounding the development of and hands-on experience with observational datasets and state-of-the-art marine ecosystem modeling approaches in the context of climate models, and the techniques of testing models verses existing datasets. An integrated approach to studying climate-ecosystem interactions is typically not offered in standard university courses; accordingly, the colloquium will provide unique and unprecedented opportunity to study and apply these research tools. As importantly, this colloquium will provide an opportunity for graduate students in the marine ecosystem, climate and climate impact sciences to collaborate. The Colloquium is co-funded by CLIVAR and GLOBEC, in collaboration with the NCAR advanced study programme organised by James Hurrell, Keith Lindsay

and Joan Kleypas (NCAR), Dale Haidvogel (Rutgers University), Thomas Powell (University of CA, Berkeley) and Michael Alexander (NOAA, ESRL).

- *ICES Annual Science Conference. Berlin, Germany, 21-25 September 2009*: The programme includes two GLOBEC theme sessions on:
- Climate impacts on marine fishes: discovering centennial patterns and disentangling current processes and
- Advances in marine ecosystem research: what we have learned from GLOBEC and what we can carry forward in future climate-related programs.

In addition, GLOBEC has hosted/will host the following SSC/working group meetings in 2008/2009:

- 18-19 September 2008: GLOBEC-ESSAS SSC meeting, Halifax, Canada
- 17 and 20 June 2009: ESSAS Scientific Steering Committee meeting
Seattle, Washington, USA
- 20 September 2008: GLOBEC Executive meeting. Halifax, Canada
- 27 June 2009: GLOBEC Executive meeting. Victoria, Canada.
- 11-13 November 2009: GLOBEC SSC Meeting Plymouth, UK

More information is available on the GLOBEC Web site, including minutes of GLOBEC SSC meetings.

2. RECENT DEVELOPMENTS AND PUBLICATIONS

2.1. Links with IMBER and future developments beyond 2010

GLOBEC is closing down in December 2009, at which point the continuing activities and outstanding scientific questions are anticipated to be taken up by IMBER. To that effect the GLOBEC and IMBER Executive Committees have been meeting together annually to advance common activities and develop the necessary synergy. In parallel, IGBP and SCOR appointed a Transition Task Team (TTT) to draft an addendum to the IMBER *Science Plan and Implementation Strategy* in preparation for the closure of GLOBEC. The TTT was an implementation of the agreement of the sponsors of both GLOBEC and IMBER (IGBP, SCOR) to merge both projects into a single ocean research project in the IGBP structure. The first meeting of the TTT was organized by GLOBEC (and co-sponsored by SCOR) and held in Reading, UK, 30 July–1 August 2008. The 2nd meeting of the TTT is expected to take place in November/December 2008. The TTT prepared a comprehensive report on the areas of GLOBEC science that needed to be incorporated in a second phase of IMBER. Some of the existing GLOBEC regional initiatives have already agreed to continue under their new umbrella (CLIOTOP, ESSAS), others will not (CCC, CCCC), and others are still under negotiation (SPACC). The sixth GLOBEC regional programme (Southern Ocean GLOBEC) concluded last year and was followed by a new GLOBEC-IMBER programme (ICED). A number of national and multi-national initiatives are already shared between IMBER and GLOBEC, and this process is expected to continue in the final stages of GLOBEC.

2.2. Partnership for Climate, Fisheries and Aquaculture (PaFCA)

As a result of GLOBEC and other initiatives, 2009 saw the creation of this partnership, initially tasked with the objective of increasing the profile of fisheries and aquaculture issues in the political negotiations in the build up and during the Conference of Parties of the UN Framework Convention for Climate Change, to take place in Copenhagen, Denmark, December 2009. In brief, the main steps of the Partnership have been

- the meeting of partners at FAO in March 2009 to establish a group strategy
- the draft of a Policy Brief to outline why fisheries should be included in the negotiations of the CoP

- the attendance of PaCFA representatives at key meetings in the build-up to the CoP to distribute the Policy Brief to national delegates and defend it (particularly Bonn, 10-14 August; Bangkok 28 Sep-9 October; Barcelona 2-6 November).
- The organisation of side events in Copenhagen (7-18 December) to act as a node of information and advice.

PaCFA includes currently the following organisations: FAO, UNEP, UNDP, GLOBEC, ICES, PICES, UNISDR, NACA, NACEE, OECD, OSPESCA, EBCD, SEAFDC, SPC, World Bank, WorldFish, and UNESCO-IOC. The creation and steering of PaCFA is a direct response of GLOBEC's engagement with policymakers and advisors, benefitting from the interest and commitment of a large number of interested parties. While the group is still ad hoc, it is likely to become increasingly formal, and is developing strong links with other ocean-oriented information groups, such as the Global Oceans Forum which is currently led by FAO and UNEP.

2.2. Publications

2007-2008 Special Issues and books

GLOBEC has produced in excess of 3,200 (>2,700 refereed) research papers since its implementation. In total, we have produced 26 special issues in peer-reviewed journals. For a full list go to <http://web.pml.ac.uk/globec/products/publications/chron/all/2007.htm> or follow links from www.globec.org

In 2008, the following special issues have been produced:

- Michael, J. Dagg., Roger Harris, Sin-ichi Uye, Luis Valdes (Eds.) 2008. 4th International Zooplankton Production Symposium: Human and Climate forcing of Zooplankton Populations. *ICES Journal of Marine Science* 65(3): 277-495.
- Eileen E. Hofmann, Peter H. Wiebe, Daniel P. Costa and Joseph J. Torres (Eds.) 2008. Dynamics of plankton, krill and predators in relation to environmental features of the western Antarctic Peninsula and related areas: SO GLOBEC Part II. *Deep-Sea Research II* 55(3-4): 269-558.
- Batchelder, H.P and Kim, S. (Eds) 2008. Climate variability and ecosystem impacts on the North Pacific: a basin-scale synthesis. *Progress in Oceanography* 77(2-3): 83-258

The full list is available at http://web.pml.ac.uk/globec/products/publications/special/spec_list.htm.

In addition, at least another 4 special issues are in press (2 in *Progress in Oceanography*, one in *ICES J. Mar. Sci.* and one in the *J. Mar. Systems*). Three books were also published in 2008 or are in press:

- Barange, M., Field, J.G., Harris, R.H., Hofmann, E.E., Perry, R.I., Werner, C. 2010. *Marine ecosystems and Climate Change*. Oxford University Press, Oxford, UK (expected to be released in Feb 2010)
- Checkley, D. M., Jr., Alheit, J. A., Oozeki, Y., and Roy, C., eds. (2009). *Climate Change and Small Pelagic Fish*, Cambridge University Press, Cambridge, UK (released in August 2009)
- Ommer, R., I. Perry, P. Cury, K. Cochrane, eds. 2010. *World Fisheries: A Social-Ecological Analysis*. Wiley-Blackwells Fisheries and Aquatic Resources Book Series. (expected early 2010).

2008/9 GLOBEC Reports

In this reporting period we produced three GLOBEC reports:

- Hampton, I., M. Barange and N. Sweijid (Eds.) 2008. *Benguela Environment Fisheries Interaction and Training Programme (BENEFIT) Research Projects*. GLOBEC Report 25

- Murphy, E.J., R.D. Cavanagh, N.M. Johnston, K. Reid and E.E. Hofmann (Eds.) 2008. *Integrating Climate and Ecosystem Dynamics in the Southern Ocean (ICED): A Circumpolar Ecosystem Programme*. Science Plan and Implementation Strategy. GLOBEC Report No.26
- Wiebe, P.H., R.P. Harris, M.A. St. John, F.E. Werner, B. deYoung and P. Pepin (Eds.) 2009. *BASIN: Basin scale analysis, synthesis and integration. Science plan and implementation strategy*. GLOBEC Report No. 27

2.3. GLOBEC Synthesis book

The GLOBEC synthesis book “**Marine Ecosystems and Global Change**” will be published by Oxford University Press. The manuscript has been submitted and will be released in time for the February 2010 ASLO meeting. It is already available for pre-order at the OUP website. The book was put together by almost 100 contributors from 17 countries, and will be the most tangible and comprehensive synthesis of the work of the programme. The structure of the book is as follows:

Editors: Manuel Barange, John Field, Roger Harris, Eileen Hofmann, Ian Perry, Cisco Werner

- Preface
- Chapter 1. Introduction: Oceans in an Earth System – Manuel Barange et al.

Section 1. The changing ocean ecosystems

- Chapter 2. Climate forcing on marine ecosystems – Ken Drinwater et al.
- Chapter 3. Human impacts on marine ecosystems - Keith Brander et al.

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

- Chapter 4. Target species – Dian Gifford et al.
- Chapter 5. Physical-biological interactions: integration and modeling – Brad deYoung et al.
- Chapter 6. Dynamics of marine ecosystems: observation and experimentation – Roger Harris et al.
- Chapter 7. Dynamics of marine ecosystems: ecological processes – Coleen Moloney et al.

Section 3. The human dimensions of marine ecosystem change

- Chapter 8. Interactions between changes in marine ecosystems and human communities – Ian Perry et al.
- Chapter 9. Marine resources management in the face of change: from ecosystem science to ecosystem-based management – Manuel Barange et al.

Section 4. A way forward

- Chapter 10. Ocean ecosystem responses to future global change scenarios: a way forward – Sin-ichi Ito et al.
- Chapter 11. Marine ecosystems and global change: a synthesis – Eileen Hofmann et al.

For more details, follow <http://ukcatalogue.oup.com/product/9780199558025.do>

2.4. GLOBEC SSC 2008

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

Name	Gender	Country	Function
Dr Jürgen Alheit	M	Germany	Chair Focus 1, SPACC Exec
Dr Kevern Cochrane	M	Italy	SSC – FAO link
Prof Brad deYoung	M	Canada	Chair Focus 3
Dr Ruben Escribano	M	Chile	SSC
Dr Roger Harris	M	UK	Chair Focus 2
Prof Eileen Hofmann	F	USA	SSC, SO Chair
Dr James Hurrell	M	USA	SSC

Dr Astrid Jarre	F	Denmark	SSC
Dr Salvador Lluch-Cota	M	Mexico	SSC
Dr Olivier Maury	M	France	SSC
Dr Ian Perry	M	Canada	Chair, Focus 4 co-Chair
Dr David Runge	M	USA	SSC
Prof Yasunori Sakurai	M	Japan	SSC
Prof Svein Sundby	M	Norway	SSC
Prof Francisco Werner	M	USA	Past SSC Chair

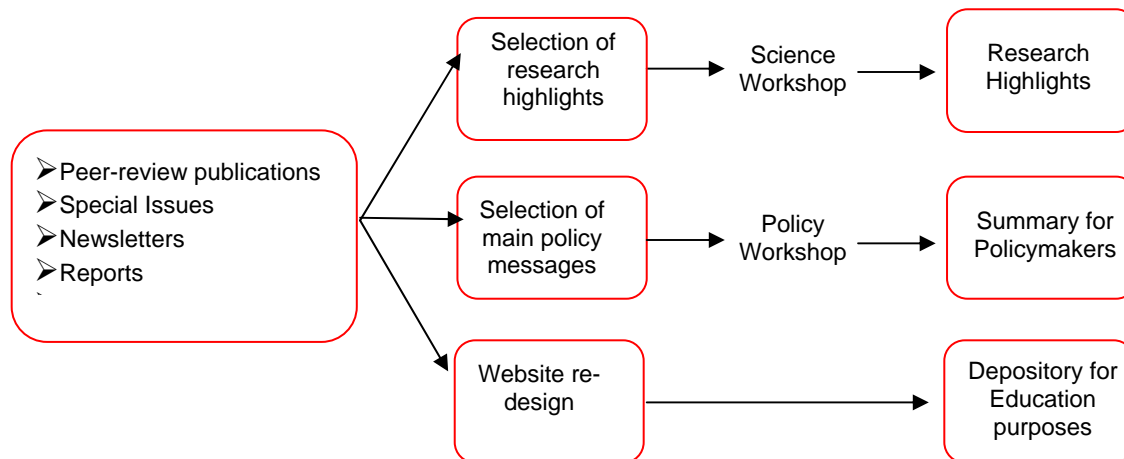
The SSC will complete its mandate at the end of December 2009, although some of the members will remain engaged in the final stages of the project (see below).

3. FINAL STEPS: Science Communication and IPO closure

3.1. Research Highlights and Summary for policymakers

In 2009, the GLOBEC IPO, in collaboration with ICES, PICES, FAO, SCOR, IGBP, DEFRA (UK) and DFO (Canada) put together a proposal for funding to the Natural Environment Research Council under their Knowledge Transfer calls to synthesise the results of GLOBEC (3,113 papers, 30 special issues, 5 synthesis books and the 33 GLOBEC Reports), to maximise its impact in policymaking, science management, advisory and educational arenas. The proposal involved producing a comprehensive Science Highlights document, a targeted Summary for Policymakers and a long-standing educationally oriented Web site that acts as a depository of GLOBEC's products. The work was to be coordinated between the Chair of GLOBEC, the International Project Office and a professional science communicator, and will benefit from the partnership established.

The proposal was intended (see diagram) to include two workshops with key scientists and policymakers.



Despite excellent reviews and a 4/5 overall score, the proposal was not funded. It is therefore unclear at this stage how much of the proposed work will be conducted, as it will depend on the savings from the 2009 budget. GLOBEC remains committed to producing the outputs outlined in the figure above, albeit with a limited level of funding (and thus possibly without the leading workshops).

While the above process was being completed, and as a result of conversations at the GLOBEC OSM meeting

in Victoria, a "Digging into Data" proposal, titled "Constructing a Summary for Policymakers in a Web2.0 World: the GLOBEC legacy", was put together in collaboration with Canadian, USA and UK teams. The objective of the proposal is to use a range of resources in digital humanities computing, social networking technologies and computer-supported collaborative work environments, to develop a technology-enhanced process for constructing a summary for policymakers from the large body of literature created through GLOBEC. If successful, this proposal will provide innovative ways of selecting summary conclusions, rather than relying on expert opinion alone.

Furthermore, also during the final OSM meeting, Elsevier proposed that GLOBEC publish a compendium of key GLOBEC research publications that have appeared throughout the duration of the programme, as a single volume. Such a product would complement the synthesis books, special issues, research highlights and summary for policymakers, in a way that would make GLOBEC unique in its final communication of its research. This offer, however, needs to be funded internally and thus needs to be discussed by the GLOBEC SSC in its final meeting.

3.2. Programme closure

The plans for the closure of GLOBEC remain as follows:

1. All science activities (with the exception of unexpected delays) to be completed by 31 December 2009
2. GLOBEC International Project Office to close at the end of March 2010
3. Steps to be taken during the period Jan.-March 2010:
 - a. Full financial reporting to sponsors
 - b. Preparation and dissemination of 2 packs of GLOBEC hardcopy documentation to three institutions with public access. Although yet to be decided these institutions would be in the UK, Africa and the Americas.
 - c. Uploading of as much documentation as possible to the GLOBEC Web site, and securing its access (if not its maintenance) for at least 10-years after closure.
4. Because some of the products of GLOBEC will only result in the final stages of the project (e.g., the GLOBEC Synthesis book is to be published in February 2010) or after its closure (e.g., Proceedings of the 3rd OSM not expected until the summer of 2010), a skeleton structure of the IPO will remain in place for final clean-up between March and July 2010.

A brief report on the programme's closure, and on the use of the SCOR-secured funds between August 2009 and the end of GLOBEC, will be included in the last report of GLOBEC to SCOR, which will be provided for the 2010 SCOR Annual Meeting.

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

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

ACTIVITIES 2008-2009

• **SSC Meeting: Galway, Ireland, June 2009**

The GEOHAB SSC met in Galway, Ireland on 11-13 June 2009 and discussed all aspects of GEOHAB work. The meeting discussions included the following topics:

- Review of all the status of all GEOHAB Core Research Projects
- Planning for an Open Science Meeting on HABs in Benthic Environments
- Update on the GEOHAB Modeling Workshop
- Beginning discussions of plans for GEOHAB completion at the end of 2013
- Discussion of a potential joint activity with IOCCG
- Interactions with GOOS and the Intergovernmental Panel on Harmful Algal Blooms
- Updates on regional, national, and GEOHAB-endorsed projects
- Report from the SCOR Project Summit
- GEOHAB Web site and publications
- Representation at meetings
- SSC rotations

A summary of the meeting is available on the GEOHAB Web site (<http://iodeweb6.vliz.be/geohab/>).

• **Implementation of Core Research Projects**

The GEOHAB *Implementation Plan*¹¹, 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 2008 SCOR General Meeting.

A. Core Research Project: HABs in Upwelling Systems

This sub-group is chaired by Grant Pitcher (South Africa). Group members are writing papers to be published in the journal *Progress in Oceanography* to synthesize previous research related to their topic, to serve as a foundation for new comparative research on HABs in upwelling systems. The special issue is almost completed. After that occurs, the group may plan a second open science meeting, on some specific aspect of HABs in upwelling systems.

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

This sub-group is co-chaired by Allan Cembella (Germany) and Leonardo Guzmán (Chile). Their Open Science Meeting took place in Viña del Mar, Chile on 26-29 April 2004. A draft of their report was presented and two SSC members volunteered to review it when completed (the review was going on as of August 2009).

