

### **3.0 LARGE-SCALE OCEAN RESEARCH PROJECTS**

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### 3.1 Scientific Steering Committee on Global Ocean Ecosystem Dynamics (GLOBEC)

(Joint with IGBP and IOC)

#### Terms of Reference:

- To oversee the implementation of the Global Ocean Ecosystem Dynamics project in accordance with the published Science and Implementation Plans;
- To develop a programme of Integration and Synthesis for GLOBEC for presentation to the sponsors and the larger scientific community;
- To recommend to the sponsoring organizations the necessary actions to be taken in accordance with the GLOBEC Science and Implementation Plans and to co-ordinate and manage the resulting activities;
- To collaborate, as appropriate, with other related global change projects and programs and planning activities, such as IMBER, LOICZ, WCRP, the IOC program on Ocean Science in relation to living resources (OSLR), and the Global Ocean Observing System;
- To establish appropriate data management policies to ensure sharing and preservation of the GLOBEC data set taking into account the related policies of the sponsors; and
- To report regularly to SCOR, IGBP and IOC and to other bodies such as WCRP, ICES and PICES, on the state of planning and accomplishments of GLOBEC.

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## GLOBEC: Global Ocean Ecosystem Dynamics

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

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### 1. RECENT PROGRESS: Symposia and Workshops

#### 1.1. GLOBEC-sponsored symposia

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

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

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

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

This meeting included the following GLOBEC/PICES CCC sessions:

1. Modelling and historical data analysis of pelagic fish, with special focus on sardine and anchovy
2. Key recruitment processes and life history strategies: bridging the temporal and spatial gap between models and data

3. Synchronous and asynchronous responses of North Pacific boundary current systems to climate variability

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

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

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

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

This multi-sponsored symposium had the following main topics:

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

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

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

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

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

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

- ***GLOBEC CLIOTOP 1<sup>st</sup> Symposium “Climate Impacts on Oceanic Top Predators”. La Paz, Mexico, 3-7 December 2007.***

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

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

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

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

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

9. Advances in image technologies and the application of image analysis to count and identify plankton
10. Analysis and synthesis: modelling zooplankton in aquatic ecosystems

Plus three pre-symposium workshops:

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

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

[http://www.pices.int/meetings/international\\_symposia/2007\\_symposia/4th\\_Zooplankton/4th\\_Zoopl.aspx](http://www.pices.int/meetings/international_symposia/2007_symposia/4th_Zooplankton/4th_Zoopl.aspx).

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

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

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

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

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

Recognising that the BCLME and the GLOBEC-BENEFIT programmes are reaching their conclusion, and noting the inauguration of the Benguela Current Commission (BCC), a concluding event will be held, to focus on key scientific outcomes and other activities and achievements made over the last decade in the Benguela region. The goal is to present the key outputs of the BCLME and BENEFIT programmes, record this legacy and to consolidate plans for future integrated management, sustainable development and protection of the Benguela Current ecosystem. Themes will range from marine scientific research, transboundary management of shared fish stocks, links between fisheries and the environment, monitoring the state of the ecosystem, data management, forecasting and global climate variability, ecosystem health and pollution, impacts of seabed mining and oil and gas exploration and production, socio-economics and governance. Attention will also be given to the philosophy and history leading to the development of regional cooperation and lessons learnt in establishing and implementing the programmes.

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

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

[http://www.pices.int/meetings/international\\_symposia/2008\\_symposia/Climate\\_change/climate\\_background\\_3.aspx](http://www.pices.int/meetings/international_symposia/2008_symposia/Climate_change/climate_background_3.aspx)

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

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

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

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

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

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

Social-ecological systems have marine (including physical-biological sub-systems) and human (including cultural, management, economic, and socio-political sub-systems) components that are highly inter-connected and interactive. The recent 4th Assessment Report of the International Panel on Climate Change (IPCC) identified a number of climate-related changes that are very likely to occur to marine systems in the near future. It identifies the need to make social-ecological systems more resilient by building "adaptive capacity". However, "natural" marine ecosystems are usually studied independently from their human components, and by different scientific disciplines with largely different scientific traditions ("natural" scientists; "social" scientists and humanists). Understanding the important issues and collaborating with other disciplines is essential for correctly interpreting the causes and dealing with the consequences of global changes in marine social-ecological systems. The central goals of the symposium are to share experiences across disciplines and to identify key next steps and common elements and approaches that promote resilience of marine social-ecological systems in the face of global changes. This involves:

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

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

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

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

1. Herring in the middle - the trophic and ecological interactions and impacts of herring - Andrew Bakun (USA)

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

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

### 1.2 GLOBEC workshops

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

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

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

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

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

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

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

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

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

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

The purpose of this workshop was:

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

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

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

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

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

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

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

This was a joint workshop between CLIOTOP WG1 (early life history) and WG4 (synthesis and modelling), co-sponsored by the Fisheries Research Agency of Japan. It gathered field scientists,

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experimentalists and modellers to put together joint research proposals linking models, observations and experimentations. It was also used to plan and prepare presentations to the forthcoming CLIOTOP Symposium.

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

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

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

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

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

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

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

The 3<sup>rd</sup> regional symposium will provide new information and a forum for discussion regarding new research findings of the national GLOBEC programmes in this region. Particular topics of interest are ecosystem structure and environmental factors, food web tropho-dynamics, physical-biological processes and models, climate change, regime shifts, bottom-up and top-down control of marine ecosystems, and ecosystem-based management. How to integrate GLOBEC and the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) project after 2009 will be discussed at the symposium.

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

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

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

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

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

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

More information is available on the GLOBEC website.

