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SCOR Proceedings, Volume 48  
REPORT OF THE XXXI SCOR GENERAL MEETING

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# **XXXI SCOR GENERAL MEETING**

Halifax, Nova Scotia, Canada

21-23 October 2012

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## **1.0 OPENING**

### **1.1 Opening Remarks and Administrative Arrangement**

Wolfgang Fennel, SCOR President, thanked everyone for attending the meeting. He announced that the meeting would take place at Dalhousie University for the next two days then at the Bedford Institute of Oceanography on the third day. (Both institutions have been important in SCOR history.) Marlon Lewis, chair of the Department of Oceanography at Dalhousie University, welcomed everyone to the university. He noted that ocean science is one of the principal areas of study at the university. Lewis welcomed SCOR back to Dalhousie; the SCOR Secretariat was located at the university between 1980 and 1992, before moving to Johns Hopkins University.

Ed Urban thanked the financial sponsors of the meeting: the Canadian National Committee for SCOR, Dalhousie University and its Department of Oceanography, ASL Environmental Sciences (<http://www.aslenv.com/>), and AMEC (<http://www.amec.com/>) for their generous support for the meeting. This is SCOR's 55<sup>th</sup> year anniversary this year.

Wolfgang Fennel announced that since the last SCOR meeting, David Dryssen from Sweden had passed away; meeting participants observed a moment of silence. Prof. Dyrssen was a Nominated Member from Sweden between the years of 1979 and 1985.

### **1.2 Approval of the Agenda**

Wolfgang Fennel asked if any changes were needed to the agenda. Doug Wallace requested to make the IGBP presentation at the same time he updates meeting participants about SOLAS activities. The change to the agenda was approved.

### **1.3 Report of the President of SCOR**

Wolfgang Fennel briefly reviewed his activities for SCOR since the SCOR Executive Committee Meeting in September 2011 in Helsinki.

### **1.4 Report of SCOR Executive Director**

Ed Urban reported on his activities for SCOR since the 2011 SCOR meeting, and on the current condition of SCOR. This has been another busy year for the SCOR Secretariat and SCOR-supported groups continue their good work.

**Finances**—Despite continuing global financial difficulties and financial difficulties experienced by some of SCOR’s partners, SCOR’s finances are healthy. SCOR has a very small staff and tries to be very efficient.

Income from dues from national SCOR committees have been received on schedule, so it is likely that dues income will meet budget. Income from dues is important for funding the central administration of SCOR, namely the costs of the Secretariat and the annual SCOR meetings. Dues also fund some costs of working groups and other SCOR activities that are not funded from grants. SCOR depends on grant funding for large-scale research projects, ocean carbon activities, and some working groups. The U.S. National Science Foundation is a major sponsor and SCOR recently received approval of a renewal proposal for the period 1 September 2012 to 31 August 2015. Proposals are pending at the U.S. National Aeronautics and Space Administration.

**Membership**—The number of countries involved in SCOR has remained stable this year. Discussions have taken place this year with individuals from Indonesia, the Philippines, and Thailand about membership in SCOR.

**Publications**—The SCOR Web site is the major vehicle for providing up-to-date information about SCOR to the international ocean science community and it is updated on a regular basis. SCOR activities yielded many publications in the primary literature and other venues this year. The use of commercial, closed-access journals is still an issue, both because of cost and because of the difficulties of some scientists in developing countries to access SCOR publications.

### **1.5 Appointment of an *ad hoc* Finance Committee**

Wolfgang Fennel noted that the SCOR Constitution requires that a Finance Committee be appointed at every SCOR meeting. It must consist of three members of SCOR who are not members of the Executive Committee. Fennel introduced the 2013 Finance Committee approved by the Executive Committee: Corina Brussaard (Netherlands), Colin Devey (Germany), and Sun Song (China-Beijing). The Finance Committee reviewed the administration of SCOR finances during the previous fiscal year and the current year, and proposed a budget for 2013 activities. The Committee report is found in section 8.3.

### **1.6 2012 Elections for SCOR Officers**

The SCOR President and all three Vice-President positions were open for nominations for the 2012 elections. Bjørn Sundby, the chair of the SCOR Nominations Committee, announced that Peter Burkill has been elected as President of SCOR by national SCOR committees, and Corina Brussaard has been elected as a new SCOR Vice-President. Two Vice-Presidents were reelected for a second two-year term: John Volkman and Satoru Taguchi. Ilana Wainer, John Compton, and Bjørn Sundby rotated off the SCOR Executive Committee.



## 2.0 WORKING GROUPS

### 2.1 Disbanded Working Groups

#### 2.1.1 WG 125—Global Comparisons of Zooplankton Time Series

The group's special issue appeared in *Progress in Oceanography*<sup>1</sup> in mid-2012. The group was disbanded and sent thank-you letters. Ed Urban noted that he was told by the journal that it would cost more than US\$1,000 to purchase one copy of the special issue. SCOR needs to continue to encourage groups to use open-access publishers. The Executive Committee is considering revising the SCOR policy regarding open access. Maciej Telszewski made the point that PDF files are free and we can provide a link to them.

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

This group has been transformed into a Joint Steering Committee on Seawater with the International Association for the Properties of Water and Steam (IAPWS) and IAPSO (see section 4.3.3). An article on this group's work was published in the open-access journal *Ocean Science*.<sup>2</sup> Denise Smythe-Wright reported that the group came up with a new international thermodynamic equation which is being adopted and has been very well received.

#### 2.1.3 SCOR WG 130 on Automatic Plankton Visual Identification

Mark Costello reported that the group was asked to make modifications to their Web site after the 2011 SCOR meeting, which they did. The group was disbanded and members were thanked for their work.

#### 2.1.4 SCOR/IAPSO WG 133: OceanScope

Missy Feeley reported that the OceanScope report was finalized and released in early 2012 (see [http://www.scor-int.org/Publications/OceanScope\\_Final\\_report.pdf](http://www.scor-int.org/Publications/OceanScope_Final_report.pdf)). Feeley brought a printed copy with her and noted that it is also on the SCOR Web site. Part of the success of the group's effort is that it got the shipping industry very interested. Working group members continue to work on implementation of the report. The group was disbanded and sent thank-you letters.

### 2.2 Current Working Groups

The Executive Committee Reporter for each working group presented an update on working group activities and progress, and made recommendations on actions to be taken. Working group chairs and members present were given time to make comments about their group. The Finance Committee took into account the recommendations of the Executive Committee as it developed the 2013 SCOR budget, which was then subject to final approval by the meeting.

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<sup>1</sup> Pepin, P., D. Mackas, and H. Verheye. 2012. Global Comparisons of Zooplankton Time Series. *Progress in Oceanography* Volumes 97-100, pp. 1-186.

<sup>2</sup> Pawlowicz, R., T. McDougall, R. Feistel, and R. Tailleux. 2012. An historical perspective on the development of the Thermodynamic Equation of Seawater – 2010. *Ocean Science* 8:161–174, 2012, [www.ocean-sci.net/8/161/2012/](http://www.ocean-sci.net/8/161/2012/). The article appears in a special issue from the working group (see [http://www.ocean-sci.net/special\\_issue14.html](http://www.ocean-sci.net/special_issue14.html)).

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

John Compton reported that this group's main objective was to compile the data sets of all major large-scale iron fertilization experiment into a single database for public access. It was an ambitious endeavor and they appear to have succeeded. There were only two members of the group (unusual for a SCOR working group): Philip Boyd (New Zealand) and Dorothee Bakker (UK). The group completed a database that can be accessed at the Biogeochemical and Chemical Oceanography Data Management Office (BCO-DMO). The database was publicized through an article in *Oceanography* magazine.<sup>3</sup> Compton noted that the group had several different Executive Reporters, of which he was the last. He would have liked them to show how to use the data. However, Compton expressed that the co-chairs accomplished what they set out to do in terms of assembling data sets. The group was originally going to assemble data and produce a product that could be used as the basis for a modeling workshop, but the group underestimated what it would take to complete this task. Compton recommended that the working group be disbanded, and the meeting agreed.

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

The group held its final SCOR-funded meeting in Crete, Greece, in conjunction with the 14<sup>th</sup> International Conference on Harmful Algae in October 2010, but conducted one subgroup meeting (funded by other sources) to continue working on publications. The co-chairs were Patricia Glibert and Lex Bouwman. The group has published several papers related to its activities and has several more papers in preparation. SCOR funding for the group has been completed. Satoru Taguchi presented the group's terms of reference. Taguchi's recommendation was to disband the group, which was accepted by the meeting.

### **2.2.3 SCOR WG 134 on The Microbial Carbon Pump in the Ocean**

Bjørn Sundby reported that the group started in 2008 and has been very active with publishing. This working group met for the third time at the Hansa Institute for Advanced Studies in Delmenhorst, Germany in August 2012, primarily funded by local sources. The group was successful in having its science area approved as one of the three topics in the 2013 IMBER IMBIZO. SCOR funding remains for one final meeting of the group, but they have been very successful with getting funds from other sources.) The group is asking to use the remaining funds for other activities/meetings, which Sundby recommended SCOR approve. The meeting approved.

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

Athena Coustenis reviewed WG 135's terms of reference. The group held its second meeting in Hangzhou, China in October 2011. It was hosted by the Second Institute of Oceanography, State Oceanic Administration. The group is developing two models to guide its work. One is a water column iron model. A preliminary version of this model was completed by early 2012, and

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<sup>3</sup>Boyd, P.W., D.C.E. Bakker, and C. Chandler. 2012. A new database to explore the findings from large-scale ocean iron enrichment experiments. *Oceanography* 25(4):64–71. <http://dx.doi.org/10.5670/oceanog.2012.104>.

model development is continuing. A similar approach has been initiated for a seafloor ecosystem model. The group is planning its final meeting and workshop for Banyuls, France in early 2013, to discuss the models and model results. SCOR meeting participants approved 2013 funds for a meeting of WG 135.

### **2.2.5 SCOR/WCRP/IAPSO Working Group 136 On the Climatic Importance of the Greater Agulhas System**

John Compton reported that he is thrilled with this working group and it is exemplary with what it has done and what it is doing. The co-chairs are Lisa Beal (USA) and Arne Biastoch (Germany). The group's membership fluctuated over the years but they were very effective in their first year in publishing an *Eos* article and a comprehensive paper in *Nature*. Compton hopes the papers are having a large impact on the perception of the role of ocean circulation on climate.

The group's final activity was a Chapman Conference, for which SCOR allocated the remainder of its funds. The AGU Chapman Conference on The Agulhas System and its Role in Changing Ocean Circulation, Climate, and Marine Ecosystems was held on 8–12 October 2012, in Stellenbosch, Western Cape, South Africa (see <http://www.agu.org/meetings/chapman/2012/ecall/>). This conference continued the group's outreach in the southern Africa region; it was the first Chapman Conference to be held in Africa. SCOR's Committee on Capacity Building approved funding for travel support to developing country scientists to the conference and IAPSO helped arrange funds from the International Union of Geodesy and Geophysics (IUGG) to the conference for developing country scientists. The working group did an excellent job in promoting the development of science in southern Africa. There were many young scientists and scientists from developing countries at the conference. The group has been effective at establishing a monitoring system for the Agulhas Current. Compton concluded that the group has done everything they set out to do and did it well. This should be an example for all working groups. Their work will have a lasting impact. Compton recommended that the group be disbanded, but hopefully their science will continue. The meeting agreed to disband the group.

### **2.2.6 WG 137: Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observation**

John Volkman reported that the group was approved at the 2009 SCOR meeting and is co-chaired by Kedong Yin and Hans Pearl. The group's main objective is to compile datasets and then examine a series of scientific questions, based on the data compiled. Each question is being handled by a subset of the working group. The Web site for data sets is at <http://wg137.net/>. Volkman expressed that the Web site is very impressive. The group met for their third time as part of the special session at the 2012 PICES meeting in Hiroshima, Japan, immediately before the SCOR meeting. The group has some funds left for another meeting, but they need to let SCOR know what they are planning for their meeting. This is an example of a group that handles data very well. Volkman concluded that this group is highly functional and productive.

A general question was raised about whether publications produced by working groups are mentioning SCOR. Ed Urban responded that most groups acknowledge SCOR in their publications, although some do not. Urban is in touch with every group when their publications are nearing completion to remind them of this requirement.

### **2.2.7 WG 138: Modern Planktic Foraminifera and Ocean Changes**

Missy Feeley reported that the basic premise of this working group is to synthesize the state of the science of modern planktic foraminifera, provide guidelines, laboratory techniques, “cookbooks” to aid science, provide a Web-based network of scientists, and document its work through open-access journals. The group had its first meeting in September 2011 and has made significant progress since then. A Web site has been developed for the group on the eForams platform ([http://www.eforams.org/index.php/WG138\\_Startpage](http://www.eforams.org/index.php/WG138_Startpage)) and is currently being filled with content. The site acknowledges SCOR sponsorship. They have an e-book, some synthesis of meetings and have done quite a bit of work to move their deliverables forward. In the area of capacity building, the first meeting included 19 PhD students attending to provide networking opportunities. The group made a few YouTube videos which were professionally done. The videos were partially funded through Dutch sources and partially from SCOR. The group will not meet this year, but would like to have two meetings next year. WG members have been busy in the past year working toward individual products. A special issue of an open-access journal is being developed, summarizing the status of knowledge on modern planktonic foraminifera. A taxonomic database and an annotated list of references also are being developed. The priority for the group’s second year will be to achieve progress in two important areas: standardization of taxonomy and standardization of methods. Two topical workshops will be held in 2013, rather than a single full group meeting. Feeley concluded that the group has been very active and has a clear focus on capacity building. She recommended that SCOR provide funding for the 2013 meetings and SCOR meeting participants agreed.