C. Core Research Project: HABs and Eutrophication

The sub-group on HABs and Eutrophication is chaired by Patricia Glibert (USA). The research plan for this CRP was published in 2006. The group is planning a 2nd GEOHAB Open Science Meeting on HABs and Eutrophication in Beijing, China, overlapping with the 2009 SCOR Executive Committee meeting and immediately after the second meeting of SCOR/LOICZ WG 132 on Land-based Nutrient Pollution and the

¹¹GEOHAB. 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.

Relationship to Harmful Algal Blooms in Coastal Marine Systems.

D. Core Research Project: HABs and Stratification

The sub-group on HABs and Stratification is chaired by Patrick Gentien (France). The report from this meeting was completed about one year ago and the SSC discussed the composition of a subcommittee for this CRP.

E. Open Science Meeting on HABs in Benthic Systems

The GEOHAB SSC budgeted funding for an open science meeting (OSM) on HABs in benthic systems, which would include algae that contribute to ciguatera, probably the most widespread of all algae-related poisonings. All SSC members recognize the importance of this issue. A potential chair was agreed upon and has accepted (Paul Bienfang, USA). The SSC is in the process of assembling a planning committee for the OSM, which will take place between May and September 2010, in Hawaii, so that the results can be reported out at the November 2010 international HAB meeting in Crete.

3. GEOHAB Modelling

GEOHAB held a workshop to help integrate modeling activities into GEOHAB CRPs and regional/national projects. The workshop was attended by about 80 participants and was held at the Martin Ryan Institute, National University of Ireland, Galway, Ireland on 15-19 June 2009. Information about the meeting is available at www.geohab-models.org. Funding was obtained from a variety of sources.

4. 2010 SSC Meeting

The 2010 SSC meeting may be held in conjunction with the OSM on HABs in Benthic Systems in Hawaii.

5. GEOHAB Asia

A meeting focused on GEOHAB-related research in Asia was held in conjunction with the 2007 SSC meeting in Tokyo, Japan. It was concluded that formation of an Asian GEOHAB collaboration would be beneficial for research in this region. A second meeting was held in Vietnam in January 2008. A Science Plan is being developed for GEOHAB research in Asia and will be reviewed by scientists in the region and GEOHAB SSC members.

6. International Programme Office [IPO]

The SSC and sponsors have concluded that with the difficulty in finding funding for a GEOHAB IPO and the fact that GEOHAB is beginning to wind down (see below), attempts to establish an IPO for the project would be stopped.

7. GEOHAB Sunset

SCOR and IOC agreed to close the GEOHAB program at the end of 2013, ten years from the publication of the GEOHAB Implementation Plan. Discussions were begun on what would be appropriate final products. At this time, ideas include a summary of program accomplishments for a broad audience and/or an update of the HABWATCH book on HAB-observing technologies.

IMBER Annual Report to SCOR August 2009

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MAJOR ACTIVITIES AND ACHIEVEMENTS

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- *Being Efficient and Environmentally Responsible* (BEER) training workshop
- *Decadal Variations of the Ocean's Interior Carbon Cycle: Synthesis and Vulnerabilities* symposium
- *Analyses of End-to-end Food Webs and Biogeochemical Cycles* Summer School
- ICED Science Plan published
- Draft Science Plan and Implementation Strategy for SIBER
- GLOBEC-IMBER Transition Task Team Report
- Incorporation of the Regional Programmes CLIOTOP and ESSAS into IMBER
- Deep-Sea Research II: *Surface Ocean CO₂ Variability and Vulnerabilities*
- Workshop on developing IMBER research in the UK
- IMBER/SOLAS meeting for the French community

Working groups

IMBER has developed five working groups or task teams which are active in the development and implementation of IMBER.

1 IMBER/SOLAS Carbon (SIC!) Working Group

The joint IMBER/SOLAS Carbon Working Group has recently been restructured. The Chairs of the three sub-groups now report directly to the IMBER and SOLAS SSCs and work closely with the International Ocean Carbon Coordination Project (IOCCP). The Joint SOLAS/IMBER Carbon Research Implementation Plan is available at (http://www.imber.info/products/Carbon_Plan_final.pdf).

Sub-group 1 (SG1) Surface Ocean System (Leader: Are Olsen, Norway)

SOLAS is currently developing new Terms of Reference for this sub-group. Are Olsen is replacing Nicolas Metzger as Chair of the group. The need for a surface CO₂ database was recognised at the SOLAS Open Science Conference in Xiamen, China in 2007 and activities of the group have focussed on achieving this. The SOCAT database will be released in late 2009. A *Deep-Sea Research II* special issue: *Surface Ocean CO₂ Variability and Vulnerabilities* was published in April 2009 (Vol. 56, Nos. 8-10) (<http://www.sciencedirect.com/science/journal/09670645>)

Sub-group 2 (SG2) Ocean Interior (Leader: Nicolas Gruber, Switzerland)

New Terms of Reference are currently being developed and membership of the group is to be increased. The group deals with inventory and observations, natural variability and transformation. Its aim is to determine the uptake, transport and storage of anthropogenic CO₂ on decadal timescales.

As part of the global synthesis SG2 organised the *Decadal Variations of the Ocean's Interior Carbon Cycle: Synthesis and Vulnerabilities* symposium at the Centro Stefano Franscini in Ancona (Switzerland) on 13-17 July 2009. Its aims were to synthesise ocean observations to obtain an estimate of oceanic uptake of anthropogenic CO₂ since the WOCE period and to identify changes in observation strategies.

Following the rationale that oxygen is very sensitive to global change, a pilot program—Oxywatch O₂ (putting oxygen sensors on Argo floats)—was developed. A White Paper was developed and Argo floats with O₂ sensors are currently being tested. A Community White Paper has been accepted for OceanObs'09, where the sub-group Chair, Niki Gruber, will deliver the keynote address.

Another activity related to this sub-group is the CARbon dioxide In the North Atlantic (*CARINA*). *CARINA* was started in June 1999 with the objective to collect carbon-relevant data sets in the North Atlantic Ocean and to form a consistent, quality-controlled data base for the Atlantic (including the Southern and Arctic ocean). The second quality control exercise was recently completed and the manuscript is soon to be submitted to *Earth System Science Data*.

Sub-group 3 (SG 3) Ocean Acidification (Leader: Jean-Pierre Gattuso, France)

The third IMBER/SOLAS Carbon Research sub-group on Ocean Acidification has recently been launched (August 2009) (http://www.imber.info/C_WG_SubGroup3.html).

The tasks of the group are to

1. coordinate international research efforts in ocean acidification, and
2. undertake synthesis activities in ocean acidification at the international level.

The group's first meeting will identify and prioritise topics for immediate attention, with proposed deliverables and a plan to achieve them.

2 Continental Margins Task Team

The IMBER/LOICZ Continental Margins Task Team was developed to link the two projects at the continental margins. The current Task Team is co-chaired by Jack Middelburg (The Netherlands) and Nancy Rabalais (USA). The group organised a Continental Margins Open Science Conference at the East China Normal University in Shanghai on 17-21 September 2007 (<https://www.confmanager.com/main.cfm?cid=792>). The draft Continental Margins Science Plan that resulted from this conference has recently been submitted. A team from the IMBER and LOICZ SSCs has been tasked with finalising the document and developing a paper to guide the Continental Margins biogeochemistry and ecosystems research going forward. The team leader is Katja Philippart.

IMBER is currently in the process of establishing an IMBER project office in China which will take the lead for Continental Margins activities. The organisation of a dedicated Continental Margins IMBIZO is being considered.

3 Capacity Building Task Team

The Capacity Building group was set up at the start of IMBER to ensure that capacity building initiatives were included in all IMBER projects. Its mission is to assist developing countries to develop research initiatives and to provide involvement in IMBER activities and training for young and developing country scientists. 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 task team is chaired by Jing Zhang. A capacity building strategy and implementation plan has been developed (http://www.imber.info/products/Capacity_Building_final.pdf). Membership of the task team is currently being reviewed and additional members from developing countries have been invited to join.

IMBER is represented on the SCOR Capacity Building Committee by Jing Zhang (see <http://www.scor-int.org/capacity.htm> for details), who is hosting a meeting of the committee in Shanghai immediately before the SCOR Executive Committee meeting.

The IMBER Capacity Building Task Team, with financial support from EUR-OCEANS, organised the *Analyses of end-to-end food webs and biogeochemical cycles* Summer School in Ankara, Turkey in August 2008 (http://www.imber.info/E2E_EcoModel_programme.html). Lectures, discussions, poster sessions and practical modelling training simulations provided the 21 participants (PhD students and Post-docs working with biogeochemical cycles and end-to-end food webs) with an overview of the methods and models that are available. Live web-broadcasting opened the presentations and discussions to participation by many more students and scientists around the world.

The Summer School has proved to be a successful capacity building exercise and consequently plans are well underway to hold the next one in August 2010 at the Institut Universitaire Européen de la Mer in Brest, France. The preliminary title is *Marine ecosystems in the context of climate change: dynamics and impacts*.

4 Data Management Task Team

The IMBER Data Management Committee (DMC) is currently chaired by Raymond Pollard (UK) with Alberto Piola (Argentina) replacing him at the end of the year. The DMC promotes a cooperative data management approach that includes involving experienced data management specialists from the start of a project, and also training young scientists in good data management procedures.

The DMC has produced a draft Data Management Policy and *The Benefits of Integrated Data Management* document. They are currently under review.

Prior to IMBIZO 1 in November 2008 in Miami (USA), the DMC held the *BEER - Being Efficient and Environmentally Responsible* training workshop, which highlighted the benefits of adding a data integration scientist to projects. Participants were given the opportunity to test some of the “recipes” for using data integration concepts and handling techniques in the IMBER Data Integration “Cookbook”. Very positive feedback was received regarding the “Cookbook” which has now been published.

The DMC have also set up a data management portal on the IMBER website and coordinated the development of a metadata portal which is hosted by GCMD.

5 End-to-end food web Task Team

The joint IMBER-GLOBEC End-to-end food web Task Team was co-chaired by Coleen Moloney (South Africa) and Mike St John (Germany). It has completed its mandate and produced draft manuscripts and was disbanded in 2008. One paper has been submitted to the DSR Special Issue from the IMBER IMBIZO and is currently under review. The other requires some revision. Coleen Moloney and Mike Roman co-chaired the *Ecological and Biogeochemical Interactions in End-to-end Food Webs* workshop at IMBIZO 1 which considered

- the relative impacts of change on material cycles through predator-prey interactions (top-down perspective), and
- the indices that should be used to describe material transfer from photosynthesis to fisheries (bottom-up perspective).

A new team is to be established to deal with end-to-end activities for IMBIZO II. It has been proposed that they organise a topic-focused mini-workshop a few months prior to the IMBIZO to do a comparative study which would provide a synthesis to feed into the IMBIZO.

The End-to-end team was involved in the organisation of the Summer School on *Analyses of the interactions between end-to-end marine food webs and biogeochemical cycles*, which was held in Ankara, Turkey in August 2008.

Regional Projects

An IMBER/GLOBEC Transition Task Team (TTT) was appointed by SCOR and IGBP to recommend how IMBER should accommodate new developments in marine ecosystem research that need addressing post-GLOBEC. The Task Team met in Reading, UK from 30 July to 1 August and in Washington DC on 15-17 December 2008. The final TTT report will be published as an addendum to the *IMBER Science Plan* in September 2009.

After considering the Transition Team Report, the IMBER SSC decided to invite all continuing GLOBEC projects to become part of the IMBER project. To date, CLIOTOP and ESSAS have accepted this invitation.

Climate Impact on Top Oceanic Predators (CLIOTOP)

CLIOTOP was started as a regional programme under GLOBEC in 2005. It aims to provide a global comparison of the impact of climate variability (at various scales) and fishing on the structure and function of open ocean pelagic ecosystems and their top predator species, and from this to develop reliable predictive capacity. CLIOTOP is co-Chaired by Patrick Lehodey and Oliver Maury and there are five working groups. The Science Plan and Implementation Strategy were accepted by GLOBEC in 2005.

The CLIOTOP mid-term workshop [is planned for late 2009 and will involve IMBER SSC members](#).

Ecosystem Studies of Sub-Arctic Seas (ESSAS)

ESSAS was developed in conjunction with GLOBEC and EUR-OCEANS in 2005 and focuses on comparative studies of the impacts of climate variability on the productivity and sustainability of Sub-Arctic marine ecosystems. There are four working groups and several national and multi-national projects. The Science Plan and *Background to the Climatology, Physical Oceanography and Ecosystems of the Sub-arctic Seas* document were produced in 2005.

ESSAS and PICES co-sponsored the *Marine Ecosystem Model Inter-comparisons* workshop on 25 October 2008, in Dalian, China. The ESSAS Annual Science Meeting [was held in Seattle, Washington, USA on 18-19 June 2009](#).

Integrating Climate and Ecosystems Dynamics (ICED)

ICED is currently an IMBER/GLOBEC project with a partnership with EUR-OCEANS. It aims to determine the main control of Southern Ocean ecosystem dynamics and potential for feedbacks as part of the Earth system. Its Science Plan, which was accepted by both IMBER and GLOBEC, was published in 2008.

At the first ICED modelling workshop, held in April 2008, there was consensus that understanding of the structure of food webs at regional and circumpolar scales was needed to be able to improve the reliability of predictions of ecosystem dynamics in the Southern Ocean. This put the focus on Southern Ocean ecosystem modelling, with particular emphasis on cross-disciplinary studies. In June 2009, the *New Frontiers in Southern Ocean Biogeochemistry and Ecosystem Research* workshop was held at Princeton University in New Jersey, USA. It aimed to facilitate interaction between the physical, biogeochemical, and ecosystem research communities to develop research strategies to resolve current limitations, gaps and discrepancies in our understanding and prediction of the Southern Ocean ecosystems, biogeochemical cycles and carbon uptake.

To provide a central focus for fieldwork planning and coordination activities in the Southern Ocean, across all disciplines, for the next decade, ICED is developing a series of interactive maps representing Southern Ocean research

The first Southern Ocean Sentinel Workshop took place in April 2009 in Hobart, Australia, to consider how to measure, assess and provide early-warning of climate change impacts on the Southern Ocean and how these could be used to signal future impacts on marine and other ecosystems elsewhere in the world. The workshop proceedings, outcomes and a strategic plan will be published. The second Sentinel Workshop is planned for 2010.

Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER)

SIBER is a developing regional program of IMBER that aims to understand climate change and anthropogenic forcing on biogeochemical cycles and ecosystems in the Indian Ocean. A planning workshop was held at NIO in Goa, India on 13-14 April 2009. The draft Science Plan and Implementation Strategy is currently being reviewed.

Endorsed Projects

IMBER now has 17 endorsed projects from 12 different countries. The following projects were endorsed by IMBER this past year.

- *BOUM Biogeochemistry from the Oligotrophic to the Ultra Oligotrophic Mediterranean Sea*
Leading applicant: Thierry MOUTIN (France)
- *CAIBEX Shelf-ocean exchanges in the Canaries-Iberian Large Marine Ecosystem*
Leading Applicants: Eric D. Barton and Javier Arístegui (Spain)
- *CROZEX CROZet Natural Iron Bloom and EXport Experiment*
Leading applicant: Raymond Pollard (UK)
- *EPOCA European Project on Ocean Acidification*
Leading applicant: Jean-Pierre Gattuso (France)
- *Fisheries Oceanography Project*
Leading applicant: Matt Pinkerton (New Zealand)
- *GENUS Geochemistry and Ecosystem Research in the Namibian Upwelling System*
Leading Applicant: Kay Emeis (Germany)
- *MALINA What is the impact of the decrease in sea ice, increase in UV radiation, and permafrost thaw on microbial biodiversity and biogeochemical fluxes in the Arctic Ocean?*
Leading applicant: Marcel Babin (France)
- *Oceans 2025 UK Strategic Marine Science Programme*
Leading applicant: Phil Williamson (UK)
- *OMMIX Food-Web structure and carbon budget in a coastal area off Central Chile (36°S): Influence of mixotrophy and omnivory.*
Leading applicant: Cristian A. Vargas (Chile)
- *POMAL Population Outbreak of Marine Life*
Leading applicant: Hiroaki Saito (IMBER-Japan)
- *SACC An International Consortium for the Study of Oceanic Related Global and Climate Changes in South America*
Leading applicant: Alberto Piola (Argentina)

OUTREACH ACTIVITIES

IMBER website

The IMBER website (<http://www.imber.info/>) is the project's main communication tool. In the interest of ensuring that information is kept up-to-date and to improve communication links, the website will be redesigned soon.

The IPO also developed and maintained several other activity-based websites, for example, for the CLIMECO workshop, IMBIZO 2008, E2E EcoModel Summer School, the IMBER data portal, and the IMBER/SOLAS

French meeting. The website for IMBIZO 2010 is under construction. There are also plans to develop an Ocean Acidification website to support the activities and findings of the IMBER/SOLAS SG3.