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## 2. RECENT DEVELOPMENTS AND PUBLICATIONS

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### 2.1. Links with IMBER

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

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

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

### 2.2. Links with CLIVAR

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

### 2.3. Publications

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

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

1. **Barange M., Nykjaer L. (eds).** 2003. ENVIFISH: Investigating environmental causes of pelagic fisheries variability in the SE Atlantic. *Progress in Oceanography*, 59(2-3), 177-338.
2. **Batchelder, H.P., Lessard, E.J., Strub, P.T., Weingartner, T.J.** 2005. US GLOBEC biological and physical studies of plankton, fish and higher trophic level production, distribution, and variability in the northeast Pacific. *Deep-Sea Research II*, 52(1-2), 1-374.

3. **Batchelder, H.P., Powell, T. (eds).** 2002. Physical and biological conditions and processes in the northeast Pacific Ocean. *Progress in Oceanography*, 53(2/4), 105-411.
4. **Beardsley, R.C., Smith, P.C., Lee, C.M. (eds).** 2003. US GLOBEC: Physical processes on Georges Bank (GLOBEC). *Journal of Geophysical Research*, 108(C11).
5. **Bograd, S.J., Checkley, D.A., Wooster, W.S. (eds).** 2003. CalCOFI: a half century of physical, chemical, and biological research in the California Current System. *Deep-Sea Research II*, 50, 2349-2594.
6. **Coombs, S., Harris, R. Perry, I., Alheit, J. (eds).** 1998. Proceedings of the GLOBEC 1st Open Science Meeting, Paris, France. *Fisheries Oceanography*, 7(3/4), 175-390.
7. **Drinkwater K.F., Loeng H., Megrey B., Bailey B.A., Cook R.M. (eds).** 2005. The influence of climate change on North Atlantic fish stocks. Proceedings of an ICES Symposium, Bergen, Norway, 11-14 May 2004. *ICES Journal of Marine Science*, 62(7), 1203-1542.
8. **Fogarty, M.J., Qinlan, J. (eds).** 2002. The US GLOBEC program. *Oceanography*, 15(2), 1-89.
9. **Hanesson, R., Barange, M., Herrick, S., Jr. (eds.)** 2006. Climate change and the economics of the world's fisheries: Examples from pelagic fish stocks. *New Horizons in Environmental Economics Series*. Edward Elgar, New York. 310pp.
10. **Harris, R., Barange, M., Werner, F.E., Tang, Q. (eds).** 2003. Proceedings of the GLOBEC 2nd Open Science Meeting, Qingdao, China. *Fisheries Oceanography*, 12(4/5), 221-522.
11. **Hofmann, E.E., Wiebe, P.H., Costa, D.P., Torres, J.J. (eds).** 2004. Integrated ecosystem studies of Western Antarctic Peninsula continental shelf waters and related Southern Ocean regions. *Deep-Sea Research II*, 51(17-19), 1921-2344.
12. **Kishi, M.J., Megrey, B.A., Ito, S.-I. Werner, F.E. (eds.).** 2007. Special issue on NEMURO and NEMURO.FISH - modeling of North Pacific marine ecosystems. *Ecological Modelling*, 202(1-2), 1-223.
13. **Mackas, D.L., de Young, B. (eds).** 2001. GLOBEC Canada: Response of marine ecosystems to environmental variability. *Canadian Journal of Fisheries and Aquatic Sciences*, 58(4), 645-761.
14. **Pinardi, N. (eds).** 2006. Seasonal, Interannual and decadal variability of the Atmosphere, ocean and marine ecosystems. *Climate Research*, 31(2-3), 135-271.
15. **Reid, P.C., Mathews, J.B.L., Smith, M.A. (eds).** 2003. Achievements of the continuous plankton recorder survey and a vision for its future. *Progress in Oceanography*, 58, 115-358.
16. **Sugimoto, T. (ed).** 2002. Long-term variations in the Northwest Pacific Ecosystems. A Korea-Japan GLOBEC Symposium. *Fisheries Oceanography*, 11(6), 315-370.
17. **Tande, K.S., Miller, C. (eds).** 2000. Population dynamics of *Calanus* in the North Atlantic: Results from the trans-Atlantic study of *Calanus finmarchicus*. *ICES Journal of Marine Science*, 57, 1527-1874.
18. **Valdés L., Harris R.P., Ikeda T., McKinnell S.M., Peterson W.T. (eds).** 2004. The role of zooplankton in global ecosystem dynamics: comparative studies from the world oceans. The Third International Zooplankton Production Symposium, Gijón, Spain, 20-23 May 2003. *ICES Journal of Marine Science*, 61(4), 441-738.
19. **Wiebe, P.H., Beardsley, C. (eds).** 1996. Physical-biological interactions on Georges Bank and its environs. *Deep-Sea Research II*, 43(7-8), 1437-2006.
20. **Wiebe, P.H., Beardsley, R.C., Bucklin, A.C., Mountain, D.G. (eds).** 2001. Coupled biological and physical studies of plankton populations: Georges Bank and related North Atlantic regions. *Deep-Sea Research II*, 48(1-3), 1-684.

21. **Wiebe, P.H., Beardsley, R.C., Mountain, D.G., Lough, R.G. (eds).** 2006. Dynamics of plankton and larval fish populations on Georges Bank, the North Atlantic US GLOBEC study site. *Deep-Sea Research II*, 53(23-24): 2455-2832.
22. **Zavatarelli, M., Pinardi, N. (eds).** 2001. First SINAPSI Symposium. *Archivio di Oceanografia e Limnologia*, 22, 1-233.

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

:

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

#### 2.4. GLOBEC Integration and Synthesis plans

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

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

#### **Global Change and Marine Ecosystems**

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

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

#### **Section 1. The changing ocean ecosystems**

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

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

- 2.1. Dynamics of marine ecosystems: physical processes [15,000 words]  
*De Young, B., E. Hofmann, D. McGillicuddy, J. Barth, C. Roy, G. Ottersen, S. Kim, H. Yamazaki*

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

### Section 3. The human dimensions of marine ecosystem change

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

### Section 4. A way forward

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

For more details, follow the links to Integration and Synthesis plans in [www.globec.org](http://www.globec.org).