### **2.2.8 WG 139: Organic Ligands – A Key Control on Trace Metal Biogeochemistry in the Ocean**

John Compton reported that this group met for the first time immediately before the Ocean Sciences meeting in Salt Lake City, Utah, USA, in February 2012. The group’s objective is to understand metals in the ocean that are associated very strongly with ligands. The group is trying to work towards a better understanding of how ligands exist in the ocean, how to best categorize them, and how to measure them. They are developing a best practices guide to establish methodology. The group published articles in *EOS*<sup>4</sup> and *Chemistry International*<sup>5</sup> to announce its work. The group is conducting an intercalibration activity now and will publish the results. A database for trace metal binding data is planned. The group will hold its second meeting on 16 February 2013, immediately before the ASLO meeting in New Orleans. As with the first meeting, this will minimize travel costs for the meeting. The group has had a special session accepted for the 2013 ASLO meeting, on “Biogeochemistry of metal-binding organic ligands in the ocean: Sources, composition and impacts on trace metal cycling.” Compton stated

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<sup>4</sup>Sander, S., K. N. Buck, and M. Lohan. 2012. Improving understanding of organic metal-binding ligands in the ocean. *EOS* 93: 244.

<sup>5</sup>Buck, K. N., M. C. Lohan, and S. G. Sander. 2012. Metal-binding organic ligands as the focus of a new SCOR Working Group. IUPAC *Chemistry International*. 34(4).

that the group has made good progress and will hopefully expand and publish a Web-based “best practices” guide. He suggested that the group should have more meetings outside the United States. He recommended funding for the group in 2013 and meeting participants agreed.

### **2.2.9 WG 140: Biogeochemical Exchange Processes at the Sea-Ice Interfaces (BEPSII)**

The group was approved at the 2011 SCOR Executive Committee meeting and recently finalized its set of Full Members. The list of Associate Members had not yet been approved because it needed to be reduced. The group held an opportunistic meeting in conjunction with the SOLAS Open Science Conference in May. In the group’s annual report is given simplified terms of reference and clarification of the products expected from the group. To achieve the group’s goals, three task groups will be formed, on methods, data, and models. The group is making connections with other projects with similar interests. The chair is exploring the possibility for a video conference of members in November 2012 and an in-person meeting in 2013. John Field asked if there is a link to SCAR. Ed Urban responded that he didn’t know, but this would be a natural connection to make.

## **2.3 New Working Group Proposals**

Seven working group proposals were received by the SCOR Secretariat. The Finance Committee determined that SCOR can fund two new working groups to begin in 2013. The selection process used this year was to create a “short list” of three proposals from the seven through discussion of each proposal in turn at the meeting. It was agreed among meeting participants that proposals with more than 50% “no” votes would be excluded from the second round of discussions, although the proponents of eliminated groups would be provided comments, recommendations, and advice, in case they want to re-submit their proposals for a later annual meeting. Monitors will draft letters for each proposal, based on suggestions during this meeting. The three proposals on the short list were discussed again and the two favored by the greatest number of national committees were selected.

### **2.3.1 SCOR Working Group on Surface Waves in Ocean Circulation and Climate System**

Athena Coustenis presented the proposal. She reported that the proponents want to explore and identify the crucial importance of surface waves. Coustenis presented the proposed terms of reference and listed the products the group is proposing, including articles in *Eos* and peer-reviewed journals. Coustenis also presented the proposed list of Full Members, which included seven men and three women, and the proposed list of Associate Members. Capacity building will be accomplished through a Web site used as a virtual workshop. In addition, the group wants to host two training courses on wave effects on ocean and climate, and to support at least 25 trainees. National committees were split in their opinions of the proposal; most expressed that the group should not be approved this year. On the positive side, the work of the group could advance understanding of physical oceanography and climate, and the results of the group could be very important for marine ecosystem, biological and chemical processes and ocean operational forecast systems. However, some nations thought the proposal described more of a research project than a working group. There was some disagreement about the need for the proposed kind of work in modelling, as the effects of waves are already parameterized in existing

models. Some nations expressed that the terms of reference and goals were not specific enough. The working group was not approved.

### **2.3.2 SCOR Working Group on an “International Nutrients Scale System” to improve the global comparability of nutrient data**

Satoru Taguchi presented the working group’s justification, objectives, terms of reference, and products. He also listed the proposed Full and Associate members. Taguchi showed a map of locations of laboratories taking part in the 2012 International Nutrients Scale System exercise. He described the capacity building activities that would be conducted by the group, and gave a summary of comments from national SCOR committees. There is a practical need for very high standards in all chemical oceanography in order to capture value from individual studies and extended time series and to make them comparable, but this proposal seemed more about an independent certification of products from a single company rather than a broader assessment of alternative approaches. One immediate problem was that there were not enough female and developing country Full Members proposed. Negative comments from national committees were that the group has already been around a long time, as an IOC activity, and the issue is not a high priority for SCOR. Some national committees thought the activity is not science-driven. More national committees expressed that the proposal should not be approved this year, than those who thought it should be funded. The proposal was not funded.

### **2.3.3 SCOR Working Group on Marine Ecosystem Reorganisation Under Climate Change**

Mark Costello presented the working group’s justifications and the three proposed tasks, as well as the products and proposed Full and Associate member lists. There was no emphasis on capacity building in the proposal. The number of national SCOR committees in favor of funding the group was about equal to those against funding. On the positive side, some committees thought the proposed activity was high priority in terms of responding to climate change issues, was timely, and scientifically sound. The proponents have an outstanding track record of science and are highly likely to publish the group’s results in *Science*, *Nature*, or some other high-profile journal. On the negative side, many national committees thought the proposed activity was too ambitious, not driven by science questions, and therefore not suitable as a working group. It was also questioned whether the data are available for the proposed work, although the existence of a group sometimes helps attract the data. The composition of the slate of Full Members would have to be revised before the group could be funded. There are some very good members proposed, but the expertise, geographic, and gender balances are not quite right. (SCOR usually recommends that groups have no more than two members from a single country.) It seems that the group will go on with or without SCOR funding, based on funding from their institutions plus funding from other areas that they have committed and outlined. A concern was whether they group would be able to complete its work according to their proposed timeline. The proposal was not approved.

### **2.3.4 SCOR Working Group on Sea-Surface Microlayers**

John Volkman presented the justification and the proposed terms of reference for the group. He also reported on the expected products and the Full Membership of the group, which he expressed is a good balance in terms of expertise, geography, and gender. Capacity building will be enhanced by including Full Members from Malaysia, Brazil, and China. Also, the group will

meet for a 3-day workshop in 2014 in Qingdao, China. For positive comments from national SCOR committees, the surface microlayer has potentially significant effects within the global context, due to its unique position between the ocean and atmosphere, including air-sea gas exchange processes and production of organic-rich aerosols that develop into cloud condensation nuclei. SCOR should be fostering “blue skies” research on new frontiers like this that may change the way we think about ocean processes, about ocean-atmosphere interactions, and about the ocean’s role in the climate system. This proposal is timely, novel, and supported by a substantial body of past research. Global change research modellers should take serious action in adopting SML into their new models. Scientific and technical issues make the proposal very interesting. Many national committees thought this is an important and appropriate topic for a SCOR working group and that the membership is nicely balanced. On the negative side, the group seems quite narrow, focusing on a topic that has been studied for years. It is not clear that this topic should be a SCOR priority. The capacity building aspects of the group are not well developed. The group’s terms of reference may be hard to achieve and they need to be more interdisciplinary, including physics and chemistry. Only four of the proposed members have published scientific papers related to sea-surface microlayer subjects. Some national committees felt that the proposed terms of reference were too vague. By the end of the discussions, this group was one of the two that meeting participants decided to fund to start in 2013, in part because many national committees ranked the proposal first or second. The group has good gender balance and developing country involvement. The terms of reference could be improved by going into better detail on techniques and more emphasis on modeling. The group could produce an e-book.

### **2.3.5 SCOR Working Group on Quality Control Procedures for Oxygen and Other Biogeochemical Sensors on Floats and Gliders**

Missy Feeley presented the justification for the working group, the proposed terms of reference, and the products. Measurement of oxygen levels systematically through the ocean has become an important goal of ocean observations. Six sensors made by three different manufacturers are used on different Argo floats. These sensors have not yet been intercalibrated and it is becoming obvious to those trying to use the data that there is a problem in comparing data from different sensors. It is a good time to develop common calibration processes and have standards for quality control of data. The group will produce a written document after each meeting. Feeley presented the proposed list of Full and Associate members, as well as the group’s plans for capacity building. The group plans to get in contact with POGO to see if their products and procedures would be useful in terms of capacity building. Feeley summarized comments from national SCOR committees. The group would have a timely influence on the next logical step for evolution of the Argo program. One reason that the Argo measurements of physical variables has been so successful is because the sensors are well intercalibrated, which is not the case for oxygen sensors. A SCOR working group would speed-up progress in this topic and would be ideal for SCOR to make an impact; this could be a high-risk but high-reward activity. On the negative side, some national committees thought the group’s plans are unfocused, the proposed plan may not be appropriate for a SCOR working group (it may be a problem for the Argo community to fix), and the terms of reference are not innovative, are superficial, and are not science-driven. Is this a problem that can be solved in the lifetime of a working group?



The proposal was approved for funding, provided that the group focus on floats or include more in the terms of reference about gliders. The group should be sure to address other sensors beyond oxygen, particularly pH. Someone who knows the Argo data system should be added to the group, along with more developing country members, particularly from Asia/South America. It is good that members of the Argo community with other expertise are proposed as members.

### **2.3.6 SCOR Working Group to identify Ecosystem Essential Ocean Variables for measuring change in the biological properties of marine ecosystems**

Mark Costello described the justification for the group, the proposed terms of reference, and the products that the group would produce. He also showed the proposed membership, which had good gender balance and two developing country scientists. Many national committees found the proposed group to be timely, topical, and deserving of SCOR support. On the other hand, some national SCOR committees thought the proposal was too vague, the terms of reference weak, the methods unclear, the objectives too diffuse and broad, and that it was unclear whether the variables to be studied would be biological, physio-chemical and/or ecosystem processes. Other negative comments are that four years would be too long to wait for the information to be delivered, and that the proposal omits clear links to related initiatives like the Group on Earth Observations Biodiversity Observation Network (GEO BON) and the International Union for Conservation of Nature Red Listing of Ecosystems process. Should the project involve the Intergovernmental Oceanographic Commission (IOC)'s Global Ocean Observing System and Ocean Biogeographic Information System, the North Pacific Marine Sciences Organization (PICES), the International Council for the Exploration of the Seas (ICES), the Framework for Ocean Observations (FOO), the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) project, and/or the Global Ocean Biodiversity Initiative's Ecologically or Biologically Significant Areas (EBSA) or Vulnerable Marine Ecosystems (VMEs) activities? The activities described are largely pelagic; what about benthic organisms? One suggestion was that SCOR could co-fund a workshop rather than funding a working group. It was decided not to fund the proposal this year, and to give the proponents feedback in case they want to re-submit the proposal in a later year. It was suggested that POGO may want to fund a workshop on this topic.<sup>6</sup>

### **2.3.7 SCOR Working Group on The reassessment of marine dinitrogen fixation methodology and measurements**

Bjørn Sundby presented the proposal, including the purpose of the project and the proposed membership. Sundby thought SCOR should praise the group's ongoing work, which is timely and urgent. There would not be enough funding from SCOR to support many of the proposed activities. Sundby stated that the meeting participants would need to decide whether the added activity of a SCOR working group would be helpful for a group that has already self organized and has already met, and know what they are doing. National committees were split on whether or not to fund the proposal. Some committees thought the group's proposed focus was too narrow and the cost of what they were proposing was too much for a SCOR working group. Missy Feeley asked if SCOR has previously funded workshops in response to working group proposals. John Field responded that it may be a question of what SCOR can afford and if SCOR were to fund a workshop, it would be necessary to have a recommendation from this

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<sup>6</sup>Following the SCOR meeting, SCOR and SCAR submitted a proposal to ICSU to fund a workshop on this group's topic and the proposal was funded.



meeting for funding. Ed Urban responded that SCOR is flexible but finances are an issue; this doesn't mean we can't try to raise funding through grants or other mechanism outside working groups. We could let the proponents know that SCOR will keep the issue in mind. It was suggested that since SCOR thinks this is an important issue, it could provide \$5000 or so "seed money" for a conference because it is important, and recipients could come back the following year with a better proposal. However, it is not clear that establishing such a precedent would be a good idea. The majority opinion was to not fund the group or provide seed money.

Colin Devey initiated a discussion as to why a decision should be made to fund two working groups when one is clearly selected and the other two are so close in the preferences from the meeting participants. Others felt that we should not reduce to one group when decisions were being made on the basis of funding two. It was also noted that the order of preference was consistent from the first round of discussions to the second for the three proposals in the second round. There was some discussion of giving one year of funding to the second- and third-ranked groups and to see what they achieve by next year, but this idea was not accepted. Corina Brussaard noted that, from the point of view of the Finance Committee, funding three working groups would not be a viable option.

### **3.0 LARGE-SCALE SCIENTIFIC PROGRAMS**

SCOR currently sponsors four large-scale research projects; three of them are co-sponsored by other organizations. Each project has its own scientific steering committee (SSC) to manage the project on a day-to-day basis. SCOR and other co-sponsors are responsible to oversee the projects, which they do primarily through responsibility for the project SSC memberships and terms of reference, although sponsors also oversee the results of the projects' activities. Any proposed changes in membership or terms of reference are considered by the SCOR Executive Committee, in partnership with other co-sponsors, throughout the year. SCOR does not use discretionary funds (funds from SCOR member nation dues) for the research projects it sponsors, instead writing grant proposals to fund meetings and other activities of the research projects. The SCOR Secretariat oversees the use of grant funds provided to the projects.

#### **3.1 SCOR/IOC Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Program**

Satoru Taguchi presented GEOHAB's terms of reference and purpose, and showed a list of the Scientific Steering Committee members. Raphael Kudela from United States is the chair and Elisa Berdalet from Spain is the Vice Chair of the GEOHAB SSC. GEOHAB has formed five Core Research Projects (CRPs) to focus efforts of the HAB science community:

1. HABs in Upwelling Systems
2. HABs in Fjords and Coastal Embayments
3. HABs in Eutrophied Systems
4. HABs in Stratified Systems
5. HABs in Benthic Systems

Taguchi showed a figure of the growth of GEOHAB publications over time, more than 200 publications since 2001 on GEOHAB-related research on harmful algal blooms. GEOHAB has published 10 reports in its report series. Two were just published: the research plan for the Core Research Project on HABS in Benthic Systems and a report from the second open science meeting of the Core Research Project on Fjords and Coastal Embayments. GEOHAB has also produced special issues of several peer-reviewed journals.

