

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

- 3.1 Global Ecology and Oceanography of Harmful Algal Blooms Program, **p. 3-1** *Taguchi*
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### 3.1 Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) (joint with IOC)

*Taguchi*

#### **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).

#### 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

# 3-2

**Chair:**

Raphael M. Kudela  
Ocean Sciences Department  
University of California  
Santa Cruz, CA 95064, USA  
Tel: +1-(831) 459-3290  
Fax: +1-(831) 459-4882  
Email: [kudela@ucsc.edu](mailto:kudela@ucsc.edu)

**Vice Chair:**

Elisa Berdalet  
Institut de Ciències del Mar (CMIMA,  
CSIC)  
Dept. Biologia Marina i Oceanografia  
Pg. Marítim, 37-49  
08003- Barcelona, Catalunya  
SPAIN  
Tel: + 34 93 2309595 (office)  
+ 34 93 2309500 (CMIMA)  
FAX: +34 93 230 9555  
E-mail: [berdalet@icm.csic.es](mailto:berdalet@icm.csic.es),  
[elisa.berdalet@icm.cat](mailto:elisa.berdalet@icm.cat)

**Members:**

Icarus Allen	UK	Songhui Lu	CHINA-Beijing
Stewart Bernard	SOUTH AFRICA	Patricia Tester	USA
Paul Bienfang	USA	Gires Usup	MALAYSIA
Michele Burford	AUSTRALIA		
Liam Fernand	UK		

**Ex-officio Member:** Robert Magnien (IOC IPHAB)

**IOC Staff:** Henrik Enevoldsen

**Executive Committee Reporter:** Satoru Taguchi

SCOR-IOC  
Global Ecology and Oceanography of Harmful Algal Blooms  
(GEOHAB) Program Activities, 2011-2012

The GEOHAB project is preparing synthesis for completion of its first phase, at the end of 2013. GEOHAB-related activities will be continued after the end of 2013, under a different format, as described at the end of this report.

**1. IPHAB-X Meeting: Paris, France, April 2011**

GEOHAB was represented by the SSC Chair (Raphe Kudela) at the Tenth Intergovernmental Panel on Harmful Algal Blooms (IPHAB-X) meeting, 12-14 April 2011. An update on GEOHAB activities during the past two years was presented, and a resolution was passed (see attached) recommending continuing support for GEOHAB through IOC, with an invitation to SCOR for continued joint oversight. SCOR requested that GEOHAB summarize its accomplishments and IPHAB requested a revised Science and Implementation plan to IPHAB. After discussion within the SSC, it was determined that the Science Plan is still valid as written. GEOHAB is developing a proposal for a new implementation plan (see end of report), to be presented to both SCOR and IOC in 2013. GEOHAB will also convene a program-wide Open Science Meeting to coincide with IPHAB-XI in Paris, April 2013 (see item 7).

**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. Since then, initiation and implementation of these CRPs has been the primary GEOHAB objective through OSMs and other activities. All four of the CRP research plans have now been published and some implementation has been accomplished. A fifth CRP plan is about to be published (see below).

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

This sub-group is chaired by Grant Pitcher (South Africa). During 2011-2012 formal activities were minimal due, in part, to budget constraints. The Upwelling CRP subcommittee proposed two options to continue the theme of HABs in upwelling systems. First, the subcommittee could be reconvened around a specific topic or organism identified in the *Core Research Project: HABs in Upwelling Systems* report. Alternatively (second), the subcommittee recommended returning to a Key Question previously identified, but not completed: “Are climate indicators predictive of HAB events in upwelling systems?” The group is discussing plans with other organizations for a meeting on climate change effects on HABs, in upwelling systems and beyond. This activity has been endorsed by IPHAB, ICES, and PICES. Funding has been secured from several organizations, and plans are underway for a workshop to be held in 2013. We anticipate a jointly published workshop report together with either a special issue or a synthesis paper to be submitted to a peer-reviewed journal.

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

This sub-group is chaired by Suzanne Roy (Canada). It held a workshop in May 2012 in Victoria, Canada, on Life Cycles of HABs, focusing particularly on benthic resting stages (see

[http://www.geohab.info/index.php?option=com\\_content&view=article&id=113:geohab-special-issue-of-harmful-algae&catid=40](http://www.geohab.info/index.php?option=com_content&view=article&id=113:geohab-special-issue-of-harmful-algae&catid=40). Outcomes of this OSM will be three-fold: (1) a GEOHAB Meeting Report with synthesis, conclusions, and future research perspectives; (2) the production of several mini-reviews to be incorporated in a special issue of an international journal, along with papers from the CRP on Stratified Systems; and (3) identification of key research areas where future international collaboration in comparative studies could lead to substantial advances in our understanding of HABs in coastal environments.

### **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 a 2<sup>nd</sup> GEOHAB OSM on HABs and Eutrophication in Beijing, China, overlapping with the 2009 SCOR Executive Committee meeting and immediately after the second meeting of SCOR/LOICZ WG 132 on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems. A special issue of the *Chinese Journal of Oceanology and Limnology* was published in 2011, based on that meeting. A brief overview of the meeting is shown on the GEOHAB Web page. The group met in Crete in conjunction with the international HAB meeting in October 2010. The work of the group is complementary and somewhat combined with the SCOR/LOICZ Working Group 132 on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems (see Tab 2).

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

The sub-group on HABs and Stratification is chaired by Robin Raine (Ireland). The group conducted a workshop on “Advances and challenges for understanding physical-biological interactions in HABs in Stratified Environments” at the Monterey Bay Aquarium Research Institution, Moss Landing, California, USA on 21-23 August 2012 (see [http://www.geohab.info/index.php?option=com\\_content&view=article&id=114:brief-on-the-geohab-open-science-meeting-on-habs-and-eutrophication-in-beijing-china-october-2009&catid=40](http://www.geohab.info/index.php?option=com_content&view=article&id=114:brief-on-the-geohab-open-science-meeting-on-habs-and-eutrophication-in-beijing-china-october-2009&catid=40)). The workshop was aimed at reviewing the major discoveries relating to the physics, biology, ecology, and/or chemistry of HABs in stratified systems. Through presentations and group discussion, the participants identified critical remaining questions, and new technologies that may be needed to fulfill sampling protocols necessary to answer them. A goal of the meeting was to produce a conceptual model or ‘roadmap’ of the direction in which biological, physical, and chemical measurements of harmful algal blooms in stratified systems should be headed during the next 10 years, as well as a manuscript synthesizing the findings from this meeting. Another goal was to produce collaborative proposals to conduct a multidisciplinary field experiment addressing this subject. Given that the workshop was held in August 2012, the outcomes of the meeting will be ready for the synthesis meeting of GEOHAB (April 2013).

This CRP is also producing a special issue in *Deep-Sea Research II*. Guest editors include R. Raine, E. Berdalet, M. McManus, and H. Yamazaki. Expected publication is December 2012 with 16 manuscripts (currently under different stages of revision or acceptance). Four more manuscripts may be received prior to the publication date.

### **E. Core Research Project: HABs in Benthic Systems (BHABs)**

GEOHAB sponsored an OSM on HABs in Benthic Systems in Honolulu, Hawaii in June 2010, with Paul Bienfang as the convener. The OSM organizing committee has completed the science plan from the meeting. Two follow-on activities have been proposed and are being actively pursued:

- Sampling/ID workshop focusing on BHAB organisms, proposed by Wayne Litaker and Patricia Tester (USA). Gires Usup (Malaysia) secured local funding for this activity, and the BHAB working group organized a workshop.
- YEOSU International Organization Collaboration Project (GEOHAB Asia & BHAB) proposal was submitted and successfully funded in 2011.

Based on the Open Science Meeting held in Honolulu (June 2010) a report edited by E. Berdalet, P. Tester and A. Zingone, is expected to be printed in late 2012. The report contains the state-of-the-art regarding HABs in Benthic Systems and the main open questions for the coming years in order to initiate and implement the CRP.

### **3. 2012 SSC Meeting**

The SSC met in Elsinore, Denmark in June 2012. SSC members discussed updates for all GEOHAB activities, plans for the 2013 open science meeting and synthesis of the first phase of GEOHAB, as well as the potential for post-2013 GEOHAB-related activities.

### **4. IOCCG/GEOHAB Working Group**

The International Ocean Colour Coordination Group and GEOHAB are co-funding a working group on HABs and Ocean Colour. The group will

- Summarize the relevance of ocean colour-based harmful algal bloom observation systems.
- Summarize the wide variety of harmful algal bloom types with regard to ecosystem function, consistent with GEOHAB Core Research structures.
- Summarize the principal methodological difficulties for ocean colour in coastal and inland waters, with reference to previous IOCCG Working Groups and other ongoing initiatives, e.g. GEO Tasks, CoastColour etc
- Summarize our current understanding of the physics of phytoplankton community composition from a bio-optical and ocean colour perspective.
- Review the relevance of Phytoplankton Functional Type (PFT) approaches (with reference to the IOCCG PFT Working Group) for harmful algal bloom observations across a variety of coastal and inland ecosystems.
- Review and summarize current and emerging harmful algal bloom-related ocean colour techniques, from reflectance-based community composition algorithms to ecosystem-specific change-detection algorithms, that is, research and operational applications.
- Compare the results of a variety of algorithms on selected bloom case studies, representative of the GEOHAB core research ecosystems with the specific addition of inland waters, and use these studies to provide a clear guide to ocean colour algorithm performance diagnostics, and optimal ocean colour-based approaches for various bloom and ecosystem types.

- Examine the utility of ocean colour observations beyond the event scale: multisensory and temporal analyses of ecological drivers and response for example systems, analysing and demonstrating the value of routine synoptic data and integration with other observations and models.
- Recommend future studies, measurements, protocols, etc. to develop, improve and better understand application limitations for harmful algal bloom-focused ocean colour algorithms
- Summarize, recommend, and present a future outlook for the development of new ocean colour observation systems, incorporating future sensors/systems.
- Prepare a monograph to be published within the IOCCG or GEOHAB series.
- Prepare a special issue in a peer-reviewed journal incorporating suitable review and case study chapters as papers.

The group has met twice and is working on a monograph for the *IOCCG Report* series and potentially a special issue of a peer-reviewed journal.

### **5. GEOHAB Modelling**

Based in part on the successful collaboration between GEOHAB and IOCCG, GEOHAB is participating in the GEO Blue Planet Symposium in Brazil 19- 21 November ([http://www.faro-project.org/blue\\_planet/announcement.html](http://www.faro-project.org/blue_planet/announcement.html)). Stewart Bernard (SSC member; South Africa), and Lourdes Velo-Suarez (Spain) will be representing GEOHAB, addressing the HAB observations and modelling needs within the GEO framework. Travel support is being provided by IOCCG through the Fisheries Applications from Remotely-Sensed Ocean Colour (FARO) effort.

### **6. Publications and Endorsed Projects**

A full list of GEOHAB reports, publications, and endorsed activities are available on the GEOHAB Web site. GEOHAB generated considerable interest from the community during this interval, and GEOHAB-endorsed work has been conducted in Australia, Canada, Chile, France, Philippines, Spain, South Africa, United Kingdom, and the United States. We continue to receive requests annually for project endorsements and are reaching out to the prior endorsed projects for inclusion in the GEOHAB synthesis activities.

### **7. GEOHAB Synthesis**

At the end of 2013, the GEOHAB program will complete 10 years from the publication of its Implementation Plan. The SCOR Executive Committee has requested that GEOHAB conduct synthesis activities and complete its current phase of activity. Discussions were begun on what would be appropriate final products. The GEOHAB Scientific Steering Committee has planned an open science meeting at UNESCO Headquarters in April 2013 to help in the synthesis. This meeting will provide an opportunity to synthesize information generated by GEOHAB activities and to discuss the research needed beyond 2013 to build on the foundation provided by GEOHAB. The meeting will generate information for several GEOHAB synthesis documents. In addition, meeting participants will be invited to submit papers to a special issue of a peer-reviewed journal.

## A. GEOHAB Summary Outcomes

Tentatively planned synthesis documents include the following:

1. Special issue from the meeting, with guest editors and the journal to be determined. The SSC is in favor of selecting an open-access journal, if possible.
2. GEOHAB Science Summary—As part of our synthesis report to both IOC and SCOR, GEOHAB will revisit the Science Plan and CRP plans to review what has been accomplished and what remains to be achieved. A draft version of this summary will be presented at the 2013 IPHAB meeting.
3. A summary/overview article will be submitted to *Oceanography* in late 2013. All SSC members would be authors. This builds on the past *Oceanography* publications highlighting the mid-stream goals and accomplishments of the GEOHAB effort, and would be suitable for the scientifically literate public, policy makers, and program managers.
4. Summary for Policy Makers. The SSC is strongly in favor of developing a *Summary* similar to previous efforts such as the *Ocean Fertilization* summary document (<http://unesdoc.unesco.org/images/0019/001906/190674e.pdf>). GEOHAB is working with IOC, SCOR, and NOAA to implement this effort.

## B. GEOHAB Beyond 2013

- Beyond 2013 it is envisaged that the GEOHAB will continue to address key research questions for improved understanding and observation of harmful algal blooms. IOC and the Intergovernmental Panel on Harmful Algal Blooms (IPHAB) may continue to pursue issues related to management of HABs, without SCOR involvement.
- The proposed mode of operation beyond 2013 is for a hybrid structure, building on past GEOHAB activities and the SCOR working-group model.
- Under this scenario, SCOR would manage a process similar to the process used for SCOR working groups, except focused on HAB-related science and with an open review process that would involve the international HAB community, rather than SCOR national committees. The important feature of the working-group process is that the ideas would be generated from the international community and would be reviewed by the community (including IPHAB) through an open process.
- The working groups would be overseen by a standing Scientific Steering Committee. The new SSC would act as a liaison between the working-group activities and the IOC/IPHAB activities as well as a coordinating body with other national and international groups such as IOCCG. The SSC could also serve as the coordinating body for peer-review of proposed working groups.
- Such HAB working groups would be supported by funding from government agencies, such as the U.S. National Science Foundation.
- The current GEOHAB SSC believes this provides an optimal combination of the strengths of the GEOHAB program (such as the *Science Plan*) and the flexibility of SCOR working groups. This proposal will be presented to the international HAB community at the International Conference on Harmful Algae (Korea, 2012) and the Open Science Meeting in Paris (April 2013) for feedback.



### **Resolution IPHAB-X.3**

## **GLOBAL ECOLOGY AND OCEANOGRAPHY OF HARMFUL ALGAL BLOOMS**

### **The IOC Intergovernmental Panel on Harmful Algal Blooms,**

**Referring** to the joint SCOR-IOC international science programme on the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) as established through IOC Resolution IOC/EC-XXXI/3, and the associated GEOHAB Science Plan and associated Implementation Plans,

**Noting** that GEOHAB provides a unique ability to address underlying scientific questions and concerns related to harmful algae and their science based management;

**Noting** the achievements and ongoing activities of GEOHAB detailed in the GEOHAB report series and the contributions made to the scientific literature;

**Noting** that GEOHAB provides an interface between IOC and other international coordinating organizations for science such as SCOR, IOCCG, ICES, and PICES;

**Noting** that within the joint framework of IOC and SCOR, GEOHAB is expected to conclude its activities by the end of 2013;

**Recognizing** that to fully realise the benefits of the accumulated investments in GEOHAB and to address any new priorities identified by the IOC in collaboration with SCOR, it would be desirable to extend specific CRPs and framework activities within the GEOHAB Terms of Reference beyond the end 2013;

**Recognizing** that GEOHAB cannot continue to be implemented without the strong endorsement of the funding agencies of IOC Member States;

**Decides**, that the GEOHAB SSC should:

- i) summarize GEOHAB contributions, successes, and yet to be achieved objectives as part of a 10-year synthesis;
- ii) evaluate the need for new scientific foci (as framework activities or new CRPs) in consultation with SCOR;
- iii) gather input from the international community by utilizing meetings such as ICHA 2012, ASLO 2012, and the planned Open Science Meeting in 2013
- iv) interface with the IPHAB Task Teams, Working Groups, and Regional Networks to remain responsive to IPHAB/IOC priorities;
- v) present to IPHAB-XI a revised Science Plan and outline of an implementation plan for GEOHAB beyond 2013;

**Anticipates** that IPHAB, pending a satisfactory revised Science Plan and outline of an Implementation Plan, will recommend to the Twenty-seventh Session of the IOC Assembly that GEOHAB continue beyond 2013 and that SCOR should be invited to continue as co-sponsor;

**Urges** Member State institutions to contribute advice and resources to help implement GEOHAB objectives.

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

Sundby

#### Terms of Reference:

*Agreed by IGBP and SCOR, April 2004*

- To develop the IMBER Science Plan and Implementation Strategy, in accordance with guidance from the sponsoring organisations.
- To oversee the development of IMBER in accordance with its Science Plan and Implementation Strategy.
- To collaborate, as appropriate, with related projects of the sponsors IGBP and SCOR, and other related programmes and organisations (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 IMBER data, taking into account the policies of the sponsors.
- To report regularly to SCOR and IGBP on the state of planning and the accomplishments of IMBER.

The IMBER SSC, its subsidiary groups and International Project Office shall operate in accordance with the operating procedures for IGBP Projects and the requirements of the other co-sponsors.

#### Chair:

**Eileen Hofmann**  
Center for Coastal  
Physical  
Oceanography  
Old Dominion  
University  
4111 Monarch  
Way  
Norfolk, VA  
23508  
USA  
Tel: +1 757-683-  
5334  
Fax: +1 757-683-  
5550  
[hofmann@ccpo.odu.edu](mailto:hofmann@ccpo.odu.edu)

#### Vice-Chairs:

**Mike Roman**  
Horn Point  
Laboratory  
University of  
Maryland Center  
for Environmental  
Science  
P.O. Box 775  
Cambridge, MD  
21613, USA  
Tel: +1 410 221  
8425  
Fax: +1 410 221  
8490  
[roman@hpl.umces.edu](mailto:roman@hpl.umces.edu)

**Javier Aristegui**  
Universidad de  
Las Palmas de  
Gran Canaria  
Campus  
Universitario de  
Tafira  
Las Palmas de  
Gran Canaria  
Islas Canarias  
35017 SPAIN  
Tel: +34 928  
452906  
Fax: +34 928  
454490  
[jaristegui@dbio.ulpgc.es](mailto:jaristegui@dbio.ulpgc.es)

**Carol Robinson**  
Univ. of East  
Anglia  
School of  
Environmental  
Sciences  
Norwich NR4 7TJ  
UK  
Tel: +44 1603  
593174  
Fax: +44 1603  
591327  
[Carol.Robinson@uea.ac.uk](mailto:Carol.Robinson@uea.ac.uk)

# 3-4

**Members:**

Alida Bundy	CANADA	Su Mei Liu	CHINA-Beijing
Claudio Campagna	ARGENTINA	Eugene Murphy	UK
Ratana Chuenpagdee	CANADA	Hiroshi Ogawa	JAPAN
Kenneth Drinkwater	NORWAY	Alberto Piola	ARGENTINA
Jean-Pierre Gattuso	FRANCE	Sinjaee Yoo	KOREA
Nicolas Gruber	SWITZERLAND		

**Executive Committee Reporter:** Bjørn Sundby

**IGBP Liaison:** Wendy Broadgate

**Executive Officer:** Bernard Avril



## Integrated Marine Biogeochemistry and Ecosystem Research

### IMBER Annual Report to SCOR, September 2012

#### MAJOR ACTIVITIES AND ACHIEVEMENTS

- Posters describing the IMBER project and research results were presented at 10 international meetings (see <http://www.imber.info/index.php/Products/Posters>)
- IMBER was involved in 8 special sessions at the TOS/ASLO/AGU 2012 Ocean Sciences Meeting, Salt Lake City, USA, 20–24 February 2012 (see <http://www.imber.info/index.php/Meetings/IMBER-Special-sessions/TOS-ASLO-AGU-2012-Ocean-Sciences-Meeting-20-24-Feb.-2012-Salt-Lake-City-Utah-USA>)
- IMBER convened three special sessions at the Planet Under Pressure Conference, held in London, UK, 26-19 March 2012 (see <http://www.imber.info/index.php/Meetings/IMBER-Special-sessions/Planet-Under-Pressure-26-29-March-2012-London-UK>). These involved the Human Dimensions working group, SOLAS-IMBER Ocean Acidification (SIOA) working group and CLIOTOP
- Two IMBER special sessions were convened at the EGU Annual Assembly, Vienna, Austria, 22-27 April 2012 (see <http://www.imber.info/index.php/Meetings/IMBER-Special-sessions/EGU-General-Assembly-22-27-April-2012-Vienna-Austria>)
- IMBER workshop (*Effects of climate change on advective fluxes in high latitude regions*) convened by ESSAS and ICED at the 2<sup>nd</sup> ICES/PICES/IOC International Symposium, Yeosu, Korea, 15-19 May 2012 (see <http://www.imber.info/index.php/Meetings/IMBER-Special-sessions/2nd-ICES-PICES-IOC-International-Symposium-15-19-May-2012-Yeosu-Korea>)
- Joint IMBER/SOLAS/IOCCP Carbon Synthesis Meeting, Paris, France, 14-16 September 2011
- Launch of the Surface Ocean CO<sub>2</sub> Atlas (SOCAT), Paris, France, 16 September 2011
- First Sustained Indian Ocean Biogeochemistry and Ecosystem Research (SIBER) national programme initiated in India with funding from the Ministry of Earth Sciences.
- IMBER partners with the *Too Big To Ignore* global research partnership to promote and revitalize small-scale fisheries, November 2011
- 5<sup>th</sup> IMBER China/Japan/Korea meeting and training course in Shanghai, China, 22-25 November 2011

# 3-6

- Relocation of the IMBER IPO to the Institute of Marine Research in Bergen, Norway, 17 April 2012
- Ms. Lisa Maddison appointed as Deputy Executive Officer of the IMBER IPO, 17 April 2012
- Dr. Bernard Avril appointed as the Executive Officer of the IMBER IPO, 4 June 2012
- 8<sup>th</sup> IMBER SSC meeting in La Paz, Mexico, 12-15 June 2012, was held in conjunction with the CLIVAR SSG meeting. A half-day mini-symposium was organised with Mexican scientists involved in IMBER-type research
- Approval of the proposal to establish an Ocean Acidification International Coordination Centre (OA-ICC), Monaco, May 2012
- IMBER ClimECO<sub>3</sub> Summer School in Ankara, Turkey, 28-31 July 2012
- IMBER workshop on Capacity Building and Needs Assessment for the Asia-Pacific Region, Shanghai, China, 31 July – 4 August 2012

## PLANNED ACTIVITIES

- The 15<sup>th</sup> Biennial Challenger Conference for Marine Science - *Ocean challenges in the 21<sup>st</sup> century* in Norwich, UK, 3–6 September 2012
- Inaugural meeting of the *Too Big To Ignore* global partnership in St. Johns, Newfoundland, Canada, 4–7 September 2012
- ESSAS session on *Subarctic-Arctic interactions: ecological consequences* at the ICES Annual Science Conference in Bergen, Norway, 21-22 September 2012
- ESSAS workshop on Arctic-Subarctic Interactions at the PICES Annual Meeting in Hiroshima, Japan, 12-21 October 2012
- IMBER Natural and Social Science Data Management Workshop, Goa, India, 27 January 2014.
- IMBER IMBIZO III at the National Institute of Oceanography in Goa, India, 28–31 January 2013 (<http://www.imber.info/index.php/Meetings/IMBIZO/IMBIZO-III>)
- 2<sup>nd</sup> CLIOTOP Symposium, Nouméa, New Caledonia, 11-15 February 2013
- IMBER Special session - *Primary production variability and coastal-offshore export in upwelling regions* - at the 45<sup>th</sup> International Liège Colloquium on Ocean Dynamics, Liège, Belgium, 13–17 May 2013
- 9<sup>th</sup> IMBER SSC meeting in Las Palmas, Gran Canaria, Spain, 17–19 June 2013
- IMBER Open Science Meeting in Bergen, Norway, 23-27 June 2014

## WORKING GROUPS

The activities of IMBER's five working groups during the past year follow.