### 2.5. Carbon Offsetting

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

From May 2006 attendees to GLOBEC-sponsored meetings are given the opportunity to voluntarily donate Climate Care £7.50 per tonne of CO<sub>2</sub> reduction associated with their flights to attend GLOBEC meetings. GLOBEC acts as an intermediary between attendees and Climate Care©, by holding per diem reimbursements as per voluntary requests. For fairness the amount deducted from claims is calculated as an average of flights taken by all participants to attend a given meeting (approximately USD10-35). Climate Care provides the GLOBEC IPO with a six-monthly certificate showing the projects that have benefited from the investment, which is available to those using this voluntary service.

<b>2.6. GLOBEC SSC 2006</b>
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The membership of the GLOBEC SSC is shown in the Table below.

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

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

## Appendix 1



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Dr Ed Urban  
 Executive Director  
 SCOR  
 The John Hopkins University  
 USA

13 July 2006

Dear Ed:

As you know **GLOBEC, IMBER and SOLAS** are co-sponsoring and organising an International Symposium on **'Eastern Boundary Upwelling Ecosystems - Integrative and comparative approaches'**. This symposium will be held in Las Palmas de Gran Canaria, Canary Islands, Spain, 2-6 June 2008.

We estimate that the symposium will attract approximately 400 persons (scientists, fisheries professionals and students) and that about 150 scientific papers will be presented. However, we are concerned that three of the four major Eastern Boundary Currents (Benguela, Humboldt and Canary Currents) occurs in the waters of developing countries. It is important to provide sufficient financial support to bring scientists from these areas to this important occasion.

In addition, this is the first time that the three SCOR research projects join efforts in organizing a major international symposium. For this reason we would like to request a contribution from SCOR to cover the expenses of 5-7 scientists from developing countries to attend this important symposium. The amount would range between \$10,000 (5 scientists supported) and \$15,000 (7-8 scientists supported). SCOR would be adequately acknowledged in the book of abstracts and Proceedings.

We would be grateful if you could bring this request to the attention of the SCOR Executive Committee at their meeting in Bergen in August 2007.

Thanks you in advance for your consideration. Regards,

Manuel Barange  
 Director GLOBEC International Project Office  
 Co-Convenor "Upwelling Ecosystems" Symposium

---

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

GLOBAL  
 I G B P  
 CHANGE

 International Council for Science  
 Scientific Committee on Oceanic Research



# 3-18

## 3.2 Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB)

(joint with IOC)

### Terms of Reference:

- To oversee the development of a Science Plan for the international SCOR/IOC program on the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) and to submit it within one year for the approval of the sponsors of the program and subsequent publication. The SSC should ensure that the Science Plan has input from the international HAB scientific community.
- To develop a detailed Implementation Plan for GEOHAB taking into account input from the scientific community, for presentation and approval by the sponsors and publication within two years.
- To coordinate and manage the resulting activities in accordance with the GEOHAB Science and Implementation Plans.
- To collaborate, as appropriate, with organizations such as ICES, PICES, etc. and related programs such as GLOBEC, LOICZ, and the emerging Global Ocean Observing System.
- To ensure effective communication between related national and regional HAB research efforts.
- To report regularly to SCOR and IOC, and to other bodies as needed, on the state of planning and accomplishments of GEOHAB.

### Chair:

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### Vice Chair:

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### Members:

Leonardo Guzman	CHILE	Patricia Glibert	USA
Marcel Babin	FRANCE	Raphael Kudela	USA
Allan Cembella	CANADA	Alicia Lavin	SPAIN
Einar Dahl	NORWAY	Dennis McGillicuddy	USA
Wolfgang Fennel	GERMANY	Robin Raine	IRELAND
Ken Furuya	JAPAN	Ming-Jiang Zhou	CHINA-Beijing
Patrick Gentien	FRANCE		

**Ex-officio Member:** Leonardo Guzman (IOC IPHAB)

**IOC Staff:** Henrik Enevoldsen

**Executive Committee Reporter:** Huasheng Hong

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

### ACTIVITIES 2006-2007

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

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

#### 2. Implementation of Core Research Projects

The GEOHAB *Implementation Plan*<sup>1</sup>, published in November 2003, specified the formation of Core Research Projects (CRPs) related to four ecosystem types—upwelling systems, fjords and coastal embayments, eutrophic systems, and stratified systems. Initiation of these CRPs has been the primary GEOHAB activity since the 2006 SCOR Executive Committee Meeting.

##### A. Core Research Project: HABs in Upwelling Systems

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

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

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

##### C. Core Research Project: HABs and Eutrophication

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

<sup>1</sup> GEOHAB. 2003. *Global Ecology and Oceanography of Harmful Algal Blooms, Implementation Plan*. P. Gentien, G. Pitcher, A. Cembella and P. Glibert (eds.), SCOR and IOC, Baltimore and Paris, 36 pp.

Eutrophication in Shenzhen, China. The group obtained extra funds from the U.S. National Oceanic and Atmospheric Administration for their activities.

## **D. Core Research Project: HABs and Stratification**

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

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

## **3. GEOHAB Modelling**

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

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

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

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

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

## **4. XIIIth International Conference on Harmful Algae**

This conference will be held in Hong Kong in November 2008 and the GEOHAB SSC has had a special session on the global ecology and oceanography of harmful algal blooms approved.

GEOHAB will plan a variety of activities associated with the meeting to publicize GEOHAB and involve more members of the international HAB science community in GEOHAB. These international meetings have been excellent venues to disseminate information about GEOHAB, including reports.