IMBER Update

The electronic newsletter "*IMBER Update*" is published three times a year. The most recent edition was published in July 2009. Included in the newsletter are IMBER science highlights, reports of the activities of the IMBER working groups and IMBER endorsed and contributing projects, regional and national programme reports, and upcoming IMBER-related conferences and workshops. The IMBER Update can be downloaded at <http://www.imber.info/newsletters.html>.

eNews

The eNews bulletin is published monthly to circulate information about IMBER activities and activities within the IMBER scientific network. Included in the publication are calls for funding, job opportunities, conferences and workshops.

IPO Report to SSC

As the SSC only meets once a year, every two months the IPO sends a report to IMBER SSC members to keep them up to date about IMBER activities and developments. This report includes IPO activities, news from the IMBER working groups, IMBER meetings, workshops and conferences, IMBER contributing, regional and national projects, sponsored activities, communication and interactions with our sponsors.

Promotional Material

The IPO has promotional material that can be sent to meetings or conferences that IMBER representatives are attending or holding. The IMBER brochure and posters introduce the global scientific context of IMBER and present the four themes of the program. Information regarding how to get involved and how to contact the International Project Office (IPO) are also included. Both the brochure and poster can be downloaded from the IMBER website (<http://www.imber.info/useful-downloads.html>) and are available on request at the IPO. A new poster will be produced shortly, that will illustrate the direction that IMBER science is moving towards with the introduction of the new regional programmes that are being incorporated into the program.

The IPO recently updated a PowerPoint presentation about the structure and activities of IMBER which can be adapted by representatives for meetings and conferences.

Training

Summer School in Ankara

The IMBER/EUR-OCEANS *Analyses of End-to-end Marine Food Webs and Biogeochemical Cycles* Summer School was held at the Middle East Technical University, Ankara (Turkey) on 11-16 August 2008. The aim was to provide an overview of methods, models and approaches for analyzing the interactions between marine biogeochemical cycles and end-to-end food web studies. There were two topics: *Main processes controlling marine food webs* and *Advances in end-to-end food web modelling*. Theoretical lectures, practical workshops were given for each topic. Discussion and poster sessions were used to stimulate interaction amongst the students and also between students and the lecturers. Debates on hot topics pertinent to end-to-end ecosystem research were also organised.

INTERNATIONAL PROJECT OFFICE (IPO)

The IMBER IPO is located at the Institut Universitaire Européen de la Mer (IUEM) in Brest, France. There are currently three staff members at the IPO. Lisa Maddison replaced Sylvie Roy as Executive Officer in April 2009. Sophie Beauvais is the Deputy Executive Officer, and a new Administrative Assistant will be appointed soon.

The IPO is primarily responsible for carrying out IMBER SSC decisions, obtaining funding to support IMBER activities, providing support for the IMBER working groups and task teams, providing administrative support

for the program's activities, maintaining communication links both within and outside the program, and maintaining a data and information archive.

The IPO is funded by a French consortium comprising the University of Brest, IUEM, the Region of Brittany, Ifremer, the Conseil Général de Bretagne (Department authorities) and the City of Brest, Centre National de la Recherche Scientifique (CNRS), Institut de Recherche pour le Développement (IRD), Université de Bretagne Occidentale (UBO).

In 2008-2009, IMBER activities and the IPO received the following sponsorship:

- IGBP: support for the SSC meeting (\$16K annually);
- SCOR: support from NSF (\$50K annually, renewed until 2011);
- French Consortium: support for IPO salaries and running expenses (\$284K)

The French consortium agreed to provide further funding to hire additional staff members to support the increased workload of the IPO after April 2010 when the regional projects from GLOBEC become part of IMBER. A meeting will be organised shortly with the French consortium to discuss the way forward for the IMBER IPO in light of the recommendations of the GLOBEC/IMBER Transition Task team.

INTERACTIONS WITH OTHER PROJECTS AND PROGRAMMES

SOLAS

Joint SOLAS/IMBER Carbon Research group (SIC!): the joint IMBER and SOLAS carbon implementation group has been restructured (see section on IMBER/SOLAS Carbon Working Group above). The Chairs of the three sub-groups work closely with each other and also with the IOCCP (International Ocean Carbon Coordination Project).

The first IMBER/SOLAS French Meeting was held at the University Paris 7 on 22-23 June 2009 to inform the community about the marine science being undertaken by French IMBER and SOLAS scientists. The main objectives were to highlight the scientific questions common to IMBER and SOLAS and to develop new collaborations. The meeting was organized by Véronique Garçon (LEGOS, Toulouse), Jean-Pierre Gattuso (LOV, Villefranche/Mer), Cécile Guieu (LOV, Villefranche/Mer), Rémi Losno (LISA, Paris) and the IMBER International Project Office (IUEM, Brest) and financed by LEFE-CYBER. There were six sessions:

1. "[Nutrients and marine ecosystems](#)",
2. "[Atmospheric aerosols](#)",
3. "[Anthropogenic carbon and acidification](#)",
4. "[Biogeochemical cycles and marine ecosystems](#)",
5. "[Transversal actions](#)", and
6. "[Trace gases and CO₂](#)".

Sixty participants from 14 French laboratories and institutions attended. It gave PhD and young scientists the opportunity to present their work to the national marine science community. Some of the presentations are available at (http://www.imber.info/IMBER_SOLAS_Programme.html).

LOICZ

Joint IMBER/LOICZ Continental Margins Task Team (CMTT): acknowledging the amount of research in continental margins IMBER has suggested that the existing CMTT be disbanded and a new one established to conduct integration and synthesis activities to draw together the national and regional research. A team of eight members, jointly appointed and funded by IMBER and LOICZ, with a representative co-chair from each project is envisaged. The team will develop perspective or white papers to stimulate integration and synthesis activities. Several knowledge gaps have been identified, including carbon and nutrient budgets for shelf seas and the role of the "continental margin pump", the differential role of physical processes in the exchange of water and biological properties between the coast and the open ocean, the effect of global warming on the

occurrence and extension of low oxygen zones, and their effects on biogeochemistry, marine ecosystems and ecosystem services (e.g. fisheries yields) and basin-to-basin variation in food web structure and functioning.

The new CMTT will meet before the end of 2009 to develop plans for the first integration and synthesis activity, possibly a “Continental Margins IMBIZO” to be held early in 2011.

Carbon and Nutrient Fluxes in Continental Margins: A Global Synthesis, Edited by Kon-Ke Liu, Larry Atkinson, Renato Quiñones and Liana Talaue-McManus has been published by Springer Verlag in the IGBP Book Series on Global Change. The book provides perspectives on the role of continental margins in the Earth's biogeochemical system as well as highlights of biogeochemical functionality in representative regional settings. More than 150 experts contributed best estimates of carbon and nutrient fluxes in seven types of continental margins.

GLOBEC

Joint IMBER/GLOBEC End- to-End Task Team: See section on End-to-end food web Task Team above.

CARBOOCEAN

A Memorandum of Understanding was signed between IMBER and CARBOOCEAN, an integrated project that aims to provide an accurate assessment of marine carbon sources and sinks with special emphasis on the Atlantic and Southern Oceans on a time scale of -200 to +200 years. All five of the core CARBOOCEAN themes contribute to IMBER's goals. For example, the North Atlantic surface ocean carbon observing system confirmed the decrease in uptake strength for anthropogenic CO₂ from the atmosphere in the late 1990s. The Southern Ocean sink has also weakened during the recent years. Among the modelling studies, an investigation on a quick transfer of anthropogenic CO₂ into deep oceanic areas close to deep water production locations show that the ocean acidification not only affects the surface ocean, but also has implications for deeper ocean areas. CARBOOCEAN has contributed to two data synthesis efforts for a global surface ocean pCO₂ data set of raw data (no climatology) and an Atlantic 3-D carbon database.

CLIVAR

Climate Variability and Predictability (CLIVAR) is a core project of the World Climate Research Programme (WCRP), with a particular focus on the role of the ocean in climate variability and change. There are IMBER representatives on the relevant CLIVAR Panels. Following the successful ClimEco (Climate driving of marine ecosystem changes – training for young marine scientists) Workshop in Brest, France in April 2008, CLIVAR organised an NCAR Advanced Study Programme Workshop on “Marine ecosystems and climate - modelling and analysis of observed variability” in Boulder, Colorado, USA on 2-14 August 2009. CLIVAR, together with IOCCP and the joint SOLAS/IMBER Carbon Group, participates in the Global Ocean Ship-based Repeat Hydrographic Investigations Panel (GO_SHIP) which is developing a strategy for a sustained program of interdisciplinary repeat hydrography.

EUR-OCEANS

IMBER signed a Memorandum of Understanding with the EUR-OCEANS Network of Excellence and continues to maintain strong links with the self-funding EURO-OCEANS Consortium. The Consortium has allocated funding for the IMBER IMBIZO II in 2010.

GODAE

The IMBER-GODAE Task Team, established in June 2007 focused on three key areas:

- (1) How IMBER modellers can benefit from the data products and insight generated by GODAE,
- (2) How GODAE products can be improved from the perspective of IMBER modellers, and
- (3) How to improve ocean observation systems to observe ocean ecosystem and biogeochemistry better.

The Task Team produced a synthesis paper in 2008 that focused on the applications of GODAE products to ecosystem and biogeochemistry projects and identified what is required to integrate biogeochemistry and

ecology into ocean data assimilation systems. The paper was presented at the final GODAE Symposium on 12-15 November 2008 in Nice, and has been submitted for publication. The Symposium proceedings can be viewed at (<http://www.godae.org/Invited-papers.html>). The meeting report was also published in IMBER Update n°12.

A White Paper about the future of GODAE was also presented at the Nice Symposium, providing the basis for an international program called GODAE Ocean-View (GOV) which will consolidate the long-term coordination and cooperation on ocean analysis and forecasting. The Marine Ecosystem Analysis and Prediction Task Team (MEAP-TT) is one of several GOV task teams that have been established and it is likely that the IMBER-GODAE Task Team will be dissolved and absorbed into the MEAP-TT.

PICES

The PICES interdisciplinary programme FUTURE, aims to forecast and understand the trends, uncertainty and responses of North Pacific marine ecosystems to climate change and human activities at basin-wide and regional scales. The FUTURE Science and Implementation Plan was published in May 2009 (see http://www.pices.int/members/scientific_programs/FUTURE/FUTURE_final_2008.pdf) FUTURE provides for collaboration between IMBER and PICES.

National activities

IMBER activities are underway in many different countries (e.g. Chile, China, France, Germany, India, Japan, Korea, New Zealand, Norway, Spain, Turkey, UK, and USA). Some examples include

- **China:** the five-year IMBER-GLOBEC Marine Dynamics project is now in its third phase. The IMBER-GLOBEC community is very active and there are plans to open an IMBER-China office next year.
- **Japan:** IMBER-Japan, established under the Science Council of Japan is chaired by Hiroaki Saito. The Population Outbreak in Marine Life (POMAL) project is an IMBER project focusing on cruises investigating the integration of biogeochemical cycles. Two cruises are planned over the next three years. SUPRFISH AND STOPJELLY are also IMBER-related projects.
- **Korea:** Although there are no formal IMBER projects in Korea, about ten current projects could be IMBER-related. The next symposium of the GLOBEC committee (members from China, Korea and Japan) will be held in Korea and consideration will be given to transforming it into an IMBER-related group and establishing a Korean IMBER research project. The Chair of IMBER has been invited to attend this meeting.
- **France:** CYBER has submitted several proposals for IMBER-related projects. The SOLAS-IMBER meeting for the French community was held in June 2009 in Paris.
- **India:** SIBER recently organised a workshop where a national committee was established which could function as an IMBER committee.
- **Spain:** There are many IMBER-related activities in Spain. The most relevant are MALOSPINA – a five-year global circumnavigation exploration of global change and biodiversity of the oceans and SUMMER – a surface mixing modulation study. Two symposia were held recently: the *International Symposium on the Effects of Climate Change on the Worlds Oceans* and the *Eastern Boundary Upwelling Ecosystems Symposium*.
- **UK:** The process to develop IMBER-UK has started (see www.imber-uk.org). Several session reports relate to the IMBER themes. There has been an 11 million GBP call for proposals on Ocean Acidification. IMBER science in the Arctic is developing and several aspects in the Southern Ocean are linked through ICED.
- **USA:** Ocean Carbon and Biogeochemistry (OCB) is the U.S. contribution to IMBER.

FUTURE ACTIVITIES

- As part of the IMBER IMBIZO series, IMBIZO II is scheduled for September/October 2010. The meeting will be held in the Creteaquarium on the island of Crete in Greece. As with the previous IMBIZO, the meeting will consist of three interdisciplinary workshops held in parallel, plenary and poster sessions. Workshops will include oral presentations showing current research and knowledge about each topic and discussion sessions to identify key questions to be addressed by IMBER. The workshops will be limited to 40 participants each and funding will be available for some scientists from developing countries to attend. Workshop outcomes will be reported as publications and synthesis papers in a peer reviewed journals.
- OceanObs09 Conference, 21-25 September 2009, Venice, Italy.
- PICES Eighteenth Annual Meeting: *Understanding ecosystem dynamics and pursuing ecosystem approaches to management*, Jeju, Korea (23 Oct-1 Nov 2009)
- AIMES OSC *Earth System Science: Climate, Global Change and People* 10-13 May 2010, Edinburgh, Scotland.
- Summer School Institut Universitaire Européen de la Mer, France August 2009)
- ICED SSC Meeting
- SIBER SSC Meeting in Perth, Australia March 2010

Annex 8 – Surface Ocean – Lower Atmosphere Study (SOLAS)

Annual Report from SOLAS to SCOR. Aug 2008- July 2009

Version of 23 July 2009 by Dr Emily Breviere

SOLAS International Project Office (IPO)

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

Currently, Dr. Emily Brévière is the Executive Officer of the IPO (since Aug. 2008), Georgia Bayliss-Brown is the IPO Project Officer (since Oct. 2008), and Hannah Mossman is IPO Research Assistant, 3 days a week (from Feb. to Aug. 2009). In Sept. 2009, Georgia Bayliss-Brown will step down from the IPO. The search for the Project Officer position is currently underway.

Funding for the operation of the IPO in Norwich expires in March 2010. Plans are being formulated for future plans for placement and funding of the IPO.

SOLAS Scientific Steering Committee (SSC)

The SOLAS SSC met in Washington, D.C., USA, in March 2009.

The current membership of the SSC:

Name	Gender	Country	Expertise
Isabel Cacho Lascorz	F	Spain	Paleoceanography
Min-Han Dai	M	China	Ocean coastal Carbon
Gerrit de Leeuw	M	Finland	Atmospheric boundary layer
Veronique Garcon	F	France	Biogeochemical models
Cecile Guieu	F	France	Marine ecosystems
Sergey Gulev (WCRP)	M	Russia	Air-sea physical interaction
David Kieber	M	USA	Photochemistry
Nilgun Kubilay	F	Turkey	Atmospheric transport
Cliff Law	M	New Zealand	Air-sea exchange / nutrients
Wade McGillis (WCRP)	M	USA	Ocean boundary layer
Patricia Quinn	F	USA	Aerosols / atm chemistry
Eric Saltzman	M	USA	Aerosol chemistry
Guang-Yu Shi	M	China	Atmospheric transport coast
Rafel Simo	M	Spain	Biogeochemical cycles
Jacqueline Stefels	F	Netherlands	Sulfur cycle
Shigenobu Takeda (Vice Chair)	M	Japan	Nutrient biogeochemistry
Roland von Glasow	M	UK	Halogens
Doug Wallace (Chair)	M	Germany	Carbon, air-sea overview

Jan 2010: To Depart - Wade McGillis, M, USA, ocean boundary layer (WCRP member)
 To Depart - Gerrit De Leeuw, M, Finland, atmospheric boundary layer
 To Depart - Shigenobu Takeda, M, Japan, nutrient biogeochemistry

SOLAS National Networks

Twenty six nations are part of the SOLAS network. Each has a representative and/or a coordinator:

Australia: Michael Grose
Belgium: Christian Lancelot
Brazil: Amauri Pereira de Oliveira
Canada: Maurice Levasseur
Chile: Giovanni Daneri
China: Guang-Yu Shi
Denmark: Soren Larsen
France: Remi Losno
Germany: Doug Wallace and Ulrich Platt
India: Dileep Kumar
Ireland: Brian Ward
Italy: Maurizio Ribera d'Alcala
Finland: Gerrit de Leeuw
Japan: Mitsuo Uematsu
Korea: Kitack Lee
Netherlands: Jacqueline Stefels
New Zealand: Phil Boyd
Norway: Abdirahman Omar
Russia: Sergey Gulev
Spain: Rafel Simo
Southern Africa: Carl Palmer
Sweden: Katarina Abrahamsson
Taiwan: Gwo-Ching Gong, Wu-Ting Tsai and Kon-Kee Liu
Turkey: Baris Saglihoglu
UK: Phil Williamson
USA: Wade McGillis

Several nations have SOLAS research programs or projects in the planning stages, but research is active in many countries. For the first time in Jan. 2009, the national representatives of the SOLAS nations were asked to fill in a template form to report on the various types of SOLAS activities in their countries that took place in the calendar year 2008. These reports are available on the SOLAS Web site. From now on, they will be asked to fill in this form annually. Some highlights are reported below.