GEOHAB and IOCCG have a joint working group on HABS and ocean color. The group has met twice and is preparing a monograph in the IOCCG report series. It will present information about what is possible and not possible in terms of observing HABS from space. SCOR has recommended that GEOHAB sunset at the end of 2013, being 10 years from the publication of the GEOHAB *Implementation Plan* and 15 years after the Open Science Meeting that led to GEOHAB. GEOHAB will hold an open science meeting at IOC Headquarters in April 2013 to help synthesize the project's work. The GEOHAB SSC has suggested that SCOR seek funding for working groups focused on HABS, managed along the lines of traditional SCOR working groups (SCOR would manage the groups and provide quality control). Urban added that if NSF provided US\$40,000 per year for HAB-focused working groups, this would be sufficient to fund two or three groups at a time. This idea came up because people know SCOR working groups have been valuable to the ocean sciences internationally. At the same time, IOC will focus on management issue related to HABS and SCOR and IOC would ensure that their HAB activities are coordinated.

### **3.2 SCOR/IGBP Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project**

Bjørn Sundby reported that the IMBER SSC met most recently in June 2012 in La Paz, Baja California, Mexico. The third IMBER Summer School was held at the Ankara (Turkey) University in August 2012. The theme was the feedbacks between ecosystems, biogeochemistry, and the Earth System in a warming world. Fifty individuals participated from 26 countries and represented both natural and social science disciplines. Lectures were Webcast live and the recording will be available soon on the IMBER Web site.

The third IMBER IMBIZO will be held in India in early 2013. The three themes of the IMBIZO are (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; and (3) Understanding and forecasting human-ocean-human interactions, drivers and pressures, with respect to global change. IMBER has held workshops at its IMBIZOs to increase awareness of the importance and benefits of establishing and following data management procedures, and to provide hands-on training on data management and data preservation and will do the same at IMBIZO III. The IMBER International Project Office moved to the Institute for Marine Research in Bergen, Norway, in early 2012 and a new Executive Officer was hired. IMBER will hold its first open science meeting in Bergen in June 2014. SCOR and IGBP approved the addition of Tatiana Rynearson (USA) to the IMBER SSC. Specific IMBER activities are carried out by four regional projects and five working groups.

IMBER's regional projects include the following:

1. Ecosystem Studies of Sub-Arctic Seas (ESSAS)—ESSAS conducts research to quantify and predict the impact of climate change on subarctic marine ecosystems and sustainability.
2. Climate Impacts on Oceanic Top Predators (CLIOTOP)— CLIOTOP uses a worldwide comparative approach to understand the impact of climate variability on fisheries of the open ocean pelagic ecosystems and their top predator species in support of oceanic ecosystem governance.
3. Sustained Indian Ocean Biogeochemistry and Ecosystem Research (SIBER)—aims to understand the interactions between biogeochemical cycles and marine ecosystem dynamics in the Indian Ocean.
4. Integrating Climate and Ecosystem Dynamics (ICED)—A Southern Ocean project that coordinates circumpolar research to better understand climate interactions with the Southern Ocean ecosystem dynamics in the context of sustainable management plans.

IMBER's working groups and task teams include the following:

1. Capacity Building Task Team
2. SOLAS/IMBER Carbon Research Working Group
3. IMBER/LOICZ Continental Margins Working Group
4. Data Management Working Group
5. Human Dimensions Working Group

The **Capacity Building Working Group** has been working on developing a plan to increase IMBER capacity building activities worldwide, but also with specific application to Asia, where the IMBER Regional Project Office is located. The group held a workshop in Shanghai, China on 31 July-4 August 2012, sponsored by the Asia-Pacific Network (APN) for Global Change Research and other sources. The results of the workshop were documented in a report to APN and summarized in an article in *Eos*.<sup>7</sup>

The **SOLAS/IMBER Carbon (SIC) Research Working Group** has three subgroups:

1. Surface ocean carbon
2. Interior ocean carbon
3. Ocean Acidification

Each of the three subgroups has been busy. The Ocean Acidification subgroup led to the Ocean Acidification International Coordination Centre (OA-ICC). The Surface Ocean CO<sub>2</sub> Atlas (SOCAT) is another important activity, with IOCCP.

The **IMBER/LOICZ Continental Margins Working Group** is led by Kon-Kee Liu (China-Taipei) for IMBER and by Helmuth Thomas (Canada) for LOICZ. The group held its first SSC meeting in Halifax, Canada in June 2012.

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<sup>7</sup>Hu, L., B. Avril, and J. Zhang. 2013. Capacity Building for Sustainable Marine Research in the Asia-Pacific Region. *Eos* 94 (2):21.

The **Data Management Working Group**, led by Alberto Piola, produced an IMBER data management “cookbook” (see <http://www.imber.info/index.php/Science/Working-Groups/Data-Management/Cookbook>). The group has also hosted a series of workshops in conjunction with major IMBER meetings to discuss data management in the context of IMBER science.

The **Human Dimension WG** (HDWG), is led by Alida Bundy (Canada) and Marie-Caroline Madjeck. The objective of this working group is to integrate physical science, biogeochemistry, ecology, and social science in an interdisciplinary way. The group held its second meeting in March 2012. It is developing the OCEAN ADaPT approach, which is an assessment of responses based on Description, Appraisal and Typology. A 5-year research plan has been developed for this project. It is linked to the IMBER regional programs, the Continental Margins Working Group, and to LOICZ. The project will help develop future research directions related to global sustainability. The working group hosted a side meeting at the Planet Under Pressure conference in London, UK in March 2012.

IMBER is also working with other projects, such as the WCRP CLIVAR project. There was a joint CLIVAR-IMBER session at the 2012 IMBER SSC meeting in La Paz, Mexico.

IMBER is due to be completed at the end of 2015, but it is expected that the project will request an extension for five additional years. This will allow the regional projects to complete their planned work. John Field commented that given how IMBER has developed he would support an appeal to continue its support since it is building momentum. Ed Urban responded that the Executive Committee has started discussing how to respond when projects asking for extension. Currently, there are no guidelines, but there will be discussions in the future to create guidelines for project extension.

### **3.3 GEOTRACES Project**

Bjørn Sundby reported that GEOTRACES is an international program that aims to improve the understanding of biogeochemical cycles and large-scale distribution of trace elements and their isotopes. GEOTRACES has two co-chairs: Gideon Henderson (UK) and Ed Boyle (USA). The GEOTRACES International Project Office (IPO) is located in Toulouse, France and the GEOTRACES Data Assembly Centre (GDAC) is located in Liverpool, UK. 37 GEOTRACES cruises have been completed; Sundby showed slides of planned and completed cruises, and some results from the cruises. GEOTRACES continues to incorporate new methods as they become available, such as new methods to evaluate trace element fluxes to the ocean from aerosols. More GEOTRACES highlights are available at <http://www.geotraces.org/science/science-highlight/>. The project has resulted in more than 100 scientific papers so far.

The GEOTRACES project is well into cruise implementation, primarily accomplishing GEOTRACES-related IPY cruises and GEOTRACES cruises in the Atlantic Ocean. Cruise implementation is increasingly shifting to the Pacific Ocean, where Japanese, Australian, New Zealand, and French cruises have already taken place. The GEOTRACES Scientific Steering Committee held its sixth meeting in Xiamen, China in September 2011, immediately after a meeting of the GEOTRACES Data Management Committee. The next SSC and Data

Management Committee meetings will be held in Goa, India, in late October 2012. The International GEOTRACES Standards and Intercalibration Committee coordinated publication of the results from the GEOTRACES intercalibration activities in a special issue of *Limnology and Oceanography: Methods*.<sup>8</sup> This committee also analyzed data for crossover stations and found the results generally satisfactory. GEOTRACES helped support a regional meeting focused on the Arctic Ocean in May 2012 and the Russian Academy of Sciences is planning a follow-on meeting later this year. A South American regional planning meeting is planned for November 2012. The project has announced its intentions to produce an intermediate data product in 2014, which will help stimulate data submission and show that GEOTRACES is making progress. SCOR approved the following new GEOTRACES SSC members in 2012: Tung-Yuan Ho (China-Taipei), Phoebe Lam (USA), Katharina Pahnke (Germany), Micha Rijkenberg (Netherlands), Alakendra Roychoudhury (South Africa), Geraldine Sarthou (France), and Yoshiki Sohrin (Japan).

The GDAC is bringing together the large amounts of data from national research cruises into an international database for the GEOTRACES Key Parameters. GDAC is staffed by a full-time Data Liaison Officer (Ed Mawji) at the British Oceanographic Data Centre, and the work is overseen by the GEOTRACES Data Management Committee. The GEOTRACES International Project Office has one full-time staff member (Elena Masferrer-Dodas) and the work of the IPO is overseen by an IPO Science Director, Catherine Jeandel.

Sundby expressed that GEOTRACES scientists are enthusiastic and highly skilled. SCOR should convey its high level of satisfaction with the project. Peter Burkill agreed, but also wondered about links between GEOTRACES with IMBER. Ed Urban responded that there is a program called bioGEOTRACES that is collecting samples on many GEOTRACES cruises for –omic analyses. This could be a connection point with IMBER.

### **3.4 SCOR/IGBP/WCRP/CACGP Surface Ocean-Lower Atmosphere Study**

Ilana Wainer reported that SOLAS conducted its fourth Open Science Conference (OSC) in Cle Elum, Washington State, USA in May 2012 and is planning its sixth summer school in 2013, in a new location, at Xiamen University in China. The SOLAS Scientific Steering Committee (SSC) met in Seattle, Washington following the OSC in May 2012. The SOLAS SSC continues development of its 7 Mid-Term Strategy topics. SCOR WG 140 on Biogeochemical Exchange Processes at the Sea-Ice Interfaces will contribute to one of the SOLAS Mid-Term Strategy themes. Each topic is at a different stage in its implementation, but there is much scientific activity ongoing and planned. SOLAS resources (e.g., travel funds, meeting support, newsletters, Web page, outreach activities) are being used to highlight/advertise/define/refine the topics and their associated scientific questions and develop white papers (see [www.solas-int.org/mts](http://www.solas-int.org/mts)); identify groups of investigators worldwide that are capable of tackling the topics; motivate these groups to coordinate their proposal writing and link their experimental/modeling activities at the international level; and plan and conduct the research with a view to facilitating data and idea exchange that will permit an international, comprehensive synthesis. Anja Enge (Germany), Michelle Graco (Peru), and Hui-Wang Gao (China-Beijing) were approved by the SOLAS co-

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<sup>8</sup>See <http://www.aslo.org/lomethods/si/intercal2012.html>.

sponsors for their first three-year terms on the SOLAS SSC. Funding of the IPO ends in January 2013. Renewal options are being investigated.

## **4.0 OCEAN CARBON AND OTHER ACTIVITIES**

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

Maciej Telszewski reported that SCOR and IOC have jointly sponsored a group on ocean carbon since 1996, but even from the 1960s, the two organizations have worked on this issue together off and on. IOCCP was started as a pilot project in 2002 and formally approved by SCOR and IOC in 2005. It continues to focus on coordination of carbon data, from collection through serving the data, particularly through the Surface Ocean CO<sub>2</sub> Atlas (SOCAT) project. Discussions continue regarding a potential role for IOCCP in relation to advising the Global Ocean Observing System on biogeochemical Essential Ocean Variables. The IOCCP project office was moved from IOC Headquarters in Paris to Sopot, Poland in 2012 and is staffed by one person, Maciej Telszewski. The IOCCP Scientific Steering Group has 10 members. The U.S. National Science Foundation is the primary financial sponsor of IOCCP and has asked that the project demonstrate multinational interest in IOCCP by diversifying its funding sources. The project office obtains complementary funding from IOC, Poland, and other sources.

A proposal is in process to obtain some support from Polish sources. The IOCCP receives in-kind support from the Carbon Dioxide Information Analysis Center (CDIAC) in terms of data management. The University of Bergen provides support for the SOCAT data set development. The NOAA Pacific Marine Environmental Laboratory provides in-kind support.

SOCAT 1.0 included 6.3 million CO<sub>2</sub> data points from 1,851 cruises from 1968 to 2007. SOCAT 2.0 will be released in 2013. The Web site for SOCAT can be found at <http://www.socat.info/>.

The GO-SHIP activity brings together scientists with an interest in physical oceanography, the carbon cycle, marine biology and ecosystems, and other uses. The GO-SHIP strategy is available at <http://www.go-ship.org/Documents.html>.

In June 2012, 62 scientist from 23 countries assembled at the University of Washington in Seattle to discuss the form and function of a global network for monitoring ocean acidification and effects on biological systems. The workshop was sponsored by NOAA, IOCCP, GOOS, and the University of Washington. The goals of the workshop were to identify the minimum suite of measurement parameters for such a system and to provide the rationale and design of the components and locations of observations.

OceanObs09 identified tremendous opportunities and significant challenges in various kinds of ocean observations. This meeting called for a framework for planning and moving forward with an enhanced global sustained ocean observation system over the next decade, integrating new physical, biogeochemical, and biology measurements. The Future of Ocean Observations (FOO) activity was incorporated in GOOS, and IOCCP has agreed to handle one of the three FOO panels, to develop Essential Ocean Variables for biogeochemical measurements, if GOOS is able to provide funding for this increased scope of IOCCP.

John Compton asked whether IOCCP is modeling fluxes. Telszewski responded that members of the IOCCP Scientific Steering Group are authors of a paper on this topic. Peter Burkill asked what role SCOR would play if there was a major cutback in funding. Telszewski replied that if SCOR continues to provide the current level of funding that would be great. Burkill emphasized that it is never good to have “all one’s eggs in one basket” and encouraged IOCCP to become more diversified in its funding.