### 1 SOLAS-IMBER Carbon (SIC!) Working Group

The joint SOLAS-IMBER carbon group oversees the scientific aspects of marine carbon process studies as outlined in the SOLAS-IMBER Carbon Research Implementation Plan ([http://www.imber.info/products/Carbon\\_Plan\\_final.pdf](http://www.imber.info/products/Carbon_Plan_final.pdf)). There are currently three sub-groups dealing with carbon in the surface ocean, carbon in the interior ocean and ocean acidification. However, the existing groups do not consider dissolved organic carbon production, transformation and storage. To address this gap, a proposal to establish a group to address key issues within this topic, submitted by members of the successful SCOR working group on the Microbial Carbon Pump, is currently being considered by the IMBER SSC.

SIC SG1 and SG2 and IOCCP convened *The Ocean Carbon Cycle at a Time of Change: Synthesis and Vulnerabilities* meeting at UNESCO, Paris, France, 14-16 September 2011. The objective of the meeting was to push forward regional to global-scale ocean carbon synthesis activities, specifically towards identifying how global change has been affecting the ocean carbon cycle in the last two decades and its ability to take up CO<sub>2</sub> from the atmosphere. These syntheses revealed that, despite impressive advances in data availability, data analyses and supporting model-based studies, many critical gaps remain (e.g., the nature and drivers of the seasonal cycle of CO<sub>2</sub> in the surface ocean and the separation of changes in ocean DIC into natural or anthropogenic CO<sub>2</sub>). These topics were used to guide breakout group discussions. See the full meeting report at <http://www.imber.info/index.php/Meetings/IMBER-sponsored-and-endorsed-meetings/2011/Joint-SOLAS-IMBER-IOCCP-Carbon-SIC-Synthesis-Meeting-14-16-Sept.-2011-UNESCO-Paris-France>

Following recommendations that emerged from the meeting, planning is underway to organise a meeting in conjunction with the 9<sup>th</sup> International CO<sub>2</sub> Conference in Beijing, China in June 2013, to consider surface ocean inter- and extrapolation methods, and an inter-comparison of methods developed to analyse decadal time-scale changes in the ocean interior.

Initially, a special journal issue was envisaged as a product of the meeting. However, many attendees have contributed to a series of synthesis chapters for the Regional Carbon Cycle Assessment and Processes (RECCAP) effort (<http://www.globalcarbonproject.org/reccap/>). Several of the ocean chapters are in review for *Biogeosciences* (see [http://www.biogeosciences-discuss.net/special\\_issue83.html](http://www.biogeosciences-discuss.net/special_issue83.html)). Many of these syntheses have been included in the Intergovernmental Panel on Climate Change Assessment Report (IPCC AR5).

#### **Sub-group 1 (SG1) Surface Ocean CO<sub>2</sub> Fluxes (Leader: Andrew Lenton, Australia)**

Andrew Lenton replaced Dorothee Bakker as Chair of SIC WG1 in 2011.

The major output of this group is a global atlas of surface ocean *p*CO<sub>2</sub> measurements—the Surface Ocean CO<sub>2</sub> Atlas (SOCAT). It was launched on 16 September 2011 at the Carbon Synthesis meeting described above, and is a compilation of the publically available surface water

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fCO<sub>2</sub> (fugacity of CO<sub>2</sub>) data obtained from more than 2,100 cruises that occurred between 1968 and 2007. The data were quality controlled. SOCAT contains approximately 7.5 million measurements of various carbon parameters in a common format. See <http://www.socat.info/>.

An article entitled *Surface Ocean CO<sub>2</sub> Atlas (SOCAT) gridded data products* was submitted to *Earth System Science Data Discussions* and is now available as a discussion paper at: [http://www.earth-syst-sci-data-discuss.net/papers\\_in\\_open\\_discussion.html](http://www.earth-syst-sci-data-discuss.net/papers_in_open_discussion.html). There was also an article in *EOS* (Global data products help assess changes to ocean carbon sink, *EOS*, 20 March 2012, Vol. 93 No. 12: 125-132).

Two meetings were held by SG1 this year. The first, in Seattle, Washington, USA in May 2012, was to discuss the automation of SOCAT, and the second in Tsukuba, Japan in July 2012, dealt with quality controlling SOCAT Version 2.0.

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

SG2 co-ordinates international research on ocean interior biogeochemical changes, undertakes synthesis activities and aims to develop sustainable observing systems, including the addition of oxygen sensors to the international Argo float programme (ARGO-O<sub>2</sub>).

This group held two meetings in the past year: one following the Carbon Synthesis meeting in Paris on 16 September 2011, and the second in conjunction with the Ocean Sciences meeting in Salt Lake City, Utah, USA in February 2012. Members of the group organised a session entitled *The changing ocean carbon cycle: data syntheses, analyses and modelling* at the meeting.

SIC SG2 submitted a proposal to establish a SCOR Working Group on *Quality control procedures for oxygen and other biogeochemical sensors on floats and gliders*, in response to the 2012 call for proposals (see <http://www.scor-int.org/2012GM/Float%20Sensors.pdf>).

Currently, the focus of SIC SG2 is to move forward with the intercomparison study of the different methods to determine the changes in carbon in the ocean's interior. A meeting in this regard is planned for summer 2013.

### **Sub-group 3 (SIOA) SOLAS-IMBER Ocean Acidification (Leader: Jean-Pierre Gattuso, France)**

The SOLAS-IMBER Ocean Acidification (SIOA) working group co-ordinates international research efforts and synthesis activities in ocean acidification. To obtain the resources necessary to undertake this coordination, the SIOA developed a proposal to obtain funding to establish an Ocean Acidification International Coordination Centre (OA-ICC) to coordinate the key activities necessary at the international level to ensure effective use of the science investment in ocean acidification. The proposal was submitted to the International Atomic Energy Agency (IAEA), as part of the Peaceful Uses Initiative and was approved in May 2012. The OA-ICC has been established at the IAEA-Environment Laboratories in Monaco and Dr. Lina Hansson has been appointed as the Executive Director. Dr. Jean-Pierre Gattuso is discussing taking on the position of Scientific Director for the OA-ICC.

The group's annual meeting, originally scheduled for November 2011, was postponed to 22-23 March 2012, because of the delayed response from IAEA to their proposal. At the meeting, which was held in Ville Franche sur Mer, France, the SIOA discussed the governance of the OA-ICC and future activities.

Members of the SIOA convened the *Ocean Acidification: Ecological impacts and societal implications* session at the Planet Under Pressure conference in London, UK in March 2012.

## **2 IMBER-LOICZ Continental Margins Working Group**

The joint IMBER-LOICZ Continental Margins Working Group (CMWG) held its first meeting in Halifax, Canada from 18-20 June 2012. As the group has multiple responsibilities (unlike its predecessor, the Continental Margins Task Team (CMTT), which was tasked only with drafting the Continental Margins Implementation Plan), it was decided to rename the group the Continental Margins Working Group.

In addition to planning the workshop that members of the CMWG will convene at IMBIZO III, much of the meeting was dedicated to revising the Continental Margins Implementation Plan drafted by the CMTT. This draft is long and outdated, so the decision was made to produce a short paper outlining the problem and the rationale, for submission to a peer-review journal, following approval by the IMBER and LOICZ SSCs. An updated addendum to the existing draft implementation plan, that highlights current important issues and questions for continental margins, will also be published.

The meeting coincided with an international conference celebrating the 30<sup>th</sup> anniversary of the United Nations Law of the Sea Convention and several CMWG members presented talks at the conference which was titled *Regulation of continental shelf development: Rethinking international standards*.

The CMWG held a special session (*Changing Biogeochemistry and Ecosystems in the Western North Pacific Continental Margins Under Climate Change and Anthropogenic Forcing*) at the Ocean Sciences Meeting in Salt Lake City, Utah, USA, February 2012.

The CMWG will lead the *Biogeochemistry-ecosystem interactions on changing continental margins* workshop at IMBIZO III in Goa, India in January 2013.

The second working group meeting is scheduled to be held just prior to IMBIZO III in Goa, to finalise of the Continental Margins Implementation Plan.

## **3 Capacity Building Task Team (CBTT)**

Capacity building is an important aspect in all IMBER activities, and the CBTT aims to facilitate the participation of early-career scientists and scientists from developing countries in IMBER and IMBER-related activities and training programmes. It also attempts to develop the research



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capabilities in regions where there are very few scientists involved in IMBER-related research. The Capacity Building Strategy and Implementation Plan is available at [http://www.imber.info/products/Capacity\\_Building\\_final.pdf](http://www.imber.info/products/Capacity_Building_final.pdf).

The CBTT is chaired by Jing Zhang (China). He also represents IMBER in an ex-officio capacity on the SCOR Capacity Building Committee (see <http://www.scor-int.org/capacity.htm> for details).

The CBTT organised a workshop to analyse the capacity development needs for IMBER-related research in the Asia-Pacific region, which took place from 31 July – 4 August 2012 at the East China Normal University, Shanghai, China. It is anticipated that the workshop results will be published in the Policy Forum section of *Science*. The participants proposed that a mentoring system be developed for the IMBIZO III that would allow established scientists to mentor early-career and developing country scientists participating in the IMBIZO.

IMBER ClimECO summer schools are held every two years and have proved to be a successful capacity building mechanism for students and early-career scientists. ClimECO<sub>3</sub> was held at the Middle East Technical University in Ankara, Turkey, 23-28 July 2012. The summer school focused on: *A view towards integrated earth system models. Human-nature interactions in the marine world*. Fifty participants were selected from the 168 applicants to facilitate the hands-on nature of the training. The selected participants were from 26 countries and were from both natural and social science disciplines. Additional information is available at: <http://www.imber.info/index.php/Science/Working-Groups/Capacity-Building/Summer-Schools/ClimECO3-July-2012-Ankara-Turkey>. Raghu Murtugudde (USA) and Beth Fulton (Australia) co-chaired the Organising Committee and Baris Salihoglu was the local host. All the lectures were webcast live and were followed by several people from around the world. Recordings of the broadcasts will be available on the IMBER website soon. SCOR Developing Country Travel funds were used to provide travel support for five participants, from Benin, Nigeria, Tunisia, Indonesia and the Ukraine.

## **4 Data Management Committee**

The IMBER Data Management Committee (DMC) promotes a cooperative data management approach, involving experienced data management specialists from the start of a project, and training young scientists in good data management procedures. The group is chaired by Alberto Piola (Argentina).

The *IMBER Data Management Cookbook* on best practices for data management has been widely distributed to laboratories and research vessels. It can be downloaded from the IMBER web site (<http://www.imber.info/index.php/Science/Working-Groups/Data-Management/Cookbook>) or alternatively, printed copies can be requested from the IMBER office ([imber@imr.no](mailto:imber@imr.no)). The document is available in English and Spanish.

As with previous IMBIZOs, the DMC is organising a Data Management workshop the day before the start of IMBIZO III. This will enable participants and local students and scientists to learn about good data management techniques from data management specialists. This workshop will deal with both natural and social science data. The DMC will also operate a booth during IMBIZO III, where participants will be able to discuss their particular data management issues and problems.

## **5 Working Group on Human Dimensions**

The IMBER Human Dimensions Working Group (HDWG) is co-chaired by natural scientist, Alida Bundy (Canada) and two social scientists, Marie-Caroline Badjeck (Canada) and Moenieba Isaacs (South Africa). The working group focuses on the interactions between human and ocean systems, and has an objective of creating an integrated and interactive natural-social science marine research community within IMBER.

The HDWG held its second meeting in London, UK, 26-29 March 2012. The objectives of this meeting were to further develop the HDWG work plan for the next five years, and to develop the ADaPT (Assessment from Description, Appraisal and Typology) conceptual framework, which will be a major output of the working group. The ADaPT framework is intended as a tool to enable decision makers to weigh potential outcomes to a specific challenge facing a marine-human system quickly and appropriately, by comparing it with situations (and responses) that have previously occurred elsewhere. The development of the typology for ADaPT requires a broad suite of case studies to capture the diversity of ecosystems, social systems, governing systems and sectors. These will be drawn from the IMBER Regional Programmes and also from participants in the *Understanding and forecasting human-ocean-human interactions, drivers and pressures, with respect to global change* workshop at IMBIZO III, which is being convened by members of the HDWG.

The HDWG, in collaboration with LOICZ and the Large Marine Ecosystem Network, organised a session at the Planet Under Pressure Conference in London in 2012. The title was: *Toward a sustainability-science knowledge-network on marine-ecosystems: achieving innovative, transdisciplinary stewardship across multiple scales.*

[http://www.planetunderpressure2012.net/pup\\_session.asp?19214](http://www.planetunderpressure2012.net/pup_session.asp?19214). The presentation, “*Understanding and forecasting human-ocean-human interactions with respect to global change*” given by Ratana Chuenpagdee on behalf of the HDWG, is to be submitted as a ‘Ghoti’ article to *Fish and Fisheries*.

The HDWG plans to hold its next meeting in conjunction with IMBIZO III in Goa, India in January 2013.

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## REGIONAL PROGRAMMES

IMBER has four regional programmes. Updates on their activities follow.

### 1. Climate Impact on Top Oceanic Predators (CLIOTOP)

CLIOTOP is a 10-year programme that started in 2005. Its aim is to use a worldwide comparative approach to identify the impact of anthropogenic and natural forcings on the structure and function of open ocean pelagic ecosystems and their top predator species. The SSC membership was revised in late 2011, in accordance with criteria such as gender balance and geographical distribution, stipulated by the IMBER SSC.

CLIOTOP is based on the interactive activities of its six working groups that focus on key processes and scales. For information on working group activities, see <http://www.imber.info/index.php/Science/Regional-Programmes/CLIOTOP>.

CLIOTOP led a two-day session entitled *Global science for global governance of oceanic ecosystems and fisheries* at the Planet Under Pressure conference in London on 25 and 26 March 2012.

Several CLIOTOP affiliates contributed to the *Vulnerability of tropical Pacific fisheries and aquaculture to climate change* book, presenting syntheses, summaries and new results, mainly focused on tuna.

CLIOTOP will hold the 2<sup>nd</sup> CLIOTOP Open Science Symposium in Nouméa, New Caledonia, 11-15 February 2013. The symposium is intended to bring together several initiatives investigating the impacts of climate change on the world's living marine resources and the people who depend on them. The theme of the symposium is *Certainty of change in pelagic systems – detection, attribution, prediction and adaptation*.

### 2. Ecosystem Studies of Sub-Arctic Seas (ESSAS)

ESSAS was started in 2005 and focuses on the impacts of climate change on Sub-Arctic marine ecosystems and their sustainability. ESSAS has four working groups and several national and multi-national projects.

ESSAS convened a session on *Arctic-subarctic interactions* at the TOS/ASLO/AGU 2012 Ocean Sciences Meeting (20-24 Feb. 2012, Salt Lake City, Utah, USA).

ESSAS and ICED organised a one-day workshop on *The effects of climate change on advective fluxes between the Arctic and Antarctic* at the PICES/ICES/IOC meeting in Yeosu, Korea on 14 May 2012. The objective was to review the advection of water masses within and between polar and subpolar regions, examine their forcing mechanisms and determine their role on the ecology of these high-latitude regions. The establishment of a new IMBER working group to continue the comparisons of Arctic and Antarctic ecosystems is being considered.

ESSAS members produced a special issue of *Deep Sea Research Part II: Topical Studies in Oceanography*, entitled “Understanding Ecosystem processes in the Eastern Bering Sea”, which was published in June 2012. The articles describe newly acquired data in the context of historical data and assess the implications for the future of the Bering Sea ecosystem.

Several peer-reviewed journal articles, as well as a chapter in *The Barents Sea. Ecosystem, Resources*, were published by ESSAS scientists and a listing of these is available at [http://www.imr.no/essas/publications\\_and\\_reportlist/primary\\_publications/en](http://www.imr.no/essas/publications_and_reportlist/primary_publications/en).

### **3. Integrating Climate and Ecosystems Dynamics (ICED)**

ICED seeks a better understanding of Southern Ocean ecosystem dynamics and the development of sustainable management procedures. The ICED Science Plan was published in 2008 and is implemented through a coordinated circumpolar approach using data synthesis, fieldwork and modelling.

ICED scientists participated in a special session on *Oceanographic Processes at the Antarctic Continental Margins* at the Ocean Sciences Meeting in Salt Lake City, Utah, USA in February 2012. E. Hofmann from IMBER co-convened this session.

ICED convened a session at the SCAR (Scientific Committee on Antarctic Research) XXII Conference that was held in Portland, Oregon, USA, 13-25 July 2012. The theme of the conference was *Antarctic Science and Policy Advice in a Changing World*, and the ICED session was entitled *Response of Southern Ocean ecosystems to change*

ICED continues to use the online fieldwork mapping tool to coordinate fieldwork in the Southern Ocean. It is progressing well, especially with cruise planning information and data rescue (particularly for zooplankton). See (<http://www.iced.ac.uk/science/fieldworkmap.htm>). As part of the EUR-OCEANS Consortium flagship *Polar Ecosystem Change and Synthesis* (PolEcoSyn), ICED is creating a network of EU polar scientists who could provide information on Southern Ocean fieldwork for the fieldwork map.

The results of the ICED Southern Ocean Food Web Modeling Workshop that was held at the Center for Coastal and Physical Oceanography, Old Dominion University, Virginia, USA in April 2008, have been published online (see <http://www.sciencedirect.com/science/article/pii/S0079661112000237>).

### **4. Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER)**

SIBER is co-sponsored by IMBER and the Indian Ocean Global Ocean Observing System (IOGOOS) and focuses on understanding climate change and anthropogenic forcing on biogeochemical cycles and ecosystems in the Indian Ocean. The SIBER Science Plan and Implementation Strategy (IMBER Report No. 4) was published in September 2011. SIBER held its second SSC meeting in Chennai, India, 26-28 July 2011 (see IMBER Report No. 6 at

<http://www.imber.info/index.php/Science/Regional-Programmes/SIBER>). SIBER III will be held in Cape Town, South Africa in October 2012.

The SIBER International Project Office is based at the Indian National Centre for Ocean Information Services (NCOIS) in Hyderabad, India. Dr. Satya Prakash is the Executive Officer. The SIBER website (<http://www.incois.gov.in/Incois/siber/siber.jsp>) has been established by the SIBER IPO. There are plans to produce a semi-annual SIBER Newsletter, to communicate SIBER activities and other relevant information about Indian Ocean research and monitoring programs.

Fourteen projects have been initiated under the Sustained Indian Ocean Biogeochemistry and Ecosystem Research (SIBER) national programme that is funded by India's Ministry of Earth Sciences (MoES). Six of these projects deal with the open ocean and the remainder relate to estuaries and coasts.

SIBER organized a special session, entitled *Physical and biogeochemical processes in the Indian Ocean: Recent progress and toward future collaborations*, for the Asia Oceania Geosciences Society (AOGS) - AGU (WPGM) Joint Assembly, held from 13-17 August 2012 in Singapore.

## **ENDORSED PROJECTS**

IMBER currently has 34 endorsed projects from 14 countries (Argentina, Brazil, Canada, Chile, China, Denmark, France, Germany, Italy, Japan, New Zealand, Spain, UK and USA). Nine projects were endorsed by IMBER this past year. They including the following:

### **Gulf of Trieste – Time-series (GoTTs)**

The Gulf of Trieste in the North Adriatic Sea is part of the international network of Long Term Ecological Research (LTER) that records hydrological, biological and biochemical data monthly. An increasing number of parameters have been added, with the aim of increasing understanding of the dynamics of the marine ecosystem of the Gulf of Trieste and to evaluate the role of the oceans in the global energy balance. Local-scale studies consider coastal and transition waters and address problems related to their sustainable management. See <http://nettuno.ogs.trieste.it/ilter/BIO/>.

### **Atmospheric deposition and ocean plankton dynamics (ADEPT)**

ADEPT will consider the effect of atmospheric aerosol deposition on the dynamics of a low-nutrient low-chlorophyll marine (LNLC) system, namely the Mediterranean Sea, using a comparative approach at various scales. At the basin scale, satellite chlorophyll data will be related to modeled Saharan dust deposition. At the coastal scale, simultaneous measurements of dust deposition and chemical and biological parameters in the water column will be taken at several locations across the NW Mediterranean, and the relationship between both sets of variables examined. Laboratory experiments with altered aerosol concentrations will be conducted to study plankton stimulation dynamics, utilization of organic matter by bacteria, and changes in bacterial composition and diversity (see

<http://www.imber.info/index.php/Science/Endorsed-projects/ADEPT-March-2012>).

**Deep-water submarine canyons and slopes in the Mediterranean and Cantabrian Seas: from synchrony of external forcings to living resources (DOSMARES)**

DOSMARES has two objectives. First, to gain an understanding of the effects of the atmospheric teleconnections between the Bay of Biscay (or Cantabrian Sea) and the north-western Mediterranean Sea, and their impacts on the deep ecosystem, (pelagic and benthic). Second, to increase our knowledge of the way the transfer of the signal from the external forcings towards the deep ecosystem controls community structure and population dynamics, thus affecting valuable living resources. The project is structured along three axes of activity, each corresponding to a work package: 1) Characterization of external forcings and abiotic conditions; 2) Links between abiotic conditions, populations and pelagic and benthopelagic resources; and 3) Links between abiotic conditions, populations and benthic resources. (See <http://www.imber.info/index.php/Science/Endorsed-projects/DOSMARES-March-2012>.)

**Mediterranean Sea Acidification in a changing climate (MedSeA)**

The MedSeA project aims to forecast chemical, climatic, ecological-biological, and socio-economical impacts resulting from the combined influences of anthropogenic acidification and warming, while taking into consideration the unique characteristics of the region. An interdisciplinary approach, using observations, experiments and modeling will be used. Projections will be based on new observations of chemical conditions as well as new observational and experimental data on the responses of key organisms and ecosystems to acidification. These will be fed into existing ocean models that take into account the Mediterranean's fine-scale features. Results will inform policymakers responsible for developing regional strategies for adaptation and mitigation. (See <http://www.imber.info/index.php/Science/Endorsed-projects/MedSeA-February-2012>.)