Belgium

Research projects in which Belgian scientists carried out SOLAS-related activities include

- BELSPO: Assessing the sensitivity of the Southern Ocean's Biological Pump to Climate Change BELCANTO
- BELSPO: Role of Pelagic calcification and export of Carbonate production in climate change PEACE
- FRFC: "Biogéochimie des glaces de mer dans les océans polaires: implications sur les échanges de gaz à effet climatique et les variations climatiques d'origine naturelle ou anthropique ». Belgian contribution to the IPY
- EU IP: Towards an integrated marine Carbon sources and sinks assessment CARBO-OCEAN
- EU IP: Southern European Seas: Assessing and Modelling Ecosystem changes SESAME

Brazil

In 2008, the SOLAS Brazil has been consolidated with three projects:

1. *FluTuA : Turbulent Fluxes over the Tropical Atlantic. Coordinator: Jacyra Soares. Air-Sea Interaction Group. Institute of Astronomy, Geophysics and Atmospheric Sciences University of São Paulo, São Paulo, Brazil.*
2. Study of the Atmospheric Boundary Layer in the Region of Brasil-Malvinas Confluence. Coordinator: Marcelo Dourado. Centre for Ocean Studies. Federal University of Paraná, Pontal do Sul, PR, Brazil.
3. Sea Waves and Coastal Monitoring at São Paulo State Valdir Innocentini. Coordinator: Valdir Innocentini. CPTEC/INPE.

Canada

The goal of the Arctic SOLAS program is to explore the interactions between sea ice, water circulation, marine microbiological activity and emissions of these gases from the ocean to the Arctic atmosphere. Two key questions are (1) How will the increased flow of Pacific waters through the Canadian Archipelago affect the dynamics of climate-active gases in the ocean, and (2) How will these gases be affected by a reduction of sea-ice cover, and increased areas of open water? These questions are being addressed during two expeditions on the Canadian research ice-breaker *Amundsen* as part of the International Polar Year. The expeditions took place during the fall of 2007 and 2008. The key preliminary findings from the 2008 cruise are

- The 2008 SOLAS transect from Resolute to Greenland effectively captured the transition from Pacific-derived waters exiting the Arctic via Lancaster Sound and the Atlantic-derived waters moving north along the Greenland coast. The strong and deep depletion of silicate near the mouth of Lancaster Sound indicates a hotspot of diatom production which could have a direct effect on the production of biogenic trace gases.
- Major progress was made on our understanding of the dynamics of DMS production in the Arctic. Our incubation experiments with radio-labelled ³⁵S-DMSP revealed low but detectable bacterial DMSP uptake and DMS production during both cruises. In 2008, DMS production was linearly related to the bacterial DMSP uptake rate which, in turn, was positively correlated with the availability of dissolved DMSP. These results suggest that DMS bacterial production at these high latitudes and time of the year are limited by the availability of substrate, not temperature. In that context, future increases in primary productivity due to climate warming as predicted by most models should lead to an increase in DMS production and ventilation with a potential cooling effect (negative feedback) on climate.
- Significant concentrations of nitrous oxide (N₂O) were detected for the first time at the bottom of annual ice in the Beaufort Sea. This represents a new source of greenhouse gas (GHG) in the Arctic which is not taken into account in current Arctic climate models. The data collected as part of this project will allow estimating the magnitude and potential importance of this source of GHG.
- Our results show important inter-annual variations in atmospheric dimethylsulfide (DMS) concentrations during the fall period. Average atmospheric DMS concentrations in September 2008 were approximately twice those in October 2007. Preliminary results from aerosol and SO₂ samples suggest a significant proportion of atmospheric S products are derived from biogenic DMS oxidation. The composition of the submicron-sized Arctic aerosol during the Fall period has sizable fractions of both organics and sulphate present, and there are very few new particle nucleation events occurring.

China (Beijing)

- A four-year China-SOLAS project funded through NSF-China ended in 2008 (The budget was RMB 8 M). Various workshops towards an effort of synthesis were organized in 2008. The project focuses on the coupling of biogeochemical and physical processes between surface ocean and lower atmosphere over two contrasting marginal seas: the Yellow Sea and the South China Sea.
- A new SOLAS-relevant research program has been funded through the National Basic Research Program (“973” program) on “Carbon cycling in China Seas – budget, controls and ocean acidification (CHOICE-C)” with a budget of about 18 million RMB for 2009-2010. The “973” program is one of the most

competitive basic research programs in China. The present project focuses on the carbon budget, controls, ecological response and future changes in coastal ocean systems. There will be many SOLAS-related activities with CHOICE-C program

China (Taipei)

There are three SOLAS-relevant research projects in Taiwan:

1. Long-term Observation and Research of the East China Sea (LORECS),
2. South-East Asia Time-series Study (SEATS), and
3. Atmospheric Forcing on Ocean Biogeochemistry (AFOBi). The new initiative, AFOBi, is focused on how the exchanges of momentum, energy and matter across the air-sea interface may affect the biogeochemistry of the ocean. The AFOBi (Contact: Professor George T.F. Wong) project is a multidisciplinary multi-institutional project involving a dozen or so of principal investigators from several institutions: the AS-RCEC, the NTU-DAS, the Institute of Oceanography, National Taiwan University, and the University of California, Davis. The main focus of the project is on how the exchanges of momentum, energy and matter across the air-sea interface may affect the biogeochemistry of the oceans. The project is supported by the Academia Sinica and has started to receive funding since 2008. A network of aerosol sampling stations have been set up at several locations around Taiwan Island, at the Tungsha Island in the remote South China Sea, at Kinmen Island adjacent to the Chinese Mainland and at Xiamen, China to examine the chemical and physical characteristics of Asian dusts and how they may have been modified during transport.

France

French SOLAS activities are funded by CNRS/INSU through the LEFE program (Fluid envelopes and environment), by ANR (National Agency for Research), by IPEV (Institut Paul Emile Victor), but also by CNES and other funding institutions (IRD, CEA, etc...) and universities. A more extensive and complete view of French SOLAS activities will be achieved at the meeting planned in June 2009, including a special joint meeting of the French IMBER and SOLAS communities, on June 22-23, 2009 at University Paris Diderot in Paris. The "state of the art" of the French SOLAS activities will be described in detail.

Ireland

- Funding of the proposal "Development of a Greenhouse Gas Ocean-Atmosphere Flux Sensor with MEMS-based Photoacoustic Technology". This grant was funded under the US-Ireland Partnership Programme. (Ward, NUIG)
- The 4th SOLAS-IE workshop was held at NUI, Galway in December 2008. There were 9 presentations from researchers at Irish universities and government agencies. (Ward, NUIG)

Japan

- STAGE (Studies on the Antarctic Ocean and Global Environment) program. Oceanographic observations were carried out in January 2008 onboard RT/V *Umitaka-maru* (Tokyo University of Marine Science and Technology) and in February 2008 onboard R/V *Hakuho-maru* (JAMSTEC) in the Indian sector of the Southern Ocean as a part of STAGE program.
- W-PASS (Western Pacific Air-Sea Interaction Study) program
 - July 29–September 18, 2008: SPEEDS (Subarctic Pacific Experiment for Ecosystem Dynamics Study) Cruise by R/V *Hakuho-Maru* (KH-08-2: SOLAS/IMBER joint cruise): Northwestern North Pacific. We found phytoplankton bloom patches of various stages with age and determined differences among composition of marine biogases from age of the patches.
 - October 13–November 10, 2008: R/V *Mirai* Cruise (MR08-04, 05): Equatorial and Northwestern North Pacific eddy-covariance flux measurements have been carried out during cruises from Japan to the equatorial and subarctic regions by R/V *Mirai* during the summer and fall of 2008.
 - December 12, 2008: Workshop on the biological responses to typhoon passing in the subtropical Pacific and its marginal seas. Faculty of Agriculture, The University of Tokyo,

Convener: Atsushi Tsuda

- anuary 15–March 30, 2009: R/V *Mirai* Cruise (MR08-06): Western North Pacific, Central Pacific, Eastern South Pacific. ATOFMS Aerosol Time-of-Flight Mass Spectrometer was set up below the bow hold of the ship as well as various atmospheric sampling equipments on the compass deck from Japan to Chile.

New Zealand

NZ SOLAS SAGE *Deep-Sea Res II* Special Issue – 10 papers (submitted and in press)

Collaborative New Zealand-Australia SOLAS-GEOTRACES activities include a trace metals/biogeochemistry research voyage in Tasman Sea (2010) and a two-ship transect of S.W. Pacific (2010-2011).

Norway

- Training workshop “The Fundamentals of carbon biogeochemistry” for students and researchers involved in ocean acidification research. 24-27 February 2009, Bjerknes Centre for Climate Research, University of Bergen, Norway. Sponsored by the EU projects EPOCA and CARBOOCEAN and the IOCCP.
- SOCAT database: Initial data base with more than 2100 cruises and > 7 million surface CO₂ measurements was produced and distributed to SOCAT scientists. Final product will be released in late 2009.

Russian Federation

“Global air-sea gas exchanges and their climate relevance” subproject is approved by the National Ministry of Education and Science as a part of the Federal Research “World Ocean” programme (funding is expected to be started in June 2009).

Southern Africa

- South African Symposium of Atmospheric Sciences, September 30–October 1, 2008
- At the annual South African Symposium of Atmospheric Sciences, Dr. Carl Palmer presented on the formation of the Southern African SOLAS network and the international project.
- Investigations of phytoplankton production were undertaken during research cruises to the southeast coast (November 2008, Mossel Bay-Port St Johns) and the west coast (February 2009, Cape Town-Orange River). Experimental work included photosynthesis-irradiance experiments using both ¹⁴C labelling and fast repetition rate fluorometry, measurements of pigments by liquid chromatography and phytoplankton absorption by integrating sphere spectrophotometry. Preliminary results indicated high primary production in patches on the west coast and low production in upwelled water near the coast, while production on the southeast coastal shelf was generally lower than on the west coast. Pigment indices revealed that diatoms tended to dominate the high productivity patches and upwelling zones, with a high proportion of Chl a in the pigment pool. Mixed communities of small flagellates, diatoms and dinoflagellates were generally observed in lower biomass waters.

Turkey

- Southern European Seas: Assessing and Modelling Ecosystem change (SESAME) project. Currently Turkish research vessel R/V *Bilim's* cruises are ongoing as part of SESAME project under FP6 of EC. During the oceanographic cruise in Mediterranean Sea, the Aegean Sea, the Sea of Marmara and the Black Sea aerosol samples have been collecting.
- IMS-METU has an atmospheric sample collection tower located at the campus of IMS-METU, which is located of the Turkish coast of the eastern Mediterranean. Aerosol and rain samples are collected on the tower to perform nutrient (nitrate, ammonium, phosphate, silicate) analyses since 1999.
- Climatic Importance of Aerosols above the Eastern Mediterranean Area: A comprehensive study was conducted of the chemical and optical aerosol characteristics, of their interrelation, for the eastern Mediterranean (Turkish Scientific and Technical Research Council – TUBITAK, 105Y368). This is a region where the direct radiative forcing by anthropogenic and natural aerosols is expected to be

much larger than average, and for which model calculations suggested that anthropogenic sulphate levels and their direct radiative effects are very pronounced. At sites in Crete (Greece) and in Erdemli (Turkey) long-term measurements have been performed of (a) the chemical and optical characteristics of the boundary layer (in situ) aerosol, (b) the column-integrated optical depth, and (c) aerosol size distribution. The various data sets obtained have been interrelated to each other to assess to what extent the ground-level in situ aerosol characteristics are representative for, are related to, or can be used for the prediction of the chemical and optical aerosol properties in the entire vertical column.

- Evaluation of the seawater solubility of Fe in the Eastern Mediterranean Aerosol Project started in September 2007 (NATO collaborative Linkage Grant, CLG – Ref 982862). Study aims to develop and test a novel approach to determine the seawater solubility of aerosol Fe and solid-state speciation of Fe in (i) the Eastern Mediterranean marine aerosol (range of aerosol population types, ranging from human input-dominated to Saharan dust-dominated populations) at three contrasting sites (ii) changing seawater solubility and solid state speciation of Fe (and other trace metals) during the transport of intense Saharan dust events and to define the change in chemical composition (major, minor and water soluble constituents) of the marine aerosol during the passage of intense Saharan dust events over the Levantine Basin of the Eastern Mediterranean.
- megaCITY-Zoom for the Environment: The main objectives of CityZen project (megaCITY-Zoom for the Environment, FP7 IP) are to quantify and understand current air pollution distribution and development in and around megacities/hot spot regions, estimate the future impact from emission changes (with a focus on the effect of rapid growth in the population of megacities/hot spots), estimate how megacities/hot spots influence climate change, develop tools to estimate interactions between different spatial scales (megacities to global) and bring the scientific results and methods developed and applied during the course of the project to semi-operational use with those consortium partners that on a more permanent basis provide technical underpinning of policy work.

United Kingdom

- The NERC-funded UK SOLAS directed programme (involving ~30 projects) is now nearing completion, with data analysis, interpretation and initial publications covering a very wide range of activities. Two research cruises were planned for 2008, but one of these was re-scheduled to 2009. The final UK SOLAS research cruise (previously scheduled for both 2006 and 2008), took place in 2009: Discovery 338 (15 Apr – 27 May, Tenerife/Tenerife). Led by Carol Robinson, UEA, it studied the impact of coastal upwelling on air-sea exchange of climatically important gases (ICON project). Involvement of several other UK SOLAS projects are involved, with close links with Theme 2 (biogeochemistry) of the Oceans 2025 programme.
- The 2008 UK SOLAS Annual Science Meeting was held at the Solent University Conference Centre, Southampton, 6-8 October. There were 56 participants, 30 oral presentations and 13 posters.
- The ASM was followed by the 9th meeting of the UK SOLAS Steering Committee, chaired by Howard Cattle.
- The 2008 Challenger Conference (Bangor, 8-11 Sep) included sessions on “Oceans, atmosphere and biogeochemistry”. These featured 20 oral presentations and 9 posters arising from UK SOLAS studies.
- Most UK SOLAS science projects will be completed by late 2009/early 2010. NERC support for data management and programme coordination will, however, continue in 2010, and the scientific effort is expected to be maintained through a broader range of funding sources. The 2009 UK SOLAS Annual Science Meeting is scheduled for September, and a ‘programme finale’ meeting is planned for early 2010. Strong national links with IMBER have been developed.

SOLAS Mid-term Strategy

The Science Plan and Implementation Strategy was approved by sponsors in 2004, and forms the foundation of the SOLAS programme. However, during a decade-long research programme, emphases shift and implementation approaches may need to be adapted.

The SOLAS Scientific Steering Committee (SSC) recently identified a set of research topics and issues relevant to SOLAS that are both topical and require international coordination to make progress. These topics are now described in a set of white papers, listed below, which have the goal to stimulate research and cooperation at the international level. These papers were presented in draft form to U.S. program managers from five funding agencies (NOAA, NASA, NSF, DOE and ONR) during the SSC meeting held in Washington, D.C. in March 2009. For the past month, SOLAS has welcomed contributions from the community towards these important developments in SOLAS science. SOLAS is distributing the white papers on the SOLAS international Web site and request comments and input.

- Sea-ice biogeochemistry and interactions with the atmosphere
- Ocean-derived aerosols: production, evolution and impacts
- Atmospheric control of nutrient cycling and production in the surface ocean
- Ship plumes: impacts on atmospheric chemistry, climate and nutrient supply to the oceans
- Activity of oxygen minimum (OMZ) in the Pacific (AMOP-SOLAS)
- SOLAS Observatory and MOIN: the Minimalist OceanSITES Interdisciplinary Network
- SOLAS large-scale field experiments - A compendium of proposals

These seven new initiatives will form the basis of the afternoon discussion sessions at the SOLAS Open Science Conference in November 2009.

The leader of the first initiative on ‘Sea-ice biogeochemistry and interactions with the atmosphere’, Jacqueline Stefels submitted a proposal to SCOR for a working group on Sea-ice biogeochemistry. This working group would have the aim of understanding the coupling between ice physics and biogeochemical processes at the sea-ice-atmosphere interfaces as a prerequisite to quantify the role of ice-covered oceans in climate change scenarios, in the past, present and future.

SOLAS Open Science Conference (OSC) 2009, 16-19 Nov 09, Barcelona, Spain

The SOLAS OSCs were held in Damp, Germany (Feb. 2000), Halifax, Canada (Oct. 2004), and Xiamen, China (March 2007). It was felt that the format of the most recent two OSCs provided unique opportunities to network and establish collaborations in an incredibly useful way. Therefore, the SOLAS SSC decided to follow the same format for the 2009 OSC.

The 2009 SOLAS OSC will be held on 16-19 November 2009 in Barcelona, Spain. This OSC is being organised by the local hosts, Isabel Cacho and Rafel Simo (Spain, both SSC members) and the IPO. A maximum of 300 scientists are expected to attend the OSC.