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

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

**6. International Programme Office [IPO]**

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

**7. Web site**

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

**8. Newsletter**

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

**9. Asian GEOHAB**

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

**10. Terms of Reference**

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

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

### Terms of Reference

The Scientific Steering Committee of the GEOHAB Programme will

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

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

### Acronyms

ANCA = IOC HAB working group for Central America and Caribbean Sea  
FANSA = IOC HAB working group for South America  
HANA = IOC HAB working group for North Africa  
GLOBEC = Global Ocean Ecosystem Dynamics project  
ICES = International Council for the Exploration of the Seas  
IMBER = Integrated Marine Biogeochemistry and Ecosystem Research project  
IOC = Intergovernmental Oceanographic Commission  
LOICZ = Land-Ocean Interactions in the Coastal Zone project  
NOWPAP = UNEP Northwest Pacific Action Plan  
PICES = North Pacific Marine Sciences Organization  
SCOR = Scientific Committee on Oceanic Research  
WESTPAC/HAB = IOC SubCommission for the Western Pacific HAB working group

### 3.3 Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) (joint with IGBP)

#### Terms of Reference:

- To develop a new IGBP/SCOR activity in ocean biogeochemistry and ecosystems within the IGBP II Vision for the next 10 years of ocean research. The new activity should be developed in harmony with the Global Ocean Ecosystem Dynamics (GLOBEC) project and be designed and implemented in close collaboration with GLOBEC.
- To revise the Draft Framework Report in Biological and Chemical Aspects of Global Change Research in the Oceans to form the intellectual basis for an Open Science Conference (planned for December 2002).
- To organise an Open Science Conference to generate new ideas for the development of the science and implementation of the Ocean Biogeochemistry and Ecosystems project.
- To use both the Framework Report and community input from the Open Science Conference to produce a Science Plan/Implementation Strategy for the new activity by the end of 2003.
- To cooperate with GLOBEC, the Land-Ocean Interactions in the Coastal Zone (LOICZ) project, the Surface Ocean-Lower Atmosphere Study (SOLAS), and other relevant projects and programmes in the development of the Science Plan/Implementation Strategy.

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Mary-Elena Carr	USA	Syed Wajih Ahmad Naqvi	INDIA
Jay Cullen	CANADA	Raymond Pollard	UK
Wilco Hazeleger	NETHERLANDS	Mike Roman	USA
Arne Körtzinger	GERMANY	Hiroaki Saito	JAPAN
Carina Lange	CHILE	Carol Turkey	UK
Coleen Maloney	SOUTH AFRICA	Jing Zhang	CHINA-Beijing
Jack Middelburg	NETHERLANDS		

**Executive Committee Reporter:** Bob Duce

**IGBP Liaison:** Wendy Broadgate

**Executive Officer:** Sylvie Roy



## Integrated Marine Biogeochemistry and Ecosystem Research

### IMBER Annual Report to SCOR June 2007

#### **Contents:**

**Major Activities and Achievements.**

**Outreach Activities.**

**International Project Office.**

**Interactions with other projects and programmes.**

**Future activities.**

#### **Major Activities and Achievements:**

##### **Working groups**

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

##### 1. End-to-End food web Task Team

The End-to-End Food Web Task Team, a joint activity with GLOBEC, is co-chaired by Coleen Moloney (South Africa) and Mike St John (Germany). The group has submitted a review paper to *Trends in Ecology & Evolution* focused on the concept for end-to-end food web research. The Task Team is also preparing a longer paper for publication. A workshop to focusing on end-to-end food webs is planned as part of the IMBER IMBIZO<sup>2</sup> to be held in late 2008.

##### 2. IMBER/SOLAS Carbon Working Group

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

##### Sub-Group 1 Surface ocean CO<sub>2</sub> fluxes (Chair: Nicolas Metzl, France)

This group is focused on synthesis, instrumentation and technology development, observations from Volunteer Observing Ships and mixed-layer sampling strategy. The first major activity of this group was to organize (with IOCCP) an Ocean Surface pCO<sub>2</sub> Variability and Vulnerabilities Workshop (UNESCO, Paris, 11-14 April 2007). The Co-

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<sup>2</sup> *Imbizo* is the Zulu word for a gathering of leaders where an important issue is resolved.

chairs of the organizing committee are Nicolas Metzl and Bronte Tillbrook ([http://www.ioc.unesco.org/ioccp/pCO2\\_2007.html](http://www.ioc.unesco.org/ioccp/pCO2_2007.html)). A special issue of *Deep-Sea Research II* is currently being prepared to disseminate information from this workshop.

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

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

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

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

### 3. Continental Margins Task Team

LOICZ and IMBER have formed a joint IMBER/LOICZ Continental Margins Task Team. The task team consists of 10 members and is co-chaired by Jack Middelburg (The Netherlands) and Nancy Rabalais (USA). The group is organizing a Continental Margins Open Science that will be held at the East China Normal University in Shanghai on 17-21 September 2007

(<https://www.confmanager.com/main.cfm?cid=792>). The aims of the Conference are to estimate the relative importance of the changing forcing factors (global, local, and human) and to determine how much changes in shelf ecosystems can be attributed to each forcing factor. Based on the outcome of this conference, the task team will write a Science Plan and Implementation Strategy for continental margins research in the two projects. There is significant interest in the conference, with more than 150 registrations and 100 papers submitted so far.

### 4. Capacity Building Task Team

The Capacity Building Task Team (chaired by Wajih Naqvi, India) developed a capacity-building strategy and implementation plan for IMBER to guide capacity building activities

([http://www.imber.info/products/Capacity\\_Building\\_final.pdf](http://www.imber.info/products/Capacity_Building_final.pdf)). One objective of the strategy is to enhance research capabilities in developing countries, especially those geographically close to interesting biogeochemical/ecosystem provinces. Another objective is to enhance research capabilities globally in those IMBER activities that have few practitioners, but are crucial for optimal implementation of the *IMBER Science Plan and Implementation Strategy*.

### 5. Data Management Task Team

The IMBER Data Management Committee (DMC) was formed in September 2006 and is chaired by Raymond Pollard (NOC, UK). The SSC also appointed the IMBER Deputy Executive Officer, Dr. Sophie Beauvais, as the IMBER Data Liaison Officer, to support the DMC and data management activities for IMBER. The Chair and DLO met with representatives from the British Oceanographic Data Centre (BODC) to discuss possibilities for the development of a realistic strategy for IMBER

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data management. The Chair and DLO also participated in the SCOR Marine Projects Coordination meeting held in London (December 2006) to discuss data management issues faced by all marine projects. The Data Management Committee met in Victoria, Canada in June and has developed an innovative strategy for data management within IMBER.