**Carbon Transport and Acidification Rates in the North Atlantic (CATARINA)**

CATARINA aims to study ocean perturbation and its consequences in response to the rise in atmospheric CO<sub>2</sub> due to human activities. Its goal is to quantify the Meridional Overturning Circulation and water mass ventilation changes and their effect on ocean uptake and storage capacity of anthropogenic carbon. An estimation of this variability is essential to evaluate future scenarios of climate changes.

CATARINA also aims to determine the effect of current CO<sub>2</sub> emissions and past atmospheric CO<sub>2</sub> concentrations on the production and preservation of CaCO<sub>3</sub> in the North Atlantic, and the potential impact of future ocean acidification on calcareous organisms. This will be done using culture experiments. CATARINA is part of a decadal experiment that started in 1997, where sampling along the A25 Greenland-Portugal hydrography/geochemistry section has been repeated every alternate year since 2002 within the OVIDE project. The CATARINA cruise was carried out in June-July 2012. (See <http://www.imber.info/index.php/Science/Endorsed-projects/CATARINA-December-2011>.)

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## **Coastal Ocean Microbial Plankton and Temperature (COMITE)**

COMITE will address the effects of future warming on the ecology and biogeochemical role of temperate coastal microbial assemblages using three approaches:

1. Retrospective analysis of the linkages between temperature, other environmental drivers and bacterial community structure and size-abundance relationships in a coastal time series initiated in 2002 off Xixón, Spain (southern Bay of Biscay);
2. Monthly experiments assessing the response of different bacterial groups to ambient temperature (-3 and +3°C) over an annual cycle; and
3. A comprehensive evaluation of the temperature dependence of organic matter fluxes through microbial plankton during four significant oceanographic periods (spring phytoplankton bloom, summer stratification, autumn bloom and winter mixing).

The final goal of COMITE data analysis is to build a predictive, testable model on the effects of realistic temperature rises on the biogeochemical role of oceanic bacteria. Among other novel approaches, the project will

1. Test whether enhanced metabolism due to higher temperature will result in lower bacterial biomass; and
2. Integrate bacterial phylogenetic and physiological structure within the temperature response as formulated in the metabolic theory of ecology.

(See <http://www.imber.info/index.php/Science/Endorsed-projects/COMITE-December-2011>.)

## **Processes Regulating Iron Supply at the Mesoscale - Ross Sea (PRISM-RS)**

The Ross Sea continental shelf is one of the most productive areas in the Southern Ocean, and may comprise a significant, but unaccounted for, oceanic CO<sub>2</sub> sink, largely driven by phytoplankton production. The processes that control the magnitude of primary production in this region are not well understood, but data suggest that iron limitation is a factor. Field observations and model simulations indicate four potential sources of dissolved iron to surface waters of the Ross Sea:

1. Circumpolar Deep Water (CDW) intruding from the shelf edge;
2. Sediments on shallow banks and nearshore areas;
3. Melting sea ice around the perimeter of the polynya; and
4. Glacial meltwater from the Ross Ice Shelf.

It is hypothesized that hydrodynamic transport via mesoscale currents, fronts and eddies facilitate the supply of dissolved iron from these sources to the surface waters of the Ross Sea polynya. These hypotheses will be tested through a combination of *in situ* observations and numerical modeling, complemented with satellite remote sensing. The research will provide new insights and a mechanistic understanding of the complex oceanographic phenomena that regulate

iron supply, primary production, and biogeochemical cycling. The research will thus form the basis for predictions about how this system may change in a warming climate.

See <http://www.imber.info/index.php/Science/Endorsed-projects/PRISM-RS-November-2011>.

### **Changes in carbon uptake and emissions by oceans in a changing climate (CARBOCHANGE)**

CARBOCHANGE aims to provide the best possible process-based quantification of net ocean carbon uptake under changing climate conditions using past and present ocean carbon cycle changes. It aims to improve the quantitative understanding of key biogeochemical processes (particle flux, ecosystem community structure, lateral advection) and physical processes (overturning circulation, ice cover, mixing) through a combination of observations and models. The project will deliver calibrated future evolutions of ocean pH and carbonate saturation as required by the research community on ocean acidification in the EU project EPOCA and others. The time history of atmosphere-ocean carbon fluxes past, present and future will be synthesised globally, as well as regionally, for the transcontinental RECCAP project. Observations and model results will merge into GEOSS/GEO through links with the European coordination action COCOS and will prepare the marine branch of the European Research Infrastructure ICOS. Results of the project will be summarised for policy makers working on climate change mitigation through specifically targeted outreach papers. (See <http://www.imber.info/index.php/Science/Endorsed-projects/CARBOCHANGE-November-2011>.)

### **Barite bio-organi-mineralization processes at mesopelagic depths (BIOBAM)**

Mineralization length scales are important indicators of the capacity of intermediate layers for longer-term carbon sequestration. A quantitative representation of this process is thus essential to every simulation of the oceans' role in the global carbon cycle. Barium barite ( $Ba-BaSO_4$ ) in suspended matter is a proxy of carbon mineralization fluxes. It seems that barite precipitation occurs in micro-environments (e.g., biogenic aggregates) sinking out of the surface layers into mesopelagic waters. Barite formation appears closely linked (directly or indirectly) with prokaryotic degradation of Organic Matter (OM) and thus with the carbon remineralization rate. Barite proxy in contrasting environments suggests that the extent of mesopelagic carbon mineralization is closely linked to specific ecosystem characteristics (e.g., differences in phytoplankton community composition, grazing pressure, trophic interactions and types of aggregates formed). However, detailed understanding of the processes controlling the formation and fate of aggregates beyond the surface layer is still unclear.

BIOBAM will focus on the subsurface and mesopelagic particle fluxes to better understand the link between the processes of barite formation, degradation and remineralization of OM and the characteristics of exported particles, and their dependency on ecosystem structure. Pressure-controlled batch-incubation experiments will be used to simulate particles sinking throughout the mesopelagic zone.

(See <http://www.imber.info/index.php/Science/Endorsed-projects/BIOBAM-September-2011>.)



## IMBER-ENDORSED MEETINGS AND ACTIVITIES

Second PICES/ICES/IOC international symposium - *Effect of climate change on the world's oceans*, Yeosu, Korea, 15-19 May 2012.

Advances in Marine Ecosystem Modelling Symposium - *AMEMR III The Next Generation*, Plymouth, UK, 27-30 June 2011. More information at: <http://www.amemr.info/http://www.amemr.info/>

PICES Annual meeting - *Mechanisms of Marine Ecosystem Reorganization in the North Pacific Ocean*, Khabarovsk, Russia, 14 - 23 October 2011. More information at: <http://www.pices.int/meetings/annual/PICES-2011/2011-background.aspx>

EUR-OCEANS Conference - *Ocean deoxygenation and implications for marine biogeochemical cycles and ecosystems*, Toulouse, France, 24–26 October 2011

*Open access for climate scientists* training course, Copenhagen, Denmark, 26 October 2011. More information at: <http://www.openaccessweek.org/>

The 5<sup>th</sup> China-Japan-Korea (CJK) IMBER Symposium: *Global ocean ecosystem dynamics, integrated marine biogeochemistry and ecosystem research*, Shanghai, China, 22-24 November 2011. Over 80 scientists from the three countries participated to review IMBER-related research and activities. The Symposium focus was on the impact of climate change and anthropogenic forcings on physical processes, biogeochemical cycles and ecosystem functioning in the northern Pacific. More information at: <http://www.imber.info/index.php/Meetings/IMBER-sponsored-and-endorsed-meetings/2011/5th-China-Japan-Korea-IMBER-Symposium-and-Training-22-25-Nov.-2011-Shanghai-China>. An article summarizing the meeting outcomes was published by the conveners (Jing Zhang, Hiroaki Saito and Se-Jong Ju) in *EOS* (Volume 93 No. 15, 10 April 2012). A one-day training course for students and early career scientists was held in conjunction with the CJK meeting, on 25 November 2011 (see below).

## OUTREACH ACTIVITIES

### IMBER website

The IMBER website is the project's main communication tool: <http://www.imber.info/>. The new IMBER website, redesigned to provide more news and information about IMBER science, activities and related events, was launched in October 2011.

The IPO has developed and maintains several other web sites for IMBER activities and events, such as the IMBIZO III website (<https://www.confmanager.com/main.cfm?cid=2614>), ClimECO<sub>3</sub> summer school web page (<http://www.imber.info/index.php/Early-Career/IMBER-Summer-Schools/ClimECO3-July-2012-Ankara-Turkey>), the CLIOTOP web page

(<http://www.imber.info/cliotop.html>), the SOLAS/IMBER/IOCCP Synthesis meeting ([http://www.imber.info/sponsored\\_meetings\\_SIC\\_sept2011.html](http://www.imber.info/sponsored_meetings_SIC_sept2011.html)).

### ***IMBER Update***

The electronic *IMBER Update* Newsletter is emailed to ~1,600 scientists three times a year. It can also be downloaded from: <http://www.imber.info/index.php/News/Newsletters>.

Issue No. 20 – May 2012 focused on French IMBER-related science, in recognition of the host country of the IMBER IPO from 2005-2012.

Issue No. 19 - December 2011 was dedicated to IMBER's SIBER regional programme following the publication of its Science Plan and Implementation Strategy

Issue No. 18 - September 2011 examined the Human Dimension in IMBER science

The theme of the next issue (September 2012) will be IMBER science in Norway – the IMBER IPO's new host country.

### **eNews**

The eNews Bulletin is published electronically each month, providing information about IMBER and IMBER-relevant activities and events. It also includes funding possibilities and calls for proposals, job opportunities, and workshop and conference announcements.

### **Promotional Material**

Brochures and posters are used to promote IMBER at meetings and conferences. An updated version of IMBER's brochure has been produced by the China Regional Project Office. An all-new brochure is planned. IMBER poster templates that can be adapted to a specific meeting topic or audience can be downloaded from the IMBER website (<http://www.imber.info/useful-downloads.html>) and are available on request from the IPO.

### **Training**

#### *ClimECO<sub>3</sub>*

IMBER organised the ClimECO<sub>3</sub> summer school at the Middle East Technical University in Ankara, Turkey in July 2012. The summer school was designed to provide participants with an overview of methods, models and approaches for analyzing the impact of climate change on marine ecosystems and the consequences for society. The post-summer school evaluations indicate that ClimECO<sub>3</sub> was a success and was enjoyed by the participants. All lectures were web cast live and will be archived on the IMBER website.

# 3-20

## *China-Japan-Korea IMBER training course*

As mentioned above, a one-day training course was held in conjunction with the 5<sup>th</sup> IMBER China-Japan-Korea meeting. Twenty-one participants were introduced to current information regarding IMBER and some of the projects that it collaborates with (e.g., the North Pacific Marine Sciences Organization (PICES) and its Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems (FUTURE) programme), as well as systemic knowledge of physical, chemical and multi-disciplinary approaches to ocean science. All lectures were web-cast live.

## *Open access for climate scientists training*

IMBER sponsored the Open Access for Climate Scientists Training Course (October 2011, Copenhagen, Denmark) and a member of the IMBER Data Management Committee (DMC) was scheduled to give a presentation. Unfortunately, this was cancelled due to illness. The lectures were all web-cast live and all resulting peer-reviewed publications are freely available via open access.

## **INTERNATIONAL PROJECT OFFICE (IPO)**

The primary role of the IPO is to ensure that the decisions of the IMBER SSC are carried out. To do this, the IPO needs to secure funding for IMBER activities, support the IMBER working groups and task teams, provide administrative support for the project's activities, maintain communication links both within and outside the programme, and maintain a data and information archive.

Following the decision of the French Consortium to reduce the support for the IMBER IPO, a proposal was submitted to the Research Council of Norway to host the IMBER IPO. This proposal was approved in December 2011, for a period of five years. Consequently, the IPO relocated to the Institute of Marine Research (IMR) in Bergen, Norway in mid-April 2012. Unfortunately, this move resulted in the resignations of the Deputy Executive Officer (DEO, Sophie Beauvais), Acting DEO (Juliette Remetz-Planchon) and Administrative Assistant (Virginie Le Saout), who were not able to relocate. Lisa Maddison was appointed as the Deputy Executive Officer and Bernard Avril took up the Executive Officer position on 4 June 2012. The half-time Administrative Assistant position is shared by Anita Jacobsen and Turid Loddengaard, who are employed by IMR.

In 2011, support for the activities of the IPO and IMBER was provided by:

- IGBP: support towards the SSC meeting (13 750 €);
- SCOR: support from NSF (\$50 000, grant until August 2012);
- French Consortium: support for IPO salaries and running expenses (129 000 €)

## **IMBER REGIONAL PROJECT OFFICE IN CHINA (CHINA RPO)**

The IMBER China Regional Project Office (RPO) opened at the East China Normal University (ECNU) in Shanghai, P.R. China in March 2011. Liuming Hu is the Deputy Executive Officer

and Fang Zuo is the Administrative Assistant. In addition to supporting the IPO, the RPO is responsible for the IMBER Continental Margins and Capacity Building activities, and promoting IMBER activities in the Asia-Pacific region. The RPO is financially supported by the ECNU.

## **INTERACTIONS WITH OTHER PROJECTS AND PROGRAMMES**

### **SOLAS**

The joint SOLAS/IMBER Carbon Group (SIC!) was formed in Oct 2005. This group works in close collaboration with IOCCP. There are three sub-groups within the SIC group:

SG1-Surface Ocean Systems. Chair: Andrew Lenton (Australia)

SG2-Interior Ocean. Chair: Nicolas Gruber (Switzerland)

SG3-Ocean Acidification. Chair: Jean-Pierre Gattuso (France)

(See the activities of these groups on pages 3 and 4).

### **LOICZ**

Kon-Kee (KK) Liu (IMBER) and Helmuth Thomas (LOICZ) lead the joint IMBER/LOICZ CMWG (see page 4). As the theme of IMBIZO III relates to continental margins, several LOICZ affiliates will participate in, and in some instances, co-convene the workshops.

### **CLIVAR**

Climate Variability and Predictability (CLIVAR), is a core project of the World Climate Research Programme (WCRP). Its focus is the role of the oceans in climate variability and change, particularly on physical climate changes.

The Indian Ocean Panel (IOP) has strong links with SIBER to cooperate to implement both physical and biogeochemical instruments on the IndoOOS infrastructure.

IMBER and CLIVAR held concurrent SSC meetings in La Paz, Mexico in June 2012, and had a one-day joint meeting and social event. Discussions are underway regarding the establishment of a joint working group.

### **EUR-OCEANS**

IMBER signed a MOU with the EUR-OCEANS Network of Excellence and continues to retain links with the new EUR-OCEANS Consortium (EO).

The IMBER IPO assisted with the administrative and logistical organisation of EUR-OCEANS Conference – *Ocean deoxygenation and implications for marine biogeochemical cycles and ecosystems* (24-26 October 2011, Toulouse, France). A poster about IMBER research in deoxygenated zones was presented. IMBER SSC members (e.g., Carol Robinson and Niki Gruber) were invited speakers at the conference.

# 3-22

A successful proposal was submitted to the EUR-OCEANS call for funding for conferences for IMBIZO III. The sum of 15,000 euros was awarded to support IMBIZO III.

## **PICES**

PICES and IMBER continue to collaborate and interact on a regular basis. A joint IMBER-PICES session entitled, *How well do our models really work and what data do we need to check and improve them?*, was held at the PICES Annual Meeting in Khabarovsk, Russia, 19-20 October 2011. IMBER provided travel support for Drs. Alexander Kurapov, Kenneth Rose and Nikolay Diansky, who were invited speakers in this session.

IMBER co-sponsored the second International PICES, ICES and IOC Symposium on *Effects of Climate Change on the World's Oceans*, held in Yeosu Korea, 14-18 May 2012. IMBER provided travel support for two invited speakers, Drs. Carin Ashjian and Nina Karnovsk, to attend a joint IMBER-PICES session. ICED and ESSAS convened a workshop on *Effects of climate change on advective fluxes in high latitude regions* (see page 7).

PICES supported five students or early-career scientists from PICES member countries, to attend the ClimECO<sub>3</sub> summer school in Ankara, Turkey in July 2012.

PICES have agreed in principal to support invited speakers from North Pacific countries to attend IMBIZO III. The amount of sponsorship will be decided at the PICES 2012 Annual Meeting in October 2012.

## **Too Big To Ignore**

IMBER has partnered with the *Too Big To Ignore* initiative, which is a research network that aims to promote and revitalize small-scale fisheries around the world. Its main goal is to improve understanding of the real contribution of small-scale fisheries to food security, nutrition, sustaining livelihoods, poverty alleviation, wealth generation and trade, as well as the impacts and implications of global change processes such as urbanization, globalization, migration, climate change, aquaculture, and communication technology on small-scale fisheries. It also aims to create an interactive web platform, a Small-scale Fisheries Information System (SFIS) for global and local analysis of small-scale fisheries and their contributions to the broader society. Many of the objectives of the IMBER HD-WG overlap with those of the initiative. The initiative is lead by IMBER SSC member Ratana Chuenpagdee. <http://toobigtoignore.net/>. The inaugural meeting of the partnership was held from 4-7 September 2012 in St. Johns, Newfoundland, Canada.

## **NATIONAL ACTIVITIES**

To increase IMBER's international exposure, National Contacts are established help to coordinate research and communication within countries and with the broader IMBER community.

IMBER currently has national activities in 31 countries (Argentina, Australia, Belgium, Brazil, Canada, Chile, China, Finland, France, Germany, Greece, India, Italy, Japan, Republic of Korea, Mexico, Namibia, The Netherlands, New-Zealand, Norway, Oman, Peru, Russia, South Africa, Spain, Switzerland, Taiwan, Turkey, UK, Uruguay and USA).

Examples of some activities:

### **Australia**

Australia is involved in the ICED regional programme via the Australian Antarctic Division (AAD), the Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC) and the Institute of Marine and Antarctic Studies (University of Tasmania).

The AAD and ACE CRC hosted the 2<sup>nd</sup> international workshop of the ICED's Southern Ocean Sentinel Monitoring project, entitled *Southern Ocean Ecosystem Change and Future Projections* in May 2012 in Hobart, Tasmania. This workshop focused on the state of knowledge of Southern Ocean food webs and how these might change in the future. The activities included the following:

- The ICED Sentinel aims to develop methods to assess the state of Antarctic and Southern Ocean marine ecosystems and to develop a field program to estimate change in Southern Ocean ecosystems. The workshop reviewed progress on this project and developed a program of work that will further these aims and to develop a proposal by 2017 for benchmarking Southern Ocean Ecosystems in 2020.
- Modelling Southern Ocean Ecosystems - this was the first of two meetings (the next will be held at the British Antarctic Survey, UK in 2013) on building end-to-end ecosystem models. A modelling action group aims to have working models within two years.
- The workshop made substantial progress in writing summaries of the effects of climate change and ocean acidification on Antarctic and Southern Ocean marine ecosystems. These summaries will be consolidated into a publication for the peer-reviewed literature. This will form an important contribution to the literature that can be used by the IPCC in its 5<sup>th</sup> assessment review.

### **Belgium**

Current projects contributing to the IMBER aims and activities include the following:

- Biogeochemical Cycles in the Southern Ocean: Role within the Earth System (BIGSOUTH); [www.belspo.be/belspo/SSD/science/projects/BIGSOUTH.E.pdf](http://www.belspo.be/belspo/SSD/science/projects/BIGSOUTH.E.pdf), funded by BELSPO
- Tracing and Integrated Modelling of Natural and Anthropogenic Effects on Hydrosystems: towards sustainable solutions (TIMOTHY); [www.ulb.ac.be/rech/inventaire/projets/8/PR4168.html](http://www.ulb.ac.be/rech/inventaire/projets/8/PR4168.html), funded by BELSPO
- Remote sensing of turbid waters in the Short Wave Infrared (SEASWIR), funded by BELSPO
- Information System on the Eutrophication of our coastal areas (ISECA); [www.iseca.eu/en](http://www.iseca.eu/en); funded by EC INTERREG IV.A 2 Seas Programme

# 3-24

## IMBER related activities in 2011-2012

- University of Liège hosted the 43<sup>rd</sup> International Liège Colloquium on Ocean Dynamics *Tracers of physical and biogeochemical processes, past changes and ongoing anthropogenic impacts* (May 2011). An IMBER special session was chaired by Javier Aristegui (IMBER SSC Vice Chair), and the 44<sup>th</sup> International Liège Colloquium on Ocean Dynamics - *Remote sensing of colour, temperature and salinity - new challenges and opportunities* (May 2012; <http://modb.oce.ulg.ac.be/colloquium>)
- *Journal of Marine Systems* Special issue on *Tracing and Integrated Modelling of Natural and Anthropogenic Effects on Hydrosystems: The Scheldt River Basin and Adjacent Coastal North Sea* (Guest editors: C. Lancelot, E. Deleersnijder and N. Gypens)
- *Journal of Marine Systems* Special issue on *Traces and Tracers: Selected papers from the Joint Liège Colloquium on Ocean Dynamics – Bonus-GoodHope – GEOTRACES meeting* (Guest editors: Bob Anderson, Bruno Delille, Marilaure Grégoire, Catherine Jeandel, Sabrina Speich)
- Alberto Borges is actively contributing as an Associate Member to the Implementation Plan of the IMBER-LOICZ CMWG.

## Future plans

University of Liège will host the 45<sup>th</sup> International Liège Colloquium on Ocean Dynamics *The variability of primary production in the ocean: from the synoptic to the global scale* (13-17 May 2013). Javier Aristegui will lead an IMBER special session.

## Brazil

The IMBER-endorsed project *Materials transfer through the continent-sea interface* (INCT-TMCOcean) ([www.inct-tmcocean.com.br](http://www.inct-tmcocean.com.br)), aims to quantify transport, alterations and fate of sediments, nutrients, organic matter and trace metals from the continent to the ocean on the northeast Brazilian continental shelf, and to investigate the relationships between that transport and biological processes. Results are relevant for building scenarios for the sustainable development of coastal areas in the light of climate change, both at regional and global scales.

## Examples of 2011 peer-reviewed publications

- Maioli, O.L.; Rodrigues, K.C.; Knoppers, B.A. & Azevedo, D.A. 2011. Distribution and sources of aliphatic and polycyclic aromatic hydrocarbons in suspended particulate matter in water from two Brazilian estuarine systems. *Continental Shelf Research*, 31: 1116-1127.
- Sifeddine, A.; Meyers, P.A.; Cordeiro, R.C.; Albuquerque, A.L.S.; Bernardes, M.C.; Turcq, B. & Abrão, J.J. 2011. Delivery and deposition of organic matter in surface sediments of Lagoa do Caçó (Brazil). *Journal of Paleolimnology*, 45:385–396.
- Gomes, F.C.; Godoy, J.M.; Godoy, M.L.D.P.; Carvalho, Z.L.; Lopes, R.T.; Sanchez-Cabeza, J.A.; Osvath, I. & Lacerda, L.D. 2011. Geochronology of anthropogenic radionuclides in Ribeira Bay sediments, Rio de Janeiro, Brazil. *Journal of Environmental Radioactivity* 102: 871-876.