This OSC will include plenary talks, long poster sessions (posters will be on display over the duration of the conference), and afternoon discussion and synthesis sessions.

- The plenary talks will be divided into eight thematic sessions, each comprising a keynote talk and several shorter talks by invited speakers (total of 28 talks).
- Parallel discussion sessions provide an informal setting where “hot” topics can be debated, with the aim of furthering research and establishing collaborations. Seven session topics have already been chosen; they are initiatives that the SOLAS SSC identified as being of important to the SOLAS Mid-term Strategy (see above). Seven more sessions proposed by the community will take place.

Until now the OSCs were held about every second year. This year, in particular, the Summer School and the OSC are 3 months apart. In order to avoid this clash in the future, it was decided during the 2009 SSC meeting, to hold future OSCs every 3 years, so the next OSCs should be held in 2012 and 2015. It was also suggested to launch a call to host the OSC 2012; the first release of the call is scheduled for the OSC in Barcelona.

4th SOLAS International Summer School (SSS), 3-15 August 2009, Cargese, Corsica

The SSS is held biennially at the Institut d'Etudes Scientifiques de Cargese in Corsica, France. This site provides a unique environment for the Summer School, with academic classrooms, laboratory facilities, and a nearby port. For each SSS, Veronique Garcon (France) has been able to secure the French research vessel *Thetys II* for ship-based practical workshops. Garcon (SSC member and new SSS coordinator) and the IPO are responsible for the planning and operation of the 4th SOLAS Summer School. For this 4th edition, 72 PhD-level students from 25 different countries (20 from developing countries and 52 from developed countries) spent more than two weeks in Cargese. 14 lecturers provided instruction on all aspects of SOLAS science, and this year discussions included publication of research and on the ethics of scientific endeavors.

The lectures from the 2007 Summer School were developed into a textbook. (Title: *Surface Ocean-Lower Atmosphere Processes*, editors: Corinne Le Quere and Eric Saltzman, publisher: AGU). The volume is designed to provide graduate students, postdoctoral fellows, and researchers with a basis for understanding current research issues in biogeochemical interactions between the surface ocean and lower atmosphere. The volume served as a textbook for the SOLAS Summer School 2009; every participant received a copy of the textbook.

To run the SOLAS International Summer Schools, we rely on generous support from various bodies. For example in 2009, the school kindly received support from SCOR, the National Science Foundation (NSF), International Geosphere - Biosphere Programme (IGBP), Centre National d'Etudes Spatiales (CNES), Centre National de la Recherche Scientifique (CNRS), Deutsche Forschungsgemeinschaft (DFG), Natural Environment Research Council (NERC) and other national funding agencies, universities, projects (53 sources in total). In particular, the first three programmes mentioned above help to bring most of the developing countries students to the school. SOLAS is extremely grateful for the support from these programs.

The SOLAS Summer School is highly successful, as self-evaluations from the students and lecturers have shown, and also from the excellent "after-SSS" careers of the alumni. The atmosphere is ideal for interaction between students and lecturers, and this capacity building is felt by SOLAS to be of fundamental importance to the long-term legacy of the project.

Following SSC members' suggestions, other locations to host the SSS are still investigated. In parallel, discussions are underway to reassess the future of the Summer School (new format, new targeted audience, new goals...potential new type of event?). These discussions will take into account the fact SOLAS is entering a new phase of its lifetime.

COST Action 735

In late 2006, SOLAS was provided networking funds from the European Coordination in the field of Scientific and Technical Research office (COST) for a dedicated 'Action' 735 which seeks to develop global air-sea flux data sets of gases and aerosols. The IPO administers the networking funds.

This COST Action 735 has held one management committee meeting in Nov. 2008 in Barcelona, Spain and has sponsored six young scientists (mostly PhD students) to carry out a Short Term Scientific Mission in 2008-2009. Coordinated efforts have been facilitated by the following workshops:

- Sub-WG3 "Coastal CO₂/N₂O/CH₄ Fluxes" meeting (22-23 January 2009, Kiel, Germany)
- Sub-WG1 "Halocarbon Database" meeting (11-12 February 2009, Kiel, Germany)

- Sub-WG1 “Aerosol Iron Solubility and Database” meeting (23-24 February 2009, Norwich, UK)
- Sub-WG2 “Surfactants and the Microlayer Gas Exchange” meeting (18-19 March 2009, Plymouth, UK)
- Sub-WG1 “Processes Controlling O₃ in the Marine Boundary Layer” meeting (12 May 2009, York, UK)
- Sub-WG1 “SOCAT Atlantic-Indian-Southern Ocean Regional” meeting (25-26 June 2009, Norwich, UK)

Reports are available to download at <http://www.cost-735.org/meetings/meetings.html>

Planning is underway for the year 2009-2010 and the next Management Committee meeting will take place in November in Barcelona, Spain.

Fast Track Initiatives (FTI)

In May 2009, IGBP launched two fast-track initiatives proposed by SOLAS and other IGBP core projects.

- 1) Upper Ocean Nutrient Limitation: processes, patterns and potential for change (2009-2011). Coordinator: Mark Moore (NOCS, UK), Co-coordinators: Matt Mills (Stanford Univ., USA)
- 2) Megacities and the Coastal Zone: air-sea interactions (2009-2011). Coordinators: Roland von Glasow (UEA, UK) and Tim Jickells (UEA, UK)

Plans are underway to secure funds and organize workshops. A request for funding from SCOR for the FTI on Megacities and coastal zone is attached to this report.

SOLAS Endorsed Projects

SOLAS has endorsed the following projects in 2009:

- EPOCA *Endorsed since early 2009)
The EU FP7 Project EPOCA (European Project on OCean Acidification) was launched in May 2008 with the overall goal to advance our understanding of the biological, ecological, biogeochemical, and societal implications of ocean acidification.
- DUNE (Endorsed since early 2009)
The main goal of DUNE, a dust experiment in a low-nutrient, low-chlorophyll ecosystem, is to estimate the impact of atmospheric inputs on an oligotrophic ecosystem submitted to strong atmospheric inputs.
- FLATOCOA (Endorsed since July 2009)
The goal is to know the amount of continental atmospheric dust deposited on the Southern Ocean, including determination of the bioavailable fraction. Special attention is given to Fe and other micro-nutrients, including Zn, Cd, Mn, P, Si and Co.

The endorsement submission forms are available at

<http://www.uea.ac.uk/env/solas/science/researchendorsements/resendprojects/endorsedprojects.html>.

Asian Dust and Ocean Ecosystem (ADOES)

SOLAS has also led the development of the Asian Dust and Ocean EcoSystem (ADOES) consortium of scientists who are interested in the response of the ocean surface biogeochemical system on inputs of masses of dust from the Asian plateau. Two ADOES workshops were held in 2005 and 2006. The Joint 4th Workshop on ADOES with Asian SOLAS to be held on 20-24 May 2009, JeJu, Korea was postponed to a later date, unknown yet.

SOLAS/IMBER EGU special session

A joint IMBER/SOLAS special session has been conducted at the 2005, 2006, 2007, 2008 and 2009 EGU General Assemblies in Vienna. This event is well attended every year.

Tropical Eastern North Atlantic Time-Series Observatory (TENATSO)

Significant effort has been placed into the development of the Tropical Eastern North Atlantic Time-Series Observatory (TENATSO) off the Cape Verde Islands. Funding for the oceanic observatory comes from the German government under the Surface Ocean Processes in the Anthropocene (SOPRAN) project and the atmospheric observatory is sponsored by UK-SOLAS, and there is significant participation by U.S.-funded scientists.

The May 2009, *IGBP Newsletter* No. 73 included an article on “SOLAS and Cape Verde scientists establish an atmosphere and ocean observatory off North West Africa” by D. Wallace

SOLAS- IMBER Carbon Group

With IMBER, SOLAS has developed a Joint Carbon Implementation Plan (SOLAS IMP3).

This group has recently agreed to move towards a “flat structure” that aims to have three Working Groups (WGs), each with a Chair. These WGs will work cooperatively with the International Ocean Carbon Coordination Project (IOCCP). Terms of reference are been developed. The three WGs are as follow:

- WG1 - Surface Ocean Systems

Chair: N. Metzl, France

Nicolas expressed his desire to step down. Replacement is currently being considered. This WG has been organising several workshops in order to establish the Surface Ocean CO₂ Atlas (SOCAT).

- WG2 - Interior ocean carbon storage

Chair: N. Gruber, Switzerland

This WG has recently held a symposium on “Decadal Variations of the Ocean’s Interior Carbon Cycle: Synthesis and Vulnerabilities,” in Switzerland on July 13-17, 2009.

- WG3- Ocean Acidification – Will be formed soon.

Chair: Jean-Pierre Gattuso, France

This WG is being built from groups and structures already in place (EPOCA for example).

SOLAS Funding

This year is rather exceptional event-wise for SOLAS, with two major SOLAS events are taking place in the same year, which has inevitably had a significant impact on the SOLAS budget, with impacts on commitments for other activities. With the development of the Mid-term Strategy initiatives, securing further funding will be crucial in order to implement them and to start the synthesis exercise. Seeking funding for coordinating activities remains an overwhelming constraint for the project and the IPO.

Annex 9 – GEOTRACES

GEOTRACES SCIENTIFIC STEERING COMMITTEE ANNUAL REPORT TO SCOR 2008/2009 July 2009

SCOR Scientific Steering Committee for GEOTRACES

Co-Chairs

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

Members

Per Andersson, Sweden
Philip Boyd, New Zealand
Ken Bruland, USA
Minhai Dai, China
Hein de Baar, Netherlands
Martin Frank, Germany
Toshitaka Gamo, Japan
Catherine Jeandel, France
William Jenkins, USA
Pere Masque, Spain
Chris Measures, USA
Felipe Niencheski, Brazil
Kristin Orians, Canada
James Orr, France
Carol Robinson, UK
Michiel Rutgers van der Loeff, Germany
Reiner Schlitzer, Germany
Sunil Kumar Singh, India
Jing Zhang, Japan (alternate, Japan)

The SSC membership (listed above) contains representatives of 13 different countries with diverse expertise including: marine biogeochemistry of carbon and nutrients; trace elements and isotopes as proxies for past climate conditions; land-sea fluxes of trace elements/sediment-water interactions; trace element effects on organisms; hydrothermal fluxes of trace elements; tracers of ocean circulation; tracers of contaminant transport; controls on distribution and speciation of trace elements; and ocean modelling.

SCOR-supported meetings during 2008/2009

SSC meeting: The third meeting of the GEOTRACES SSC was held for three days (6-8 November 2008) in Toyama, Japan, hosted by Toyama University. This was attended by all but two of the SSC members. Jing Zhang, Japan, served as local host. The chair of the GEOTRACES Intercalibration Subcommittee (Greg Cutter) also attended, as did Ed Urban, representing SCOR. Ed Mawji (GEOTRACES Data Assembly Centre) and Juan Brown (British Oceanographic Data Centre) joined the SSC meeting and remained for the meeting of the Data Management Committee (see below).

SSC discussions were wide ranging. The meeting began with a review of national efforts and of GEOTRACES cruises carried out as part of the International Polar Year. Publicizing information about GEOTRACES and providing information in a format appropriate for users is important as the program enters its period of main field activity. Production of a GEOTRACES brochure and upgrading the Web site are therefore a priority. The SSC set guidelines for the brochure, but will defer action on the Web site until the IPO is staffed (see below). In addition to relationships with other programmes, major issues for discussion included measurement intercalibration, data management, ocean modelling, and criteria for GEOTRACES participation. Topics that received special emphasis include:

- International Project Office (IPO) - funding is in place to hire an executive officer to staff the IPO in Toulouse. Funds will cover salary and expenses for two years. Catherine Jeandel will represent GEOTRACES in developing a contract with Laboratoire d'Etudes en Géophysique et océanographie Spatiale (LEGOS), the host institution. As there is no national or institutional sponsor of the entire cost of the IPO, it is vital that all nations participating in GEOTRACES seek contributions to sustain the office.
- 2008 Intercalibration cruise - Greg Cutter reported on preliminary results from the first GEOTRACES intercalibration cruise, held in June and July 2008, between Bermuda and Norfolk, Virginia. Of note is the finding that the sampling rosette designed specifically for U.S. GEOTRACES was shown to collect water samples free of contamination for metals such as iron, lead, zinc and mercury. The ability to sample the water column rapidly and without contamination represents a vital technological advance that will enable GEOTRACES to measure trace element distributions at high spatial resolution on a global scale. Other nations are now developing clean sampling systems based on this design. Several hundred seawater samples from SAFE and GEOTRACES have been archived to use as working standards during future cruises.
- Data Management - The SSC heard a report from Ed Mawji, the GEOTRACES Data Liaison Officer, on steps being taken to establish the GEOTRACES Data Assembly Centre at BODC. The role of GDAC includes
 1. Establish a global database of GEOTRACES parameters
 2. Provide guidance on metadata requirements

The next SSC meeting is scheduled for 4-6 November 2009 in Washington, D.C. Ed Urban and Lora Carter are overseeing local arrangements. The GEOTRACES Data Management Committee will meet on 7 November.

Arctic Ocean Basin Workshop in 2009

A workshop to set research priorities and plan the implementation of GEOTRACES science in the Arctic Ocean was held on 8-10 June 2009, at the Hanse Institute for Advanced Study, Delmenhorst, Germany. This workshop followed the precedent of the three successful international workshops held in 2007 to set priorities for the three major ocean basins – Pacific, Atlantic, and Indian.

Information about the Arctic workshop was publicized on the GEOTRACES Web site. Travel subsidies were provided for many participants with support from SCOR, from the European COST Action (see below), and from a variety of national sources. During the meeting workshop participants identified the key regions and research questions for the Arctic basin, and discussed opportunities for international collaboration to address the goals laid out in the *GEOTRACES Science Plan*. International collaboration will be necessary due to the difficult logistics involved when working in the Arctic Ocean.

The Arctic Ocean workshop report will be published on the GEOTRACES Web site. It is intended mainly for use by national and regional planning groups for implementing GEOTRACES cruises. The SSC will extract material from these reports to prepare an overview document to be disseminated more widely.

Measurement Intercalibration during the GEOTRACES programme

There was early recognition during the planning of GEOTRACES that intercalibration of measurements between laboratories would be critical to the success of the program. To that end, intercalibration, along with data management, has been one of the two primary “enabling” activities since the establishment of the GEOTRACES program. To date, GEOTRACES has completed two major intercalibration cruises:

- 1) 8 June-12 July 2008: sampling mainly at the Bermuda Atlantic Time Series Station, but also in continental slope waters near the east coast of the United States
- 2) 6-30 May 2009: sampling mainly at the SAFE station in the eastern subtropical North Pacific Ocean, but also in the Santa Barbara Basin, off the west coast of the United States. Samples were collected at the SAFE site to test the collection and analysis of samples for a broad spectrum of dissolved and particulate trace elements and isotopes. Samples were collected in the Santa Barbara Basin to test analytical methods used under low-oxygen conditions to measure the chemical speciation of redox-sensitive trace elements.

Results from the first intercalibration cruise were presented and discussed at a workshop (13-14 December 2008; San Francisco, USA) attended by about 45 persons. Team leaders compared results from participating labs worldwide, both in terms of different classes of trace elements and isotopes and in terms of different sampling techniques.

In general, results from different sampling systems were found to be in agreement. For many of the trace elements, inter-lab agreement was good as well, although some problems were identified. However, agreement was poorer than expected for some of the radioisotope measurements. These results led to the design of new tests to be conducted during the second intercalibration cruise (May 2009). Results from that cruise are not yet available.

A final workshop (March 2010, Norfolk, USA) will synthesize results from the intercalibration activities and begin preparation of a “Best Practices Manual” documenting lessons learned from the intercalibration and making recommendations to facilitate acquisition of reliable data on future GEOTRACES cruises. The manual will be completed by the GEOTRACES Standards and Intercalibration Committee (Greg Cutter, Chair) and made available via the GEOTRACES Web site.

Data Management for GEOTRACES

The Data Management Committee, co-chaired by Chris Measures and Reiner Schlitzer, met immediately following the SSC meeting on 9 - 10 November in Toyama, Japan. Progress in establishing the international GEOTRACES Data Assembly Centre in the UK was reviewed, and priorities for future activities of the centre were developed. Currently the GDAC is operating under two years of funding provided in equal amounts by the UK NERC and by the US NSF. It is anticipated that future support for the GEOTRACES data management office will be provided via a national subscription policy. Each nation that carries out a GEOTRACES cruise is expected to include in the overall cruise budget a request for data management funds. The precise level of funding expected from each cruise remains to be established by the Data Management Committee.

During the past year, Ed Mawji (GEOTRACES Data Liaison Officer) has set up a Web page (<http://www.bodc.ac.uk/geotraces/>), established metadata requirements for GEOTRACES cruises, contacted cruise leaders to submit metadata, designed an interface for submission of data and metadata, contacted representatives of national data centres to establish protocols for data transfer, and initiated a Web site with information about GEOTRACES cruises. Most recently, he has started to request data from the principal investigators who participated in GEOTRACES IPY cruises.