## Human Dimension

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

## Regional Projects

### Integrating Climate and Ecosystems Dynamics (ICED)

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

### Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER) Conference October 3-6, 2006, Goa (India).

This event, hosted by India's National Institute of Oceanography (NIO), included 4 days of presentations, posters and working group discussions, with participation of more than 200 scientists from all over the world. The participants attended working group discussions organized around seven different themes. The presentations and working groups identified numerous gaps in our knowledge and defined several major scientific questions, including the need for carrying out basin-wide research on the potential role of mesozooplankton grazing in limiting phytoplankton production during the Southwest Monsoon, and relative importance of denitrification and the anaerobic ammonium oxidation (anammox) in the production of N<sub>2</sub>. The SIBER workshop provided crucial information that will allow the development of a summary of the state of understanding the Indian Ocean and the definition of the major research questions that need to be addressed. The major outcomes of the workshop include a special journal issue and the development of a science plan to guide future research in the Indian Ocean basin and providing the basis for a major regional research program of IMBER. A workshop to develop a Science Plan for SIBER is being organised in late November in Goa, India.

## Endorsed Projects

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

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

In August 2006, a Danish research vessel embarked on a global 9-month research cruise: The Galathea Expedition. The cruise track can be seen at <http://www.galathea3.dk>. The largest project on the expedition, “The marine carbon cycle from North to South along the Galathea route”, is a multidisciplinary effort focusing on obtaining a better understanding of the carbon cycle in the upper ocean and in the lower atmospheric boundary layer, and the role of the ocean in climate change. This IMBER-endorsed project is compiling a global dataset describing the upper ocean processes controlling ocean-atmosphere carbon exchange, which will increase our understanding of how physical, chemical and biological processes in the sea influence the carbon dioxide (CO<sub>2</sub>) content of the atmosphere.

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

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

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

Integration Analysis of North Adriatic Marine Ecosystem (ECOMADR)

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

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

**Biogeochemistry and Optics South Pacific Experiment (BIOSOPE)**

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

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

**Kerguelen Ocean and Plateau compared Study (KEOPS)**

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

The general objective of KEOPS is to improve our understanding of the response of the Southern Ocean to global climate change. Particularly, KEOPS will study the effects of natural iron fertilisation of the ocean by the Kerguelen plateau on the biological pump of CO<sub>2</sub> and on the cycles of other chemical compounds relevant for climate. Careful examination of the large data set gathered during the natural iron fertilisation experiment (cruise in January-February 2005) has revealed original features. KEOPS results contrast with the observations made in short-term blooms triggered by deliberated iron fertilisation experiments. This is the case for the ecosystem structure, for the magnitude of the carbon export in response to the iron fertilisation, for the DMS production and for the decoupling between the nitrogen and the silicon cycles. Preliminary results have been presented as part of a special session at the Ocean Science meeting (Hawaii Feb 2006) and detailed papers are in the review process for publication as a special issue of *Deep-Sea Research II*. The data set will also fuel different coupled models aiming to describe and to understand the spatial and temporal variability of the natural bloom sustained by natural iron and major nutrient fertilisation. (Contact [stephane.blain@univmed.fr](mailto:stephane.blain@univmed.fr)). <http://www.obs-vlfr.fr/proof/vt/op/ec/keops/keo.html>

**Outreach activities****IMBER website**

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

1. The "**Science Highlight**" page is dedicated to IMBER research, ongoing projects, scientific news, etc... ([http://www.imber.info/Science\\_Highlight.html](http://www.imber.info/Science_Highlight.html));

2. The “**Young Scientists**” page includes information regarding Early Career Scientist Conferences, Student Courses, Summer Schools and Opportunities for developing country young scientists and students ([http://www.imber.info/Education\\_and\\_Training.html](http://www.imber.info/Education_and_Training.html)).

### **IMBER update**

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

### **Brochure and Poster**

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

### **e-News**

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

### **IPO report**

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

### **International Project Office**

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

### **IPO Funding**

IMBER's activities and international office are sponsored by:

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

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

## **Interactions with other projects and programmes**

### **SOLAS**

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

### **LOICZ**

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

### **GLOBEC**

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

### **IMBER/GLOBEC Transition Team**

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

### **CLIVAR**

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

### **EurOceans**

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

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

### **CARBOOCEAN**

CARBOOCEAN is a European integrated project that aims at an accurate scientific assessment of the marine carbon sources and sinks, with special emphasis on the Atlantic and Southern Oceans on

a time scale of -200 to +200 years from now. An M.O.U was signed between IMBER and CARBOOCEAN and discussions are underway to develop joint activities.

### **GODAE**

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

### **National activities:**

IMBER activities are starting in many countries (e.g., Chile, P.R. China, Finland, France, Germany, India, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Taiwan, Turkey, UK, USA). For example, China has 5-year funding for a IMBER/GLOBEC programme and will be hosting the Second Large Marine Ecosystems Conference. IMBER-JAPAN was established under the Science Council of Japan, chaired by Hiroaki Saito. A northwest Pacific Ocean cruise has been funded for Summer 2008. France just funded for three years the CYBER programme "CYscles Biogéochimiques, Ecosystèmes et Ressources". Spain is developing a co-sponsored proposal with The Netherlands for a "Deep-water Oceanography" project and will be holding a Spanish IMBER symposium in March 2007.