- Dias, F.J.S.; Lacerda, L.D.; Marins, R.v. & De Paula, F.C.F. 2011. Comparative analysis of rating curve and ADP estimate of instantaneous water discharge through estuaries in two contrasting Brazilian rivers. *Hydrological Processes* 25: 2188–2201.
- Carreira, R.S.; Araújo, M.P.; Costa, T.L.F.; Sporn, G. & Knoppers, B.A. 2011. Lipids in the sedimentary record as markers of the sources and deposition of organic matter in a tropical Brazilian estuarine-lagoon system. *Marine Chemistry* 127: 1-11
- Rudoff, N.M.; Kampei, M. & Rezende, C.E. 2011. Spectral mapping of the Paraíba do Sul River plume (Brazil) using multitemporal Landsat images. *Journal of Applied Remote Sensing* 5(1): 1-19.
- Di Benedetto, A.P.M.; Souza, C.M.M.; Kehrig, H.A.; Rezende, C.E. 2011 Use of multiple tools to assess the feeding preference of coastal dolphins. *Marine Biology* 158: 2209–2217.
- Melo-Magalhães, E.M.; Moura, A.N.; Medeiros, P.R.P.; Lima, E.L.R. & Koenig, M.L. 2011. Phytoplankton of the São Francisco river estuarine region (Northeastern Brazil): a study of its diversity. *Brazilian Journal of Aquatic Sciences and Technology*, 15(1): 95-105.
- Silva, M.V.N.; Sial, A.N.; Ferreira, V.P.; Neumann, V.H.; Barbosa, J.A.; Pimentel, M.M. & Lacerda, L.D. 2011. Cretaceous-Paleogene Transition at the Paraíba Basin, Northeastern, Brazil: Carbon-Isotope and mercury subsurface stratigraphy. *Journal of South American Earth Sciences* 32: 379-392.
- Azevedo, J.S.; Braga, E.S.; Favaro, D.T.; Perretti, A.R.; Rezende, C.E. & Souza, C.M.M. 2011. Total mercury in sediments and in Brazilian Ariidae catfish from two estuaries under different anthropogenic influence. *Marine Pollution Bulletin* 62: 2724-2731.
- Costa, T.L.F.; Araújo, M.P.; Knoppers, B.A.; Carreira, R.S. 2011. Sources and distribution of particulate organic matter of a tropical estuarine-lagoon system from NE Brazil as indicated by lipid biomarkers. *Aquatic Geochemistry*, 17: 1-19.

### **Future perspectives of new Brazilian IMBER endorsed projects**

Between 2009 and 2011, government agencies substantially increased funds for oceanographic research in Brazil and a number of multi-disciplinary oceanographic surveys were conducted over the south and southeastern Brazilian continental shelf. New oceanographic vessels will be available soon for research and new mooring sites with continuous biological measurements are also expected and partially funded. It is anticipated that at least two new projects will apply for IMBER endorsement in 2012.

### **France**

Key initiatives contributing to the investigation of the sensitivity of marine biogeochemical cycles and ecosystems to global change, on time scales ranging from years to decades:

- CYcles Biogéochimiques, Ecosystèmes et Ressources (CYBER); [www.insu.cnrs.fr/lefe/cycles-biogeochimiques-environnement-et-ressources-cyber](http://www.insu.cnrs.fr/lefe/cycles-biogeochimiques-environnement-et-ressources-cyber); until 2015. Scientific activities within CYBER are organized in four foci, some being the French counterpart of international programmes (IMBER, SOLAS, and GEOTRACES). The first focus is a French contribution to IMBER and deals with the ecosystem structure, functional diversity, ecosystem functioning and biogeochemical cycles and trophic transfers in the ocean. For information about CYBER see:



[www.insu.cnrs.fr/co/files/rendu\\_cyber.pdf](http://www.insu.cnrs.fr/co/files/rendu_cyber.pdf) and [www.insu.cnrs.fr/co/prospectives/oa/2010/cycles-biogeochimiques-environnement-et-ressources](http://www.insu.cnrs.fr/co/prospectives/oa/2010/cycles-biogeochimiques-environnement-et-ressources)

- Marine Ecosystems Response in the Mediterranean Experiment (MERMEX) (<http://mERMEX.com.univ-mrs.fr>) is dedicated to biogeochemical cycles and the structure and functioning of the Mediterranean marine ecosystem. Key publication: MERMEX Group, F., 2011. Marine Ecosystems Responses to climatic and anthropogenic forcings in the Mediterranean. *Progress in Oceanography*, 2, 91: 97-166.
- Earth, Ocean, Continental Surfaces and Atmosphere (TOSCA) ([www.cnes.fr/web/CNES-en/7454-earth-sciences.php,2011-2015](http://www.cnes.fr/web/CNES-en/7454-earth-sciences.php,2011-2015)) has an ocean component that funds projects dedicated to the understanding of ocean primary productivity from sub-mesoscale to basin scale in coastal and open ocean, based on the use of the satellite images from different spatial missions.

### Related projects supported by national programmes

- Biogeochemistry and Optics South Pacific Experiment (BIOSOPE)
- [www.obs-vlfr.fr/proof/vt/op/ec/biosope/bio.htm](http://www.obs-vlfr.fr/proof/vt/op/ec/biosope/bio.htm). IMBER-endorsed (2001-2011)
- Biogeochemistry from the Oligotrophic to the Ultraoligotrophic Mediterranean (BOUM) [www.com.univ-mrs.fr/BOUM](http://www.com.univ-mrs.fr/BOUM). IMBER-endorsed (2006-2011). BOUM special issue in *Biogeosciences Discussion* ([http://www.biogeosciences-discuss.net/special\\_issue63.html](http://www.biogeosciences-discuss.net/special_issue63.html)) in late 2012.
- Pressure effects On marines prokaryotes (POTES) - IMBER-endorsed project. [www.com.univ-mrs.fr/LMGEM/potes](http://www.com.univ-mrs.fr/LMGEM/potes)
- Toward AN eddying Global Green Ocean (TANGGO). [www.tanggo.grenoble.cnrs.fr/web](http://www.tanggo.grenoble.cnrs.fr/web)
- Etude in situ de l'impact de la diversité biologique sur la reminéralisation de la matière organique à l'interface eau-sédiment (BIOMIN). <http://www.epoc.u-bordeaux.fr/index.php?lang=en&page=eqecobiocprojets>
- Observations du zooplancton et micronecton dans la zone économique calédonienne pour mieux comprendre la distribution du thon germon (NECTALIS).
- Les Patterns de la Répartition Spatio-Temporelle du Phytoplancton dans l'Océan: Caractérisation par une Nouvelle Approche Observationnelle (BIOPATTERNS). <http://wwz.ifremer.fr/lpo/SO-Argo-France>.
- Novel Argo Ocean observing System (NAOS) <http://wwz.ifremer.fr/naos/Argo>
- Kerguelen Ocean and Plateau compared Study KEOPS2) [www.obs-vlfr.fr/keops2](http://www.obs-vlfr.fr/keops2)
- Impact of climate change on the fate of terrestrial carbon exported to the Arctic Ocean, on the photosynthetic production of organic carbon, and on microbial diversity (MALINA). [www.obs-vlfr.fr/Malina](http://www.obs-vlfr.fr/Malina)

### National Projects started in 2012

- Variability of vertical and tropHic transfer of fixed N<sub>2</sub> in the southwest Pacific and potential impact on the oceanic carbon pump (VAHINE). Contact: Sophie Bonnet (MIO)

- Dissolved Organic matter composition and degradation in the ocean (DORADE). Contact: Panagiotopoulos Christos (MIO)
- OCEANS-C13. Contact: Lo Monaco (LOCEAN)
- A MACROscope for Oceanic Earth System (MACROES) [www.macroes.ird.fr](http://www.macroes.ird.fr)

### **Projects supported by European programmes and coordinated in France**

European Project on Ocean Acidification (EPOCA), [www.epoca-project.eu](http://www.epoca-project.eu). This EU FP7 funded, IMBER-endorsed project, ended in May 2012. EPOCA generated a large amount of critical data. Since the launch of the project, there have been more than 170 publications. A major product was the book “Ocean Acidification” (September 2011), edited by J.-P. Gattuso and L. Hansson and with contributions from many EPOCA scientists.

EUR-OCEANS Consortium (EUR-OCEANS), [www.eur-oceans.eu](http://www.eur-oceans.eu), favours joint initiatives between key research and funding organisations across Europe, to help the community to make significant advances in marine science. The focus of the Consortium is on the impact of climate/global change on marine ecosystems and biogeochemical cycles, and the construction of scenarios relevant to the emerging International Platform on Biodiversity and Ecosystem Services (IPBES).

Other European projects with French contributions: **MedSeA**, <http://medsea-project.eu/> (endorsed by IMBER), **CARBOCHANGE**, <http://carbochange.b.uib.no> (endorsed by IMBER); **EURO-BASIN** from the International Basin-scale Analysis, Synthesis and Integration (BASIN) Programme, <http://na-basin.org>; **MEECE** [www.meece.eu](http://www.meece.eu); **PERSEUS**, [www.perseus-net.eu](http://www.perseus-net.eu)

### **Key IMBER-related meetings in 2011-2012**

Colloquium on *Coastal ecosystems vulnerability to global change and extreme events*, October 2011, Biarritz. [http://www.ifremer.fr/biarritz\\_2011\\_eng/](http://www.ifremer.fr/biarritz_2011_eng/)

TOSCA colloquium organized by CNES, March 2012, Paris, <http://cnes.cborg.fr/TOSCA>

### **Germany**

#### **Geochemistry and Ecology of the Namibian Upwelling System (GENUS)**

<http://genus.zmaw.de>

After a successful first phase (2009-2012), the GENUS project (funded by BMBF, the German Federal Ministry for Education and Research) has been extended until 2015. GENUS requests for ship time on large German research vessels off southwest Africa have been approved for oceanography following positive evaluation. In addition to the existing cooperation with Namibia, further cooperation with South Africa and Angola is being established with the *Science Partnerships for the Assessment of Complex Earth System Processes in southern Africa* (SPACES) Programme ([www.ptj.de/wtz-suedliches-afrika](http://www.ptj.de/wtz-suedliches-afrika)).

### **Biological Impacts of Ocean ACIDification (BIOACID) [www.bioacid.de](http://www.bioacid.de)**

The first three-year phase of the BIOACID project (funded by BMBF, the German Federal Ministry for Education and Research) ended on 31 August 2012. The results of BIOACID research, as well as those of the international partner programs EPOCA, UKOARP and MedSeA, show the growing evidence of potential biological impacts of ocean acidification. They affirm that this global change phenomenon may pose a serious threat to marine organisms and ecosystems. Despite a wealth of knowledge on specific effects of acidification and the related changes in seawater chemistry on the physiology of individual marine taxa, many uncertainties still remain. Because the majority of studies are based on single-species experiments, little is currently known about possible impacts on natural communities, food webs and ecosystems. Few studies have addressed possible interacting effects of environmental changes occurring in parallel, such as ocean acidification, warming, and deoxygenation and changes in surface layer stratification and nutrient supply. Almost completely unknown at present is the potential for evolutionary adaptation to ocean acidification. To pave the way for a more encompassing assessment of future biological responses to ocean change and their possible socio-economic consequences Phase 2 of BIOACID (09/2012 – 08/2015) will include the following:

- Strengthen the integration within the BIOACID community to allow for more realistic community-level experimentation and field observation
- Focus more on interacting affects through multiple stressors
- Expand evolutionary biology to assess the potential for adaptation of key taxa
- Integrate socio-economic assessments and stakeholder involvement
- The overarching focus of BIOACID II will be to address and better understand the chain from biological mechanisms, through individual organism responses, through food web and ecosystem effects, to economic impacts.
- BIOACID has been extended for a second 3-year phase starting on 1 September 2012. Building on the knowledge gained during Phase 1, BIOACID II will aim at community-level responses to ocean acidification, their ecosystem and biogeochemical consequences and socio-economic impacts.

### **India**

The national **Sustained Indian Ocean Biogeochemical and Ecological Research** (SIBER, [www.incois.gov.in/Incois/siber/siber.jsp](http://www.incois.gov.in/Incois/siber/siber.jsp)) programme, supported by the Ministry of Earth Sciences (MoES), has been continued. Internationally, SIBER is jointly endorsed and supported by IMBER and IO-GOOS (Indian Ocean Global Ocean Observing System). Its Science Plan and Implementation Strategy was published in 2011. The 2<sup>nd</sup> SIBER SSC meeting was hosted by the National Institute of Ocean Technology, Chennai, in July 2011. The Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, now hosts SIBER's International Project Office. SIBER-India consists of 14 projects that are clustered under two groups as summarized below.

#### Open-Ocean Cluster

- 1) Long-term monitoring of oceanographic, biogeochemical and ecological processes in the North Indian Ocean through establishment of open-ocean time series stations in the Arabian

Sea and Bay of Bengal. Contact: S.W.A. Naqvi, National Institute of Oceanography (NIO), Goa.

- 2) Elucidation of long-term changes in microbial communities in intensely denitrifying and oligotrophic environs through metagenomic analyses. Contact: N. Ramaiah, NIO, Goa.
- 3) Flow of matter through trophic levels and biogeochemical cycles in marine and estuarine ecosystems. Contact: Sujitha Thomas, Central Marine Fisheries Research Institute, Mangalore.
- 4) Particulate organic carbon export flux from upper Arabian Sea and Bay of Bengal using  $^{234}\text{Th}$  as a tracer. Contact: R. Rengarajan, Physical Research Laboratory, Ahmedabad.
- 5) The role of anaerobic ammonium oxidation (anammox) in nitrogen-loss from the Arabian Sea. Contact: R. Ramesh, Physical Research Laboratory, Ahmedabad.
- 6) Modelling of marine biogeochemical cycles in the Indian Ocean. Contact: M.K. Sharada, CSIR Centre for Mathematical Modelling and Computer Simulation, Bangalore.

#### Estuaries & Coasts Cluster

- 1) Dynamics of selected biogenic elements in Indian estuaries – A case study of the Mandovi–Zuari estuarine system. Contact: S.W.A. Naqvi, NIO, Goa.
- 2) Assessing macro and meiobenthic diversity off Goa Coast with special emphasis on OMZ. Contact: C. Annapurna, Andhra University, Visakhapatnam.
- 3) Atmospheric deposition and its influence on nutrients in coastal waters of Goa - West coast of India. Contact: Vishnu Murty Matta, Goa University.
- 4) Assessing the anthropogenic impact on south-west coast of India. Contact: B.R. Manjunatha, Mangalore University.
- 5) Role of heterotrophic bacteria and cyanobacteria in the nitrogen cycle in the Cochin estuary and coastal waters with special reference to nitrification, denitrification and nitrogen fixing capabilities. Contact: A.A. Mohamed Hatha, Cochin University of Science and Technology, Cochin.
- 6) Time-Series studies on the biogeochemical aspects in the estuarine and coastal waters of Kochi, southwest coast of India. Contact: V.N. Sanjeevan, Centre for Marine Living Resources and Ecology, Kochi.
- 7) Hydro-biological studies of Vellar–Coleroon estuarine system. Contact: T. Balasubramanian, Centre of Advanced Study in Marine Biology, Annamalai Univ., Parangipettai, Tamilnadu.
- 8) Biogeochemical dynamics of the Hooghly-Matla estuarine systems along the northeast coast of the Bay of Bengal, India. Contact: S. K. Mukhopadhyay, University of Calcutta.

Regular cruises have been planned to two time-series locations – the Arabian Sea and Bay of Bengal. The observations in the coastal regions are proceeding as planned. However, there are problems in operation/maintenance of the two open ocean time-series sites. There are two major constraints. First, the MoES research ships are overcommitted, and so sufficient ship time is not available for SIBER projects. Secondly, in the case of the Arabian Sea, piracy is a major issue.

Two new projects proposed by the National Institute of Oceanography (NIO) are (1) Ocean Science Toward Forecasting Indian Marine Living Resource Potential, and (2) Indian Aquatic Systems: Impact of Deoxygenation, Eutrophication and Acidification. Although, formal approval

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is yet to be obtained, these projects are likely to provide the main thrust for addressing IMBER-relevant issues in the Indian Ocean region.

## Japan

### 1. Research Cruises

A research cruise entitled *Comparative oceanography between the North and South Pacific related to biogeochemical processes and biological communities in the subtropical systems* was conducted during December 2011 - January 2012 in the subtropical and tropical Pacific on the R/V *Hakuho-maru* (KH-11-10, Contact: K. Furuya). The cruise gathered 30 scientists related to SOLAS and IMBER. Detailed distributions and fluxes of a variety of chemical and biological parameters within the oligotrophic region in the both North and South Pacific should be obtained and compared.

Another research cruise related to IMBER took place in July-August 2012 in the western North Pacific, on board R/V *Hakuho-maru* (KH-12-3, P.I. Dr. H. Ogawa).

### 2. Symposia

*Comparative oceanography in the subtropical Pacific related to plankton communities and biogeochemical cycles*, October 2011, Tokyo - convenors: K. Furuya and H. Saito.

**Recent findings and future challenges of IMBER-Japan activities**, June 2012, Tokyo - [www.aori.u-tokyo.ac.jp/english/aori\\_news/meeting/2012/20120604.html](http://www.aori.u-tokyo.ac.jp/english/aori_news/meeting/2012/20120604.html) - convenors: H. Ogawa and H. Saito.

These symposiums were organized mainly by the IMBER-Japan community. Speakers from various disciplines including physics, chemistry, and biology presented the latest knowledge of biogeochemical cycles and plankton ecosystems in Pacific Ocean from each viewpoint.

### 3. Funding

A proposal entitled *A New Image of the Ocean – the function and the sustainable use* was submitted by a mainly IMBER-related group in Japan including both the natural and the social sciences (contact: K. Furuya) to a large-scale research fund - *Scientific Research on Innovative Area* - sponsored by Ministry of Education, Culture, Sports, Science and Technology. The proposal was successful and the project has been funded for five years (2012-2016).

## Korea

IMBER-related Korean research activities have been extended from coastal and marginal seas to the open ocean. Most of these activities are focused on the first two IMBER research themes - *Interactions between biogeochemical cycles & food webs* and *Sensitivity to Global Change*. On-going IMBER-related research projects include the following:

- Korea East Asian Seas Time-series (EAST) – 1 (2006-2015), <http://east-1.snu.ac.kr/intro/index.php>
- Understanding the mechanisms of the East Sea ecosystem changes (2011-2016)
- Assessment of climate impact on marine ecosystem of the south sea of Korea (2008-2013)
- Study of the physical dynamics of the Yellow Sea bottom cold water and its impact on the ecosystem (2009-2014)
- Long-term change of structure and function in marine ecosystems of Korea (LTMER-KOREA) (2011-2016)
- Northwestern Pacific Ocean Study on Environment & Interactions between Deep Ocean & marginal seas (POSEIDON) (2006-2015)

These projects are being conducted to identify, quantify and model the physical and biogeochemical processes responding to climate variability and their linkage to changes in the marine ecosystems of Korean waters (Yellow Sea, East/Japan Sea, East China Sea, etc.). Real-time monitoring data of meteorological and oceanic parameters including  $p\text{CO}_2$  have been provided from three surface monitoring buoys launched in East/Japan Seas, the southern coastal seas and tropical Pacific through these projects. Multidisciplinary research cruises have been carried out in Korean waters and the north western Pacific by Korea Institute of Ocean Science & Technology (KIOST), previously KORDI, [http://eng.kiost.ac/kordi\\_eng/main/](http://eng.kiost.ac/kordi_eng/main/) since July 2012. Results from these projects have been presented at various international and regional conferences, such as 2<sup>nd</sup> ICES/PICES/IOC International Symposium on *Effects of Climate Change on the World's Oceans* (May 2012, Yeosu, Korea, [www.pices.int/meetings/international\\_symposia/2012/Yeosu/sci\\_program.aspx](http://www.pices.int/meetings/international_symposia/2012/Yeosu/sci_program.aspx)).

### **Namibia**

The Northern Benguela upwelling system off Namibia continues to attract scientific interest due to the extremes in environment and the often unpredictable behaviour of this important system that supports a cornerstone fishery industry. Regrettably Namibia's own capacity for research into large-scale aspects of relevance to IMBER within the northern Benguela is limited due to difficulty in obtaining appropriate ship-time for the local research vessels and the lack of sophisticated sampling equipment and analytical capabilities. Such investigations are predominantly carried out by foreign scientists. However, interesting in-house inshore research includes the influence of nutrient ratios on phytoplankton blooms with special focus on toxic dinoflagellates; the biology of local jellyfish species, and biodiversity studies on littoral and benthic invertebrate species. Exciting collaborative research with Norwegian colleagues has provided interesting information about the Bearded Goby, a fish species well suited to the Namibian benthic environment.

In the first half of 2011 Namibia was honoured by sabbatical visits from distinguished scientists Prof. Lisa Levin and Prof. Dave Checkley, both from Scripps Institution of Oceanography, and Prof. Anne-Gro Salvanes from the University of Bergen. They were based at the National Marine Information and Research Centre NatMIRC of the Namibian Ministry of Fisheries and Marine Resources, at Swakopmund. Their time with Namibian scientists and students enhanced our

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understanding of benthic ecology, fisheries dynamics and fish behavior. The visits allowed direct exposure to acknowledged experts in fields of marine science that are largely neglected in Namibia because national marine research is mainly fisheries-driven, with limited opportunity to extend into academic fields, and lacking in sophisticated amenities. The spectrum of activities carried out during their visits included the initiation of new projects, teaching activities to students of the University of Namibia, and weekly seminars at NatMIRC

Two German-initiated and -funded partnerships are currently running in Namibia:

- Science Partnerships for the Assessment of Complex Earth System Processes (SPACES) Projects involving Namibia will be funded under the SPACES-Declaration signed by the BMBF, Germany and the MoE, Republic of Namibia, on October 28, 2010. The first call for projects went out early January 2012. Under the SPACES programme, the RV *Maria S Merian* was used to carry out a Training and Capacity Building Cruise in Namibian waters in September and October 2011 for researchers and students from ten different African countries and Germany. This was coordinated through the University of Namibia's Sam Nujoma Marine and Coastal Research Centre SANUMARC. The aim of this cruise was to contribute to better understanding of the Benguela Current Ecosystem, thereby fostering cooperation by helping to set up partnership projects in research and development.
- The Geochemistry and Ecology of the Namibian Upwelling System (GENUS) project started in 2009 and is endorsed by IMBER and the Census of Marine Life (CoML) and CMarZ (Census of Marine Zooplankton) initiatives. GENUS builds on the previous regional Benguela Environment Fisheries Interaction and Training (BENEFIT), 1997-2007 and the Benguela Current Large Marine Ecosystem (BCLME). These initiatives fostered fruitful cooperation with research institutions in the Benguela region (South Africa, Namibia and Angola). Cruise MSM 17/3 onboard RV *Maria S Merian* was dedicated to the GENUS project and represented the third field campaign within this project since 2009. The research focused on the northern Benguela region under low to moderate upwelling conditions during austral mid-summer and aimed to clarify linkages between climate change, biogeochemical cycles of nutrients, and ecosystem structure.