Modeling in GEOTRACES

Building on the success of the first GEOTRACES international data-model synergy workshop in 2007, the SSC initiated plans for a second workshop, to be chaired by Jean-Claude Dutay (Venue: École Normale Supérieure, Paris, France; 7 - 10 December 2009). Additional information is posted on the GEOTRACES Web site: http://www.geotraces.org/PW2009_Data_Model_Synergy.html.

Links with other programmes

GEOTRACES remains committed to maintaining strong links to other relevant programmes. During the past year members of the GEOTRACES SSC have held discussions with Doug Wallace, Chair of the SOLAS SSC, to explore opportunities for collaboration. GEOTRACES and SOLAS are both interested in the supply of iron and other micronutrients that are essential for marine organisms, as well as in the biological response to variability in the supply of these micronutrients. In support of that interest, GEOTRACES is considering opportunities to make a limited suite of measurements aboard section cruises that would characterize biological parameters related to organism physiology and their sensitivity to micronutrient limitation. This initiative has been labelled bioGEOTRACES. Meanwhile, SOLAS has identified a related topic "Atmospheric control of nutrient cycling and primary production in the Surface Ocean" as a focus activity for its future research. This is one of the themes to be highlighted at the SOLAS Open Science Conference in Barcelona. Ideally, SOLAS and GEOTRACES would join forces to plan a process study that exploits information gained about micronutrient supply from the GEOTRACES sections to test new hypotheses concerning ecosystem response to varying micronutrient availability. At this time, individuals are being sought who would take the lead on organizing such an effort.

Capacity Building

It became evident during the basin planning workshops that many nations with scientists interested in GEOTRACES lack the experience and expertise to collect and process seawater samples free of contamination of certain trace elements. Consequently, it was decided that a training workshop that included the collection and processing of samples at sea would be a valuable capacity building activity for GEOTRACES. Chris Measures (University of Hawaii) volunteered to take the lead in seeking support for the workshop, and to host the workshop in Hawaii. However, despite intense enthusiasm among GEOTRACES SSC members for this capacity building effort, initial requests for support have met with discouraging responses. At this time, Chris Measures continues to lead an effort to seek alternative sources of funding for the training activity. The major sticking point is the need to pay for ship time.

GEOTRACES also seeks to build communities of marine biogeochemists within individual nations to expand the network of scientists contributing toward GEOTRACES goals. Toward that end, the Indian Ocean basin-planning workshop was held in India in 2007 to help organize Indian scientists with interests in the marine biogeochemistry of trace elements and their isotopes. It was rewarding, therefore, when the government of India Ministry of Earth Sciences announced its intentions in mid-2009 to support an Indian national GEOTRACES program (see national report from India).

In May 2009, SSC members Chris Measures and Bob Anderson visited university and government labs in Korea to assist in organizing a Korean GEOTRACES program (see national report from Korea).

GEOTRACES anticipates holding an East Asian regional planning workshop in early 2010. Workshop organizers (Minhan Dai, China, and Jing Zhang, Japan) have offered to hold that workshop in Korea if doing so will enhance the visibility of Korean GEOTRACES organizing efforts and help secure funding for a Korean GEOTRACES program.

International Project Office

The principal activity during the past year involved developing a legal contract with the hosting institution. This proved to be a time-consuming effort. The GEOTRACES SSC wishes to thank Ed Urban for his valuable assistance in completing the contract. The GEOTRACES Executive Officer position was advertised in early July, 2009. It is hoped that the executive officer will be hired and in place by the time of the next GEOTRACES SSC meeting (November 2009). A search committee consisting of Ed Urban (SCOR), Gideon Henderson and Bob Anderson (SSC co-Chairs), and Catherine Jeandel (local IPO supervisor) will review the applications and interview finalists for the position, on 7 September.

Other Activities

GEOTRACES Co-Chairs Henderson and Anderson attended the SCOR 50th Anniversary Symposium (The Changing Ocean: From Past to Future) and the 2008 SCOR General Meeting in Woods Hole, Massachusetts, USA, on 20-24 October 2008.

Anderson also participated in the Third SCOR Summit of International Marine Research Projects (Newark, Delaware, USA; 30 March-1 April 2009).

European GEOTRACES activities are supported by COST Action ES0801: The ocean chemistry of bioactive trace elements and paleoclimate proxies. This COST Action directly supports the International GEOTRACES Programme, but extends beyond that programme to cover all marine trace-metal research in the COST region. Supported activities include cruise planning, intercalibration, data management and training. For more information, see <http://costaction.earth.ox.ac.uk/>.

GEOTRACES-related sessions at international conferences

GEOTRACES research goals are regularly promoted through special sessions at international conferences. Highlights during the past year include:

Goldschmidt 2009 - Challenges to Our Volatile Planet

21-26 June; Davos, Switzerland

Theme 14: Ocean Chemistry Past and Present - Sessions:

- 14a: Present-Day Ocean Chemistry and Biogeochemical Cycling of Elements and Metals
- 14b: New Developments in Marine Geochemical and Isotopic Proxies
- 14c: Past Ocean Circulation
- 14d: Ocean-Lithosphere Exchange and Fluid-Rock Interaction

ASLO Aquatic Sciences Meeting 2009

25-30 January; Nice, France

- 009. Progress in the application of short-lived radionuclides as tracers of particle cycling and export in the ocean
- 016. Aquatic biogeochemistry as only skin deep: Trace element exchange, meta-stable speciation and reactions at interfaces
- 081. Biological transformations of trace metals
- 097. Chemical speciation of metals in waters and its dynamics
- 099. IPY-GEOTRACES: Trace Elements and Isotopes in Polar Oceans

Looking forward, two special sessions at the Ocean Sciences meeting (22-26 February 2010; Portland, Oregon) will highlight results pertaining to trace elements and their isotopes:

- CO07: GEOTRACES in the International Polar Year, and
- CO09: Getting the Right Number: Precision and Accuracy in Chemical Oceanography.

Acknowledgements

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

National Reports

Australia

Summary of Australian GEOTRACES activities in the period July 2008-June 2009:

- Metadata and cruise reports from IPY-GEOTRACES projects *SIPEX*, *SAZ-Sense* and *SR3* submitted to Edward Mawji at BODC in the United Kingdom
- IPY-GEOTRACES voyages (*SIPEX*, *SAZ-Sense* and *SR3*) -- analyses and interpretation ongoing, publication outputs listed below
- SS01/2010 voyage planning underway for international interdisciplinary study of the macro- / micro-nutrient gradients and biogeochemistry in the Tasman Sea (Jan/Feb 2010); looking for endorsement as a GEOTRACES process study (PI: Christel Hassler)
- Australian Government funds new oceanographic research vessel; looking to be operational 2012/13. Requests from Bowie/Butler for vessel to conform to GEOTRACES “standards”
- Proposal submitted to Australian Marine National facility for shiptime in May/June 2011 for joint Australian-NZ GEOTRACES two-ship voyage along line P06 (~30°S) east of Australia (153°E to 160°W) (PI: Andrew Bowie)
- Australia joins European Union COST Action ES0801 for GEOTRACES (“The ocean chemistry of bioactive trace elements and paleoclimate proxies”) as non-COST international participant (National representative: Andrew Bowie)

Outputs from IPY-GEOTRACES activities involving Australian researchers:

Journal articles:

- Bowie A.R., Lannuzel D., Remenyi T.A., Wagener T., Lam P., Boyd P.W., Guieu C., Townsend A.T., Trull T.W., 2009. Different processes structure biogeochemical iron budgets in the subantarctic and polar Southern Ocean south of Australia during summer. *Global Biogeochemical Cycles*, accepted subject to minor revision
- Lannuzel D., Schoemann V., Pasquer B., van der Merwe P., Bowie A.R., 2009. What controls the distribution of dissolved iron in Antarctic sea ice? Spatial, seasonal and inter-annual variability. *Journal of Geophysical Research - Biogeosciences*, accepted subject to major revision
- van der Merwe P., Lannuzel D., Mancuso Nichols C.A., Meiners K., Heil P., Norman L., Thomas D., Bowie A.R., 2009. Biogeochemical observations during the winter-spring transition in East Antarctic sea ice: evidence of iron and exopolysaccharide controls. *Marine Chemistry*, accepted subject to minor revision
- Lannuzel D., Remenyi T., Lam P., Townsend A., Ibanami E., Butler E., Wagener T., Schoemann V., Bowie A.R., 2009. Distributions of dissolved and particulate iron in the sub-Antarctic and polar frontal Southern Ocean (Australian sector). *Deep-Sea Research II*, accepted subject to minor revision
- Ibanami E.B., Hunter K.A., Sander S., Boyd P.W., Bowie A.R., 2009. Vertical distributions of iron-(III) complexing ligands in the Southern Ocean, *Deep-Sea Research II*, accepted subject to minor revision

Conference presentations:

- Bowie A., Lannuzel D., Remenyi T., Wagener T., Lam P., Boyd P., Guieu C., Townsend A., Trull T.W., Griffiths B., SAZ-Sense Team, 2009. Different processes drive biogeochemical iron budgets in the subantarctic and polar Southern Ocean. 2nd International Forum on the Sub-Antarctic (IFSA), Environmental Change in the Sub-Antarctic, Hobart, Australia, 26-27 April
- Trull T.W., Bowie A.R., Boyd P., Cassar N., Davidson A., Griffiths F.B., Rintoul S.R., Thomson P., Tilbrook B., Wright S., SAZ-Sense team, 2009. The Australian SAZ-Sense Study of the sensitivity of the Sub-Antarctic zone to Climate Change, 2nd International Forum on the Sub-Antarctic, Environmental Change in the Sub-Antarctic, Hobart, Australia, 26-27 April
- Bowie A., Lannuzel D., Remenyi T., Wagener T., Lam P., Boyd P., Guieu C., Townsend A., Trull T.W., Griffiths B., SAZ-Sense Team, 2009. Different processes drive biogeochemical iron budgets in the subantarctic and polar Southern Ocean. Gordon Research Conference: Polar Marine Science - Beyond IPY: Crossing Boundaries, Lucca, Italy, March 15-20

- Bowie A.R., Boye M., de Baar H., Bathmann U., Cardinal D., Murphy E., Treguer P., 2009. An overview of the biogeochemical features of the Southern Ocean during the International Polar Year. Gordon Research Conference: Polar Marine Science - Beyond IPY: Crossing Boundaries, Lucca, Italy, March 15-20
- Boye M., de Baar H., Bowie A.R., Masque P., Dehairs F., Rutgers van der Loeff M., Butler E., Tovar-Sanchez A., Croot P., Nishioka J., 2009. GEOTRACES in the International Polar Year: an overview. ASLO 2009 Aquatic Sciences Meeting, Nice (France), January 25-30
- Boye M., de Baar H., Bowie A.R., Bathmann U., Cardinal D., Murphy E., Treguer P., 2009. An overview of the biogeochemical features of the Southern Ocean during the International Polar Year. ASLO 2009 Aquatic Sciences Meeting, Nice (France), January 25-30
- Sedwick P., Marsay C., Bowie A., Church T., Cullen J., Giesbrecht T., Johnson R., Lohan M., McGillicuddy D., Ussher S., 2008. Dynamics and speciation of dissolved iron in the Sargasso Sea (BATS Region). *Eos, Transactions, American Geophysical Union* 89(52), Fall Meet. Suppl., OS21G-03
- Cossa D., Butler E., Heimbürger L., Averty B., Bowie A., Watson R., Remenyi T., 2008. Methylmercury distribution in the upper part of the Southern Ocean (SR3, GEOTRACES). *Eos, Transactions, American Geophysical Union* 89(52), Fall Meet. Suppl., C11C-0515
- de Baar H.J.W., Bowie A.R., Boye M., Butler E., Croot P., Dehairs F., Masque P., Nishioka J., Rutgers van der Loeff M., Tovar-Sanchez A., 2008. IPY-GEOTRACES : Trace Elements and Isotopes in Polar Oceans. SCAR/IASP IPY Open Science Conference: Polar Research - Arctic and Antarctic Perspectives in the International Polar Year, St Petersburg, Russia, July 8-11
- Trull T.W., Bowie A.R., Davidson A., Griffiths F.B., Thompson P., Rintoul S.R., Tilbrook B., Wright S.W., SAZ-SENSE team, 2008. The Australian SAZ-SENSE study of the sensitivity of the Sub-Antarctic Zone to climate change: an introduction. International Symposium on the Effects of Climate Change on the World's Oceans, Gijon, Spain, May 19-23
- C.S. Hassler, V. Schoemann, E. Alasonati, C. Mancuso-Nichols, V.I. Slaveykova, E.C.V. Butler, 2009. Are sugars the key to ubiquitous control of oceanic iron limitation? Gordon Research Conference on Polar Marine Science. 'Beyond IPY: Crossing Boundaries', Lucca (Barga), Italy.
- V. Schoemann, C.S. Hassler, I. Dumont, F. Masson, A. Bowie, D. Lannuzel, J.T.M. de Jong, and S. Becquevort, 2008. Control of organic ligands on Fe bioavailability, carbon production and export. European Network of Excellence for Ocean Ecosystems Analysis (EUR-OCEAN) Workshop "Controls on organic carbon export and twilight zone mineralisation". Brussels, Belgium.
- C.S. Hassler and V. Schoemann, 2008. Iron bioavailability and primary productivity to model phytoplankton of the Southern Ocean. European Network of Excellence for Ocean Ecosystems Analysis (EUR-OCEAN) Workshop "Controls on organic carbon export and twilight zone mineralisation". Brussels, Belgium.
- C.S. Hassler, and V. Schoemann, 2008. On the role of organically bound iron in controlling iron bioavailability to model phytoplankton of the Southern Ocean. European Network of Excellence for Ocean Ecosystems Analysis (EUR-OCEAN) Workshop "Iron biogeochemistry across marine systems at changing times". Gothenburg, Sweden.
- V. Schoemann, C.S. Hassler, I. Dumont, F. Masson, A. Bowie, D. Lannuzel, J.T.M. de Jong, and S. Becquevort, 2008. European Network of Excellence for Ocean Ecosystems Analysis (EUR-OCEAN) Workshop "Iron biogeochemistry across marine systems at changing times". Gothenburg, Sweden.

Other publications:

- E.C.V. Butler, and A.R. Bowie, 2008. Tracing elements in the ocean. *Australian Antarctic Magazine*, (14): 20.
- C.S. Hassler, 2008. Bioavailability of organically bound iron to phytoplankton of the Southern Ocean. *SOLAS Newsletter*, (7): 2-3.

Prepared by: Andrew Bowie (Antarctic Climate & Ecosystems CRC)
Ed Butler (CSIRO Marine & Atmospheric Research)

Brazil

Workshop:

State of Knowledge on Southwestern Atlantic Ocean Margin Processes (16-21 Nov).

Although considerable research has been carried out on the Southwestern Atlantic Ocean Margin, there has been little integration of results across disciplines and the few recent summaries of research that have been published do not take into account more recent scientific findings in the region.

The purpose of the Montevideo's workshop is to bring together scientists from Brazil, Uruguay, Argentina and the United States to assess the state of knowledge on ocean margin processes of the Southwestern Atlantic Ocean. The goal is to develop a summary of the present understanding of physical and biogeochemical processes operating in this region and how they are linked and to identify major areas of uncertainty. The anticipated outcomes of the workshop are: 1) to initiate the pursuit of cooperative research projects/programs in the region that articulate with more global research agendas and 2) to enhance North-South American, and regional-national collaborations.

Multidisciplinary syntheses of research in this region will not only benefit regional researchers in planning future efforts, but will also serve the wider marine research community by providing a better overview of the state of knowledge of this important ocean region.

Scientific activities:

1. We have realized the first observations of naturally occurring geochemical tracers (^{222}Rn , ^{223}Ra , ^{224}Ra) in the coastal waters as proxies of SGD into the Albardão shelf, extremely Southern Brazil, close to the Uruguayan borders. Coastal seawater and shallow beach groundwater (<4m deep) were sampled in January 2007 and September 2008. Groundwater samples were collected with a stainless steel drive-point piezometer system ("Retract-a-Tip" from AMS®). For measuring ^{222}Rn ($t_{1/2} = 3.8$ days), we used a portable, continuous radon-in-air monitor modified for radon-in-water (Rad-7, DurrIDGE Company) deployed on a rubber boat in the surf zone. Radium sampling was carried out by passing large volumes of water (~20 L for groundwater; ~200 L for surface waters) through a "Mn fiber" adsorber. Activities of ^{223}Ra ($t_{1/2} = 11.4$ days) and ^{224}Ra ($t_{1/2} = 3.7$ days) were then measured on a delayed coincidence counter.

Offshore radium transects indicated a nearshore groundwater source. Given the environmental conditions of the southern Brazilian continental shelf (e.g., wavy, open shoreline), radium may provide more consistent information than radon, as it is difficult to estimate the influence of waves on radon atmospheric evasion.