### **Future Activities**

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

#### SIBER workshop

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

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

#### 1<sup>st</sup> IMBER IMBIZO

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

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

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

IMBER supported meeting include:

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

### 3.4 GEOTRACES

#### Terms of Reference:

- Organize national and international planning workshops as well as special sessions at international conferences to obtain community input on the design and implementation of GEOTRACES.
- Establish priorities for research on the sources, sinks, internal cycling, transport, speciation and fate of TEIs, and develop this information into an International Science Plan.
- Promote intercalibration of analytical methods, and the development of standard reference materials.
- Identify new instrumentation and related infrastructure that will help achieve GEOTRACES objectives.
- Define a policy for data management and sample archival.
- Forge scientific linkages with other research programs holding overlapping interests to create synergies where possible and avoid duplication of efforts. To the extent practical, this will involve cross-membership between the GEOTRACES Planning Group and the Planning Groups and Science Steering Committees of other programs.
- Interact with SCOR Working Groups that share common interests including, but not limited to, SCOR/IMAGES WG 123 on Reconstruction of Past Ocean Circulation (PACE) and SCOR/IMAGES WG 124 on Analyzing the Links Between Present Oceanic Processes and Paleo-Records (LINKS).

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#### Other Members

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Hein de Baar	NETHERLANDS	Kristin Orians	CANADA
Martin Frank	SWITZERLAND	Reiner Schlitzer	GERMANY
Toshitaka Gamo	JAPAN	Michiel Rutgers	
Catherine Jeandel	FRANCE	van der Loeff	GERMANY
Bill Jenkins	USA		
Pere Masque	SPAIN		

Alternate: Jing Zhang JAPAN

**Executive Committee Reporter:** Robert Duce

**GEOTRACES PLANNING GROUP**  
**ANNUAL REPORT TO SCOR 2006/2007**  
**June 2007**

**Publication of Science Plan and formation of SSC**

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

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

**GEOTRACES meetings during 2006/2007**

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

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

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

**Ocean Basin Workshops in 2007**

Three international workshop meetings will be held in 2007 to plan the implementation of GEOTRACES science in each of the major ocean basins – Pacific, Atlantic, and Indian (note: initial

work on the high-latitude oceans has been planned under IPY, as detailed below). These workshop are planned in:

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

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

### **Modelling and GEOTRACES**

A fourth workshop is also planned during 2007 to address the role of modelling in the GEOTRACES programme. This workshop will be held at the Hanse Wissenschaftskolleg, Delmenhorst, Germany on 6-8 September 2007 and will be hosted by Reiner Schlitzer (Alfred Wegener Institute, Germany) and Jim Orr (IAEA, Monaco). The workshop will review the present state of models of trace elements and isotopes (TEI) in the marine environment and will discuss promising new modelling approaches and projects in the light of recent advances in our understanding of TEI cycles and the expected increase in quality and quantity of TEI observations during GEOTRACES. The workshop will produce a set of recommendations that will be used by the GEOTRACES SSC to develop a coherent modelling and synthesis plan for the GEOTRACES program.

### **Measurement Intercalibration during the GEOTRACES programme**

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

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

### **Data Management for GEOTRACES**

The importance of good protocols for data management was also recognized early in planning for GEOTRACES and a subcommittee convened under the leadership of Chris Measures (Hawaii, USA) and Raymond Pollard (National Oceanography Centre, UK). That subcommittee met in

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December 2005 and produced a report that, after input from the community, was approved by the SSC in December 2006. The report is available from the GEOTRACES website.

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

## **GEOTRACES cruises during IPY**

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

### Arctic

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

### Antarctic:

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

## **Links with other programmes**

GEOTRACES remains committed to maintaining strong links to other relevant programmes. Representatives of CLIVAR, SOLAS, and IMBER attended the SSC meeting, and GEOTRACES representatives attended the most recent SOLAS SSC (Jing Zhang, Japan) and IMBER SSC (Kristin Orians, Canada).

## **Developments at national level**

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

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

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

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

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

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

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

#### **GEOTRACES sessions at international conferences**

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

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

#### **Acknowledgements**

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

### 3.5 Surface Ocean–Lower Atmosphere Study (SOLAS) (joint with IGBP, WCRP, and CACGP)

#### Terms of Reference:

- To develop the Surface Ocean - Lower Atmosphere Study (SOLAS) Science Plan and an Implementation Strategy, in accordance with guidance of the sponsoring organisations.
- To oversee the development of SOLAS in accordance with its Science Plan/Implementation Strategy.
- To collaborate, as appropriate, with other related projects of IGBP, WCRP, SCOR and CACGP and related projects and programmes (e.g., IHDP, DIVERSITAS, IOC and the Global Ocean Observing System (GOOS), etc.)
- To establish appropriate data management policies to ensure access to, sharing of, and preservation of SOLAS data, taking into account policies of the sponsors.
- To report regularly to SCOR, IGBP, WCRP and CACGP on the state of planning and accomplishments of SOLAS.
- The SOLAS SSC, its subsidiary groups and International Project Office shall operate in accordance with the operating procedures for IGBP Projects and as required by other co-sponsors.

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Christiane Lancelot	BELGIUM	Doug Wallace	GERMANY

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**IGBP Liaison:** Wendy Broadgate

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**SOLAS International Project Office  
Annual Report to SCOR 2006/2007**