## **New Zealand**

The second *New Zealand Fisheries Oceanography* voyage was successfully completed in November 2011 ([www.niwa.co.nz/fisheries-oceanography-ii-chatham-rise-tan1116-voyage-log](http://www.niwa.co.nz/fisheries-oceanography-ii-chatham-rise-tan1116-voyage-log)). The 21-day research voyage on board RV *Tangaroa* focused on measuring the abundance, distribution and trophic connections of key mid-trophic level taxa in the Chatham Rise region of New Zealand. Key mid-trophic level taxa studied included meso- and macrozooplankton, mesopelagic fish (especially myctophids), squid, larval and juvenile fish, and hyperbenthic invertebrates (especially shrimps and prawns).

In February 2012, a cruise of the *Surface Ocean Aerosol Processes* (SOAP), [www.niwa.co.nz/atmosphere/projects/soap](http://www.niwa.co.nz/atmosphere/projects/soap) took place on board RV *Tangaroa* to study relationships between ocean productivity, sulphur biogeochemistry, air-sea gas exchange and

aerosol formation, again over the Chatham Rise, to understand the role ocean processes play in cloud formation and climate.

In the coastal zone of New Zealand, the multi-disciplinary *Taking Stock* project (contact: Alison MacDiarmid, NIWA), developed five balanced end-to-end ecosystem models representing the food-web of the Hauraki Gulf in five periods through history: (1) present day; (2) 1950 AD, just prior to onset of industrial-scale fishing; (3) 1790 AD, before European whaling and sealing; (4) 1500 AD, early Maori settlement phase; (5) 1000 AD, before human settlement in New Zealand. The models show how the structure and function of these New Zealand shelf ecosystems are likely to have changed during human occupation in response to climate variation and human activities such as fishing.

The *Ross Sea food-web modelling: Data from the New Zealand International Polar Year-Census of Antarctic Marine Life* voyage to the Ross Sea in 2008 has continued to provide insights into the feeding of key biota, and overall trophic relationships in the Ross Sea region of Antarctica.

Other work in New Zealand over the last year includes research on the effects of ocean acidification on plankton in New Zealand waters, including research on coccolithophore blooms.

### **Russia**

The Laboratory of Arctic Research (contact: Igor Semiletov), Laboratory of Physical Oceanography (contact: Vyacheslav Lobanov) and Hydrochemistry Laboratory (Pavel Tishchenko), of the Pacific Oceanological Institute (POI) carry out IMBER-related studies.

### **Arctic Study**

During the past year, two international expeditions to the east Arctic region of Russia were carried out. In these expeditions, the drilling of the underwater permafrost of the Laptev Sea to a depth of 65 m occurred, in April 2011. The first results about the structure of the sediments of Laptev Sea using paleo- and biomarkers suggest the existence of methane flux from sediments to the seawater and then to the atmosphere. For the first time, it is shown that terrestrial organic matter caused by erosion of soil is the dominant source of organic matter to the Russian Arctic Seas (Laptev Sea, East Siberian Sea). These seas are a source of CO<sub>2</sub>. Mechanisms of seasonal variability of CO<sub>2</sub> emission by Arctic Seas were investigated. Peculiarities of the distributions of carbonate system parameters in the Arctic Seas were studied in these expeditions. Methane fluxes were observed by means of bubbles from the sea to the atmosphere using sonic methods. Emission fields of methane were studied in detail.

### **Laboratory of Arctic Research's publications related to IMBER research**

Charkin A.N., Dudarev O.V., Semiletov I.P., Kruhmalev A.V., Vonk J.E., Sánchez-García L., Karlsson E., and Ö. Gustafsson (2011). Seasonal and interannual variability of sedimentation and organic matter distribution in the Buor-Khaya Gulf: the primary recipient of input from Lena River and coastal erosion in the southeast Laptev Sea. *Biogeosciences*, 8, 2581-2594, doi:10.5194/bg-8-2581-2011;



- Semiletov I.P., Pipko I.I., Shakhova N.E., Dudarev O.V., Pugach S.P., Charkin A.N., McRoy C.P., Kosmach D., and Ö. Gustafsson (2011). Carbon transport by the Lena River from its headwaters to the Arctic Ocean, with emphasis on fluvial input of terrestrial particulate organic carbon vs. carbon transport by coastal erosion. *Biogeosciences*, 8, 2407-2426, doi:10.5194/bg-8-2407-2011;
- Sánchez-García L., Alling V., Pugach S., Vonk J., van Dongen B., Humborg C., Dudarev O., Semiletov I., and Ö. Gustafsson (2011). Distribution, sources and inventories of particulate organic carbon in the Laptev and East Siberian Seas. *Global Biogeochemical Cycles*, 25, GB2007, doi: 10.1029/2010GB003862;
- Karlsson, E.S., Charkin, A., Dudarev, O., Semiletov I., Vonk, J.E., Sánchez-García, L., Andersson, A., and Gustafsson Ö. (2011). Carbon isotopes and lipid biomarker investigation of sources, transport and degradation of terrestrial organic matter in the Buor-Khaya Bay, SE Laptev Sea. *Biogeosciences*, 8, 1865-1879, doi:10.5194/bg-8-1865-2011;
- Gustafsson Ö., van Dongen B.E., Vonk J.E., Dudarev O.V., and I.P. Semiletov (2011). Widespread release of old carbon across the Siberian Arctic echoed by its large rivers. *Biogeosciences*, 8, 1737-1743, doi: 10.5194/bg-8-1737-2011.
- Pipko I.I., Semiletov I.P., Pugach S.P., I. Wählström, and Anderson L.G. (2011). Interannual variability of air-sea CO<sub>2</sub> fluxes and carbon system in the East Siberian Sea. *Biogeosciences*, 8, 1987-2007, doi:10.5194/bg-8-1987-2011;
- Anderson, L.G., Björk, G., Jutterström, S., Pipko, I., Shakhova, N. Semiletov, I. and Wählström, I. (2011). East Siberian Sea, an Arctic region of very high biogeochemical activity. *Biogeosciences*, 8, 1745-1754, doi:10.5194/bg-8-1745-2011

### **Shelf of Peter the Great Bay (Japan Sea) Study**

The laboratories of Physical Oceanography and Hydrochemistry of POI collaborate in the study of biogeochemical processes in estuarial and coastal areas near Vladivostok, in two programmes: *Seasonal hypoxia of Peter the Great Bay (Japan Sea)* and *Production/destruction processes in estuaries of rivers of Peter the Great Bay (Japan Sea)* supported by the Russian Foundation for Basic Research (RFBR). Four hydrochemical expeditions were carried out to study the seasonal variability of the hydrochemical properties of the waters of Ussuriyskiy Bay and estuaries of Artemovka, Shkotovka and Razdolnaya Rivers. It was established that Artemovka and Knevichanka Rivers are significant contributors of nutrients into Ussuriyskiy Bay. During the summer high eutrophication of Knevichanka and Artemovka Rivers results in a bloom in Murovinaya Bight. This exhibits extremely high values of pH (9) and extremely low values of carbon dioxide partial pressure (30 µatm). Ussuriyskiy Bay is a sink for atmospheric carbon dioxide during winter, spring and autumn seasons. A hydrochemical mooring with sensors of temperature, conductivity, pressure, dissolved oxygen, turbidity of inorganic particles, chlorophyll fluorescence, and optical sensors - TRIPLET-ECO, was deployed in the Amurskiy Bay. Using this approach the assessment of eutrophication status of Amurskiy Bay was characterized as high.

### Hydrochemistry Laboratory's publications related to IMBER research

- Khodorenko N.D., Volkova T.I., Zvalinskii V.I., and Tishchenko P. Ya (2012). Extraction Kinetics and Quantitative Analysis of Bottom Sediments for Humic Substances. *Geochemistry International*, 50(4), 385-391.
- Tishchenko P. Ya., Pavlova G. Yu., and Shkirknikova E.M. (2012). A New Look at the Alkalinity of the Sea of Japan. *Oceanology*, 52(1), 21-33.
- Dong-Jin Kang, P.Y. Tishchenko, Hyun Kahng (2011). On board Comparison of Total Hydrogen Ion Concentration (pH) and Total Alkalinity measurements in Seawater. *J. Korean Soc. Mar. Envir. Eng.*, 14(3), 205-211
- Tishchenko P. Y., Dong-Jin Kang, R.V. Chichkin, A.Yu. Lazaryuk, Chi Shing Wong, W.K. Johnson (2011). Application of potentiometric method using a cell without liquid junction to underway pH Measurements in surface seawater. *Deep-Sea Res. I*, 58, 778-786.
- NOWPAP CEARAC 2011: Integrated Report on Eutrophication Assessment in Selected Sea Areas in the NOWPAP Region: Evaluation of the NOWPAP Common Procedure ISBN 978-4-9902809-5-6.
- Tishchenko P. Ya., Pavlova G. Yu., Shkirknikova E.M. (2012). Alkalinity of the Japan/East Sea // Ecosystem status report of the Japan Sea. Canada. PICES. (accepted).
- Tishchenko P. Ya., Pavlova G. Yu., Shkirknikova E.M. (2012). Peculiarities in distribution of the N:P ratio in seawater of the Japan/East Sea // Ecosystem status report of the Japan Sea. Canada. PICES. (accepted).

### Spain

Five ongoing national or international projects coordinated in Spain are currently endorsed by IMBER: (i) **Circumnavigation Expedition Malaspina 2010: Global change and biodiversity exploration of the global ocean (MALASPINA 2010)**, led by Carlos M. Duarte; (ii) **Coastal ocean microbial plankton and temperature (COMITE)**, led by Xosé Anxelu Gutiérrez Morán; (iii) **Mediterranean Sea acidification in a changing climate (MedSeA)** led by Patrizia Ziveri; (iv) **Deep-water submarine canyons and slopes in the Mediterranean and Cantabrian seas: from synchrony of external forcings to living resources (DOS MARES)**, led by Miquel Canals; and (v) **Aerosol deposition and ocean plankton dynamics (ADEPT)**, led by Franz Peters. Information about these projects may be found through links at the IMBER web site.

Although Spain does not have a national IMBER programme, several projects funded in the 2011 call of the National Subprogram of Marine Science and Technology are closely related to IMBER goals. We have selected ten projects of this call that deal with IMBER scientific goals. They have received about 42% of the 5.42 M€ distributed by the subprogram in 2011 (ship time not included), and obtained additional funds of about 1.10 M€ for training of nine PhD students.

- Aerosol deposition and ocean plankton dynamics (ADEPT), led by Franz Peters (CSIC, Barcelona).
- Topics in copepod ecology: understanding ecophysiological key factors that regulate copepod populations, led by Enric Saiz Sendrós (CSIC, Barcelona).
- Sources of organic matter and functional diversity of microplanktonic communities in deep North Atlantic waters (MODUPLAN), led by Marta Varela (IEO, A Coruña).

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- Oceanographic impact on the distribution and trophic ecology of wild common octopus paralarvae in a seasonal upwelling area (LARECO), led by Ángel Francisco González González (CSIC, Vigo).
- Dynamics and ecological role of small pelagic fishes in the Northwestern Mediterranean: Energy transfer from planktonic organisms and top predators (**ECOTRANS**), led by Isabel Palomera (CSIC, Barcelona).
- Fluxes of Greenhouse gasses in the Natural Park of the Bay of Cádiz: Interrelation with anthropogenic factors (FLIPA), led by Teodora Ortega Díaz (Univ. of Cádiz).
- Scaling, monitoring and predicting marine plankton metabolism in a changing ocean (SCALAR), led by Pablo Serret Ituarte (Univ. of Vigo).
- Dark-ocean water mass boundaries and mixing zones as "hot spots" of biodiversity and biogeochemical fluxes across the Mediterranean Sea and Eastern North Atlantic (HOTMIX), led by Javier Arístegui Ruiz (Univ. of Las Palmas de Gran Canaria) and Xosé Antón Álvarez Salgado (CSIC, Vigo).
- Response of coastal ecosystems to allochthonous inputs of matter in the context of anthropogenic global environmental change (REIMAGE), led by Emilio Fernández (Univ. of Vigo) and F. Gómez Figueiras (CSIC, Vigo).
- Effect of seawater acidification ( $\text{CO}_2$  and  $\text{HCO}_3^-$  rise) on nutrient uptake by marine phanerogams, led by José A. Fernández (Univ. of Málaga).

## United Kingdom

### Arctic study of ocean acidification impacts has begun

The research is part of the **UK Ocean Acidification (UKOA)** research programme, funded by the NERC, DEFRA and DECC (see [www.nerc.ac.uk/research/programmes/oceanacidification/](http://www.nerc.ac.uk/research/programmes/oceanacidification/)). An Arctic research cruise aboard the RRS *James Clark Ross* gathered thirty researchers from eight laboratories in June-July 2012 to study the effect of ocean acidification on the Norwegian, Barents and Greenland seas. The scientists studied the impact of the changing chemistry on marine organisms and ecosystems, the cycling of carbon and nutrients in the sea and how the sea interacts with the atmosphere to influence climate. Two approaches will be used in this study. Firstly, the researchers looked at how ecosystems vary between areas where the chemistry of seawater is naturally more acidic or alkaline. By contrasting the observations over a range of different conditions, researchers will discover how acidification may affect organisms living in their natural environment, where natural selection and adaptation have had time to play out. The second approach is experimental, using tanks of natural seawater collected from the upper ocean and brought into controlled conditions on deck. This natural seawater was subjected to various levels of  $\text{CO}_2$  that are likely to occur in the future.

### NERC has agreed funding for a programme on shelf sea biogeochemistry

The continental shelf regions have been identified as the most valuable biome on Earth in one recent environmental economic analysis and their value to the UK is particularly high given the scale and economic significance of the UK continental shelf. Continental shelf regions are the sites of major biogeochemical transformations that occur at a scale that affects the whole Earth

system, including carbon storage and denitrification, but we do not understand the controls on these processes and therefore cannot predict how they will change in the future.

### **Arctic Research Programme**

The first phase of a five-year NERC Arctic Research Programme ([www.nerc.ac.uk/research/programmes/arctic/documents/arctic-awards.pdf](http://www.nerc.ac.uk/research/programmes/arctic/documents/arctic-awards.pdf)) is mainly focusing on physical processes with some aerosol studies, with the following projects:

- Arctic Predictability and Prediction On Seasonal to Inter-annual Timescales (APPOSITE)
- Aerosol-Cloud Coupling And Climate Interactions in the Arctic (ACCACIA)
- The Environment of the Arctic: Climate, Ocean and Sea Ice (TEA-COSI)
- Methane and Other Greenhouse Gases in the Arctic - Measurements, Process Studies and Modelling (MAMM)
- Submarine Estimates of Arctic Turbulence Spectra (SEATS)

### **Main UK-centred activities in the Integrating Climate and Ecosystems Dynamics in the Southern Ocean (ICED) programme**

- The British Antarctic Survey (BAS) has led activities to develop integrated analyses of the seasonal dynamics of Southern Ocean ecosystems, which has generated the DSR II volume describing the changing system dynamics between spring, summer and autumn in the Scotia Sea. This is a contribution to the ICED Programme. *DISCOVERY 2010: Spatial and Temporal Variability in a Dynamic Polar Ecosystem* (2012) Edited by Geraint A. Tarling, Peter Ward, Angus Atkinson, Martin A. Collins and Eugene J. Murphy. 59–60, (January 2012), <http://www.sciencedirect.com/science/journal/09670645/59>
- The EUR-OCEANS Consortium developed and funded a Polar Flagship activity led jointly by BAS and the Alfred-Wegener Institute (AWI). This aims to develop analyses of Polar Ecosystem change and generate a European network of polar ocean ecosystem scientists. In conjunction with ICED it is undertaking a synthesis of understanding end-to-end operation of Southern Ocean ecosystems.
- The NERC ‘**Funded International Opportunities**’ Funded Project on ICED begins in July 2012 and will further develop coordination of Southern Ocean ecosystem science activities, including analyses and models to undertake projections of the future state of Southern Ocean ecosystems.
- Over the last year, BAS scientists have contributed to food web modelling activities, including the ICED food web modelling paper that is now published in *Progress in Oceanography*. BAS scientists have also contributed in comparative analyses of the west Antarctic and South Georgia ecosystems. Major progress is being made in data syntheses, modelling and development of projections. UK researchers have contributed in the coordination and development of a number of ICED meetings and workshops, including a major session at the IPY meeting and the second Sentinel meeting in Hobart in early May aimed at understanding the status of Southern Ocean ecosystems.

## **NERC funded responsive mode grants**

A range of individual grant projects of relevance to IMBER have also been funded and we will endeavour to engage the scientists involved with IMBER.

## **USA**

### **OCB Scientific Leadership Changes**

- Scientific steering committee – OCB welcomes five new members, including **Simone Alin** (NOAA/PMEL), **Barney Balch** (Bigelow), **Sonya Dyhrman** (WHOI), **Ricardo Letelier** (OSU), and **Jorge Sarmiento** (Princeton)
- Ocean acidification subcommittee – OCB welcomes four new members, including **Simone Alin** (NOAA/PMEL), **Cathy Pfister** (U Chicago), **Joe Salisbury** (UNH), and **Kim Yates** (USGS)
- Ocean Time-Series Advisory Committee - OCB welcomes five new members, including **John Dunne** (NOAA/GFDL), **Ricardo Letelier** (OSU), **Susanne Neuer** (ASU), **Mary Jane Perry** (U Maine), and **Paul Quay** (UW)

### **Upcoming and Recent Meetings**

- **2012 OCB summer workshop** (July 2012, Woods Hole, MA, [www.whoi.edu/workshops/ocbworkshop2012](http://www.whoi.edu/workshops/ocbworkshop2012)). This year's meeting includes sessions on the following cross-disciplinary themes:
  - Multiple stressors in marine ecosystems
  - Ocean biogeochemistry from satellite data
  - Land-ocean transport and linkages with global change
  - Integrating measurements across multiple time and space scales
  - New observations from an Arctic Ocean in rapid transition
- **International Ocean Acidification Monitoring Workshop** (June 26-28, 2012, Seattle, WA) (Conveners: NOAA Ocean Acidification Program Office, University of Washington, Northwest Association of Networked Ocean Observing Systems (NANOOS))
- **Ocean acidification data management workshop** (March 13-15, 2012, Seattle, WA) (Conveners: NOAA Ocean Acidification Program Office, University of Washington, Northwest Association of Networked Ocean Observing Systems (NANOOS))
- **OCB Scoping Workshop A Biogeochemical Flux program aligned with the Ocean Observatories Initiative** (May 2011, Woods Hole, MA)
- **OCB Ocean Acidification Principal Investigators' Meeting** (March 2011, Woods Hole, MA)

### **Partner Activities and Co-Sponsorships**

- **Joint Scientific Working Groups with U.S. CLIVAR** (2012-2015) – Outcome of joint U.S. CLIVAR/OCB science session at 2011 Summer OCB workshop
- **Oceanic carbon uptake in the CMIP5 models** (Co-Chairs: Annalisa Bracco, Curtis Deutsch, Taka Ito)
- **Heat and carbon uptake by the Southern Ocean** (Co-Chairs: Joellen Russell, Igor Kamenkovich)
- **Coastal Synthesis Activities** with the North American Carbon Program

- **East Coast Regional Team Meeting** (January 19-20, 2012, Gloucester Point, VA)
- **Coastal Synthesis Wiki Site** (updates on regional coastal synthesis activities)
- Articles on regional synthesis activities published in OCB newsletter (east coast, west coast, Gulf of Mexico, Arctic, Great Lakes)
- OCB co-sponsored **SOLAS meeting on nitrogen fixation methods** (Feb. 2012, Kiel, DE)
- OCB providing **travel support for U.S. students to participate in IMBER ClimECO3 summer school**

#### **Education, Public Outreach, Policy**

- OCB publishes **open letter about ocean acidification**, recommending that ocean acidification be considered a key consideration for international decision makers
- **ASLO e-lecture on ocean acidification** (Authors: Richard Feely, NOAA/PMEL, Scott Doney, WHOI)
- OCB provided support for five U.S. students to participate in **Friday Harbor Laboratories summer course Experimental Approaches to Understanding Ocean Acidification** (June-July 2011)
- **OCB ocean fertilization website** cited as a primary informational resource by the USG delegation to the London Convention

#### **Ocean Observing Activities**

- Town Hall at 2012 Ocean Sciences Meeting on Development of Global Autonomous Biogeochemical Observing System (OCB)
- SCOR Working Group Proposal (pending): Quality control procedures for oxygen and other biogeochemical sensors on floats and gliders (Lead PIs: Ken Johnson, MBARI, Arne Körtzinger, IFM-GEOMAR)
- Molecular Methods Pilot Cruise (May 2012, Lead PI: Ginger Armbrust); measurements include inorganic and organic geochemistry, -omics, nitrogen cycling, etc. (outcome of the OCB scoping workshop The molecular biology of biogeochemistry: Using molecular methods to link ocean chemistry with biological activity)

#### **Reports and Publications (OCB and others)**

- **2011 U.S. Carbon Cycle Science Plan** (U.S. Carbon Cycle Science Program), [www.carboncyclescience.gov/USCarbonCycleSciencePlan-August2011.pdf](http://www.carboncyclescience.gov/USCarbonCycleSciencePlan-August2011.pdf)
- OCB Scoping Workshop Report: A Biogeochemical Flux program aligned with the Ocean Observatories Initiative (May 2011, Woods Hole, MA), <http://gbf-ooi.who.edu/>
- OCB Ocean Acidification Principal Investigators' Meeting Report (March 2011, Woods Hole, MA), [www.us-ocb.org/publications/OCB\\_OA\\_PIwkshp2011.pdf](http://www.us-ocb.org/publications/OCB_OA_PIwkshp2011.pdf)
- National Research Council report "Assessing Requirements for Sustained Ocean Color Research and Operations", [https://download.nap.edu/catalog.php?record\\_id=13127](https://download.nap.edu/catalog.php?record_id=13127)

More information available at [www.us-ocb.org](http://www.us-ocb.org).

## FUTURE ACTIVITIES

**IMBER IMBIZO III** will be held at the National Institute of Oceanography (NIO) in Goa, India, 28–31 January 2013. The overall theme is: *The future of marine biogeochemistry, ecosystems and societies. Multi-dimensional approaches to the challenges of global change in continental margins and open ocean systems*. Only 120 participants will be accepted to participate in IMBIZO III. The format of the meeting will be the same as that at previous IMBIZOs – joint plenary and poster sessions and three concurrent, but interacting workshops. The workshop themes are the following:

1. Biogeochemistry-ecosystem interactions on changing continental margins
2. The impact of anthropogenic perturbations on open ocean carbon sequestration via the dissolved and particulate phases of the biological carbon pump
3. Understanding and forecasting human-ocean-human interactions, drivers and pressures, with respect to global change.

For additional information, see: [IMBIZO III](#).

An optional data management workshop, that will consider good data management practices and processes for dealing with both natural- and social science data, will be held prior to IMBIZO III, on 27 January 2012.

The **First IMBER Open Science Meeting (OSM)** will be held in Bergen, Norway, on 23-27 June 2014. The Scientific Organising Committee has been established and planning is underway.

## PUBLICATIONS

There are currently more than 756 peer-reviewed research papers in the IMBER database. In 2011, 83 papers were published and 10 so far in 2012.