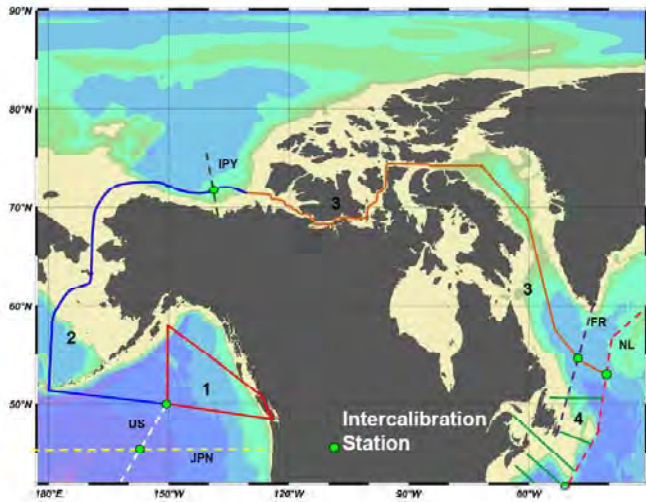
2. We are in contact with Brazilian Navy to conduct three transects (from the coast up to the shelf break) in between latitude 26° - 33° S, to analyze macronutrients and isotopes. This is a joint project involving the Navy, IEAPM (Instituto de Estudos Almirante Paulo Moreira) and IRD/CNEN (Instituto de Radioproteção e Dosimetria/Comissão Nacional de Energia Nuclear). It is scheduled for 2009. The scientists involved took part in the the *Ubatuba, Brazil* SGD assessment intercomparison that was held in 2005.

Canada

The Canadian GEOTRACES IPY cruise in the Arctic Ocean was delayed until 27 August - 15 September 2009. It is anticipated that all key GEOTRACES parameters will be measured, with the possible exception of aerosols. The cruise track is shown below.



The Canadian GEOTRACES community is also looking forward to collaborating with other nations in a larger study of the Arctic Ocean.



Tentative plan for a Canadian GEOTRACES NSERC Strategic Network.

China (Beijing)

GEOTRACES Activities in China
An annual report for 2008-2009
July 15, 2009
By China-GEOTRACES Working Group

1. Activities:

- a. Participation to the international GEOTRACES activities- inter-comparison:
 - Xiamen University: Th, Ra, Pb and Po
 - East China Normal University (Jinzhou Du): U, Ra.
 - Ocean University of China (Jingling Ren): Al and As
- b. Attendance in the International Polar Year-GEOTRACES program
- c. Continue to explore the possibility of a trace metal sampling/analysis training workshop with Chris Measures
- d. "973" Carbon project--part of China-GEOTRACES has been accommodated in this project and there is the first cruise to Chinese Marginal Seas between July-September, 2009
- e. Planning of a 3rd Asian-GEOTRACES workshop, with the exploration of a Korean host
- f. Start to plan a GEOTRACES process cruise in Pacific in 2011

2. Products:

- a. Preliminary results from GEOTRACES inter-calibration exercise are available. Details not shown.
- b. Supported by the Alexander von Humboldt Foundation and BMBF, the cooperation between Xiamen University and Alfred-Wegener Institute of Polar and Marine Research in the POC export studies in the Arctic Ocean and the Southern Ocean has led to two submitted manuscripts of Cai et al., 2009 (JGR-Oceans) and Rutgers van der Loeff et al., 2009 (DSR II). The major findings are the very low POC export in the central Arctic Ocean (Figure not shown) and that simultaneous determinations of ²³⁴Th is crucial for understanding the geochemical behaviors of other particle reactive elements, like Mn and Fe (Figure not shown).

3. Promotion of GEOTRACES in China:

- a. China-GEOTRACES theme has been in the NSFC key project proposal call in 2009 on "Ocean response to terrestrial input in western Pacific and its marginal seas--A biogeochemistry study of trace elements and their isotopes". We are trying to extend this same proposal call in 2010.
- b. Capacity building on trace metals start to accumulate
 - a couple of "clean" systems will be tested for underway and stationary trace metal sampling in an upcoming cruise to South China Sea in July-September 2009
 - We have shown capacity to measure Fe isotopes in suspended particulate material collected in the South China Sea, a largest marginal sea in the West Pacific.

France

The French GEOTRACES held a planning workshop attended by 30 participants (representing roughly 50 interested people). Scientists from Belgium and Spain participated as well, reflecting anticipated international collaboration.

GEOTRACES-France confirms its plan to carry out a section along the "OVIDE" North Atlantic track (between France and Greenland) in 2014 (Catherine Jeandel, lead investigator). GEOTRACES-France is also considering an Indian Ocean action (Keops II) and probable section (at least from La Reunion to Kerguelen, both led by Stephane Blain, possibly as early as 2012). A pre-proposal has been submitted to test the willingness of the French scientific committees to support such an operation. Finally, plans are being initiated for a Mediterranean GEOTRACES action under the direction of C Guieu.

GEOTRACES-France has ordered a clean rosette with the cable and 12 bottles. It is anticipated that the winch will be purchased in the next year.

Germany

Many activities were related to the GEOTRACES IPY expeditions with RV *Polarstern* to the central Arctic (July-Oct, 2007) and to the Atlantic sector of the Southern Ocean (ZERO and DRAKE, Febr-Apr, 2008):

Post-cruise workshops of these IPY *Polarstern* expeditions took place:

- Antarctic expedition ZERO and DRAKE: ANT XXIV/3 (AWI, Bremerhaven, September 2008)
- Arctic expedition ARK XXII/2 (AWI, Bremerhaven, June 2009)

Results based on GEOTRACES-related work on these IPY expeditions were presented at international conferences (ASLO-Nice; Goldschmidt-Davos) and led to the submission of a first set of publications.

In addition to the three basin workshops organized in 2007, an international Arctic Cruise Planning workshop was held in Delmenhorst 8-10 June 2009 (http://www.geotraces.org/PW2009_ArcticCruise.html) to discuss and coordinate future GEOTRACES activities in the Arctic.

Directly after the Delmenhorst meeting a cruise preparation meeting for a German RV *Meteor* GEOTRACES expedition to the tropical Atlantic (*Meteor* M81/1, February 2010 Las Palmas – Port of Spain (Trinidad and Tobago), chief scientist Martin Frank) was held on June 10.

India

Indian GEOTRACES Report Sunil Kumar Singh

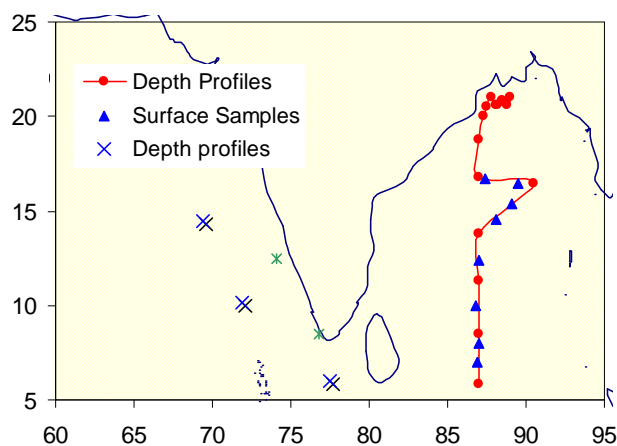


Fig. 1: Cruise track and sampling location in BoB and



Fig. 2: Cruise track in Southern

After the successful organisation of GEOTRACES Indian Basin Planning workshop at Goa during October 2007, further interaction among Indian scientists resulted in concurrence to submit a combined proposal under

GEOTRACES (India) to the Ministry of Earth Sciences (MoES) to get funding and required facilities to study trace elements and isotopes (TEIs) in Indian and Southern oceans. In the beginning of 2009, nine proposals dealing with biogeochemistry of TEIs in Indian Ocean from various institutions in India were put together. These proposals plan to study the various aspects of biogeochemistry of TEIs, such as their sources-sinks, water column distribution, inter-oceanic exchange, etc. As the coordinator of this programme, I presented these proposals to MoES in a meeting chaired by the secretary, MoES in middle of April 2009. Immediately after the talk, the secretary announced the formation of GEOTRACES (India) and assured us all the financial and logistical helps including the

ship timing for this programme. He also agreed to provide necessary funding for acquiring a clean sampling system including the clean van and other instruments under GEOTRACES (India) programme. We hope to start the acquisition process for the clean sampling system and other instruments in late September 2009.

As has been discussed earlier, we had initiated some work related to GEOTRACES by studying U, Mo, Re and Ba distribution in the Bay of Bengal and Arabian Sea. During November 2008, we arranged a 25-day cruise in the Arabian Sea (AS) and the Bay of Bengal (BoB) to collect seawater samples from various depth profiles (Fig. 1). Further, we participated in the Southern Ocean cruise Akademik Boris Petrov, Cruise # 35 during February 12 to April 14, 2009 and seawater samples were collected along the cruise track shown in Fig. 2

The samples from BoB have been analysed for Ba, U, Re and Mo and some of the initial results given in Fig. 3.

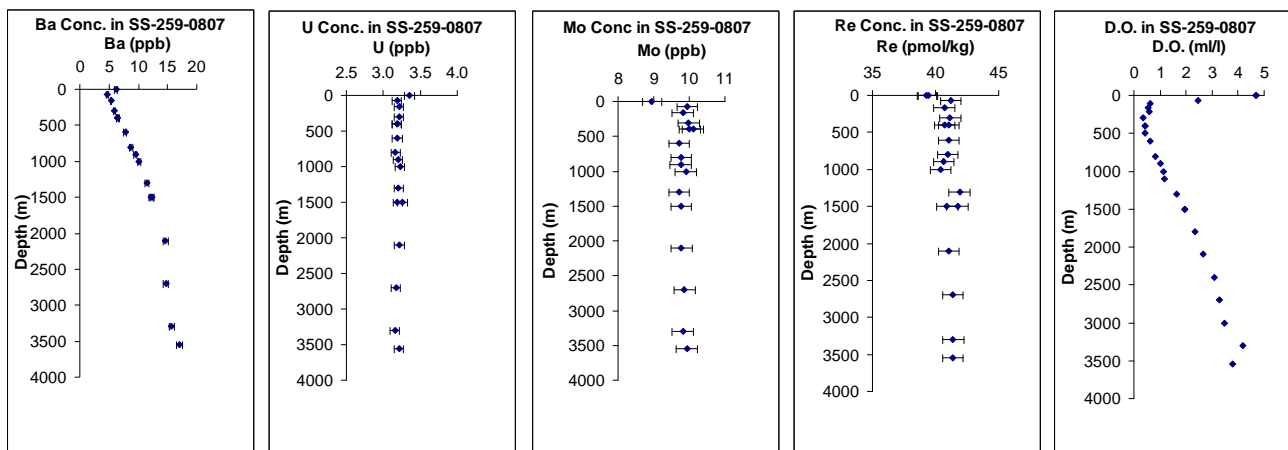


Fig. 3: Ba, U, Mo, Re and D.O. concentrations in the Bay of Bengal

Japan

Major GEOTRACES-related activities in Japan during the past year are as follows:

- 1) Publication of two special sections in *Journal of Oceanography* (Oceanographical Society of Japan) Vol. 64 (Nos. 2 and 3) on GEOTRACES-related studies in the east Asia. Vol. 64(2) was published in April 2008, which contains 11 papers including Preface by W.S. Broecker and R.F. Anderson and Introduction by the guest editors (J. Zhang, T. Gamo, M. Dai, C-T. A. Chen, and Y. Sohrin), and Vol. 64(3) was published in June 2008, which contains 7 papers. Titles and abstracts of these papers have been uploaded in the TERRAPUB Web site (<http://www.terrapub.co.jp/journals/JO/index.html>).
- 2) Participation in the intercalibration cruise in June. Two young researchers from Japan took part in the U.S. GEOTRACES intercalibration cruise Leg. 1 from Norfolk to Bermuda (from 8 to 27 June 2008) as observers. During the cruise, Dr. Hajime Obata (ORI, U. Tokyo) and Dr. Kazuhiro Norisuye (ICR, Kyoto Univ.) used Niskin-X samplers for clean water sampling, and showed that the samplers are clean enough for contamination-prone trace metals, like Zn and Hg.
- 3) Although many of the Japanese geotraces as well as some foreign geotraces had been actively preparing for the GEOTRACES Indian Ocean cruise scheduled in December 2008 to January 2009, the cruise was postponed to the next year (November and December 2009) due to unusual increase of oil prices.
- 4) A five-year proposal of a new grant-in-aid (totally \$14M) for GEOTRACES studies in Japan was submitted to the

Government in April 2008, but it was not approved. A revised proposal was again submitted in December 2008.

GEOTRACES-Japan will begin its first major ocean section cruise in November 2009, covering a meridional transect in the western Indian Ocean.

Korea

- Planning project for a Korea GEOTRACES Program (K-GEOTRACES) were funded and started from November 2008.
- The scientific committees and working groups (Intercalibration and TEI research) have been formed to develop a K-GEOTRACES in Feb. 2009.
- K-GEOTRACES Planning Committees hosted Dr. Bob Anderson (co-chair of international GEOTRACES program), LDEO, and Dr. Chris Measures, University of Hawaii to get comments and recommendations in developing a Korean GEOTRACES program (K-GEOTRACES) in May 2009 (referred the photo below).
- We organized the open science meeting of interested scientists for launching a K-GEOTRACES program at the bi-annual meeting of Korean Society of Oceanography in May 2009.
- The working groups are planning to get together to prepare a national implementation plan and priority goals for a K-GEOTRACES program and Korean oceanographic community in Aug. 2009.



Dr. Bob Anderson introduced the overview of international GEOTRACE program during the open science meeting at Korea in May 2009.

Netherlands

Netherlands activities focused on continued analysis of samples, and interpretation of results generated during International Polar Year cruises.

Arctic Polarstern cruise July-October 2007

Datasets for Fe, Mn, Al, high-accuracy nutrients; samples collected for Ag (to be analyzed with Eric Achterberg), and Cu, Cd, Ni, Zn (to be analyzed with Bill Landing). Most other GEOTRACES sampling for Ba, REE and radioisotopes was done by the German team of Michiel Rutgers van der Loeff. Manuscript on Al is ready and awaiting few minor corrections before submitting to *Marine Chemistry*.

Antarctic Polarstern cruise February-April 2008

Datasets for Fe, Mn, Al, high-accuracy nutrients; samples collected for Ag (to be analyzed with Eric Achterberg), and Cu, Cd, Ni, Zn (to be analyzed with Bill Landing). Most other GEOTRACES sampling for Ba, REE and radioisotopes was done by the German team of Michiel Rutgers van der Loeff. Moreover, more trace metals research by team of Peter Croot, Kiel, Germany. Results from the zero meridian for Fe, Al, Mn and Fe speciation & colloids will appear in a special issue DSR II for this cruise.

During all the above cruises, SAFe samples were used as standards and results for Fe, Al and Mn were submitted to SAFe data coordinator Ken Bruland. There is excellent agreement between several labs for Fe, also for the few labs for Al and Mn.

Hein de Baar co-chaired with Marie Boye (France) an IPY GEOTRACES session at the ASLO meeting in January 2009 in Nice. Some 22 abstracts were received.

A Netherlands GEOTRACES cruise has been approved to conduct the West Atlantic Ocean section to in 2010 and 2011. We are now looking into all the logistics etc. to first come up with a ship time plan (which months we will use for each of these 4 sections)

New Zealand

The following activities have been conducted over the last 12 months:

- a) The first GEOTRACES process study – an interdisciplinary study of trace metal cycling and budgets during a spring bloom event in high-iron waters east of New Zealand.
- b) Ongoing ship-of-opportunity sampling for aerosol iron between Japan and New Zealand, Australia and New Zealand, and Tasmania and East Antarctica.
- c) Planning and co-ordination with Australian colleagues of a joint GEOTRACES survey voyage from N Queensland to Tahiti (i.e., Western portion of the WOCE P06 zonal section).

The process study took place in September 2008, and involved 31 scientists from New Zealand, Australia, USA and Canada. We successfully captured the onset and development of the spring bloom, and were able to sample in a quasi-Lagrangian mode by locating the centre of an almost stationary eddy. The voyage had a strong physics component to underpin the daily sampling of trace metals using both specialised clean rosettes and particle pumps. Samples were taken for a wide range of chemical (such as redox speciation, metal isotopes, electrochemistry) and biological (uptake and recycling of metals, trace metal content of individual cells and organisms) processes. A voyage data workshop will take place in Wellington in December 2009, and we will liaise closely with GEOTRACES data management in both the UK (BODC) and U.S. (BCO-DMO). Samples for both dissolved and particulates have been archived from the voyage and will be available to other GEOTRACES labs for inter-comparison.

Three meridional transects (17 aerosol samples per transect) were sampled between Japan and New Zealand in the last 12 months. These samples are analysed at UEA (UK) by the Jickells/Baker group to enable the inter-

comparison between Atlantic (AMT) and Pacific transects. Due to ship logistics only one transect was sampled between Tasmania and E Antarctica in 2008/9, as was the case for the Melbourne/Auckland zonal section.

New Zealand has secured 26 days' shiptime for one of the legs (SE of New Caledonia) of the joint Australian/New Zealand survey. We contributed to the writing of the Australian shiptime proposal and hope to be able to confirm voyage dates in the next six months.