#### **4.2 Symposia on The Ocean in a High-CO<sub>2</sub> World**

John Volkman reported that the symposium attracted about 540 registered participants, significantly more than expected. 421 abstracts were received for oral and poster presentations. The International Planning Committee decided to have three parallel sessions during the symposium, which made it possible for 135 oral presentations to be made, beyond the 10 plenary presentations. This limitation in the number of oral presentations required establishment of a process to select oral presentations and only about 60% of those requesting to make oral presentations could be accommodated; the others were asked to present posters. Funding was arranged from various sources to support (partially or fully) about 50 early-career scientists. The symposium was notable for a large participation of early-career scientists and women scientists.

John Volkman was not able to attend the symposium, but the symposium seems to have been successful. The consensus of meeting participants was to have another meeting in 4 years’ time (in 2016). Volkman congratulated Ed Urban for his role in the successful meeting. Urban responded that this was a major undertaking for him and Liz Gross. They were expecting 350-400 participants, but the larger turnout was more challenging. Urban presented the results of an analysis of the abstracts from the meeting: the countries from which they were submitted, the stressors considered in the research, the organism type, and the type of study (e.g., single species, ecosystem, etc.). He also presented the results of an online survey of symposium participants. A great majority of respondents (94%) thought that there should be a fourth symposium in 2016. Most people thought the size of the 2016 symposium should not be restricted. Of those that did think the size should be restricted, the median number was about the same as attended the 2012 symposium. In terms of how time is divided at the meeting, respondents would prefer less time spent in parallel sessions and policy discussions, and more in plenary and poster sessions. The best aspects of the symposium were considered to be the plenary sessions and speakers, opportunities to network, the participation of a large number of early-career scientists, and the special dinner at the Monterey Bay Aquarium. The worst aspects were the length of the poster sessions (too little) and how it was set up (divided into two rooms on two different floors). There were too many parallel sessions (3), overlapping in two buildings.

Missy Feeley asked how much it would cost to hire a professional meeting organizer. Urban responded that they spent approximately US\$23,000 for Liz Gross’ time and to have someone else do the work would cost approximately twice this amount. Urban added that we should consider professional handling in the future, but he has worked with Gross on many meetings and there is a risk with starting over with a new organizer. Peter Burkill expressed that he was delighted that the symposium was so successful, but asked whether it would be possible to obtain funding from outside the United States. Feeley asked if NSF would still contribute if the

symposium were held somewhere other than the United States. Urban responded that NSF does not limit where such events can be held and provided funding for the first two symposia, which were held in France and Monaco. It was suggested that perhaps the registration fees could be increased the next time. Urban noted that the fees are set to cover known costs.

John Compton asked about media session and how useful that was. Ed Urban responded that media prefer relatively simple messages without too much nuance. This symposium had the most media outreach for any of the symposia and his goal was to make sure a balanced message, backed up by available science, was presented. That goal seems to have been achieved.

SCOR will need to determine its role in future symposia. Should SCOR lead planning again or focus on a smaller ocean acidification issue and bring together a workshop of 20-30 people to discuss how to progress that area of science, for example, genetic aspects of acclimation and evolution?

### **4.3 Other Activities**

#### **4.3.1 Data Publication Activity**

Mark Costello reported that SCOR, IOC's International Oceanographic Data and Information Exchange (IODE), and the MBLWHOI Library have been working together for the past several years on a project to link data to research papers, and to get these data into national and international data management systems in forms that can be cited. The activity started in 2008, but its history goes back to 2003, when the issue was raised by Doug Wallace at a meeting sponsored by SCOR and IGBP to help SOLAS and IMBER develop data management plans. A 2006 meeting of SCOR projects raised the topic again and it was finally pursued when IODE expressed an interest in it. The MBLWHO library was working on a similar project and decided to join the SCOR/IODE project.

The group is conducting two pilot projects and the results of these pilot projects have been reported at meetings of ocean scientists, data managers, and ocean librarians. The group has met five times so far to advance two primary activities: (1) implementation of two pilot projects by BODC and MBLWHOI library and (2) dissemination of project idea to ocean scientists, data managers and librarians. The principals met in Woods Hole, Massachusetts, USA in mid-October 2012 to assess progress on the pilot projects and to plan activities for the coming year. The next step is to develop a "Cookbook" to help the ocean science community get DOIs assigned to data. An article was published in *Eos* during the SCOR meeting entitled "Pilot Projects for Publishing and Citing Ocean Data."<sup>9</sup> The group is trying to get this idea out to the community, but there is still reluctance among many ocean scientists about this approach. Meeting participants approved a budget for this activity in 2013.

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<sup>9</sup>Urban, E., A. Leadbetter, G. Moncoiffe, P. Pissierssens, L. Raymond, and L. Pikula. 2012. Pilot Projects for Publishing and Citing Ocean Data. *Eos* 93:425-426.



#### **4.3.2 SCOR/POGO International Quiet Ocean Experiment**

Missy Feeley reported that an open science meeting was held at UNESCO Headquarters in Paris, France on 30 August-1 Sept. 2011 to develop a science plan for the project (see [www.iqoe-2011.org](http://www.iqoe-2011.org)). This meeting was funded through support from the Alfred P. Sloan Foundation. The Science Plan is nearly completed and ready for review, and reviewers have been selected. Scientists from several nations have already begun planning activities that would fit within the IQOE framework. Following review of the Science Plan, SCOR and POGO will determine whether to accept IQOE as a co-sponsored project. The decision will depend on whether funding can be developed for a project Scientific Steering Committee and other activities.

#### **4.3.3 Joint Committee on Seawater (SCOR/IAPWS/IAPSO)**

Ed Urban reported that SCOR agreed to form a Joint Subcommittee on Seawater with IAPSO and the International Association for the Properties of Water and Steam (IAPWS). This group is a follow-on to SCOR/IAPSO Working Group 127 on the Thermodynamic Properties of Seawater. The Joint Subcommittee is a subgroup of the IAPWS Working Group on Thermophysical Properties of Water and Steam. It was launched at the IAPWS annual meeting at the end of September 2012. The SCOR Executive Committee has approved a three-member Executive Committee and Terms of Reference for the group, which will come back to the co-sponsors with nominations for the full group. The chair has requested funding for 2013, which was approved. This funding will allow the Executive Committee to participate in meetings of the IAPWS.

### **5.0 CAPACITY-BUILDING ACTIVITIES**

#### **5.1 SCOR Committee on Capacity Building**

Venu Ittekkot reported on activities of the committee since its meeting last year. The committee met in Halifax immediately before the SCOR General Meeting to prepare for the SCOR meeting discussions. Ittekkot listed the Visiting Scholars for 2012: Rene Swift (UK), Jacob Larsen (Denmark), and Alice Newton (Norway). For 2013, Geoff Millward (UK) and Lisa Beal (USA) are being carried over from previous years. Other recipients will be added after the 2013 call for applications. Jacob Larsen presented a Workshop on Harmful Algae at the University of Ghana on October 8-19, 2012 for his assignment.

A workshop will be held in Namibia in November 2012 to focus on capacity building in ocean sciences for southern Africa. Representatives from countries in the region, as well as from IOC and POGO, will participate in the meeting. SCOR's efforts in Namibia have been effective. Kurt Hanselmann, after serving as a SCOR Visiting Scholar in Namibia twice, has organized several shipments of used lab equipment on research vessels to the University of Namibia.

Peter Burkill suggested that it is important to carefully examine the effectiveness of such capacity building activities. John Compton replied that there has been feedback from host and scientists receiving POGO-SCOR fellowships, and that they feel the program is very effective; there is a huge positive impact on individuals. Urban added that it would be nice to expand SCOR capacity building activities, but it is unlikely that this can be done through the NSF grant.

## **5.2 SCOR Visiting Scholars**

Venu Ittekkot reported that SCOR started a program of SCOR Visiting Scholars in 2009 and has now appointed 9 different Visiting Scholars. The program provides airfare and some funding for subsistence for ocean scientists to teach and mentor students for several weeks to months. Local hosts are expected to provide some support for local expenses. The program has resulted in new exposure for SCOR in countries like Ghana, Myanmar, and Thailand.

## **5.3 Regional Graduate Networks of Oceanography and Marine Environmental Sciences**

Venu Ittekkot reported that this activity is still unfunded, but the SCOR Committee on Capacity Building and SCOR staff continue to promote the idea in regional forums, including a meeting focused the Asia/Pacific region in August 2012 and a planned meeting for the southern Africa region in November 2012.

## **5.4 POGO-SCOR Visiting Fellowships for Oceanographic Observations**

Ed Urban reported that POGO and SCOR have co-funded this program since 2001 and have supported more than 120 participants so far. POGO and SCOR work together to screen the applicants. Approximately 75% of the funding comes from POGO in most years. Both recipients and hosts have expressed that this has been a worthwhile program. The SCOR Committee on Capacity Building Committee recommended continued support for this program in 2013 and the recommendation was approved by meeting participants.

## **5.5 NSF Travel Support for Developing Country Scientists**

Ed Urban reported that the grant to SCOR from the U.S. National Science Foundation continues at a level of \$75,000 per year. The grants have been an important source of support for several SCOR-related meetings in the past year. Meeting participants approved a set of meetings that will be supported with these funds in the coming year.

## **5.6 SCOR Reports to Developing Country Libraries**

Ed Urban reported that one book, *Phytoplankton Pigments: Characterization, Chemotaxonomy and Applications in Oceanography*, was distributed to libraries in developing countries and countries with economies in transition in the past year.

# **6.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS**

## **6.1 Intergovernmental Oceanographic Commission**

Ed Urban attended the IOC Executive Council meeting in June 2012 to represent SCOR and ICSU. SCOR and IOC cooperate on several different activities, as discussed in other sections of this document: the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Program, the International Ocean Carbon Coordination Project, and the Symposium on the Ocean in a High-CO<sub>2</sub> World. IOC also partners with SCOR on capacity-building activities. IOC

support for joint activities has been significantly curtailed because of drastic cuts in activity funding at IOC resulting from the United States and other nations withdrawing their funding to UNESCO.

Maciej Telszewski reported that IOC arose from an intergovernmental conference on oceanic research on 11-16 July 1960. IOC is part of UNESCO, but has functional independence within the UNESCO system, with its own Assembly. The IOC Headquarters is located in Paris, France. Within the UNESCO system, IOC is the focal point for ocean observations, science, services, and data exchange. The IOC is a competent international organization for marine science under the United Nations Convention on the Law of the Sea (UNCLOS).

The Global Ocean Observing System (GOOS) has an office at UNESCO Headquarters, staffed by Albert Fisher. The WMO-IOC Joint Technical Commission for Oceanography and Marine Meteorology In-site Platform Observing Support Center (JCOMMOPS) provides technical coordination for GOOS. The JCOMMOPS office is located in Toulouse, France.

IOC is one of the co-sponsors of GESAMP and Telszewski specifically noted the work of GESAMP WG 40 on Sources, Fate & Effects of Micro-plastics in the Marine Environment: A Global Assessment. The working group held its first meeting in March 2012.

IOC assumed the management responsibility for the Ocean Biogeographic Information System (OBIS) after the Census of Marine Life was completed. This data portal provides species-specific data from more than 80 national oceanographic data centers and other partners.

Other IOC-related developments that are relevant to ocean sciences include the following:

- IOC helped organize ocean-related activities at Rio+20. The central document for this meeting, called “The Future We Want”, was endorsed by the UN General Assembly.
- The UN Division for Ocean Affairs and the Law of the Sea (DOALOS), UNEP and IOC/UNESCO plan to complete the first global integrated assessment of the state of the marine environment by 2014, which will be considered by the UN General Assembly.
- The Oceans Compact is an initiative within the UN system to develop a strategic vision. It aims to provide a platform for all stakeholders to collaborate and accelerate progress.
- The Global Partnership for Oceans is a growing alliance for more than 100 governments, international organizations, civil society groups, and private sector interest groups that will mobilize knowledge and financial resources to address threats to ocean health, resilience and productivity. It aims to achieve its goals by 2022.
- Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)—IOC and OBIS are contributing to this activity.

## **6.2 International Council for Exploration of the Seas**

Wolfgang Fennel reported that ICES was founded as a regional intergovernmental organization more than 100 years ago, in 1902. Much ICES work focuses on climate change and impacts on ecosystems and fisheries. Fisheries science has become more prominent in recent years. ICES supports two cross-organization standing committees, an Advisory Committee and a Science

Committee. The president is Paul Connolly and the General Secretary is Anne Christine Brusendorff.

ICES has been involved in various SCOR activities in the past few years, including co-sponsoring a regional program of GLOBEC. New ICES Strategic Initiatives are on Biodiversity Science and Advice, Spatial Planning and Area-based Management, and Stock Assessment Methods. ICES is sponsoring a workshop on ocean observation and the role of the maritime shipping and offshore industry during the SeaTech week in October 2012, and have invited the OceanScope (WG 133) leaders to participate.

ICES supports a variety of scientific meetings each year. For example, together with the North Atlantic Fisheries Organization (NAFO), ICES is sponsoring a symposium on “Gadid fisheries: the ecology and management of rebuilding” in Canada in June 2013. ICES and FAO are co-sponsoring the World Symposium on Stock Assessment Methods in Boston, Massachusetts, USA in July 2013. The ICES Science Conference will be held in September 2013 in Reykjavik, Iceland.

Peter Burkill will try to make contact with the new president and secretary to determine if there could be fruitful areas of cooperation between SCOR and ICES. It is not clear what would be the best mechanism for cooperation between SCOR and ICES. Joint working groups might be possible.

### **6.3 Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)**

Ed Urban reported that SCOR provided support for one meeting of GESAMP Working Group 38 on The Atmospheric Input of Chemicals to the Ocean, which has published two papers, in which SCOR support was credited. The group has been extended and NSF is providing support through SCOR for a workshop in February 2013 at the University of East Anglia (UK).