### Selected publications

1. Comeau S, Gattuso J-P, Nisumaa A-M, Orr J (2011) Impact of aragonite saturation state changes on migratory pteropods. *Proceedings of the Royal Society B: Biological Sciences* doi:10.1098/rspb.2011.0910.
2. Drinkwater K F (2011) The influence of climate variability and change on the ecosystems of the Barents Sea and adjacent waters: Review and synthesis of recent studies from the NESSAS Project, *Progress in Oceanography* 90, 47-61.
3. Gruber N, Hauri C, Lachkar Z, Loher D, Frolicher T L (2012) Rapid progression of ocean acidification in the California Current system. *Science* 337(6091): 220-223.
4. Mackey A P, Atkinson A, Hill S I, Ward P, Cunningham N J, Johnston N M, Murphy E J (2011) Antarctic macrozooplankton of the southwest Atlantic sector and Bellingshausen Sea: Baseline historical distributions (Discovery Investigations, 1928–1935) related to temperature and food, with projections for subsequent ocean warming, *Deep-Sea Research II* doi:10.1016/j.dsr2.2011.08.011.

5. Mauriac R, Moutin T, Baklouti M (2011) Accumulation of DOC in Low Phosphate Low Chlorophyll (LPLC) area: is it related to higher production under high N:P ratio? *Biogeosciences* 8, 933-950.
6. The Mermex group, Durrieu de Madron X, Guieu C, Sempéré R, et al., (2011) Marine ecosystems' responses to climatic and anthropogenic forcings in the Mediterranean, *Progress in Oceanography* 91, 97-166.
7. Moloney C, St John M, Denman K, Karl D, Köster F, Sundby S, Wilson R (2011) Weaving marine food webs from end to end under global change, *Journal of Marine Systems* 84, 106-116.
8. Murphy, E. J., E. E. Hofmann. 2012. End-to-end in Southern Ocean ecosystems. *Current Opinion in Environmental Sustainability*. 4, 264-271. [Link](#)
9. Renner, A. H. H., S. E. Thorpe, et al. (2012). Advective pathways near the tip of the Antarctic Peninsula: Trends, variability and ecosystem implications. *Deep Sea Research Part I: Oceanographic Research Papers* 63: 91-101. (ICED Programme contribution) [Link](#)
10. Rose K A, Allen J I, Artioli Y, et al. (2011) End-To-End Models for the Analysis of Marine Ecosystems: Challenges, Issues, and Next Steps. *Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science* 115-130.
11. Saba V S, Friedrichs M A M, and the PPARR team (2011) An evaluation of ocean color model estimates of marine primary productivity in coastal and pelagic regions across the globe, *Biogeosciences* 8, 489-503, doi: 10.5194/bg-8-489-2011.
12. Simeon L, Hill, Keeble K, Atkinson A and Murphy E (2011) A food web model to explore uncertainties in the South Georgia shelf pelagic ecosystem, *Deep-Sea Research II* doi:10.1016/j.dsr2.2011.09.001.
13. SIBER Science Plan and Implementation Strategy (2011). IMBER Report No. 4.
14. Nisumaa A-M, Schlitzer R, Hansson L & Gattuso J-P (2012) EPOCA data management activities: a summary. See <http://www.imber.info/index.php/Science/Working-Groups/SOLAS-IMBER-Carbon/Subgroup-3/Publications-and-reports/EPOCA-data-management>

### Special journal issues

*Current Opinion in Environment Sustainability* (July 2012) Aquatic and marine systems. Ian Perry, Alida Bundy and Eileen Hofmann (eds.). Vol 3 Issue 3 : 253-374

### Books and chapters in books/edited volumes:

1. Bell J D, Johnson J E and Hobday A J (2011) Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change. Secretariat of the Pacific Community, Noumea, New Caledonia.
2. Gattuso J-P, Hansson L (eds.) (2011) Ocean Acidification, Oxford University Press. 326pp.
3. Hood R R, Naqvi S W A, Wiggert J D, Landry M R, Rixen T, Beckley L E, Goyet C, Cowie G L, Maddison L M (eds.) (2011) SIBER Science Plan and Implementation Strategy, IMBER Report No. 4.
4. Kleypas, J. A., Anthony, K. R. N. and Gattuso, J.-P. (2011), Coral reefs modify their seawater carbon chemistry – case study from a barrier reef (Moorea, French Polynesia). *Global Change*



## Biology.

5. Miller K, Golubtsov P and McKelvey R (2011) Fleets, Sites and Conservation Goals: Game Theoretic Insights on Management Options for Multinational Tuna Fisheries, in Rosemary Ommer, Ian Perry, Philippe Cury, Kevern Cochrane (Eds.), *World Fisheries: a Social-Ecological Analysis*, Chapter 4: 60-88.
6. Moutin T, Prieur L, Jeanthon C, Borges A V (eds.) (2011) Biogeosciences Special issue in Vol 8 (10 papers): Interactions between planktonic organisms and the biogeochemical cycles of biogenic elements in the Mediterranean Sea during intense summer stratification: the BOUM experiment.
7. Murphy E, Cavanagh R, Hofmann E, Hill S, Constable A, Costa D, Pinkerton M, Johnston N, Trathan P, Klinck J, Wolf-Gladrow D, Daly K, Maury O, Doney S. (2012). Developing integrated models of Southern Ocean food webs: including ecological complexity, accounting for uncertainty and the importance of scale. Special issue of *Progress in Oceanography* on Comparative Analysis of Marine Food Webs, 102, 74-92.
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10. Pollard R, Moncoiffé G, O'Brien T (2011) The IMBER Data Management Cookbook - A project guide to good data practices. IMBER Report No. 3, IPO Secretariat, Plouzané, France. 16pp.
11. Pollard R, Moncoiffé G, O'Brien T (2011) Recetario para el Manejo de Datos IMBER - Una guía para el buen manejo de datos Reporte IMBER 3, Secretaria de la Oficina de Proyecto Internacional (OPI), Plouzané, France. 16pp.
12. Pörtner H-O, Gutowska M, Ishimatsu A, Lucassen M, Melzner F, Seibel B (2011) Effects of Ocean Acidification on Nektonic Organisms. *Ocean Acidification* (344pp). Jean-Pierre Gattuso and Lina Hansson (eds).
13. Smith W O Jr., Hofmann E E, Mosby A (2011) Aquatic Biogeochemistry – Marine, in: R A Meyers (ed.), *Encyclopaedia of Sustainability Science and Technology*, DOI 10.1007/978-1-4419-0851-3, Springer Science and Business Media, LLC.

## UPCOMING PUBLICATIONS

- Hood R R, Drinkwater K F, Mihalopoulos N (In Press, Accepted Manuscript) Introduction: Large-Scale Regional Comparisons of Marine Biogeochemistry and Ecosystem Processes – Research Approaches and Results *Journal of Marine Systems* [Link](#)
- Murphy, E. J., E. E. Hofmann, et al. (In Press, Corrected Proof). "Comparison of the structure and function of Southern Ocean regional ecosystems: the Antarctic Peninsula and South Georgia." *Journal of Marine Systems*. [Link](#)
- Salihoglu, B., S. Neuer, S. Painting, R. Murtugudde, E.E. Hofmann, J.H. Steele, R.R Hood, L. Legendre, M.W. Lomas, J. Wiggert, S.-I. Ito, Z. Lachkar, G. Hunt, K. Drinkwater and C.L. Sabine, in press, Bridging marine ecosystem and biogeochemistry research: Lessons and recommendations from comparative studies, *Journal of Marine Systems*. [Link](#)

**REQUEST FOR FUNDING**

IMBER requests SCOR Developing Country Travel Funds to assist scientists from developing countries to attend IMBIZO III that will be held in Goa, India in January 2013.

**Amount requested: US\$7 500**

**ACKNOWLEDGEMENTS**

IMBER would like to take this opportunity to thank SCOR for its ongoing support. We are extremely grateful, not only for the financial contribution, but also for the help, advice and guidance provided by Ed Urban, Liz Gross and Lora Carter.

## 3.3 GEOTRACES

*Sundby***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).

**Co-Chairs:**

Ed Boyle  
 Dept. of Earth, Atmospheric, and  
 Planetary Sciences  
 Massachusetts Institute of Technology  
 77 Massachusetts Ave  
 Cambridge, MA 02139-4307, USA  
 Tel: +1-617-253-3388  
 Fax: +1-617-253-8298  
 E-mail: eaboyle@mit.edu

Gideon M. Henderson  
 Department of Earth Sciences  
 Parks Road  
 Oxford OX1 3PR UK  
 Tel: +44 (0)1865 282123  
 Fax: +44 (0)1865 272072  
 E-mail: Gideon.Henderson@earth.ox.ac.uk

**Other Members**

Andrew Bowie	AUSTRALIA	Jordi Garcia Orellana	SPAIN
Pinghe Cai	CHINA-Beijing	Micha Rijkenberg	NETHERLANDS
Jordi Garcia-Orellana	SPAIN	Alakendra Roychoudhury	SOUTH AFRICA
Tung-Yuan Ho	China-Taipei	Géraldine Sarthou	FRANCE
Phoebe Lam	USA	Sunil Singh	INDIA
Maeve Lohan	UK	Yoshiki Sohrin	JAPAN
Maria Maldonado	CANADA	David Turner	SWEDEN
Oliver Marchal	USA	Angela Wagner	BRAZIL

**Executive Committee Reporter:** Bjørn Sundby

GEOTRACES SCIENTIFIC STEERING COMMITTEE  
ANNUAL REPORT TO SCOR 2011/2012  
July 2012

SCOR Scientific Steering Committee (SSC) for GEOTRACES

*Co-Chairs*

Ed Boyle, USA  
Gideon M. Henderson, UK

*Members*

Andrew Bowie, Australia  
Pinghe Cai, China  
Jordi Garcia-Orellana, Spain  
Tung-Yuan Ho, China-Taipei  
Phoebe Lam, USA  
Maeve Lohan, UK  
Maria T (Maite) Maldonado, Canada  
Olivier Marchal, USA  
Micha Rijkenberg, Netherlands  
Alakendra Roychoudhury, South Africa  
Géraldine Sarthou, France  
Sunil Kumar Singh, India  
Yoshiki Sohrin, Japan  
David Turner, Sweden  
Angela Wagener, Brazil

*Members rotating off at the end of 2011*

Bob Anderson, USA  
Philip Boyd, New Zealand  
Ken Bruland, USA  
Hein de Baar, Netherlands  
Martin Frank, Germany  
Catherine Jeandel, France  
Reiner Schlitzer, Germany  
Igor Semilitov, Russia  
Jing Zhang, Japan

The SSC membership (listed above) contains representatives of 15 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 modeling.

**1. SSC meeting**

The sixth meeting of the GEOTRACES SSC was held for three days (6-8 September 2011) in Xiamen, China. The meeting was hosted by Minhan Dai and Pinghe Cai at the State Key Laboratory of Marine Environmental Science, Xiamen University. The meeting was attended by 16 members of the 2010/2011 SSC. Other attendees included Chris Measures (Co-chair of the Data Management Committee); Greg Cutter (Chair of the Standards and Intercalibration Committee); Ed Urban (SCOR); Ed Mawji (GEOTRACES Data Assembly Centre); Elena Masferrer (GEOTRACES International Project Office); and Tung-Yuan Ho, Yoshiki Sohrin, Toshitaka Gamo and Jingling Ren, as observers.

The morning of the first day, following introductions and welcome, was spent reviewing national reports detailing GEOTRACES activities of the past year in 15 countries. The afternoon of the first

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day was dedicated to presentation of activities of the International Project Office. The day ended with a review of the International Partnerships, and EU and cross-national activities.

The morning of the second day of the SSC meeting focused on two issues that will be reported on elsewhere in this report: (1) data management and (2) intercalibration. Subsequent discussion addressed funding for the GEOTRACES Program and discussion of applications from two studies to become GEOTRACES process studies. After this, progress on the GEOTRACES Sections was reviewed. The day concluded with discussion on rotations of SSC and Data Management Committee (DMC).

The third and final day of the SSC meeting started with a review of the forthcoming GEOTRACES Workshops and Special Sessions. Subsequent discussion addressed capacity building, and publicity and outreach.

The next SSC meeting is scheduled for 29-31 October in Goa, India, and will be hosted by Sunil Kumar Singh.

## **2. GEOTRACES Intercalibration**

The Standards and Intercalibration Committee met at the University of Plymouth, UK, on 6-9 March 2012. The meeting was hosted by Maeve Lohan. The primary task of the meeting was to evaluate and assess the accuracy of sampling and analyses of data from “Crossover Stations” where two cruises had occupied the same location for sampling. The Committee examined data from 6 Crossover Stations in the Atlantic Ocean that were sampled in 2009–2011. Including the hydrographic salinity, oxygen, and nutrient data, this meeting examined more than 3600 data points. These represent only a portion of the final expected data because some measurements, such as radionuclide and particulates, are not yet available for most of the cruises. In general, the agreements between the array of trace elements and isotopes examined in GEOTRACES were good. For those that were not, the investigators from each cruise have received brief reports to enable further intercalibration with their crossover partners to generate the best possible results.

Another significant activity in 2011-2012 was the publication of results from the GEOTRACES Intercalibration Program in a special issue of *Limnology and Oceanography: Methods* entitled, “Intercalibration in Chemical Oceanography: <http://www.aslo.org/lomethods/si/intercal2012.html>. The editors of this special volume are Greg Cutter (USA), Peter Croot (UK), and Per Andersson (Sweden).

## **3. Data Management for GEOTRACES**

The GEOTRACES Data Assembly Centre (GDAC) is hosted by the British Oceanography Data Centre (BODC), Liverpool, UK. GDAC is responsible for all GEOTRACES data activities, including interacting with cruise Principal Scientific Officers (PSOs) and national data centers, and will eventually become the central point for all GEOTRACES data. Edward Mawji is the GEOTRACES Data Manager—a full-time employee of the GEOTRACES Program who runs GDAC.

GDAC Activities are overseen by a sub-committee of the GEOTRACES SSC—the Data Management Committee. This is chaired by Reiner Schlitzer and Chris Measures, and has established data-management guidelines and policy. Further details are at:

<http://www.geotraces.org/science/data-management>.

From the start of GDAC a high priority has been placed on meeting representatives from national data centers. Under the present data model, GDAC will not contact the scientist directly (unless the PSO has granted prior permission) and all requests for data are channeled through the local/national data centers. This requires GDAC to have a good working relationship with each national data center.

Over the past three years, funding from the COST Action ES0801 has helped fund this interaction. This source of funding will no longer be available to GDAC from the last quarter of 2012. At the next SSC meeting the committee needs to advise GDAC on funds available to arrange and attend future meetings.

During 2011-2012, COST money was made available for meetings with the representatives from France and Germany:

*15-18 November 2011, 3rd GEOTRACES Data-Model Synergy Workshop (Barcelona, Spain)*

This meeting gave Edward Mawji the chance to gain an overview of the different methods used to collect particulate data during the GEOTRACES program and highlighted the different uses of the data by modelers.

*13 -15 February 2012 (Villefranche, France)*

During 2011, the French data manager resigned, leaving the position vacant until the beginning of 2012. This had a serious cascading effect; data from the IPY cruise Bonus Good Hope (BGH) was not submitted to the French data center and hence GDAC. The data management position was filled in early 2012, so it was considered a high priority for Edward Mawji to meet the new data manager.

Two days were spent in Villefranche with Catherine Schmechtig (new French data manager), Catherine Jeandel (GEOTRACES SSC member) and Elena Masferrer (IPO office). Progress was made on the following topics:

- Data submission from BGH with hydrographical data submitted to GDAC at the meeting.
- A working relationship was established

*Future meetings 2012*

Meeting with the German data managers and **Reiner Schlitzer**.

Overall, this year has been successful in establishing and keeping links between GDAC and national data centers in Europe. Last year, it was recognized that a greater effort needs to be made to build links with the Asian community and this remains a high priority. GDAC should invest time and effort to build and develop links with data centers from Asian countries.

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## ***Working with the IPO***

A good working mechanism has been established between GDAC and Elena Masferrer-Dodas at the GEOTRACES IPO, despite their geographical separation. Information is freely exchanged between the two sites. The IPO has helped GDAC keep up to date with new developments and upcoming cruises, which in the past has proved a difficult task.

## ***Web site progress***

In 2011, a basic delivery mechanism was added to the GDAC Web site, which is now capable of delivering hydrographic data and will also be used to deliver discrete sample data (bottle data). This data portal will become a vital mechanism for scientists who wish to use GEOTRACES data and will be maintained after the lifespan of the project as part of the BODC archive. BODC will continue to make improvements to this service.

In 2012, following requests from the DMC and SSC, work has started on a dynamic map to replace the static maps on the Web site; this product could also be made available to the IPO. This service will use a base map of GEBCO WMS and work using GEO RSS feed. A prototype product is expected to be ready by the DMC and SSC meetings in October 2012 (India).

A major Web site overhaul is planned by GDAC in 2012/2013 to make the maps and delivery mechanism more prominent on the GDAC site.

## ***Data tracking and data submission***

### ***Post-cruise Metadata***

To keep the GEOTRACES inventory up to date, PIs have been required to submit metadata forms. If forms are not submitted or completed in full, cruises cannot be added to the database and GDAC cannot track future GEOTRACES data. The post cruise metadata form provides three levels of data:

- At the Project level
- At the Cruise level
- At Individual level

To date, the forms have been very successful. GDAC has received post-cruise metadata forms from all IPY cruises and most section cruises; however, it has been noted that this is not the case for process studies. At present, GDAC has no awareness of what has been measured on approved process studies, this issue needs to be raised at the next DMC meeting.

### ***Data***

With 37 cruises associated with GEOTRACES and 775 data sets identified (expected to increase once missing metadata forms are submitted) the data management of the project is reaching a critical stage. It is vital for PIs to start to submit data as soon as possible.

2011/2012 has been a relatively successful year for GDAC; considerable progress has been made collecting IPY data and the hydrographic data from the section cruises. However, some PIs are

still reluctant to submit discrete sample data; continual efforts through the SSC and national bodies are required to overcome this reluctance.

#### *Intermediate data product*

The program plans an intermediate data product for release in early 2014. The Data Management Committee, working with GDAC, will collate all available data from GEOTRACES cruises available by the end of 2012, ensure that they are sufficiently well intercalibrated, and ensure that the data quality is high. The product will be provided to all interested users to ensure that GEOTRACES data is seeing maximum interdisciplinary use.

#### *Summary of GEOTRACES cruises*

Cruises to date include the following:

- 14 IPY cruises
- 1 cruise producing GEOTRACES Compliant data
- 5 process studies
- 15 GEOTRACES section cruises

#### *GEOTRACES section cruises*

The past 3 years has been a busy time for GEOTRACES, especially in the Atlantic Ocean. Overall, 15 full GEOTRACES cruises have taken place covering nine GEOTRACES section lines.

#### GEOTRACES sections- 15 cruises

Pacific Ocean	GP13	2 cruises: Australia and New Zealand
Pacific Ocean	GP03	1 cruise: Japan
Indian Ocean	GI04	1 cruise: Japan
Atlantic Ocean	GA02	3 cruises: Netherlands
Atlantic Ocean	GA10	2 cruises: UK
Atlantic Ocean	GA06	1 cruise: UK
Atlantic Ocean	GA11	1 cruise: Germany
Atlantic Ocean	GA03	2 cruises: USA
Indian Ocean	GI02	2 cruises: India

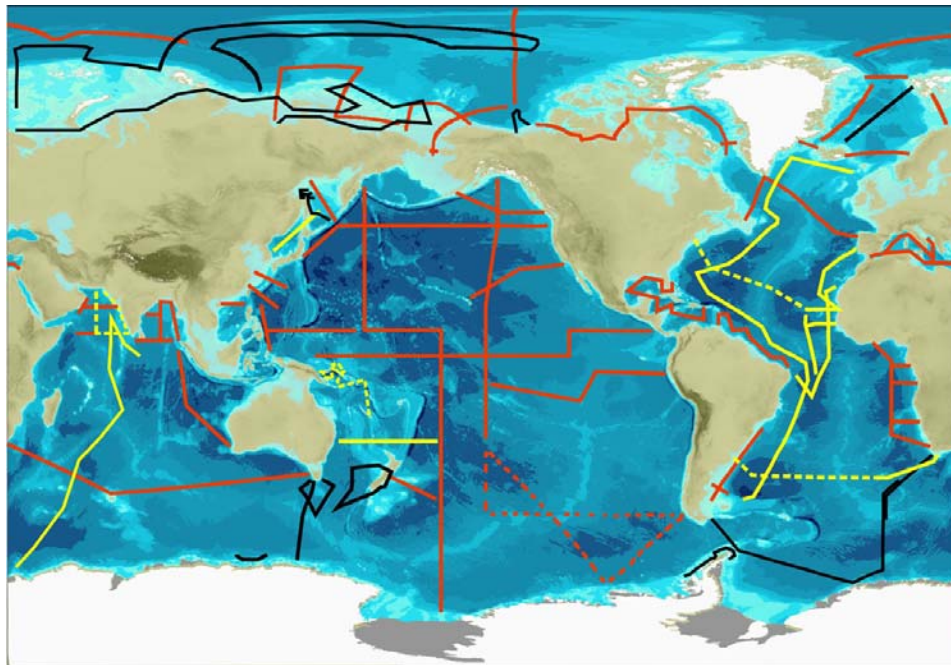
With the vast quantity of data from these cruises expected in 2013, it is vitally important that scientists submit data following the GEOTRACES/BODC submission guidelines to ensure smooth processing and archiving.

In summary, GDAC policies are proving effective with clear results; PIs are following guidelines and metadata are being submitted, hydrographic, nutrients data and event logs have been submitted from 9 GEOTRACES sections already (ahead of time).



#### **4. Status of GEOTRACES Section Cruises**

The anticipated decade-long field program is now well underway and is enjoying a successful implementation (Figure 1). Country reports are available at [http://www.scor-int.org/2012GM/GEOTRACES\\_National\\_Reports.pdf](http://www.scor-int.org/2012GM/GEOTRACES_National_Reports.pdf).



**Figure 1.** Status of GEOTRACES global survey of trace elements and their isotopes. In black: Sections completed as GEOTRACES contribution to the International Polar Year. In yellow: Sections completed as part of the primary GEOTRACES global survey (dotted yellow, completed during the past year). In red: Planned Sections. An updated version of this map can be found on the GEOTRACES home page <<http://www.geotraces.org>>.

#### **5. GEOTRACES International Project Office**

The GEOTRACES International Project Office (IPO) is based at the Laboratoire d'Etudes en Géophysique et Océanographie Spatiales (LEGOS) in Toulouse, France. The IPO is staffed by a single person, the IPO Executive Officer, Elena Masferrer Dodas. She works under the scientific supervision of Catherine Jeandel (CNRS, LEGOS, France). The IPO Executive Officer is responsible for assisting the Scientific Steering Committee (SSC) in implementing the GEOTRACES Science Plan and implementation plans of the program; organizing and staffing meetings of the SSC, working groups and task teams; liaising with the sponsors and other relevant organizations; seeking and managing program finances; representing the project at international meetings; maintaining the project Web site and mailing lists; assisting the GDAC in securing information about upcoming cruises; and interacting with GEOTRACES national committees and groups, as well as other international projects. During the last year, the GEOTRACES IPO has also initiated the following three activities:

**Databases:** New databases have been set up:

*GEOTRACES Researchers Database:* The IPO has worked with the GEOTRACES Standards and Intercalibration Committee and the GEOTRACES Intercalibration Coordinators to set up a database of GEOTRACES Researchers' Analytical Expertise. Currently, a form is available on the GEOTRACES site for all researchers to register in: <http://www.geotraces.org/science/geotraces-researchers-expertise-form>

*GEOTRACES Peer-reviewed Papers and PhD Dissertations Databases:* Both databases have been set up by the IPO using the Mendeley free academic reference manager and they are available on the GEOTRACES site. The IPO ensures they are kept up to date. So far, 86 GEOTRACES peer-reviewed papers and 8 GEOTRACES-related PhD Dissertations have been added to the database.