Sweden

Report on GEOTRACES related activities in Sweden during 2008

Swedish GEOTRACES activities during 2008 include participation in planning activities for GEOTRACES projects in both the Arctic and Antarctic regions. During 2008 also one major expedition with GEOTRACES-related work was conducted in the East Siberian Sea.

Planning work related to GEOTRACES

The Swedish icebreaker *Oden* is rented by NSF on a five-year contract with the main task to clear a channel for resupply operations into the US McMurdo base in Antarctica. The agreement also includes approximately 20 dedicated science days each year in conjunction with ice-breaking service. At a joint Swedish-U.S. workshop outside Stockholm in February 10-13, 2008 about 50 Swedish and U.S. scientists and science administrators discussed the capabilities of the vessel and possible scientific usage. The discussion included projects related to the GEOTRACES programme. A report from the workshop is available at NSF and Swedish Science Council (VR) and can be downloaded from

http://www.vr.se/download/18.72e6b52e1211cd0bba880006699/Oden_workshop_report08.pdf

During 2008, Sweden also joined the COST action ES0801 "The ocean chemistry of bioactive trace elements and paleoclimate proxies", which directly support the international GEOTRACES programme. Most of the Scandinavian countries are involved in the ES0801 action and an increased interest in the GEOTRACES programme from all countries have been noticed during latter part of 2008 and early 2009. A workshop for trace metal work in the Baltic Sea is currently being planned by the Finnish community. This is a very positive development for the GEOTRACES programme in Scandinavia.

A workshop, supported by COST action ES0801 on GEOTRACES project planning in the Arctic Ocean, Bering Sea and the Nordic Seas took place in Delmenhorst, Germany, during 8-9 June 2009. The workshop included 4 Swedish participants.

Expedition work related to GEOTRACES

Scientists from the Swedish Museum of Natural History, Stockholm University and Luleå Technical University took part in the analyses of samples collected during the GEOTRACES intercalibration cruises 2008-2009.

The International Siberian Shelf Study 2008 (ISSS-08) was a "GEOTRACES-compliant" cruise and a major IPY ship-based programme along the entire Eurasian-Arctic continental shelf with combined biogeochemical and geophysical observations (see Fig 1). The work was conducted from the Russian research vessel *R/V Yakov Smirnitsky* during 15 Aug. to 25 Sept.

ISSS-2008

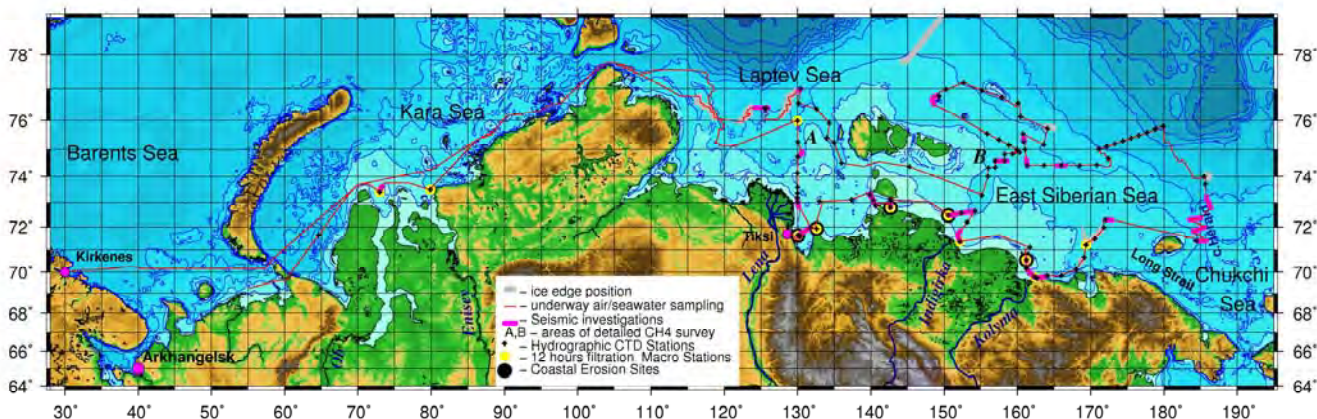


Fig. 1. The transect of the ISSS-08 starting and ending in Kirkenes, Norway. More than 130 stations for CTD and water sampling, 100 sediment coring sites, and 4 coastal erosion sites were investigated.

Planned analyses of collected air, seawater, eroding soil and sediment material include molecular and isotopic biomarker composition, as well as trace element and isotope characterizations following the protocol launched for GEOTRACES work during IPY.

A more detailed report on ISSS-08 with participants and scientific programmes can be found in the journal EOS <http://www.agu.org/journals/eo/eo0917/2009EO170001.pdf#anchor> and supplementary information http://www.agu.org/eos_elec/2009/gustafsson_90_17.html

Per Andersson/

Stockholm 21 July, 2009

UK and EU Cost Action

UK-GEOTRACES

1. South Atlantic Zonal GEOTRACES Section

Funding has been secured from the UK funding agency NERC for the A10 GEOTRACES Section along 40°S from Cape Town to Montevideo in a proposal led by Gideon Henderson (Oxford); Rachel Mills (Southampton); Richard Pancost (Bristol); and Ros Rickaby (Oxford). That proposal also provides funding for the paleoproxy measurements suggested in the GEOTRACES Science Plan. A second proposal has recently been submitted to fund an extensive set of trace metal measurements, which would complete the GEOTRACES key parameters and establish a formal UK-GEOTRACES programme. The cruise is likely to take place in November 2010.

2. Tropical Atlantic Zig-Zag GEOTRACES Section

Funding has also recently been secured from NERC for the A06 GEOTRACES Section under the Saharan dust plume in the north tropical Atlantic via a proposal led by Eric Achterberg (Southampton) and Maeve Lohan (Plymouth). That proposal includes funding for a large number of the GEOTRACES key parameters. The cruise is likely to take place sometime in 2011.

3. Data Management

The UK hosts the GEOTRACES International Data Assembly Centre at the British Oceanographic Data Centre in Liverpool. Ed Mawji co-ordinates data management efforts for the programme. See <http://www.bodc.ac.uk/geotraces/> for details.

GEOTRACES COST Action

An ESF-funded “COST Action” helps to co-ordinate GEOTRACES activities across Europe. Eighteen countries have signed up for the Action and are represented on its Management Committee (Belgium, Croatia, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, United Kingdom). Four working groups have oversight of Cruise Planning; Intercalibration; Data Management; and Training. The Action provides funding for short-exchange visits for scientists travelling from one European country to another to conduct GEOTRACES-related science. It has also contributed to the costs and organisation of the recent GEOTRACES Arctic Workshop (8-10 June 2009, Germany) and will do likewise for the forthcoming 2nd Data-Modelling Synergy workshop (7-10 December 2009, France). Future open meetings are planned to discuss GEOTRACES Activities in the Mediterranean and the Baltic. Full details of the Action can be found at: <http://costaction.earth.ox.ac.uk/>.

USA

U.S. GEOTRACES scientists have been involved in the following activities during the past year.

1) Intercalibration: Both GEOTRACES intercalibration cruises (June-July, 2008, Bermuda to Norfolk; 6-30 May 2009, Honolulu to San Diego) took place aboard the U.S. Research Vessel *Knorr*. U.S. GEOTRACES hosted the international Intercalibration workshop in San Francisco (13-14 December 2009).

2) Planning Workshops: A Planning and Implementation workshop was held in Woods Hole (22-24 September 2008) to develop a strategic plan for the first U.S. GEOTRACES section, tentatively planned for late 2010 from Woods Hole to Lisbon. A second Planning and Implementation workshop (1-3 October 2008; Los Angeles) developed preliminary plans for the second and third U.S. GEOTRACES sections, tentatively in the Pacific Ocean. One section runs from Alaska to Tahiti and the other from Tahiti to Peru.

The report from the Atlantic workshop was quickly revised to produce an implementation plan, which is available via the Web:

<http://www.whoi.edu/files/server.do?id=46083&pt=2&p=52929>, or at
http://www.geotraces.org/documents/US_GEOTRACES_Atlantic_Impln_23Dec08c_46083.pdf.

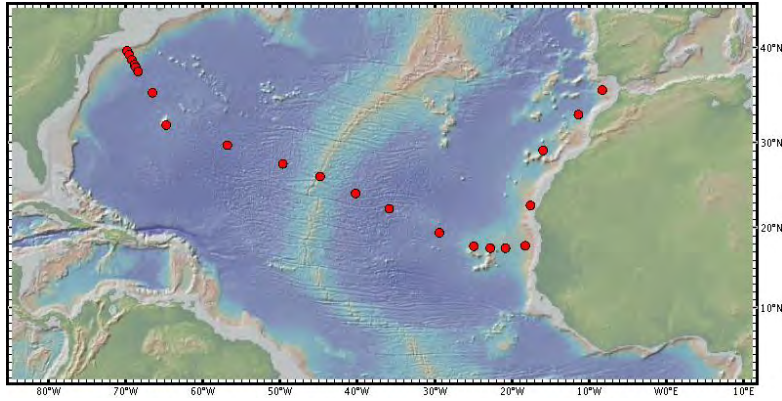
The Pacific workshop report is also available via the web at

http://www.geotraces.org/documents/US_GEOTRACES_Pacific_Report_Jun09.pdf.

3) The U.S. GEOTRACES SSC met 3-4 June 2009 at the NSF. Among other topics covered, the U.S. SSC decided that the Tahiti to Peru section would take place before the Alaska to Tahiti section if the two sections could not be run consecutively. A long-range goal is to link the U.S. section from Tahiti to Peru with the combined Australia-New Zealand section running eastward from Northern Australia to produce a complete quasi-zonal section across the southern tropical Pacific Ocean.

4) Proposals from individual scientists seeking to participate in the U.S. GEOTRACES zonal section crossing the North Atlantic were submitted to a NSF deadline 15 February 2009. A complete count is unavailable, but approximately 20 to 25 proposals were submitted. At the time of this report, funding decisions are still being made concerning those proposals. A small number of additional proposals will be submitted to NSF for a deadline on 15 August 2009. It is anticipated that all GEOTRACES key parameters will be measured on the North Atlantic section.

Representatives from each of the funded projects will create a final section plan at a cruise planning meeting in March 2010. The cruise dates are not yet set, but the cruise is anticipated to begin sometime between August and November 2010.



Station locations along the US GEOTRACES North Atlantic cruise track (US GEOTRACES North Atlantic Implementation Plan). Red dots represent stations where full water column sampling is anticipated. Final station locations will be determined by funded investigators at a pre-cruise meeting.

Annex 10 – Post-Audit Financial Statement for 2008 (all values in US\$)

Budget shown is for Discretionary Funds only	2008 Approved Budget	2008 Final (Post-Audit) Statement		
		DISCRETIONARY	FLOW-THROUGH	TOTAL
INCOME				
Membership Dues	276,528	276,739		276,739
Misc. Income, Interest, pigment book	1,212	3,649		3,649
U.S. Government Grants:	102,163	118,031	449,047	567,078
Non-US Grants and Contracts:		9,981	144,482	154,463
Registration Fees	3,825	31,305	136,081	167,386
TOTAL INCOME	383,728	439,705	729,610	1,169,315
EXPENSES				
WG 125 - Zooplankton	4,760	4,760	13,112	17,872
WG 127 - Equation of State	20,000	20,572		20,572
WG 128 - Hypoxia	2,493	2,493		2,493
WG 129 - DOES	15,000	11,881	31,474	43,355
WG 130 - Automated Plankton Visual ID	1,222	1,722	.	1,722
WG 131 - Iron	7,000	7,000		7,000
WG 132 - Coastal HABs	5,000	8,600	3,100	11,700
GEOHAB			27,498	27,498
GEOTRACES			32,474	32,474
GLOBEC	11,016	11,016	110,627	121,643
High CO2 Symposium (Ocean Acid'n)	3,678	14,341	95,517	109,858
IMBER			106,404	106,404
IOCCP			64,416	64,416
PACKMEDS	3,000	1,836		1,836
Data Publishing Meeting	6,531	8,487		8,487
SOLAS			41,532	41,532
GLOBEC/IMBER Transition	7,500	7,500		7,500
SCAR/SCOR Expert Group	6,000	4,614		4,614
Sloan Ocean Technology Panel			46,859	46,859
GESAMP Project	4,100	4,120		4,120
SCOR 50th Anniversary Symposium	50,000	58,024	8,461	66,485
Travel Grant Program			78,322	78,322
Capacity Building Committee	7,500	10,420		10,420
Publication Distributions		200		200
NASA Funds transferred to IOCCG			69,387	69,387
Representation	17,745	19,603		19,603
Publications and Pigment Book	8,000	8,933		8,933
Annual Meeting	30,000	34,700	427	35,127
Salaries and Benefits	132,190	129,898		129,898
Outside Services (Finance Officer)	30,000	21,139	.	21,139
Salary charges to grants	(17,000)	(21,500)		(21,500)
Communications	4,600	2,400		2,400
Office Equipment	1,500	496		496
Insurance	1,629	4,048		4,048
Meeting Management Expenses	1,800	3,076		3,076
Audit and Accounting Services	11,500	11,500		11,500
UD overhead charges	20,308	19,683		19,683
Miscellaneous, office supplies,	4,600	4,490		4,490
Uncollectable Membership Exp		5,456		5,456
Total Expenses	401,672	421,508	729,610	1,151,118
Beginning Net Assets	197,414	197,414	from 2007 audit	
Income - Expenses	(17,944)	18,197	agrees with 2008 audit	
Ending Net Assets	179,470	215,612	Agrees with 2008 audit	
Less Commitments	(9,635)	(40,932)		
Actual Cash Balance	169,835	174,679		

Annex 11 – SCOR-Related Meetings (2008-2009)

2008		
9-12 April	GEOHAB SSC Meeting	Annapolis, Maryland, USA
May	WG 125 on Global Comparisons of Zooplankton Time Series	Gijón, Spain
5-6 May	GLOBEC SSC Meeting IMBER SSC Meeting SOLAS SSC Meeting	Cape Town, South Africa
6-9 May	WG 130 on Automatic Plankton Visual Identification	São Paulo, Brazil
17-19 June	SCOR/IODE Workshop on Data Publishing	Oostende, Belgium
28-31 July	WG 132 on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems	Geesthacht, Germany
7-13 September	WG 127 on Thermodynamics and Equation of State of Seawater	Berlin, Germany
6-8 October	Second Symposium on the Ocean in a High-CO ₂ World	Monte Carlo, Monaco
6-8 October	SCOR/IAPSO WG 129 Workshop on Deep Ocean Exchanges with the Shelf	Cape Town, South Africa
20-21 October	SCOR 50th Anniversary Symposium	Woods Hole, Massachusetts, USA
22-24 October	SCOR General Meeting	Woods Hole, Massachusetts, USA
6-11 November	GEOTRACES SSC and Data Management Committee	Toyama, Japan
10-13 November	IMBER Imbizo	Miami, Florida, USA
11-13 December	SCOR Panel on New Technologies for Observing Marine Life	Newark, Delaware, USA
2009		
25-27 March	SOLAS SSC	Washington, D.C., USA
30 March-1 April	Third SCOR Project Summit	Newark, Delaware, USA
2-3 April	GEOTRACES Subcommittee on Standards and Intercalibration	Norfolk, Virginia, USA
13-15 May	WG 130 on Automatic Plankton Visual Identification	Baton Rouge, Louisiana, USA
14-16 May	WG 126 on The Role of Viruses in Marine Ecosystems	Newark, Delaware, USA
2-5 June	IMBER Scientific Steering Committee	Paris, France
11-13 June	GEOHAB Scientific Steering Committee	Galway, Ireland
15-19 June	GEOHAB Modeling Workshop	Galway, Ireland
22-26 June	GLOBEC 3rd Open Science Meeting	Victoria, B.C., Canada

17-19 July	SCOR/IAPSO WG 133 - OceanScope	Montreal, Quebec, Canada
20-23 July	SCOR/IAPSO WG 129 on Deep Ocean Exchanges with the Shelf	Montreal, Quebec, Canada
2-5 September	SCOR/IAPSO WG 127 on Thermodynamics and Equation of State of Seawater	Arnhem, The Netherlands
16-18 September	Workshop on Ocean Biology Observatories	Mestre, Italy
26 September	SCAR/SCOR Expert Group on Oceanography	Venice, Italy
13-16 October	SCOR/LOICZ WG 132 on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems	Beijing, China
17-21 October	Second GEOHAB Open Science Meeting on HABs and Eutrophication	Beijing, China
20-22 October	SCOR Executive Committee Meeting	Beijing, China
27-30 October	WG 134 on The Microbial Carbon Pump in the Ocean	Xiamen, China
4-6 November	GEOTRACES Scientific Steering Committee	Washington, D.C., USA
7 November	GEOTRACES Data Management Committee	Washington, D.C., USA
11-13 November	GLOBEC Scientific Steering Committee	Dartington, UK
16-19 November	SOLAS Open Science Conference	Barcelona, Spain
23-24 November	SCOR/InterRidge WG 135 on Hydrothermal Energy Transfer and its Impact on the Ocean Carbon Cycles	Woods Hole, Massachusetts, USA
7-10 December	Second GEOTRACES Data-Model Synergy Workshop	Paris, France