### **6.4 North Pacific Marine Science Organization (PICES)**

Satoru Taguchi reported that PICES’ goals are to (1) advance scientific knowledge and capacity available for the member countries, including information on human activities affecting, and affected by, marine ecosystems, and (2) to provide a mechanism for collaboration among scientists in addressing timely and critical scientific questions. PICES conducts several activities that are relevant to SCOR interests and that implement SCOR activities in the North Pacific region and often supports members of SCOR working groups related to PICES activities, for example, SCOR WG 125 on Global Comparisons of Zooplankton Time Series, WG 137 on Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observation, and WG 140 on Biogeochemical Exchange Processes at the Sea-Ice Interfaces. A PICES representative is a member of the SCOR Committee on Capacity Building. PICES has prioritized four of the 7 working group proposals submitted for this meeting. PICES co-sponsors the meetings of SCOR research projects and hosts special sessions at annual PICES meetings. SCOR has provided travel support for scientists from developing countries and countries with economies in transition to attend PICES-related meetings and summer schools.

## **7.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS**

### **7.1 International Council for Science**

Wolfgang Fennel reported that ICSU has designated SCOR its representative at IOC annual meetings. ICSU has a new Executive Director since April 2012, Steven Wilson. ICSU officially launched the Future Earth Initiative at the Rio+20 summit in June 2012. The initiative will bring together IGBP, DIVERSITAS, and the International Human Dimensions Programme (IHDP) in a new structure entitled *Future Earth: research for global sustainability*. The World Climate Research Programme will initially have observer status in the new initiative. An interim Future Earth governing body should be in place by 2013 and a secretariat will be established by mid-2014. More information is available at <http://www.icsu.org/future-earth/>.

#### **7.1.1 International Geosphere-Biosphere Program (IGBP)**

Wolfgang Fennel attended the 2012 IGBP Science Committee meeting in Bergen, Norway to represent SCOR. SCOR and IGBP staff members have ongoing discussions in relation to co-sponsored projects. SCOR and IGBP are co-sponsoring WG 138 on Modern Planktic Foraminifera and Ocean Changes, and SCOR contributed support for travel of developing country scientists to two IGBP Fast-Track Initiatives. James Syvitski is the chair of IGBP since 1 January 2012. (Syvitski was co-chair of SCOR/LOICZ WG 122 on Mechanisms of Sediment Retention in Estuaries.)

Doug Wallace made a presentation on behalf of IGBP. The 2012 Planet Under Pressure conference, sponsored by the global change programs and ICSU, attracted 3,000 scientists, decision makers, business representatives, journalists and others. It was held on 26-29 March 2012 in London, UK. The conference resulted in a State of the Planet declaration (see [http://www.planetunderpressure2012.net/pdf/state\\_of\\_planet\\_declaration.pdf](http://www.planetunderpressure2012.net/pdf/state_of_planet_declaration.pdf)). Wallace showed the video available at <http://vimeo.com/39048998>.

Wallace briefed meeting participants about the Future Earth Initiative. Its goal is to “provide the knowledge required for societies in the world to face risks posed by global environmental change and to seize opportunities in a transition to global sustainability.” Future Earth will provide an overarching structure that will integrate the GEC programs, ESSP and other structures. It will promote the use of co-design of research with scientists, funders, operational service providers and users. The core projects of the GEC programs have been invited to join Future Earth.

#### **7.1.2 World Climate Research Programme (WCRP)**

Ilana Wainer reported that WCRP is focused on the climate aspects of different parts of the Earth system, including the ocean. WCRP is co-sponsoring the SOLAS project, SCOR/WCRP/IAPSO WG 136 on Climatic Importance of the Greater Agulhas System, and development of the Southern Ocean Observing System. SCOR projects (including IOCCP) are working well with CLIVAR, the part of WCRP most relevant to SCOR. The WCRP Open Science Conference entitled “Climate Research in Service to Society” was held in Denver, Colorado, USA, in October 2011 and attracted more than 1,900 scientists and stakeholders, many of them oceanographers, from 86 countries. The conference included 541 early-career scientists and

students, 332 from developing countries. The conference featured a different theme each day, emphasizing the integrative aspects of WRCP.

Based on output from this meeting, the WCRP Joint Scientific Committee identified scientific and programmatic challenges to WCRP for the next decade. Ocean observations is an area of potential future cooperation between SCOR and WCRP.

WCRP's mission is to "facilitate analysis and prediction of Earth system variability and change for use in an increasing range of practical applications of direct relevance, benefit and value to society."

WCRP's Grand Challenges are the following:

- be both highly specific and highly focused identifying a specific barrier preventing progress in a critical area of climate science
- enable the development of targeted research efforts with the likelihood of significant progress over 5-10 years, even if its ultimate success is uncertain
- enable the implementation of effective and measurable performance metrics
- be transformative, a Grand Challenge should bring the best minds to the table (voluntarily), building and strengthening communities of innovators that are collaborative, perhaps also extending beyond "in-house expertise"
- capture the public's imagination: teams of world-leading scientists working to solve pressing challenges
- can offer compelling storylines to capture the interest of media and the public

### **7.1.3 Scientific Committee on Antarctic Research (SCAR)**

Ilana Wainer reported that SCAR and SCOR are co-sponsoring the Southern Ocean Observing System (SOOS), which released its *Initial Science and Implementation Strategy* since last year's SCOR meeting. SOOS is an "international initiative to enhance, coordinate, and expand the strategic observations of the Southern Oceans that are required to address key scientific and societal challenges" (see <http://www.soos.aq/>). Ed Urban and Lora Carter worked on editing the text of the SOOS document, obtaining permissions to reprint graphics, getting some figures redrawn, and having the report formatted and printed at the University of Delaware. An office to promote implementation of the SOOS plan is being funded by Australia, and Louise Newman, formally of the PAGES IPO, is the project director there. The SOOS SSC met in February 2012 in conjunction with the Ocean Sciences meeting in Salt Lake City, Utah, USA, and will meet next in China in 2013. A workshop on Seeing Below the Ice will be held in Hobart, Australia in October 2012.

SOOS is organized around 6 science themes:

- Theme 1: The role of the Southern Ocean in the planet's heat and freshwater balance
- Theme 2: The stability of the Southern Ocean overturning circulation
- Theme 3: The role of the ocean in the stability of the Antarctic Ice Sheet and its future contribution to sea-level rise
- Theme 4: The future and consequences of Southern Ocean carbon uptake

- Theme 5: The future of Antarctic sea ice
- Theme 6: Impacts of global change on Southern Ocean ecosystems

Beyond 2012, SOOS will develop sampling strategies to address these themes. It will facilitate the development and provision of data products, identify new funding opportunities, and initiate and maintain contact with key Antarctic logistic, scientific, and funding organizations.

Wainer presented a slide of Brazilian monitoring activities in the Southern Ocean, including moorings. The Brazilian activities cover the period from 2000 to 2011, including the following projects: DOVETAIL, GOAL, WWPS, SOS-Climate, and PolarCANION.

## **7.2 Affiliated Organizations**

### **7.2.1 International Association for Biological Oceanography (IABO)**

Mark Costello reported that IABO held a General Assembly in Aberdeen, Scotland in 2011. The next assembly will be held in Oct. 2014 in Qingdao, China. Both assemblies are in conjunction with world conferences on marine biodiversity. Costello listed IABO Executive Committee members.

A major activity of IABO has been to promote the World Register of Marine Species (WoRMS): see [www.marinespecies.org](http://www.marinespecies.org). The WoRMS community includes 270 editors, 146 institutions, 32 countries, 7 global sub-databases, organized around four themes. There are 70,000 visitors per year to the WoRMS Web site. Ed Urban noted that WoRMS is a great example of a working group proposal that was turned down that went on and did well without SCOR. WoRMS is used to quality control species names in the IOC Ocean Biogeographic Information Service, which has reached a level of 35.5 million records.

### **7.2.2 International Association for Meteorology and Atmospheric Sciences (IAMAS)**

Athena Coustenis reported that IAMAS is one of 8 associations dealing with the Earth system and its environments that make up the International Union of Geodesy and Geophysics (IUGG). The scope of IAMAS includes study of the atmospheres of Earth and other planets. IAMAS looks at all different aspects of atmosphere, including air-sea interactions. IAMAS is made up of ten international commissions (IC), one of which is the international Commission on Atmospheric Chemistry and Global Pollution (iCACGP), which is a co-sponsor of SOLAS.

The IAMAS Business meeting will be held in Paris, France on 15-16 November 2012. The first day of the meeting will be devoted to discussions of collaboration with IAMAS partners and other associations and of the IAMAS contribution to future meetings. IAMAS has invited SCOR to participate and contribute to these discussions. IAMAS is also actively preparing for the Davos Atmosphere and Cryosphere assembly 13 (DACA-13) meeting (see <http://www.daca-13.org>).

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

Denise Smythe-Wright reported that SCOR and IAPSO are currently co-sponsoring WG 136 on Climatic Importance of the Greater Agulhas System (with WCRP) and the new

IAPWS/SCOR/IAPSO Joint Committee on Seawater. At the IUGG Assembly in Melbourne, Australia in 2011, there were 7 IAPSO-led symposium. The next IAPSO Assembly will be held in July 2013 in Gothenburg, Sweden.

Other recent working groups co-sponsored by IAPSO and SCOR have included WG 121 on Ocean Mixing, WG 127 on Thermodynamics and Equation of State of Seawater, WG 129 on Deep-Ocean Exchanges with the Shelf, and WG 133 (OceanScope). IAPSO is particularly proud of WG 127; it will make a great difference to the oceanographic community. The final workshop of WG 136 was held a few weeks ago. There are no new joint working groups.

IAPSO awards two medals at its General Assemblies, the Prince Albert Medal and the Eugene LaFond medal. The Prince Albert Medal is awarded to “a scientist who has made outstanding contributions to the enhancement and advancement of the physical and/or chemical sciences of the oceans.” Trevor McDougall won the 2011 award for his “outstanding work on (1) important and fundamental problems of ocean fluid dynamics over the full range of ocean scales, and (2) the thermodynamic properties of seawater”. (McDougall chaired WG 127.) The Eugene LaFond medal is “awarded to an ocean scientist from a developing country making a presentation (poster or oral) in a IAPSO-sponsored or co-sponsored symposium at the IUGG or IAPSO assemblies.” The 2011 medal was awarded to Towhinda Radhid from Bangladesh.

### **7.3 Affiliated Programs**

The benefit of continued affiliation to SCOR is evaluated at each General Meeting, but annual reports are requested from the programs for information.

#### **7.3.1 International Marine Global Changes Study (IMAGES)**

John Compton reported that a new science plan draft has been finalized and discussions are ongoing about whether IMAGES-type work and coring may be considered for inclusion as part of the Integrated Ocean Drilling Program. IMAGES has been struggling over several years to keep a sustainable program active. IMAGES has been mostly inactive since 2007, but is in discussion with a European drilling program. Compton expressed that it would be nice to see IMAGES come back in strength and get programs going.

#### **7.3.2 InterRidge - International, Interdisciplinary Ridge Studies**

John Compton reported that InterRidge has an active program of working groups and scientific meetings, as well as significant education and outreach activities. Working Groups are the principal mechanism for implementing the InterRidge program, their main function being to identify new areas of high-priority scientific research that focuses on processes related to mid-ocean ridge systems. There are currently seven active InterRidge Working Groups, including the SCOR/InterRidge WG 135 on Hydrothermal Energy Transfer and its Impact on the Ocean Carbon Cycles. The InterRidge program office will be moving from the National Oceanography Center, Southampton, UK to Peking University at the beginning of 2013. China has a lot of activity on science around ridge systems. The new chair will be John Chen (School of Earth and Space Sciences, Peking University, Beijing) and the co-chair is Jiabiao Li (Second Institute of Oceanography, Hangzhou). InterRidge has been working on its Third Decadal Plan throughout 2012.



Compton suggested that it would be nice to see additional cooperative activities between SCOR and InterRidge in addition to WG 135. Compton recommended that meeting participants visit the InterRidge Web site (<http://interridge.org/>). The project is entering its third decade and it is deciding what to do next. It may extend its science beyond ridges, but still largely focus on ridges. InterRidge is conducting capacity building in unique and effective ways (see <http://interridge.org/EO>), such as the InterRidge cruise travel bursary program. InterRidge interacts with GEOTRACES in the form of shared membership of groups in which the two organizations have mutual interest.

### **7.3.3 International Ocean Colour Coordinating Group (IOCCG)**

John Volkman reported that IOCCG scientific activities are carried out by specialized scientific working groups which investigate various aspects of ocean-color technology and its applications, and produce a report on the topic, published in the growing *IOCCG Report* series (12 reports published to date, see [www.ioccg.org](http://www.ioccg.org)). Over the past decade, IOCCG has played an important role in training and capacity building on a global scale.

Venetia Stuart gave a presentation about IOCCG. She explained the basis for observing phytoplankton pigments from satellite-based sensors. Stuart described ocean color radiometry products and applications. IOCCG was established in 1996, became an affiliated program of SCOR in 1997, and is an associate member of the Committee on Earth Observation Satellites (CEOS). An important role for IOCCG internationally is to continually make the case for ocean color satellite missions. The IOCCG project office is located at the Bedford Institute of Oceanography in Halifax, Nova Scotia, Canada. The IOCCG steering committee consists of space agency representatives and some academic scientists. The current chair is David Antoine (France). IOCCG's mandate is to provide a common voice for the user community, and a portal for information about ocean color remote sensing, through IOCCG reports, meetings, a Web site and newsletters.

There are currently 6 IOCCG working groups:

1. Calibration of Ocean-Colour Sensors
2. Phytoplankton Functional Types
3. Harmful Algal Blooms. This group is a joint project between IOCCG and GEOHAB. The group's report will document the kinds of HABs for which remote sensing is useful and distinguish these from others for which remote sensing is unlikely to be useful. Case studies will include toxin-producing and fish-killing HABs, ecologically disruptive algal blooms, and anoxia/hypoxia inducers. The group has two deliverables: an IOCCG Report and a special issue of a peer-reviewed journal.
4. Ocean Colour Remote Sensing in Polar Seas
5. Uncertainties in Ocean Colour Remote Sensing
6. Intercomparison of Retrieval Algorithms for Coastal Waters

IOCCG sponsors a variety of training initiatives and other capacity building activities and has so far involved a total of 494 students from 86 countries. The IOCCG summer lecture series is a new activity. The first one was held in July 2012 and the next is planned for July 2014.