**Outreach:** Two new tools have been developed:

*Science Highlights Newsletter:* To help disseminate the main scientific results of the GEOTRACES program, a Science Highlight Newsletter has been created. The highlights consist of very short summaries (about 10 lines) describing GEOTRACES main achievements. The aim is to produce three newsletters a year, and two issues have so far been released. The Highlights are emailed to the GEOTRACES mailing list, and are also available on the GEOTRACES Web site. The SSC will consider whether to expand the highlights newsletter into a full GEOTRACES Newsletter at the next SSC meeting in Goa.

*Outreach Library:* An educational material page is available for all SSC members on the private GEOTRACES site (to be introduced during the SSC meeting).

Also, the GEOTRACES IPO has updated and extended the information available on the entry "GEOTRACES" of the Wikipedia.

**Communication tools:** The GEOTRACES IPO has continued to improve and maintain the following communication tools:

*GEOTRACES Web site* <<http://www.geotraces.org>>: Maintaining the program Web site is a very time-consuming activity for the GEOTRACES IPO. The Web site provides up-to-date information about the GEOTRACES Cruise program and all GEOTRACES Activities. New features on the site include:

- A Forum on "Methods to measure major particle composition" is available on the Web site. Phoebe Lam, GEOTRACES SSC member, moderates the forum.
- A new page has been set up to describe GEOTRACES Capacity Building Activities and inform researchers about the existing opportunities for funding.

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*GEOTRACES Poster:* A poster to be presented at international meetings and conferences has been designed and presented to several international conferences. A customizable template is available on the private GEOTRACES site.

*New Brochure:* Thanks to the support provided by the Royal Netherlands Institute for Sea Research, a new GEOTRACES Brochure has been published. The brochure is available on the GEOTRACES Web site and hardcopies can be requested to the GEOTRACES IPO.

*Funding:* The GEOTRACES IPO has concluded two new funding agreements this year. The Royal Netherlands Institute for Sea Research and the GEOMAR | Helmholtz Centre for Ocean Research Kiel will contribute funds to the IPO. The GEOTRACES IPO has worked hard to assure French funding for this year. Several meetings were held within the GEOTRACES IPO, specially the IPO Scientific Director, and several French funding institutions. At the same time, the GEOTRACES IPO has been pursuing European funding opportunities. A meeting was held with the European Commission Environment Directorate General (September 2011) and also with the Pyrenees-Mediterranean Euroregion (May 2012).

*Meeting organization:* The GEOTRACES IPO has helped to organize the 3<sup>rd</sup> GEOTRACES Data-Model Synergy Workshop, the 2<sup>nd</sup> GEOTRACES Mediterranean Workshop, the upcoming 2012 SSC meeting in Goa (India) and the forthcoming GEOTRACES Latin American Workshop (see below).

## **6. Workshops and events**

### GEOTRACES Data-Model Synergy

The third in a series of workshops to bring together the oceanic observational and modeling communities was held in Barcelona from 14 to 17 November 2011. The workshop focused on ocean particles, with emphasis on their role in the biogeochemical cycle of trace elements and isotopes (TEIs). Major sessions included:

- Observing particles in the ocean: Methods, Results, & Lacunae,
- Role of particles in the cycle of TEIs, and
- Transport & transformation of particles.
- 

The major goal of the workshop was to address these two questions:

- 1) What measurements of particles should GEOTRACES make?
- 2) How should models of ocean biogeochemistry represent particles?

Further details of the agenda and discussion are available at <http://www.geotraces.org/archived-articles/241-3rd-geotraces-data-model-synergy-workshop> and [http://costaction.earth.ox.ac.uk/open\\_meetings](http://costaction.earth.ox.ac.uk/open_meetings).

Funding for the meeting was provided through SCOR-GEOTRACES funding, and through the GEOTRACES COST Action (<http://costaction.earth.ox.ac.uk/>)

#### GEOTRACES Arctic Planning Workshops

Two workshops were held this year to help plan GEOTRACES activities in the Arctic region. The first one took place on 19-20 April 2012 in Bremehaven, Germany, and the second one in Vancouver, Canada, on 2-4 May 2012. The main outcomes of the workshops were (1) the coordination of an international GEOTRACES research program in the Arctic Ocean, (2) the coordination of this program with other relevant Arctic projects “Arctic Great Rivers Observatory” and “Arctic in Rapid Transition”, and (3) initiation of the organization of a follow-up workshop in Moscow, provisionally on 27-30 November 2012.

For more information:

Workshop in Bremehaven: <http://www.geotraces.org/meetings/meetings-by-year/eventdetail/115/-/european-geotraces-arctic-workshop>

Workshop in Vancouver: <http://www.arctic-climate-change.pwias.ubc.ca/>

#### GEOTRACES-COST Training School “Are your GEOTRACES data reliable?”

A training school was held on 30-31 May 2012 at the IRMM (Institute for Reference Materials and Measurements) in Geel (Belgium). 21 trainees (M.Sc., Ph.D. students and post-docs) from 11 countries attended the school to discuss issues related to uncertainty of marine chemistry analyses. The course was co-organized by the COST Action on GEOTRACES (<http://costaction.earth.ox.ac.uk/>) and by TrainMIC (Training for Metrology in Chemistry).

*Forthcoming:*

#### Russian GEOTRACES Workshop

A Russian GEOTRACES Workshop is planned on 27-30 November 2012 in Moscow, Russia. The main objectives of this workshop are to acquaint the international scientific community with GEOTRACES-related research in Russia and to discuss the possibility of cruises in 2015 in the Russian economic zone in Arctic Ocean.

#### GEOTRACES Latin American Workshop

To foster the involvement of Latin American (LA) scientists in the GEOTRACES program, the GEOTRACES SSC will hold a workshop in Rio de Janeiro (12-15 November 2012) with the following objectives: (1) Define scientific questions of global interest that are geographically proximal to LA nations; (2) Define scientific questions of national or regional interest that are too large, or too complex, to be addressed by a single nation or by small projects, and therefore would benefit from international collaboration; (3) Identify opportunities and strategies for collaboration within the scope of the GEOTRACES Program; (4) Identify opportunities for technology transfer and training that would increase the capacity of scientists in LA nations to undertake GEOTRACES-related research.

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The workshop intends to bring together scientists from the region who may have interest in developing research activities related to the program. Senior international investigators from the GEOTRACES Program will also participate, conveying their experience, and information on opportunities for collaboration. The meeting will be hosted by Angela Wagener, who has secured significant funding from Brazilian sources to cover the costs of attendees.

For further information: <http://www.geotraces.org/meetings/meetings-by-year/eventsbyyear/2012/-?start=30>

## GEOTRACES-COST Workshop –Stable isotopes of biologically important trace metals

Stable isotope analyses of biologically important trace metals such as Fe, Ni, Cu, Zn, and Cd in seawater and other marine samples (e.g., particles, sediments, aerosols) are extremely challenging, but there are many known and potential scientific rewards. Isotopic analyses of related trace metals, such as Pb, offer similar analytical challenges and complementary insights into marine biogeochemical cycles.

A workshop to discuss analytical and scientific aspects of isotopic analyses for such elements in seawater and solid samples will be held at Imperial College London, UK, on 13-14 September 2012. The organizing committee consists of Mark Rehkämper, Tina van de Flierdt, Dominik Weiss, Gideon Henderson, and Hein de Baar.

Important issues to be discussed will include (1) Sample collection, analytical techniques and isotopic standards; (2) Intercalibration and intercomparison of data—past results and future plans; (3) State of the art—presentation, interpretation and discussion of recent results; (4) Quo vadis—what scientific issues need to be addressed and how?

For further information: <http://www.geotraces.org/meetings/meetings-by-year/eventdetail/121/-/geotraces-cost-workshop-stable-isotopes-of-biologically-important-trace-metals>

## GEOTRACES-COST Voltametric Workshop

A workshop will be held in Šibenik, Croatia on 6-9 October 2012 to address the following topics: (1) The application and usage of Voltammetry within GEOTRACES: Past, present and future; (2) Utilizing the ongoing lessons of GEOTRACES for developing intercalibration studies for voltammetric measurements in seawater; (3) Development of Standard Operating Procedures (SOPs) for data treatment and speciation calculations using voltammetry. Including sampling and storage of samples; experimental design for speciation/complexation studies; (4) Application of new types of sensors (e.g., solid electrodes, micro electrodes) to work in GEOTRACES; and (5) Tips and tricks in voltammetry—a networking approach: Sharing experiences and ideas on voltammetry through GEOTRACES activities.

The organizing committee includes Dr. Peter Croot (Ireland), Dr. Antonio Cobelo Garcia (Spain), Dr. Cédric Garnier (France) and Dr. Dario Omanovic, Dr. Ivanka Pizeta, Dr. Irena Ciglonečki-Jušić from Rudjer Bošković (Croatia).

For further information: <http://www.geotraces.org/meetings/meetings-by-year/eventdetail/119/-/cost-geotraces-voltammetry-workshop>

### **7. Special sessions at international conferences featuring GEOTRACES findings**

Several special sessions with relevance to GEOTRACES featured at major international meetings, including the following:

2012 Ocean Sciences Meeting, 20–24 February 2012, Salt Lake City, USA

\*057: Biogeochemical Cycling of Micronutrient Trace Elements

Presentations available at:

<http://www.sgmeet.com/osm2012/sessionschedule.asp?SessionID=057#2/22/2012>

Organizers: Maeve Lohan, University of Plymouth; Andrew Bowie, Antarctic Climate & Ecosystems CRC; Toshi Gamo, University of Tokyo; Greg Cutter, Old Dominion University

\*049: Advances in the Oceanography of Trace Elements and Isotopes in the Atlantic and Polar Oceans

Presentations available at:

<http://www.sgmeet.com/osm2012/sessionschedule.asp?SessionID=049>

Organizers: Micha Rijkenberg, Royal Netherlands Institute for Sea Research; Rob Middag, University of California, Santa Cruz; Stephanie Owens, Woods Hole Oceanographic Institution; Patricia Cámara Mor, Universidad Autonoma de Barcelona

\*005: Metal Speciation in the Ocean: Metal-Binding ligand composition and role in the transport of metals through the marine environment

Presentations available at:

<http://www.sgmeet.com/osm2012/sessionschedule.asp?SessionID=005#2/23/2012>

Organizers: Sylvia Sander, University of Otago; Constant van den Berg, University of Liverpool; Kristen Buck, Bermuda Institute of Ocean Sciences

\*166: Redox and Coordination Chemistry of Iron Marine Systems

Presentations available at:

<http://www.sgmeet.com/osm2012/sessionschedule.asp?SessionID=116#2/24/2012>

Organizers: James Moffett, University of Southern California; Katherine Barbeau, UC San Diego

\*EVW09: US Arctic GEOTRACES (Town Hall)

Organizers: David Kadko, University of Miami; Robert Anderson, Lamont-Doherty Earth Observatory.

Goldschmidt 2012, 24-29 June 2012, □Montréal, Canada

\*13d. GEOTRACES, the international science program

Co-convenors: Géraldine Sarthou (Université de Brest) - Kazuyo Tachikawa (CEREGE, France)  
- Tina van De Flierdt (Imperial College, London)

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\*12b. Pa and Th distributions in the ocean: controlling mechanisms

Co-conveners: Abel Guihou (SUNY-Stony Brook) - Robert F Anderson (LDEO of Columbia University)

\*10c. Past and future changes in ocean circulation

Co-conveners: Eric Galbraith (GEOTOP-McGill University) - Laura Robinson (University of Bristol)

\*17e. The application of synchrotron X-ray techniques to study marine biogeochemical cycles

Co-conveners: Phoebe J. Lam (Woods Hole Oceanographic Institution) - Brandy M. Toner (University of Minnesota – Twin Cities) - Benjamin S. Twining (Bigelow Laboratory for Ocean Sciences)

GEOTRACES-relevant sessions are already being planned for major conferences in 2013.

## **8. Capacity building**

At-Sea Training GEOTRACES gratefully acknowledges support from SCOR to enable one scientist per year from a developing nation to participate in a GEOTRACES cruise. These opportunities are vital to the development of technical expertise in sampling and sample handling for contamination prone elements aboard “dirty” ships.

Sampling Systems It is a goal of GEOTRACES that every nation carrying out oceanographic research should have access to a trace metal-clean sampling system. GEOTRACES offers guidance based on past experience in the design and construction of sampling systems as well as advice in operating these systems as shared facilities. A complementary goal is to establish a program whereby scientists who have gained experience in operating these systems can share that knowledge with scientists from nations that either have clean sampling systems already or are in the process of acquiring them.

An updated status of trace metal-clean sampling systems to support GEOTRACES research is provided in the table below. Scientists interested in developing one of these systems for their own use are encouraged to contact the GEOTRACES IPO or any member of the SSC, who will arrange for contact with an appropriate person to provide technical information about the design, construction and cost of a system.

<b>Nation</b>	<b>Status</b>	<b>System/ Carousel</b>	<b>Bottles</b>	<b>Depth</b>
Australia	Complete (2nd system planned)	Powder coated aluminum, autonomous 1018 intelligent rosette system	12 x 10-L Teflon-lined Niskin-1010X	6000 m; 6 mm Dynex rope
Canada	Complete	Powder coated aluminum with titanium CTD	24 X 12-L GO-Flo	3000 m; conducting Vectran

		housing, Seabird Rosette		
China - Beijing	Complete	Towed fish	NA	Surface
China - Taipei	Complete	Teflon coated rosette	Multi- size GO-Flo	3000 m; Kevlar line
France	Complete	Powder coated aluminum with titanium pressure housing for CTD	12 X 12-L GO-Flo	8000 m; conducting Kevlar
Germany	CTD and bottles purchased, winch planned	Powder coated aluminum with titanium pressure housings and fittings	27 x 12-L OTE GO-Flo	8000 m; conducting Kevlar
India	Ordered	Powder coated aluminum with titanium pressure housings and fittings	12-L Niskin-X	8000 m; conducting Kevlar
Italy	Complete	Go-Flo bottles on Kevlar line	5 x 20-L Go-Flos	Kevlar
Japan	Complete	Powder coated aluminum	12-L Niskin-X	10000 m; titanium armored cable
Netherlands	Complete	Titanium frame	24 X 12-liter GO-Flo	10000 m; conducting Kevlar
Netherlands	Complete	Titanium frame	24 X 27-liter ultraclean PVDF	10000 m; conducting Kevlar
New Zealand	Complete	Powder coated aluminum	5-L Teflon-lined Niskin-X	2000 m; 8 mm Kevlar line
South Africa	Complete	Powder coated aluminum, titanium housing/fittings	24 X 12-liter GO-Flo	6500 m; Kevlar cable
UK	In testing phase	Titanium frame, Ti pressure housings	24 10-L OTE	8000m conducting Kevlar
USA - CLIVAR	Complete	Powder coated aluminum	12 X 12-L GO-Flo	1500 m; conducting Kevlar
USA - GEOTRACES	Complete	Powder coated aluminum with titanium pressure housings and fittings	24 X 12-L GO-Flo	8000 m; conducting Kevlar
USA- University of Alaska Fairbanks	Complete	Seabird Rosette. Powder coated aluminum with Ti parts and pressure housing. Fires at pre-programmable depths	12 X 5-L Teflon-lined Niskin-X	No Kevlar line available yet.
USA- Old Dominion	Complete	Seabird Rosette. SBE-19plusV2 CTD unit.	12 X 5-L Teflon-lined	2000 m 0.5-inch Kevlar wire



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University		Powder coated aluminum with Ti parts and pressure housing. Fires at pre-programmable depths	Niskin-X	
USA – Polar Programs	Complete	Powder coated aluminum with titanium pressure housings and fittings	12 X12-L Niskin-X	3000 m; conducting Kevlar

## **Acknowledgements**

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

Written and compiled by:

Elena Masferrer (GEOTRACES IPO Executive Officer)

Gideon Henderson (Co-Chair GEOTRACES SSC)

Ed Boyle (Co-Chair GEOTRACES SSC)

August 2012

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

*Wainer*

#### 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.

#### Chair:

Eric Saltzman  
Department of Earth System Science  
University of California, Irvine  
Phone: +1-949-285-2111  
[esaltzma@uci.edu](mailto:esaltzma@uci.edu)

#### Vice-Chair:

Veronique Garçon  
LEGOS  
18 Avenue Edouard Belin  
31401 Toulouse Cedex 9, France  
Phone : +33561332957  
Fax : +33561253205  
[veronique.garcon@legos.obs-mip.fr](mailto:veronique.garcon@legos.obs-mip.fr)

#### Members:

Minhan Dai	CHINA-Beijing	Lisa Miller	CANADA
Anja Engel	GERMANY	Yukihiro Nojiri	JAPAN
Diego Gairo	ARGENTINA	Patricia Quinn	USA
Christophe Garbe	GERMANY	Rafel Simo	SPAIN
Cecile Guieu	FRANCE	Jacqueline Stefels	NETHERLANDS
Christophe Heinze	NORWAY	Roland Von Glasow	UK
Hui-wang Gao	CHINA-Beijing	Brian Ward	IRELAND
David Kieber	USA		
Cliff Law	NEW ZEALAND		

**Executive Committee Reporter:** Ilana Wainer

**IGBP Liaison:** Wendy Broadgate

**Executive Officer:** Emily Breviere

## *Annual Report from SOLAS to SCOR*

**Reporting period: June 2011- June 2012**

**Version of 12 July 2012 by Dr Emilie Brévière**

### SOLAS International Project Office, Kiel and Node Office, Norwich

The SOLAS IPO is hosted at the GEOMAR| Helmholtz Centre for Ocean Research Kiel in Kiel, Germany. The office is staffed with the Executive Officer, Dr. Emilie Brévière and the Project Officer, Stefan Kontradowitz. GEOMAR provides office space and funds both staff salaries. The IPO activities are supported until January 2013 by the German Ministry of Education and Research (BMBF). The IPO in Kiel has benefitted since August 2011 from the assistance of a student, Roberto Benavides (75 hours per month) funded by BMBF.

The SOLAS Node Office (NO) is located at the University of East Anglia (UEA), UK, former location of the IPO. The office is staffed with the Project Officer, Kath Mortimer, funded by the UK NERC until the end of Sept. 2012. UEA provides office space and the Natural Environment Research Council (UK NERC) supported office activities until March 2011. The Node Office in Norwich has benefitted since June 2011 and until August 2012, from the assistance of a student, Georgia Bayliss-Brown (10 hours per week), funded by IGBP block grant 2010-11.

Between October 2011 and April 2012, Dr. Emilie Brévière was on maternity leave. Her position was covered by Dr. Ellie Farahani in Dec 2011 and Jan 2012 and by Dr. Susanna Pakkasmaa from February to May 2012.

Since 1 January 2012, GEOMAR is part of the Helmholtz Association. The association is a community of 18 scientific-technical and biological-medical research centres. These centres have been commissioned with pursuing long-term research goals on behalf of the state and society. GEOMAR's mandate is the interdisciplinary investigation of all relevant aspects of modern marine sciences, from seafloor geology to marine meteorology.

### **SOLAS Scientific Steering Committee**

Since July 2011, Eric Saltzman has served as Scientific Steering Committee (SSC) Chair and Véronique Garçon as vice-Chair.

The SOLAS SSC met in Seattle, USA, 11-13 May 2012 for its 11<sup>th</sup> SSC meeting. The current membership of the SSC is listed below:

Name	Gender	Country	Expertise	Term	Term ends
Garçon Véronique	F	France	Ocean Biogeochemical modelling	2	2012
Kieber David	M	USA	Marine Photochemistry	2	2012
Law Cliff	M	New Zealand	Air-sea exchange / nutrients	2	2012
Saltzman Eric	M	USA	Atmospheric chemistry	2	2013
Stefels Jacqueline	F	Netherlands	Sulfur cycle / sea ice	2	2013
von Glasow Roland	M	UK	Atmospheric halogens / modelling	2	2013
Heinze Christoph	M	Norway	Carbon cycle modelling / paleoceanogr.	1	2012
Nojiri Yukihiro	M	Japan	Ocean carbon	1	2012
Ward Brian (WCRP)	M	Ireland	Air-sea physical interaction	1	2013
Miller Lisa	F	Canada	Sea-ice / CO2 exchanges	1	2013
Garbe Christoph	M	Germany	Air-sea physical interaction	1	2013
Galero Diego	M	Argentina	Aerosol chemical composition / deposition	1	2013
Dai Minhan	M	China	Coastal Carbon / acidification	2	2014
Guleu Cecile	F	France	Marine ecosystems / nutrients	2	2014
Quinn Patricia	F	USA	Aerosols / atmos chemistry	2	2014
Simo Rafael	M	Spain	Ocean biogeochemistry / trace gases	2	2014
Graco Michelle	F	Peru	Nitrogen and carbon cycling OMZ	1	2014
Gao Huiwang	M	China	Atmosph. Deposition / marine ecosystems	1	2014
Engel Anja	F	Germany	Microbial biogeochemistry	1	2014

In December 2012:

- Véronique Garçon (vice-Chair), Dave Kieber and Cliff Law will rotate off the SOLAS SSC after two terms.
- Christoph Heinze and Yukihiro Nojiri will end their first term on the SOLAS SSC and will be nominated for a 2<sup>nd</sup> term.

Ilan Koren from Israel was nominated to the SOLAS sponsors to become SSC member from Jan 2013. His appointment is pending.

At their 11<sup>th</sup> SSC meeting, the SSC members elected an Executive Committee. It is composed of Eric Saltzman, Véronique Garçon, Roland von Glasow, and Christoph Heinze.

#### *SOLAS National Networks*

Twenty-eight nations are part of the SOLAS network. Each has a representative (see list below). The country and name underlined are changes which took place during the reporting time.