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**30 June 2007**

**SOLAS Implementation Plans**

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

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

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

**SOLAS Scientific Steering Committee (SSC)**

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

**SOLAS International Project Office**

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

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

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

National Networks

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

- **Australia** –SOLAS-related research occurs at academic institutions and government laboratories (CSIRO), and collaborations with scientists from New Zealand are frequent. Australian scientists led and executed the SOLAS-endorsed project, Precursors to Particles (P2P), at the Cape Grim Baseline Air Pollution Station in January 2006. Australia also has a new National Representative in Dr. Jill Cainey (Cape Grim Observatory), and she was an invited speaker at the SOLAS Open Science Meeting in Xiamen, China.
- **Belgium** – The Belgian Federal Science Policy (BELSPO) has generously contributed funds to permit a half-time Secretariat for IMP1 over a 2-year period beginning January 2005, and Dr. Veronique Schoemann from the Université Libre de Bruxelles (ULB) fills that role. A proposal to renew the funding for this position is awaiting approval. This agency has also provided funding for research groups within the nation to consolidate SOLAS research activities into a Cluster. The funding has established a communications office and a database management system at ULB, has led to coordination of modeling efforts, and has funded the development of a national SOLAS website. In December 2006, ULB organized and hosted the Comparison of Oceanic Dimethylsulfide Models (CODiM) workshop, which brought together 20 scientists for intercomparison of 1-D and 3-D DMS models. The results of this synthesis are still under development, and plans have been made for another workshop in a few years. The Belgian National Representative for SOLAS is Christiane Lancelot (ULB), and she is also a member of the SOLAS SSC.
- **Brazil** – There have been four SOLAS experimental efforts in Brazil:
  1. FluTuA – Turbulent Fluxes over the Tropical Atlantic,
  2. Numerical Study of the Surface Fluxes in the South Atlantic,
  3. Sea Waves and Coastal Monitoring at Sao Paulo State, and
  4. Global Scale Studies of Oceanic Fluxes using Remote Sensing.

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

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

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

- **Chile** – SOLAS research is conducted at COPAS (Centro de Investigación Oceanográfica en el Pacífico Sur-Oriental) at the University of Concepción, with other academic institutions also contributing. There are plans underway to coordinate SOLAS research with the upcoming CLIVAR Variability of American Monsoon Systems (VAMOS) Ocean Cloud Atmosphere Land Study (VOCALS) program field intensive in October 2008, and this collaboration involves significant participation by Chilean SOLAS researchers. Osvaldo Ulloa (Universidad de Concepción) is the SOLAS National Representative and is a member of the SOLAS SSC.
- **China (Beijing)** – China SOLAS obtained more than US\$1 million to conduct SOLAS research from 2003 to 2007, networking with national neighbors (China-Taipei, Korea, Japan, etc) has increased, and the national scientists look forward to more progress in international cooperation across the Asian network. The Chinese are focused on the effects of dust and marine primary productivity, nitrogen loading in coastal waters and marginal seas, processes controlling mass and energy exchange at the air-sea interface, variability of CO<sub>2</sub> fluxes between the air and sea, and effect of these fluxes on cloud and radiative budgets. Cruises have been executed in the Yellow Sea and in the South China Sea. Chinese and Japanese scientists are leading an effort to establish the Asian Dust and Ocean Ecosystems (ADOES) project participants into a SOLAS Task Team, with a second ADOES workshop conducted in August 2006 in Inner Mongolia. China hosted the International SOLAS Open Science Meeting in Xiamen (March 6-9 2007). Guang-Yu Shi (Institute of Atmospheric Physics) is the National Representative to SOLAS, a member of the SOLAS SSC, and the Chair of the Organizing Committee for the 2007 SOLAS Open Science Meeting in China.
- **China (Taipei)** – National scientists continue to participate in three major SOLAS activities:
  1. Long-term Observation and Research of the East China Sea (LORECS; the goal is to investigate the biogeochemical processes in the East China Sea that lead to uptake of carbon dioxide and to detect changes due to the damming of the Yangtze River),
  2. the Straight Watch on the Environment and Ecosystem with Telemetry (SWEET),
  - and

3. the South East Asia Time-Series Station (SEATS; a long-term buoy deployment in the South China Sea to understand upper ocean dynamics and variability of biogeochemical fluxes).

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

- **Denmark** – The Danish SOLAS team was involved in the EU-funded Marine Effects of Atmospheric Deposition (MEAD) project, which investigated the effects of nitrogen deposition on coastal water biogeochemistry. An around-the-world cruise campaign was conducted from August 2006 until April 2007 (GALATHEA) to measure surface concentrations and fluxes of carbon dioxide. Lise Lotte Sorensen (Riso National Laboratory) was an invited speaker at the 2007 SOLAS Open Science Meeting in China and is the SOLAS National Representative in Denmark.
- **France** – French scientists are very active in SOLAS-related research, and the French program originally operated under the moniker of PROOF (acronym for biogeochemical processes in the ocean and fluxes). A new ‘umbrella’ for research within the SOLAS remit has been established: LEFE (Fluid Envelopes and Environment). This program includes projects on atmospheric chemistry (CHAT), biogeochemical cycles (CYBER), climate variability on a global scale (EVE), and interactions and dynamics of the ocean and atmosphere (IDAO). SOLAS-France plans a national meeting in September 2007. Remi Losno (LISA) and Veronique Garcon (SSC Member) are the SOLAS National Representatives. Dr. Garcon was an invited speaker at the 2007 SOLAS Open Science Meeting in Xiamen.
- **Germany** – D-SOLAS scientists are very active in the SOLAS research regimes, combining institutional (Max Planck Institutes) and university researchers. The SOLAS effort in Germany operates under the recently funded (6.5m EUR over 5 years) SOPRAN (Surface Ocean Processes in the Anthropocene) project. SOPRAN includes 12 institutions, 43 investigator, and has four main foci: interphase transfer at the air-sea interface, effect of anthropogenic CO<sub>2</sub> on marine ecosystems and sea-air flux of gases, production and emission of radiatively and chemically active gases in the tropics, and the oceanic response to dust deposition. D-SOLAS has teamed up with UK-SOLAS to plan the development of a unique atmospheric (UK) and oceanic (D) observatory in the Cape Verde Islands. Cruises and aircraft flights funded by each nation in the vicinity of the observatory are also planned, making optimal use of the facility and the continuous data set. In addition, collaborations have been developed for Cape Verde with researchers in the United States. An atmosphere-related SOLAS proposal will soon be submitted to national funding agencies, and this program is called the Marine Multi-Phase Halogen Chemistry and its Coupling to Nitrogen and Sulfur Cycles (MAPHiNS). Doug Wallace (IfM-GEOMAR, Kiel) is one of the German National Representatives and has been approved as Chair of the International SOLAS SSC. He was also an invited speaker at the most recent SOLAS Open Science Meeting in China. The other National Representative is Uli Platt (University of Heidelberg).