Another new activity of IOCCG is its International Ocean Color Science (IOCS) meeting, the first of which will be held in Darmstadt, Germany in May 2013. It is intended that this will be a continuing series.

Stuart described the benefits of IOCCG's affiliation to SCOR. IOCCG has had a favorable and positive relationship with SCOR since 1997. Wolfgang Fennel noted that there are no financial implications to the relationship since IOCCG is an affiliated program. Bjørn Sundby added that we should encourage links through new working groups. Stuart enquired about the possibility of obtaining SCOR support for the participation of young scientists from developing countries at the 2014 IOCCG Summer Lecture Series.

#### **7.3.4 Global Alliance of CPR Surveys (GACS)**

The SCOR Executive Committee approved GACS as a new affiliated project to SCOR. Peter Burkill was instrumental in developing GACS and gave a presentation about it. Scientists from ten different countries participate in GACS, which is governed by a board of governance, chaired by Graham Hosie (Australia). Wolfgang Fennel commented that GACS is a great program and it will be good to have it affiliated to SCOR.

### **7.4 Other Organizations**

#### **7.4.1 Partnership for Observation of the Global Oceans (POGO)**

Wolfgang Fennel reported that POGO is a non-profit consortium of oceanographic institutions from around the world. POGO promotes global oceanography, particularly the implementation of international and integrated global ocean observing systems. POGO has focused much of its attention in recent years on interactions with the Group on Earth Observations (GEO) to represent ocean observation issues. GEO is a program dedicated to encouraging Earth observations for societal benefit. A new Task on "Oceans and Society: the Blue Planet" is included in the GEO Work plan, and this task draws together POGO and many of the other organizations and projects involved in ocean observations. POGO is convening a kick-off symposium for the task, to be held in Brazil on 19-21 November 2012. POGO and SCOR are cooperating on development of the International Quiet Ocean Experiment (IQOE) and co-fund the POGO-SCOR Visiting Fellowships for Oceanographic Observations. Ed Urban attended the 2012 POGO annual meeting to represent SCOR and to participate in a discussion of IQOE.

John Field, the POGO Chair, gave a presentation about POGO activities. POGO is "a forum for leaders of major oceanographic institutions around the world to promote global oceanography, particularly the implementation of international and integrated global ocean observing systems."<sup>10</sup> It is a partnership initiated in 1999 by the directors of the Scripps Institution of Oceanography, the Woods Hole Oceanographic Institution, and the Southampton Oceanography Centre and now includes 37 members from 21 countries. POGO is like SCOR in being a non-governmental organization that is complementary to IOC and to the Global Ocean Observing System (GOOS). GOOS and IOC include government representatives, their decisions are

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<sup>10</sup> <http://www.ocean-partners.org/>

binding on governments, and they can be slow to respond to problems and opportunities. In POGO as in SCOR, scientists are members, not governments, allowing the organizations to be flexible and quick to respond to new developments. POGO has supported the Argo network of more than 3,500 drifting floats. POGO also supports the OceanSITES network. The Global Alliance of CPR Surveys (GACS) is affiliated to POGO. Field noted that Sophie Seeyave is the scientific coordinator of POGO. POGO contributed to the establishment of the Southern Ocean Observing System (SOOS) in 2011.

POGO conducts several different capacity building activities, including the following:

- POGO-SCOR Fellowship—This program, reported earlier during the report on SCOR-sponsored capacity building activities, supports young scientists from developing countries to visit laboratories in a different country for periods of one to three months. Between 9 and 15 fellowships have been awarded each year since 2001. The program is in high demand, with many more applicants than can be supported with the available funds.
- POGO Visiting Professorship Programme—This program provides for one distinguished scientist to travel each year to teach and mentor in a developing country institution and to develop new cooperation.
- The Nippon Foundation-POGO Centre of Excellence—The program has provided (since 2007) training for 10 candidates for 10 months each. The first phase of the program was held at the Bermuda Institute of Ocean Science and the second phase will be held at the Alfred Wegener Institute for Polar and Marine Research in Germany.
- Austral Summer Institutes—These institutes are run at the University of Concepción (Chile) and are co-sponsored by POGO.
- University of Cape Town Postgraduate Bursary—These bursaries make it possible for an African student from outside South Africa to study marine science at the University of Cape Town.
- Research Cruise Training—Fellowship for training on cruises of the Atlantic Meridional Transect (AMT) time series. This fellowship program was started in 2008. Fellowships have been awarded to young scientists from Uruguay, Philippines, Czech Republic, Egypt and Brazil. Each fellow is funded to work in Plymouth (UK) for one month to prepare for the cruise, participate in the cruise, then spend an additional month in Plymouth analyzing samples and data from the cruise.
- NF-POGO Alumni Network for Oceans (NANO). This is a network of participants from the various different POGO capacity-building activities. The aims of the network are to maximize the benefits to the alumni from the training they have received; facilitate active contacts among the alumni and with the training faculty; and promote joint research activities that will build on the training. NANO has 150 members from 37 countries.

The relationship with POGO has been a good strategic situation for SCOR.

#### **7.4.2 Scientific Committee on Problems of the Environment (SCOPE)**

Ed Urban reported that SCOPE continues to be a partner with IGBP in the International Nitrogen Initiative. It participates in the SCOPE-Zhongyu Environmental Awards on a regular basis; SCOPE and the Zhongyu Environmental Technologies Corporation have started an International

Forum series to “provide a framework for 2-way information exchange between the scientific community and decision makers on multiple aspects of environmental sciences, challenges and opportunities at international scale and perspectives to help better manage world resources.” Elsevier and SCOPE are cooperating to publish a new quarterly journal called *Environmental Development*, started in 2011. SCOPE continues to work with UNEP and UNESCO on various policy publications, including the *UNESCO-SCOPE-UNEP Policy Brief Series*.

### **7.4.3 Arctic Ocean Sciences Board (AOSB)**

Wolfgang Fennel reported that the Arctic Ocean Sciences Board (AOSB):Marine Working Group of the International Arctic Science Committee (IASC) is a non-governmental body that includes members and participants from research and governmental institutions in all 19 IASC countries. It was established in May 1984 to fill a recognized need to coordinate the priorities and programs of countries and institutions engaged in research in the Arctic Ocean. The ASOB:MWG has identified the following priority themes for 2011-2015: Arctic Ocean System: predicting and understanding rapid changes in the Arctic; sea ice structure dynamics and the Arctic system; ecosystem responses to changing physical parameters in the Arctic; understanding geochemical process in the Arctic Ocean and Sub-Arctic Seas; and improving access to the geological record of the Arctic Ocean. There may be potential interactions between some of these groups and SCOR WG 140 on Biogeochemical Exchange Processes at the Sea-Ice Interfaces.

## **8.0 ORGANIZATION AND FINANCE**

### **8.1 Membership**

#### **8.1.1 National Committees**

The changes in Nominated Members since the 2011 Executive Committee Meeting were listed in the background book (see <http://www.scor-int.org/2012GM/Tab%208.pdf>).

### **8.2 Publications Arising from SCOR Activities**

SCOR-sponsored research projects have produced many peer-reviewed publications, as listed in their project reports in section 3. One SCOR working group completed a special issue from its work in the past year, and several other groups published articles about their work in *Eos* and other publications. Finally, a book from a special SCOR project on techniques for phytoplankton pigment analysis was completed this year.<sup>11</sup>

2011 *SCOR Proceedings*—The *Proceedings* was distributed in electronic form only.

SCOR Web site—The SCOR Web site is updated and checked for dead links regularly. Many historical documents from the SCOR files have been scanned and are available on the SCOR History page (<http://www.scor-int.org/history.htm>). The papers of Robert Snider (first

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<sup>11</sup> S. Roy, C.A. Llewellyn, E.S. Egeland, and G. Johnsen. 2011. *Phytoplankton Pigments: Characterization, Chemotaxonomy and Applications to Oceanography*. Cambridge University Press.

coordinator of the International Indian Ocean Expedition) were scanned and are available on a specific page for the IIOE ([http://www.scor-int.org/IIOE\\_History.htm](http://www.scor-int.org/IIOE_History.htm)).

*SCOR Newsletter*—The SCOR Newsletter was started late in 2004, to provide more frequent updates about SCOR activities between annual meetings. Twenty-two issues have been distributed so far. (All are available on the SCOR Web site.) The Newsletter is printed in hard copy occasionally for limited distribution.

### **8.3 Finances**

All SCOR staff worked to prepare information for the auditors this year. The financial records and financial controls were found to follow accepted standards. New U.S. government requirements have resulted in a more expensive audit and more work for SCOR staff in recent years.

SCOR received the following new or renewal grants since the 2011 SCOR meeting:

- Three-year renewal of NSF grant for SCOR scientific activities
- Grant from NASA for SOLAS Open Science Conference
- Grant from the Gordon and Betty Moore Foundation to support early-career scientists attending the Third Symposium on The Ocean in a High-CO<sub>2</sub> World

The ad hoc SCOR Finance Committee for 2012 included Corina Brussaard (Netherlands), Colin Devey (Germany), and Song Sun (China-Beijing). The committee had following tasks:

1. Review the auditor's report of the 2011 SCOR finances to determine whether any action is needed by SCOR,
2. Examine revised 2012 SCOR budget and determine whether to recommend its approval,
3. Examine proposed 2013 SCOR budget and revise it to present to the meeting, and
4. Recommend any dues increases for 2015.

Colin Devey presented the outcomes of the Finance Committee's discussions.

**2011**—In 2011, there was a total income of US\$1,081,671 and expenses of US\$1,099,247, resulting in a deficit of US\$17,577. SCOR assets at the end of 2011 were US\$261,229 and the end-of-year cash balance was US\$152,187. The committee reviewed the auditors' report of 2011 finances. The auditor found no discrepancies and found SCOR a "low-risk auditee." However, the auditor issued a management letter noting that NSF conducted a "desk review" of SCOR in 2011 and requested that SCOR's financial procedures be better documented in writing. Ed Urban is in the process of expanding the financial procedures manual, but is not yet finished. When finished, the procedures need to be reviewed by and accepted by the SCOR Executive Committee. The Finance Committee recommended that the Executive Committee make sure that Urban has enough time to finish the revision of the manual by the end of 2012. The Finance Committee recommended acceptance of the 2011 financial reports, which was agreed by the SCOR Executive Committee and meeting participants.

**2012**—Devey presented a slide of the 2012 budget approved at last year’s SCOR meeting in Helsinki. The income for SCOR discretionary activities was budgeted at US\$388,273 and the SCOR Secretariat proposed a revised income of US\$394,050. The increase resulted from a contribution from SCAR for SOOS activities and a contribution from IGBP of \$5,000 for WG138 activities. The 2012 expenses were budgeted at US\$413,451 at the Helsinki meeting. In the revised budget, expenses are expected to be US\$370,500, because working group expenses will be lower than budgeted. These increases in income and decreases in expenses will result in a projected increased in the end-of-the-year cash balance from US\$144,653 (budgeted in Helsinki) to US\$170,757. The Finance Committee recommended that the revised 2012 budget be approved and the SCOR Executive Committee and meeting participants approved it.

**2013**—Devey presented a draft budget for SCOR discretionary income and expenses for 2013. The cash balance is projected to decrease from the end of 2012 to the end of 2013 from \$170,757 to US\$163,934. This is above the set minimum cash balance limit maintained by SCOR of US\$100,000. The Finance Committee recommended acceptance of the proposed budget for 2013. The cash situation for 2012 allows the planned establishment of two new working groups in 2012 (and we can expect to be able to fund a maximum of 2 new groups in 2013). In terms of projected budgets, 7 working groups @ \$15k/year is potentially non-sustainable, although raising WG financing does not seem practicable or necessary. Meeting participants approved the proposed 2013 budget.

Mark Costello asked about unspent money for each working group from 2012 being carried over to 2013. Ed Urban clarified that each group has a set total budget and funds can be used in a later year if not used in the year that they are budgeted. . These rules should be better communicated to the groups. One possibility would be to give groups only four years to spend their funding. This is an idea that the SCOR Executive Committee should discuss before it is implemented. Denise Smythe-Wright mentioned if there is a working group with IAPSO, or other co-sponsor, that decreases SCOR’s financial commitment, because the IAPSO funds substitute for and do not add to the SCOR funds

Mark Costello asked about new countries that might join SCOR. Ed Urban responded that we have a meeting participant from Indonesia at this meeting who is investigating whether Indonesia should join SCOR.

## **9.0 SCOR-RELATED MEETINGS**

### **9.1 SCOR Annual Meetings**

At present, hosts for the annual meetings extends to 2016, so it is not yet necessary to plan for 2017 and beyond.

#### **9.1.1 2012 General Meeting – Halifax, Canada**

The SCOR Secretariat sent letters thanking the meeting hosts.

### **9.1.2 2013 Executive Committee Meeting – New Zealand**

The SCOR Executive Committee has accepted an offer from New Zealand to hold its 2013 meeting there, in Wellington during the week of 25-29 November 2013.

### **9.1.3 2014 General Meeting – Bremen, Germany**

The SCOR Executive Committee has accepted an invitation to hold the 2014 SCOR General Meeting in Bremen, Germany. Wolfgang Fennel noted that there are many ocean science institutions in northern Germany (Bremerhaven, Bremen, Kiel), so this is a good location for a SCOR meeting. The dates of the meeting will be determined later.

### **9.1.4 2015 Executive Committee Meeting - India**

The SCOR Executive Committee accepted an invitation to meet in India (probably Goa) for the 2015 Executive Committee meeting. The meeting will be held in conjunction with a celebration of the 50<sup>th</sup> anniversary of the International Indian Ocean Expedition.

### **9.1.5 2016 General Meeting - Poland**

The SCOR Executive Committee accepted an invitation to meet in Poland for the 2016 General Meeting.

## **9.2 Gifts of Appreciation**

Wolfgang Fennel thanked Executive Committee members that are rotating off the group:

- Ilana Wainer, Vice-President since 2010
- John Compton, co-opted member since 2008
- Bjorn Sunday served as Past President since 2008.