Australia: Sarah Lawson and Andrew Bowie

Belgium: Christiane Lancelot

Brazil: Amauri Pereira de Oliveira

Canada: Maurice Levasseur

Chile: Laura Farias

China (Beijing): Minhan Dai

China (Taipei): Gwo-Ching Gong

Denmark: Lise Lotte Soerensen and

Mikael Sejr

France: Remi Losno

Germany: Hermann Bange and Ulrich Platt

India: Dileep Kumar

Ireland: Brian Ward

Italy: Chiara Santinelli

Finland: Gerrit de Leeuw

Japan: Mitsuo Uematsu

Korea: Kitack Lee

Mexico: Jose Martin Hernandez

Ayon

Netherlands: Jacqueline Stefels

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New Zealand: Cliff Law  
Norway: Abdirahman Omar  
Peru: Michelle Graco  
Russia: Sergey Gulev  
Spain: Rafel Simo  
Southern Africa: Carl Palmer

Sweden: Katarina Abrahamsson  
Turkey: Baris Saglihoglu and  
Mustafa Koçak  
UK: Phil Williamson  
USA: Bill Miller

Implemented in January 2009, national representatives are asked to report annually about SOLAS activities in their country. To facilitate the reporting effort, a template form is provided. In January 2012, 19 reports were received and posted on the SOLAS Web site. The reports have been/are a great source of information for the IPO to report to sponsors, but also to facilitate project coordination and to distribute the results and progress from some nations to the rest of the SOLAS community via the Newsletters and the Web site. All the reports received during the reporting period are available in an Addendum to this report (see <http://www.scor-int.org/2012GM/Full%20SOLAS%20Report.pdf>).

## **Development of the SOLAS Mid-term strategy**

SOLAS resources (i.e., travel funds, meeting support, communication and outreach) will be focused on supporting the development of the Mid-term strategy (MTS) themes, identified as areas where progress can be accelerated significantly with the support of an international programme such as SOLAS.

The MTS directed much of the programme for the Open Science Conference (OSC) 2012, where each theme was examined in detail and developed further.

An overview article for the journal *Environmental Chemistry* is currently in preparation and will be published in fall 2012.

Each theme is at a different stage in its implementation but, clearly, there is a major amount of scientific activity ongoing and planned:

### **• Sea-ice biogeochemistry and interactions with the atmosphere**

An *EOS* paper is been published resulting from the OASIS meeting in June 2011 (Telluride, CO, USA). (Shepson et al., 2012, *EOS* 93(11): 117-118).

SCOR accepted the working group (WG) proposal on 'Biogeochemical Exchange Processes at the Sea-Ice Interfaces (BEPSII)', co-chaired by Jacqueline Stefels and Nadja Steiner (WG140). The WG began early 2012. The goals of BEPSII are the following:

1. Compile a review on the current state-of-the-art methodologies for sea ice biogeochemistry (BGC) studies.
2. Identify the main processes and parameterisations through comparison of 1D sea ice models.

3. Translate relevant processes from small-scale models to global Earth System Models.
4. Analyse the role of sea-ice BGC in climate simulations.

The theme integrates with several ongoing studies and initiatives such as the CFL (Circumpolar Flaw Lead System Study), SIPEX (Sea Ice Physics and Ecosystem Experiment), SIMBA (Sea Ice Mass Balance in Antarctica), PolarCat (POLAR study using aircraft, remote sensing, surface measurements and models, of Climate, chemistry, Aerosols, and Transport), ArcticNet (a network of centres of excellence in Canada) and several relevant (integrated Land Ecosystem - Atmosphere Process Study) iLEAPS-recognised projects.

The new network was presented at the International Polar Year conference in March 2012 (Montreal, Canada). The WG held an opportunistic meeting during the SOLAS OSC in Seattle, USA, in May 2012.

• **Atmospheric control of nutrient cycling and production in the surface ocean**

Following the COST Action 735 workshop in December 2010 (Istanbul, Turkey), a review article is being evaluated for publication in *Science*: “Atmospheric deposition impacts in the low nutrient low chlorophyll ocean”. The IGBP/SCOR Fast Track Initiative workshop held in November 2010 (Southampton, UK), also led to a review article being submitted to *Nature Geoscience* “Oceanic nutrient limitation: processes, patterns and potential for change”, the article is currently under review. Ocean-atmosphere interactions of particles will also be covered by the forthcoming COST 735 book and the relevant chapter is currently under review. Five related projects have been endorsed by SOLAS (ADEPT, DUNE, FLATOCOA, MedSea and MERMEX).

• **Air-sea gas fluxes at Eastern Boundary upwelling systems**

This MTS has been moving forward very successfully with increased participation from the International Global Atmosphere Chemistry (IGAC) project and a strong IMBER presence at the EUR-OCEANS meeting, co-sponsored by SOLAS, “Ocean deoxygenation and implications for marine biogeochemical cycles and ecosystems” 24–26 October 2011, Le Mas des Canelles, Toulouse, France. This Gordon-like Conference was attended by more than 90 scientists from 19 different countries. The conference aims were to bring together biological, biogeochemical, and physical oceanographers to discuss the issue of deoxygenation in the world ocean and its implications for ocean productivity, nutrient cycling, carbon cycling, and marine habitats (see <http://www.eur-oceans.eu/?q=conf-oxygen>). Outcomes of the conference are a special issue in *Biogeosciences/Climate of the Past* with the title ‘Low oxygen in marine environments from the Cretaceous to the present ocean: Driving mechanisms, impact, recovery’ and a series of e-lectures in *Limnology and Oceanography* ([www.aslo.org/lectures](http://www.aslo.org/lectures)).

There was a session at ESA/SOLAS/EGU “Earth Observations for Ocean Atmosphere Interactions Science” conference, 29 November–2 December 2011, Frascati, Italy and the EUR-OCEANS Consortium Annual Meeting took place on 7–8 February 2012, Sète, France.

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A EUR-OCEANS Flagship on Ocean deoxygenation in Eastern Boundary Upwelling Systems has been awarded to GEOMAR, Kiel, Germany, LEGOS CNRS and IRD, Toulouse; and LOCEAN, Paris, France; with IMARPE, IGP, Lima, Peru as a co-partner. A two-year post-doctoral fellow, between Toulouse, Lima and Kiel, has been recruited; Ivonne Montes started in September 2011 on the theme.

The structure of the theme is in place and the experimental part is underway now, with the following activities:

- East South Pacific Cruises Meteor, German SFB754, October 2012 -March 2013
- Mesocosms experiments off Peru, between February and April 2015
- AMOP Mooring deployment for 3 years
- January 2013 Meteor cruise, regular site visits, R/V Olaya
- AMOP Cruise hopefully 2013, R/V L'Atalante and Olaya together
- On the road Course, ONTRC, IMARPE-IGP-GEOMAR-LEGOS, Lima, 6 days between February and April 2014

• **Ship plumes: impacts on atmospheric chemistry climate and nutrient supply to the oceans**

Little progress was made despite attempts to gain engagement from the ocean community.

• **Ocean-derived aerosols: production, evolution and impacts**

A cruise is being organised with Trish Quinn and Tim Bates from Boston to Bermuda over nine days and will cover atmospheric gas phase measurements, ambient aerosol and sea sweep aerosols, sea spray, composition and many more; with IGAC participation on the cruise. There was a workshop in June 2012 in North Carolina to organise the group.

The SOLAS News Issue 13 (Summer 2011) focused on the SOLAS Mid-Term Strategy. It contains scientific articles relating to many of the strategy themes as well as an overview of the strategy itself (historic, description, implementation strategy and progresses).

**SOLAS Open Science Conference 2012**

The SOLAS Open Science Conference (OSC) was held May 7–10, 2012, in the Cascade mountains east of Seattle at the Suncadia Resort, and about 200 scientists from 28 countries attended. The themes for the 2012 conference included the following:

- Sea-ice biogeochemistry and interactions with the atmosphere;
- Ocean-derived aerosols: production, evolution, and impacts;
- Atmospheric control of nutrient cycling and production in the surface ocean;
- Air-sea gas fluxes at eastern boundary upwelling and oxygen minimum zone systems;
- Physics of air-sea exchange;
- Long-lived greenhouse gases: air-sea exchange and impact; and
- SOLAS and the future ocean: integration and modeling.

Five poster prizes were awarded to students whose poster presentations demonstrated outstanding originality, scientific quality, and clarity, thanks to a donation from CMOS. SOLAS thanks SCOR for providing partial support for scientists from developing countries (Mexico, South Africa, Chile, China and Turkey) to participate in the conference.

The OSC was mainly supported by NASA, NOAA, NSF, Suncadia Resort, ESA and BMBF. The OSC event will be featured in the next issue of the SOLAS newsletter, scheduled for publication in August 2012 (<http://www.solas-int.org/news/newsletter/newsletter.html>).

### **International SOLAS Summer School 2011**

The 5<sup>th</sup> Summer School took place in Cargèse, Corsica between the 29 August and 10 September 2011. All information about the SOLAS summer school may be found at <http://www.solas-int.org/summerschool/>. Following the format of the previous 4 schools, the 2011 edition of the school brought together 71 PhD students and early-career scientists from 26 countries and 17 world-leading international scientists, for a mix of lectures and practical workshops. For this edition, 212 applications were received. The budget to run the school, excluding all costs of students' attendance, was about 80,000 euro (room rental, equipment, cruise vessel, attendance expenses of all lecturers, hospitality, transports to and from airport and for practicals). The students' attendance cost around 115,000 euro total; the IPO developed and managed about 80,000 euros of this amount. The SSS organisers would like to thank the 50 or so sponsors that make the school possible. The SSS event will be featured in the next issue of the SOLAS newsletter, due for publication in August 2012 (<http://www.solas-int.org/news/newsletter/newsletter.html>).

The school will move to Xiamen in China in 2013 thanks to the support of the State Key Laboratory of Marine Environmental Science, Xiamen University. Due to the excellent feedback from previous attendees the same programme of lectures, practical sessions, poster sessions and interaction time will be kept and funding will be applied for to retain the same balance of countries and career levels attending.

### **Toward the ending of the COST Action 735**

In late 2006, SOLAS was provided networking funds from the European Coordination in the field of Scientific and Technical Research office (COST) for a dedicated 'Action' 735, which seeks to develop global air-sea flux data sets of gases and aerosols. The IPO administers the networking funds. The Action ended in October 2011. To pull together its achievements, a final action event took place in November 2011 and a high-level textbook is currently being prepared, expected to be published in 2012. A Sub-WG 1,2&3 meeting 'Cost Action 735 publication lead authors meeting 2' and the COST Action 735 final event took place on 28 November 2011 in Frascati, Italy. The report and list of attendees are available at <http://www.cost-735.org/meetings/meetings.html>. The book, entitled "Ocean-Atmosphere Interactions of Gases and Particles", will be published by Springer later this year. More than 60 authors have contributed to the book, and it will have approximately 300 pages, divided in the following



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chapters:

Chapter 1: Trace gases in the surface ocean and atmosphere

Chapter 2: Transfer across the air-sea interface

Chapter 3: Air-sea interactions of natural long-lived greenhouse gases (CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>) in a changing climate

Chapter 4: Ocean-Atmosphere interactions of particles

Chapter 5: Perspectives and Integration in SOLAS science

## ***Fast Track Initiatives***

In May 2009, IGBP launched two fast-track initiatives (FTIs) proposed by SOLAS and other IGBP core projects. Both FTIs were endorsed by SCOR. SOLAS is coordinator of the IGBP/SCOR Fast Track Initiative on Upper Ocean Nutrient Limitation: processes, patterns and potential for change (2009-2011). The scientific coordinators are Mark Moore (NOCS, UK) and Matt Mills (Stanford Univ., USA). A workshop took place in Southampton, UK on 3-5 Nov 2010 to address the FTI goals. The key SOLAS relevant highlights resulting from the workshop were all incorporated within the primary review paper submitted to *Nature Geoscience*. In particular, a novel meta-analysis of nutrient addition experiments and natural marine microbial responses within dust addition experiments was included within this manuscript. Novel data meta-analyses have been produced as part of generating the review paper and extensive work has been performed on these during the past 12 months. The article is currently under review. The annual progress report received during the reporting period is available in an Addendum to this report.

SOLAS is contributing to the IGBP/SCOR Fast Track Initiative on Megacities and the Coastal Zone: air-sea interactions (2009-2011). This initiative is coordinated by the IGAC IPO, Roland von Glasow (UEA, UK), Tim Jickells (UEA, UK), Tong Zhu (Peking University, China), Ramesh Ramachandran (Institute for Ocean Management, India) and Josef Pacyna (Norwegian Institute for Air Research, Norway). Three IGBP core projects are contributing to this FTI: LOICZ, IGAC and SOLAS. A workshop took place in Norwich, UK, on 13-15 April 2010 to address the FTI goals. The results of the workshop were presented via a poster at the IGBP Planet under pressure conference, March 2012, London, UK; at the SOLAS OSC2012, May 2012, Seattle, USA; and via an oral presentation at the EGU, April 2012, Vienna, Austria. A revised manuscript was re-submitted in June 2012 to the journal *Ambio*.

## ***Task teams***

### **The SOLAS task team: Asian Dust and Ocean EcoSystem (ADOES)**

The Joint 6th Workshop on ADOES with Asian SOLAS took place on 5–9 October 2011 in Qingdao, China. More than 50 participants attended the workshop and 29 scientists from China, Japan, South Korea and the United States were invited to present their latest research results and findings, with a focus on Asian dust and its potential impact on marine ecosystem (see <http://solas-int.org/news/meetingreports/ADOESSOLAS6.pdf>).

**SOLAS/IGAC Task Team: Halogens in the Troposphere (HitT)**

<http://www.HitT-task.net/>

A session took place at the EGU 2012 conference on Halogens in the Troposphere to discuss future research needs. The suggested foci included reducing detection limits of existing instrumentation; field comparison of instruments; solid regional and global assessment of quantitative importance of halogens for atmospheric composition and climate forcing; and kinetic studies on gas, but especially heterogeneous reactions. The need for internationally co-ordinated funding was identified, but currently no calls for funding appear to be available.

During the SOLAS OSC12 conference in Washington State, a discussion session took place on the "Climate impact of seasalt-derived Cl atoms" that explicitly focused on the importance of the reaction of the Cl atom with the greenhouse gas methane. A brief report will be published in the SOLAS newsletter issue 14.

A session contributing to the HitT Task team will take place at the AGU Fall meeting, 3-7 Dec 2012, San Francisco, CA, USA. Session: A075: Tropospheric Chemistry and Tropical Oceans, Conveners: Rainer Volkamer, Alfonso Saiz-Lopez, Mitsuo Uematsu, Roland von Glasow  
The annual progress report received during the reporting period is available in an Addendum to this report.

**Endorsed projects**

Over the reporting period, SOLAS endorsed 5 projects:

- SOAP-Surface Ocean Aerosol Production- NZ project
- MERMEX-Marine Ecosystems Response in the Mediterranean Experiment–French project
- CARBOCHANGE- Changes in carbon uptake and emissions by oceans in a changing climate- EU FP7 large-scale integrating project
- MedSeA- Mediterranean sea acidification in a changing climate- EU FP7 project
- ADEPT- Aerosol deposition and ocean plankton dynamics- Spanish project

The endorsement submission forms and update reports are available on the SOLAS Web site. All the submission forms of the newly endorsed projects and update reports received during the reporting period are available in an Addendum to this report.

**SOLAS- IMBER Carbon Group**

Much of the science of SOLAS Focus 3 overlaps with IMBER and thus a joint SOLAS/IMBER Carbon Group (SIC) was formed during a meeting held in Colorado in October 2005. This group is working in close collaboration with International Ocean Carbon Coordination Project (IOCCP). The SIC group is currently subdivided into three working groups:

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- **WG1-Surface Ocean Systems.** Chair: Andrew Lenton (Australia) (since Sept 2011)
- **WG2-Interior Ocean.** Chair: Nicolas Gruber (Switzerland)
- **WG3-Ocean Acidification.** Chair: Jean-Pierre Gattuso (France)

## **\*WG1-Surface Ocean Systems**

Andrew Lenton from Tasmania, Australia took over Dorothee Bakker in September 2011.

The past 3 years of activities of the WG1 led to the establishment of an international sea surface pCO<sub>2</sub> data-base, called SOCAT (Surface Ocean Carbon ATlas, <http://www.socat.info/>). The first release of SOCAT took place at the SIC WG1 & WG2 Synthesis meeting in Paris on 14-16 September 2011. Roughly 85 scientists and data providers contributed to this effort (6.3 million fCO<sub>2</sub> data points from 1851 cruises from 1968 to 2007). This database is widely regarded as one of the scientific highlight of 2011. Two SOCAT products are available via <http://www.socat.info/>:

1. A global data set of recalculated surface water fCO<sub>2</sub> values in a uniform format, which has undergone 2nd-level quality control; and
2. A global, gridded product of monthly mean surface water fCO<sub>2</sub>, with no temporal or spatial interpolation, and individual cruise files with recalculated fCO<sub>2</sub> values.

An article was published in *EOS* in March 2012: "Global Data Products Help Assess Changes to Ocean Carbon Sink." A series of papers are submitted and in preparation. The SOCAT version V2.0 is well underway. A meeting took place in July in Japan to discuss next steps.

## **\*WG2-Interior Ocean**

The membership of the SIC WG2 has been revised. The eight members held their first meeting in conjunction with the Synthesis meeting in Paris in September 2011. The SIC WG1 and WG2 and IOCCP organized a workshop on 'The Ocean Carbon Cycle at a Time of Change: Synthesis and Vulnerabilities' at UNESCO, Paris from 14 to 16 September 2011. The meeting was attended by 102 participants from more than 25 countries. SOLAS, IMBER, IOCCP, Eur-OCEAN and SCOR co-sponsored the meeting. The objectives of the meeting were (i) to synthesize the presently available information about the decadal time-scale changes of the ocean carbon cycle, (ii) to connect the changes in the surface ocean to those occurring at depth, and (iii) to assess the processes responsible for these changes. Concrete outcomes are a series of synthesis papers, many ideas, new collaborations and new projects.

## **\*WG3-Ocean Acidification**

The main goal of the working group on Ocean Acidification (WG3) is to coordinate international research efforts in ocean acidification and undertake synthesis activities in ocean acidification at the international level. The proposal for funding submitted to the IAEA was successful; an "Ocean Acidification International Coordination Office (OA-ICO)" will be established. The ICO was launched at the Rio+20.

SOLAS Project Integration

In 2010, funding was secured for running the project for two more years and since November 2010, Shital Rohekar took over Tom Bell's position. As a Project Integrator, Shital has worked with the aerosol community to assemble the available aerosol/rain data which has been submitted to the British Oceanographic Data Centre (BODC). The database is now live at [http://www.bodc.ac.uk/solas\\_integration/implementation\\_products/group1/aerosol\\_rain/](http://www.bodc.ac.uk/solas_integration/implementation_products/group1/aerosol_rain/) and contains more than 1200 data points.

Other SOLAS activities

→ **PICES 2011 Annual Meeting “Mechanisms of Marine Ecosystem Reorganization in the North Pacific Ocean”**, October 14-23, 2011, Khabarovsk, Russia

SOLAS sponsored Minhan Dai, to attend the meeting and represent SOLAS, in order to liaise better with PICES.

→ OS3.1 IMBER/SOLAS special Session at the **European Geosciences Union General Assembly 2012** “Sensitivity of marine ecosystems and biogeochemical cycles to global change”, 23-27 April 2012, Vienna, Austria

Convener: B. Salihoglu, Co-Conveners: C. Robinson, C. Garbe, V. Garçon, A. V. Borges

→ In Feb 2011, the **European Space Agency** (ESA) opened a call “Support To Science Element (STSE)”, an element of the Earth Observation Envelope Program (EOEP-3) to both public and private institutions on 3 topics: (1) Sea spray aerosol production, 2) Sources and sinks of climatically active gases in the Eastern Boundary Upwelling and Oxygen Minimum Zone (OMZ) systems, and 3) Air-sea exchange of greenhouse gases using satellite data. The SOLAS community submitted one proposal to each of the ESA calls and was successful with all 3 proposals.

1. Theme: Sea spray aerosol production

Acronym: OSSA (Oceanflux Sea spray Aerosol Production)

Duration: 24 months.

Total grant: 350 000 Euros

PI and co PI's: PI: (FMI) Gerrit de Leeuw, subcontractors National Univ of Ireland Galway (NUIG: Colin O'Dowd) TNO (Astrid Manders)

2. Theme: Sources and sinks of climatically-active gases in the Eastern Boundary Upwelling and Oxygen Minimum Zone (OMZ) systems

Duration: 18 months.

Total grant: 150 000 Euros

PI and co PI's: Christoph Garbe, Véronique Garçon, André Butz, Boris Dewitte, Aurélien Paulmier, Joël Sudre, Isabelle Dadou and Hussein Yahia.

3. Theme: Air-sea exchange of greenhouse gases using satellite data

Acronym: “Oceanflux Greenhouse Gases” Duration: 24 months

Total grant: 350 000 Euros

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PI and co PI's: UHI (David Woolf), PML, (Jamie Shutler), IFREMER (Bertrand Chapron), NOC (Margaret Yelland)

Starting date: Nov 2011

→ **European Space Agency (ESA) / SOLAS / European Geosciences Union (EGU) conference on Earth Observation for Ocean-Atmosphere Interactions Science**  
29 November–2 December, Frascati, Italy

The topical conference brought together the Earth Observation and SOLAS communities, as well as scientific institutions and space agencies involved in the observation, characterization and forecasting of ocean-atmosphere interactions and their impacts. Visit [www.eo4oceanatmosphere.info](http://www.eo4oceanatmosphere.info) for more info.

### SOLAS communication

SOLAS Web site: <http://www.solas-int.org/>

COST Action 735 Web site: <http://www.cost-735.org/>

SOLASNews newsletter emailed to ~2000 scientists and airmailed to ~150 scientists, the latter mainly from developing countries. Copies are held by the SOLAS IPO for distribution at SOLAS-relevant conferences and meetings. The NL is also available from the Web site. SOLASNews is printed and airmailed from China courtesy of State Key Laboratory of Marine Environment Science, Xiamen University. Since issue 11, SOLAS also implemented an on screen reader pdf version.

Issue 13 (summer 2011) focuses on the progress of the SOLAS Mid-Term Strategy, with articles from researchers in many of the strategy themes and updates from majority of theme leaders. As well as reports from national representatives and partner projects, there are COST Action 735 mission reports, an appeal for data from SOLAS Project Integrator Shital Rohekar, and information on SOLAS's new chair, Dr. Eric Saltzman.

E-bulletins are sent to more than 2000 SOLAS scientists roughly 10-12 times per year and previous issues are archived on the website at <http://www.solas-int.org/news/bulletin/bulletin.html>. The bulletins contain news from SOLAS, opportunities for meetings, abstract submission deadlines, recent publications, vacancies and news from relevant partner project and collaborators.

### SOLAS Funding

In July 2012, an additional student started to help the IPO in Kiel, Jasmin Mögeltönder funded by BMBF.

After the closure of the Node Office in Norwich, from Oct 2012, the IPO will be operated by the Executive Officer (EO), Dr. Emilie Brévière, Project Officer (PO), Stefan Kontradowitz (both funded by GEOMAR) and two assistants, Roberto Benavides and Jasmin Mögeltönder (both

funded by BMBF). From January 2013, the SOLAS activities will be managed by the EO and PO only. The BMBF funding will end in January 2013, as long as the EO and PO contracts.

However, as per today it is very likely that the EO contract will be renewed for 3 years (2013, 2014 and 2015) and funded by GEOMAR. The PO contract will also be renewed for 3 years and likely to be funded by BMBF. Unfortunately, no money for IPO activities (publication/travel/workshops/meetings) have been secured so far. Plans are underway to develop some funding. Some agencies have been approached.