- **India** – SOLAS and IMBER collaborate strongly in India, but resources within the nation are limited. Interest areas include oxygen dynamics in the upper ocean, halocarbon fluxes, and time-series measurements of biogeochemical species. The Indians have established a new time-series station in the coastal Bay of Bengal, and this project is funded for the next 3 years. Dileep Kumar (NIO, Goa) is the SOLAS National Representative and is a former member of the SOLAS SSC.
- **Ireland** – A small number of scientists are working on SOLAS-related research within the nation, and a planning and coordinating meeting was held in Galway in November 2006. Irish scientists led the 2006 experimental effort for Marine Aerosol Production (MAP), which was funded by the European Commission. Colin O’Dowd (Galway) is the SOLAS National Representative.
- **Japan** – SOLAS in Japan recently received a boost with the successful funding of the Western Pacific Air-Sea Interaction Study (W-PASS). This award amounts to about US\$9 million over 5 years to understand primary production in the Western Pacific, to determine how the marine ecological system will respond to changing atmospheric composition, to determine how production and emission of biogenic gases will affect the composition of the atmosphere, and to evaluate the contribution of marine biogenic gases to global warming. Mitsuo Uematsu (University of Tokyo) is the SOLAS National Representative and is a member of the SOLAS SSC.
- **Korea** – There are SOLAS activities within the nation, much of it occurring at the Korean Ocean Research and Development Institute (KORDI). In addition, university researchers are working on controlled (mesocosm) biogas transfer experiments, biogeochemical cycling, and other SOLAS research areas. Sung Yang (Gwangju University) is the SOLAS National Representative.
- **Netherlands** – The universities and government laboratories in the nation have a tradition of strong science in SOLAS research areas and have been successful at developing international projects funded by the EU. SOLAS research is in the fields of air-sea exchange of aerosols, DMS, CO<sub>2</sub> and momentum fluxes. Several institutions work on the EU Integrated Project CARBOOCEAN. Recent years have seen more emphasis on IMBER-related research. During the 2006 SOLAS SSC meeting in Amsterdam, the Netherlands SOLAS/IMBER/GEOTRACES network held a well-attended one-day workshop in which SSC members were invited to participate. Gerrit DeLeeuw (TNO) is an SSC Member and is the National Representative.
- **New Zealand** – A cruise was conducted in March 2006 to investigate the nitrogen cycle in the subtropical waters off NW New Zealand. Future NZ-SOLAS research includes investigations of event-based dust storms from Australia, and they plan to follow up on the two previous cruise expeditions with more perturbation and natural event investigations. Phil Boyd (NIWA) is the SOLAS National Representative.
- **Norway** – Norwegian SOLAS at present does not have direct national funding for SOLAS science, but several SOLAS-related activities are underway within the country.

The Norwegians have been successful in obtaining EU funds for their SOLAS-related research, including work toward long-term measurements of natural carbon dioxide variability in the North Atlantic. Norwegian SOLAS scientists are involved in investigations of the cycling of bioreactive gases between the air and sea, mesocosm perturbation experiments, coupled 3-D modeling, etc. CARBOOCEAN, which is endorsed by SOLAS, is housed at the University of Bergen. Abdirahman Omar (Bjerknes Centre) is the SOLAS National Representative.

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

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

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

### Other Activities

#### SOLAS International Summer School

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

#### Open Science Meeting

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

# 3-46

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

## Other Activities

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

The SOLAS SSC is concerned about the plans by some corporate interests to conduct large-scale iron fertilization of the ocean surface in the guise of "carbon offsetting." In response to this, the SSC has developed a position statement. "Large-scale fertilisation of the ocean is being actively promoted by various commercial organisations as a strategy to reduce atmospheric CO<sub>2</sub> levels. However the current scientific evidence indicates that this will not significantly increase carbon transfer into the deep ocean or lower atmospheric CO<sub>2</sub>. Furthermore there may be negative impacts of iron fertilization including dissolved oxygen depletion, altered trace gas emissions that affect climate and air quality, changes in biodiversity, and decreased productivity in other oceanic regions. It is then critical and essential that robust and independent scientific verification is undertaken before large-scale fertilisation is considered. Given our present lack of knowledge, the judgement of the SOLAS SSC is that ocean fertilisation will be ineffective and potentially deleterious, and should not be used as a strategy for offsetting CO<sub>2</sub> emissions."

In November 2006, 30 scientists from a dozen nations met at the University of East Anglia for a workshop on the "Anthropogenic Nitrogen Impacts on the Open Ocean". Nitrogen is deposited to the ocean via atmospheric and riverine inputs, but the impact of increased atmospheric nitrogen loading has not been discussed coherently within the scientific community. These concerns led SCOR, SOLAS, NOAA, the International Nitrogen Initiative (INI), and the European Science Foundation (ESF) to sponsor a four-day workshop in Norwich, UK. The output of the workshop is expected to be at least one seminal review paper on the topic, suitable for publication in *Science* or *Nature*.

Along with the International Oceanic Carbon Coordination Project (IOCCP), the Global Carbon Project (GCP), and IMBER, SOLAS co-sponsored the April 2007 workshop in Paris on "Surface Ocean CO<sub>2</sub> Variability and Vulnerabilities". More than 100 scientists from 20 nations met in Paris to review the current knowledge base and develop deeper international collaboration to resolve the variability and processes governing ocean surface carbon dioxide. The workshop included a number of breakout working group meetings on topics of value to the ocean carbon community, a discussion on observing systems, and the development of a cross-basin synthesis

of surface ocean carbon observations. The organizing committee is currently working on a summary report of the meeting which will include recommendations for further research and networking within the community.

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

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

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

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

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

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

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

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

# 3-48

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

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

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

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

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

## **Capacity Building and Inclusion of Less Developed Country scientists**

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

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

Jeffrey Hare  
Emily Breviere