Ed Urban presented a gift on behalf of SCOR to each of these individuals. Urban thanked Wolfgang Fennel for serving as the SCOR President for the past four years. The SCOR Executive Director works most closely with the President, who devoted much time to the job. Urban showed a slide of the present for Fennel, a globe, which will be mailed to him. Peter Burkill said that he is delighted to begin his term as SCOR President and noted that it is great that people maintain contact with SCOR after rotating off the Executive Committee. Burkill thinks SCOR is in good shape, both financially and scientifically. He thanked Fennel and stated that he looked forward to working with Fennel in his new position of Past President of SCOR. Burkill would like to spend time in southeast Asia to meet with additional countries about joining SCOR. John Field thanked the SCOR Secretariat for meeting assistance.

## Appendix 1

### XXXI SCOR GENERAL MEETING

Halifax, Nova Scotia, Canada

21-23 October 2012

#### AGENDA

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##### 1.0 OPENING

- |   |                             |
|---|-----------------------------|
| 1.1 Opening Remarks and Administrative Arrangements   | <i>Lewis, Fennel, Urban</i> |
| 1.2 Approval of the Agenda                            | <i>Fennel</i>               |
| 1.3 Report of the President of SCOR                   | <i>Fennel</i>               |
| 1.4 Report of SCOR Executive Director                 | <i>Urban</i>                |
| 1.5 Appointment of an <i>ad hoc</i> Finance Committee | <i>Fennel</i>               |
| 1.6 2012 Elections for SCOR Officers                  | <i>Sundby</i>               |

##### 2.0 WORKING GROUPS

- |   |                      |
|---|----------------------|
| 2.1 Disbanded Working Groups  |                      |
| 2.1.1 WG 125—Global Comparisons of Zooplankton Time Series  | <i>Costello</i>      |
| 2.1.2 SCOR/IAPSO WG 127 on Thermodynamics and Equation of State of Seawater   | <i>Smythe-Wright</i> |
| 2.1.3 SCOR WG 130 on Automatic Plankton Visual Identification   | <i>Costello</i>      |
| 2.1.4 SCOR/IAPSO WG 133: OceanScope   | <i>Feeley</i>        |
| 2.2 Current Working Groups  |                      |
| 2.2.1 SCOR WG 131 on The Legacy of in situ Iron Enrichment: Data Compilation and Modeling                                       | <i>Compton</i>       |
| 2.2.2 SCOR/LOICZ WG 132 on Land-based Nutrient Pollution and the Relationship to Harmful Algal Blooms in Coastal Marine Systems | <i>Taguchi</i>       |
| 2.2.3 SCOR WG 134 on The Microbial Carbon Pump in the Ocean   | <i>Sundby</i>        |
| 2.2.4 SCOR/InterRidge WG 135 on Hydrothermal energy transfer and its impact on the ocean carbon cycles                          | <i>Coustenis</i>     |
| 2.2.5 SCOR/WCRP/IAPSO Working Group 136 On the Climatic Importance of the Greater Agulhas System                                | <i>Compton</i>       |
| 2.2.6 WG 137: Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observation         | <i>Volkman</i>       |
| 2.2.7 WG 138: Modern Planktic Foraminifera and Ocean Changes  | <i>Feeley</i>        |
| 2.2.8 WG 139: Organic Ligands – A Key Control on Trace Metal Biogeochemistry in the Ocean                                       | <i>Compton</i>       |
| 2.2.9 WG 140: Biogeochemical Exchange Processes at the Sea-Ice Interfaces   | <i>Volkman</i>       |



2.3	New Working Group Proposals	
2.3.1	SCOR Working Group on Surface Waves in Ocean Circulation and Climate System	<i>Coustenis</i>
2.3.2	SCOR Working Group on an “International Nutrients Scale System” to improve the global comparability of nutrient data	<i>Taguchi</i>
2.3.3	SCOR Working Group on Marine ecosystem reorganisation under climate change	<i>Costello</i>
2.3.4	SCOR Working Group on Sea-Surface Microlayers	<i>Volkman</i>
2.3.5	SCOR Working Group on Quality Control Procedures for Oxygen and Other Biogeochemical Sensors on Floats and Gliders	<i>Feeley</i>
2.3.6	SCOR Working Group to identify Ecosystem Essential Ocean Variables for measuring change in the biological properties of marine ecosystems	<i>Costello</i>
2.3.7	SCOR Working Group on The reassessment of marine dinitrogen fixation methodology\ and measurements	<i>Sundby</i>

### 3.0 LARGE-SCALE SCIENTIFIC PROGRAMS

3.1	SCOR/IOC Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Program	<i>Taguchi</i>
3.2	SCOR/IGBP Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project	<i>Sundby</i>
3.3	GEOTRACES Project	<i>Sundby</i>
3.4	SCOR/IGBP/WCRP/CACGP Surface Ocean-Lower Atmosphere Study	<i>Wainer</i>

### 4.0 OCEAN CARBON AND OTHER ACTIVITIES

4.1	IOC/SCOR International Ocean Carbon Coordination Project (IOCCP)	<i>Fennel, Telszewski</i>
4.2	Symposia on The Ocean in a High-CO <sub>2</sub> World	<i>Volkman</i>
4.3	Other Activities	
4.3.1	Data Publication Activity	<i>Costello</i>
4.3.2	SCOR/POGO International Quiet Ocean Experiment	<i>Feeley</i>
4.3.3	Joint Committee on Seawater (SCOR/IAPWS/IAPSO)	<i>Urban</i>

### 5.0 CAPACITY-BUILDING ACTIVITIES

5.1	SCOR Committee on Capacity Building	<i>Ittekkot</i>
5.2	SCOR Visiting Scholars	<i>Ittekkot</i>
5.3	Regional Graduate Networks of Oceanography and Marine Environmental Sciences	<i>Ittekkot</i>
5.4	POGO-SCOR Visiting Fellowships for Oceanographic Observations	<i>Urban</i>
5.5	NSF Travel Support for Developing Country Scientists	<i>Urban</i>

5.6 SCOR Reports to Developing Country Libraries *Urban*

## 6.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS

6.1 Intergovernmental Oceanographic Commission *Fennel*

6.2 International Council for Exploration of the Seas *Fennel*

6.3 Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) *Urban*

6.4 North Pacific Marine Science Organization (PICES) *Taguchi*

## 7.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

7.1 International Council for Science *Fennel*

7.1.1 International Geosphere-Biosphere Program (IGBP) *Fennel*

7.1.2 World Climate Research Programme (WCRP) *Wainer*

7.1.3 Scientific Committee on Antarctic Research (SCAR) *Wainer*

7.2 Affiliated Organizations

7.2.1 International Association for Biological Oceanography (IABO) *Costello*

7.2.2 International Association for Meteorology and Atmospheric Sciences (IAMAS) *Coustenis*

7.2.3 International Association for the Physical Sciences of the Oceans (IAPSO) *Smythe-Wright*

7.3 Affiliated Programs

7.3.1 International Marine Global Changes Study (IMAGES) *Compton*

7.3.2 InterRidge - International, Interdisciplinary Ridge Studies *Compton*

7.3.3 International Ocean Colour Coordinating Group (IOCCG) *Stuart, Volkman*

7.4 Other Organizations

7.4.1 Partnership for Observation of the Global Oceans (POGO) *Field, Fennel*

7.4.2 Scientific Committee on Problems of the Environment (SCOPE) *Urban*

7.4.3 Arctic Ocean Sciences Board (AOSB) *Fennel*

## 8.0 ORGANIZATION AND FINANCE

8.1 Membership

8.1.1 National Committees *Urban*

8.2 Publications Arising from SCOR Activities *Urban*

8.3 Finances *Finance Committee, Urban*

## 9.0 SCOR-RELATED MEETINGS

9.1 SCOR Annual Meetings

9.1.1 2012 General Meeting – Halifax, Canada *Fennel*

9.1.2 2013 Executive Committee Meeting – New Zealand *Fennel*

9.1.3 2014 General Meeting – Bremen, Germany *Fennel*

9.1.4 2015 Executive Committee Meeting *Fennel*

- 9.1.5 2016 General Meeting *Fennel*
- 9.2 Locations of Past SCOR Annual Meetings
- 9.3 SCOR-Related Meetings Since the 2011 SCOR Executive Committee Meeting and Planned for the Future

Appendix 2  
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## Appendix 3

### Proposal for Sea-Surface Microlayers

#### Abstract

The sea-surface microlayer (SML) is the boundary interface between the atmosphere and ocean, covering about 70% of the Earth's surface. With a typical thickness of 40-100  $\mu\text{m}$ , the SML has physicochemical and biological properties that are measurably distinct from underlying waters. Because of its unique position at the air-sea interface, the SML is central to a range of global biogeochemical and climate-related processes. Although known for the last five decades, the microlayer often has remained in a distinct research niche, primarily as it was thought to not exist at typical oceanic conditions. Recent studies now indicate that the SML covers the ocean to a significant extent, and evidence shows that it is an aggregate-enriched biofilm environment with distinct microbial communities. The redeveloped SML paradigm pushes the SML into a new and wider context that is relevant to many ocean and climate sciences.

The overall objective of the working group is to increase the awareness of the science community to the importance of the SML in a wide range of biogeochemical and climate-related processes. Specifically, the working group aims to (1) publish a unified definition of the microlayer in terms of physical, chemical and biological perspectives; (2) review sampling techniques and publish detailed sampling protocols; (3) outline the SML's role in a changing ocean; (4) initiate sessions on SML research during major meetings (e.g., Ocean Sciences Meeting); and (5) synthesize and publish available data on the SML as a book or a special issue of an open-access journal.

#### Rationale

The discovery that the SML is a widespread gelatinous and biofilm-like environment (Wurl and Holmes, 2008; Wurl et al., 2009; Cunliffe et al., 2009a; Wurl et al., 2011a) has created a new perspective of the air-water interface. Recent mass spectrometric measurements reveals unique and complex mixtures of biogenic molecules and polymers in the SML (Frew et al., 2006), complementing studies since the 1970s on enrichments of carbohydrates, protein and lipids in this layer relative to underlying waters. With recent advancement in the understanding of distinct microbial communities in the SML and their survival strategies (Cunliffe et al., 2011), it becomes clear that the SML is a microbe- and carbon-rich milieu with potentially unique transformation processes of organic material. Its role in biogeochemical cycling and the interactions between microbial diversity and ecosystem function are not yet fully understood. What is clear is that the SML has potentially significant effects within a global context, due to its unique position between the ocean and atmosphere including, for example, air-sea gas exchange processes (Upstill-Goddard et al., 2003; Salter et al., 2011) and production of organic-rich aerosols which develop into cloud condensation nuclei (Leck and Brigg, 2005; Russel et al., 2010; Orellana et al., 2011).

A SCOR SML working group will use a multidisciplinary perspective to suggest the future direction of SML research at an international level. The group will bring scientists from various disciplines together to consider chemical, biological and physical aspects of the SML, and to understand governing mechanisms in its formation and role in biogeochemical cycling and climate science. Deliverables of the group will include publications on the best practices in the sampling of the SML, consolidation of SML data sets and an updated SML review publication. SCOR as a non-governmental organization is an appropriate mechanism to promote future multinational and multidisciplinary fundamental SML research. A SCOR working group will ensure the involvement of scientists from developing countries and those at early career stages.

#### Scientific Background

The following is a summary of recent developments in SML research, which motivated the organization of the working group to submit this proposal. A complete review of research from the last five decades would be too extensive in the context of the proposal.

##### *SML coverage of the ocean's surface*

A misleading, but initially intuitive, assumption is that the SML is unstable under typical oceanic conditions. During a two-year long systematic study, however, it was shown that the SML is consistently enriched in surface-active organic matter at wind speeds of up to at least 10 m/s (Wurl et al., 2011b), which exceeds the global average wind speed over the ocean by 3.5 m/s (Archer and Jacobson, 2005). Higher enrichments found under oligotrophic conditions also suggest that the SML covers a significant fraction of the Earth's surface (Wurl et al., 2011b). Other studies support such conclusion with observed enrichment of organic matter at wind speeds of up to 10 m/s (Carlson et al., 1983; Kuznetsova et al., 2004; Reinthaler et

al., 2008). Although temporarily disrupted by breaking waves, the SML is rapidly reformed through rising air bubble plumes, which are covered quickly with dispersed SML material during the ascent (Liss, 1975). In both laboratory (Dragčević and Pravdić, 1981) and field (Williams et al., 1986) experiments, surface films (i.e. SML) appear to reform within seconds after disruption. Zhou et al. (1998) showed formation of TEP by bubbling dissolved seawater through the aggregation of DOM at bubble surfaces. This result indicates that breaking waves can actually facilitate the production of TEP, which eventually accumulates in the SML with rising bubble plumes forming biofilm-like matrices on the ocean's surface under typical oceanic conditions (Wurl et al., 2011a).

#### *Effects on air-sea gas exchange*

The enrichment of naturally occurring organic compounds, such as carbohydrates, proteins and lipids, modifies the chemical and physical properties of the sea surface to form the SML film, which retards gas exchange processes (e.g., Broecker et al., 1978; Frew et al., 2004; Schmidt and Schneider, 2011). The SML is a laminar layer in the absence of turbulence, and gas transport is dominated by slower molecular diffusion as a limiting step. A release of an artificial surfactant film in the Atlantic Ocean confirmed the suppression of gas exchange by at least 25%, even at higher wind conditions (10 m/s) (Salter et al., 2011), similar to earlier observation in the North Sea (Brockman et al., 1982) and in a wind-wave tunnel (Broecker et al., 1978). Frew et al. (2004) found that enrichment of organic matter in the SML can reduce the wave slopes, and therefore reduce gas transfer velocities. Schmidt and Schneider (2011) reported seasonal variations of the gas transfer velocity in laboratory experiments, likely due to differences in the quantity and composition of organic material becoming enriched in the SML.

The direct involvement of the bacterioneuston in air-sea gas exchange has been examined experimentally in situ using free-floating gas exchange boxes (Conrad and Seiler, 1988; Frost, 1999) and with a laboratory gas exchange tank (Upstill-Goddard et al., 2003). Reinthaler et al. (2008) reported similar bacterial growth efficiency between communities in the SML and underlying water, but increased bacterial respiration in the SML, indicating that there could be bacterial control of O<sub>2</sub>/CO<sub>2</sub> fluxes through the interface. These studies also highlight the complexity of air-sea gas exchange, and the need to address this research with an interdisciplinary approach.

#### *Production of organic-rich aerosols*

A biofilm environment at the air-water interface opens new directions in research on organic-rich aerosols. Several investigators have found gel-like matrices in marine aerosols (Leck and Brigg, 2005; Russel et al., 2010; Orellana et al., 2011) that could potentially form cloud condensation nuclei. Bubble bursting seems to be the primary vector for the production of marine-derived aerosol containing SML components (O'Dowd and Leeuw, 2007). It has been hypothesized that the enrichment of gel particles in the SML, the primary component of the biofilm-like ecosystem, is the source of gel-rich aerosols found in the Arctic atmosphere (Leck and Bigg, 2005). Such studies have initiated a hypothesis of a direct link between the SML and marine-derived aerosols; however, direct measurements remain for future research. Combined SML and aerosol measurement with good integrity seems to be challenging and requires various skills from different disciplines (chemistry, atmospheric, physics).

#### *SML's role in biogeochemical cycles.*

Sieburth (1983) hypothesized that the SML is a hydrated gel-like layer formed by a complex structure of carbohydrates, proteins, and lipids. His hypothesis has been recently confirmed by finding that transparent exopolymer particles (TEP), abundant gel-like particles in the ocean, are enriched in the SML (Wurl and Holmes, 2008; Wurl et al. 2009; Cunliffe et al., 2009a; Wurl et al., 2011a). It can be concluded that the SML is a microbial- and carbon-rich milieu and Ellison et al. (1999) estimated that 200 Tg C /yr accumulates in the SML, similar to sedimentation rates of carbon to the ocean's seabed.

Although the total volume of the microlayer is small compared to the ocean's volume, Carlson (1993) suggested in his seminal paper that unique interfacial reactions may occur in microlayers that may not occur in underlying water or that may occur at a much slower rate, and therefore hypothesized that the microlayer plays an important role in the diagenesis of carbon in the upper ocean. For example, proteins spread on air-water interfaces undergo unusual configurations, including unfolding (MacRitchie, 1986) and orientation of the helical axis parallel to the interface (Fujita et al., 1995). Denatured molecules in the SML may expose reactive sites and thus undergo interactions with neighbouring molecules which were precluded in the bulk seawater. Molecular orientation also occurs in polymeric carbohydrate monolayers resembling natural films (Mao et al., 1996; J. Miñones et al., 2002). Rotation of molecules within the biofilm matrixes may be hindered. Carlson (1987) provided evidence that the rotation of fluorescent probes was limited in the SML. Reinthaler et al. (2008) reported high enrichment of dissolved amino acids in oceanic SML, which were, however, not readily available for bacteria. This may indicate that there is a high fraction of refractory organic material in the SML.



The enrichment of trace metals in the SML is another example of how the SML may influence biogeochemical cycles. Trace metals are essential, but often limiting, micronutrients for phytoplankton growth. Over the last decades the interests in the atmospheric deposition of trace metals to the ocean's surface has increased within the ocean science community, especially in the context of sand/dust storms. Interestingly, the SML has been widely ignored in this context, although bioavailability of trace metals may change within the SML due to SML-specific solubilisation or transformation processes.

Hoffman et al. (1974) compared rates of atmospheric deposition with their findings on SML enrichments of trace metals offshore West Africa under the influence of the Saharan dust plume. They concluded that deposition rates were sufficiently great to explain the observed enrichment. Many studies followed on the enrichment of trace metals in the SML, but without detailed investigation of atmospheric inputs and chemical transformation within the SML. However, Jones (2011) recently suggested that dissolved trace metals in the SML undergo complex photochemical and scavenging processes.

#### *Sampling techniques*

Based on the current research literature, the SML can be summarized as being a microhabitat comprised of several layers distinguished by their ecological, chemical and physical properties with an operational total thickness of between 1 and 1000  $\mu\text{m}$ . Based on the literature it is proposed that an SML of a thickness of 60  $\mu\text{m}$  could be meaningfully used for studying the physicochemical properties of the SML (Zhang et al., 2003), and up to 1000  $\mu\text{m}$  for biological properties, depending the organism, or ecological features, of interest. Cunliffe et al. (2009c) and Stolle et al. (2009) conducted a systematic comparison study of microlayer sampling techniques to investigate microbiological features. Cunliffe et al. (2009c) found that floating polycarbonate membranes are the best approach to detect differences in microbial structures between the SML and underlying water. Such differences could not be detected in microlayer samples collected by glass plate (Harvey and Burzell, 1972) or mesh screen sampler (Garrett, 1965). Different specificity and collection efficiency of sampling techniques are potential reasons of this observation (Stolle et al., 2009). On the other hand, glass plate and mesh screen sampler are most suitable for the chemical characterization of the SML (Hatcher and Parker, 1974; Momizkoff et al., 2005), but different sampling techniques challenges the linkage to microbiological parameters.

Despite the availability of several inexpensive sampling devices (reviewed by Hühnerfuss, 1981), collection of SML samples of an acceptable integrity remains a challenge. Reasons for this are: (i) the SML is physically, chemically and biological heterogeneous. For example, the thickness of SML changes according to wind speed, as a result of wave motion. The chemical composition also is subject to rapid alteration in areas of natural slicks, where surface tension is higher; (ii) operation of sample techniques requires experience to collect samples with high reproducibility and under higher sea states (Wurl et al., 2011b); (iii) different sampling devices collects layers of different thicknesses and selectivity (Carlson, 1982; Momizkoff et al., 2005; Cunliffe et al., 2009c); and (iv) typically sampling involves immersion and slow withdrawal of sampler device (e.g. glass plate, mesh screen) collecting only several mL of SML per withdrawal. Therefore the period of sampling may be excessive in order to collect an adequate volume of SML sample, for example, for trace contaminant analysis.

#### Terms of reference

The proposed sea surface microlayer working group will pursue the following terms of reference:

- 1) Review sampling techniques and provide best practice sampling protocols. Such protocols will support new scientists entering the field of SML research to produce reliable and comparable data among different research groups/oceanic regions.
- 2) Create a consensus definition of the SML in terms of physical, chemical and biological perspectives for a better understanding within the ocean science community.
- 3) Outline the SML's role in a changing ocean, delivered as a short communication publication, to support its implementation in future international projects concerning future changes of the ocean.
- 4) Initiate sessions on SML research during major meetings (e.g., Ocean Sciences Meetings), to increase the awareness of the importance of the SML within the general ocean science community.
- 5) Summarize and publish the latest advances in microlayer research (e.g., in the form of a book or a special issue of a peer-reviewed journal), including consolidation of existing sea surface microlayer datasets among different disciplines (chemistry, biology, atmospheric, physics). The publication will promote new research ideas and projects at an interdisciplinary level.

### Capacity building

The proposed membership includes scientists from developing countries (Malaysia, Brazil and China) to promote scientific activities. The working group will meet for a 3-day workshop in 2014 planned to be held in China (Qingdao Ocean University). Additional students from this university or other national universities (depending on additional funding) will be invited for one day to the workshop. Working group members will give lectures and present their current SML activities. The working group plans to run a field trip for students to teach SML sampling techniques and simple measurements (i.e., surface film pressure). Inviting students will increase awareness and promote SML research among the next generation of oceanographers.

### Working group membership

The proposed working group will include ten full members and six associate members. Additional associate members may be nominated after the first meeting. The proposed list of full members includes researcher from early stages to senior level, with expertise in SML research within the context to chemical, biological, fishery and physical oceanography, as well meteorology and aerosol chemistry. The proposed membership list ensures a wide geographic balance.

### Timeline and working group activities (including specific products to be delivered)

Upon funding, the working group will organize a first meeting in early to mid-2013, potentially in conjunction with an ASLO meeting (2013). During the first meeting, members of the working group will present their current scientific activities, and will discuss, establish and commit to the working group programme. The working group will share their experiences in sampling techniques, and produce a report, lead by the co-chairs, on the best practices in SML sampling (Product 1) to be finalized at a workshop held in 2014. The report will be available on the web for making it freely accessible to the international marine science community.

During the 2014 workshop, potentially to be held in China, the group will discuss a better definition of the SML for the science community, as well establishing first commitments to writing individual chapters of a book or special issue of a journal (to be published in 2016) upon agreement of its content. In 2015, the working group will also publish a short communication paper, preferably in an open-access journal, from the 2014 workshop incorporating the developed definition of the SML under the lead of the co- chairs (Product 2).

The final meeting will be held in early-2016 in conjunction with a major meeting, potentially the 2016 Ocean Sciences Meeting. The members of the working group are expected to contribute to a session on SML research during this meeting, and the book publication or special issue of an open-access journal will be finalized (Product 3).

The co-chairs will approach other non-profit organizations for co-sponsoring the working group (i.e. IMBER, SOLAS) as they may share interests in this topic. The working group will also apply for additional funding from SCOR to support early-career scientists to attend the meetings and workshop.

### References

- Archer, C. L., Jacobson, M. Z. 2005. Evaluation of global wind power. *Journal of Geophysical Research* 110, D12110.
- Broecker, H.-C., Petermann, J., Siems, W. 1978. The influence of wind on CO<sub>2</sub> exchange in a windtunnel, including the effect of monolayers. *Journal of Marine Research* 36, 595-610.
- Brockmann, U.H., Hühnerfuss, H., Kattner, G., Broecker, H.-C., Hentschel, G. 1982. Artificial surface films in the sea area near Sylt. *Limnology and Oceanography* 27, 1050-1058.
- Carlson, D.J. 1983. Dissolved organic materials in surface microlayers: Temporal and spatial variability and relation to sea state. *Limnology and Oceanography* 28, 415-431.
- Carlson, D.J. 1993. The early diagenesis of organic matter: Reaction at the air-sea interface. In: Engel, M. H., Macko, S. A. (Eds), *Organic Geochemistry*. Plenum Press, New York, pp. 255-267.
- Carlson, D.J. 1987. Viscosity of sea-surface slicks. *Nature* 329, 823-825.
- Conrad, R., Seiler, W., 1988. Influence of the surface microlayer on the flux of nonconservative trace gases (CO, H<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) across the ocean-atmosphere interface. *Journal of Atmospheric Chemistry* 6, 83-94.
- Cunliffe, M., Salter, M., Mann, P.J., Whiteley, A.S., Upstill-Goddard, R.C., Murrell, J.C., 2009a. Dissolved organic carbon and bacterial populations in the gelatinous surface microlayer of a Norwegian fjord mesocosm. *FEMS Microbiology Letters* 299, 248-254.
- Cunliffe, M., Murrell, J.C., 2009b. The sea surface microlayer is a gelatinous biofilm. *The ISME Journal* 3, 1001–1003.
- Cunliffe, M., Harrison, E., Salter, M., Schäfer, H., Upstill-Goddard, R.C., Murrell, J.C., 2009c. Comparison and validation of sampling strategies for the molecular ecological analysis of surface microlayers. *Aquatic Microbial Ecology* 57, 69-77.
- Cunliffe, M., Upstill-Goddard, R.C., Murrell, J.C., 2011. Microbiology of aquatic surface microlayers. *FEMS Microbiology*

Reviews 35, 233-246.

- Dragcevic, D., Pravdic, V. 1981. Properties of seawater-air interfaces: rates of surface film formation under steady state conditions. *Limnology and Oceanography* 26, 492-499.
- Ellison, G.B., Tuck, A.F., Vaida, V. Atmospheric processing of organic aerosols. *Journal of Geophysical Research* 104, D9, 11633-11641.
- Frew, N. M., Bock, E. J., Schimpf, U., Hara, T., Hausbecker, H., Edson, J. B., McGillis, W. R., Nelson, R. K., McKenna, S. P., and Jähne, B.: Air-sea gas transfer: Its dependence on wind stress, small-scale roughness, and surface films. *Journal of Geophysical Research* 109, C08S17, doi:10.1029/2003JC002131, 2004.
- Frew, N.M., Nelson, R.K., Johnson, C.G., 2006. Sea slicks: variability in chemical composition and surface elasticity, in: Gade, M., Hühnerfuss, H., Korenowski, G. (Eds.), *Marine Surface Films*, Springer, Berlin, pp. 45-56.
- Frost, T., 1999. Environmental control of air-water gas exchange. University of Newcastle upon Tyne. Fujita, K., Kimura, S., Imanishi, Y., Okamura, E., Umemura, E. 1995. Monolayer formation and molecular orientation of various helical peptides at the air/water interface. *Langmuir* 11, 1675-1679.
- Garrett, W.D. 1965. Collection of slick-forming materials from the sea surface. *Limnology Oceanography* 10, 602-605.
- Harvey, G.W., Burzell, L.A. 1972. A simple microlayer method for small samples. *Limnology Oceanography* 17, 156-157.
- Hatcher, R.F., Parker, B.C. 1974. Laboratory comparisons of four surface microlayer samplers. *Limnology Oceanography* 19, 162-165.
- Hoffman, G. L., Duce, R.A., Walsh, P.R., Hoffman, E.J., RAY, B.J., Fasching, J.L. 1974. Residence time of some particulate tract metals in the oceanic surface microlayer: Significance of atmospheric deposition. *Journal Recherche Atmosphere* 8, 746-759.
- Hühnerfuss, H., 1981a. On the problem of sea surface film sampling: a comparison of 21 microlayer-, 2 multilayer-, and 4 selected subsurface-samplers-Part 1. *Sonderdruck Meerestechnik* 12, 137-142.
- Jones, M.R. 2011. A Study of Trace Metals in the Surface Microlayer. PhD thesis, University of East Anglia, UK.
- Kuznetsova, M., Lee, C., Aller, J., Frew, N. 2004. Enrichment of amino acids in the sea-surface microlayers at coastal and open ocean sites in the North Atlantic Ocean. *Limnology and Oceanography* 49, 1605-1619.
- Leck, C., Bigg, E.K., 2005. Biogenic particles in the surface microlayer and overlaying atmosphere in the central Arctic Ocean during summer. *Tellus* 57B, 305-316.
- Mac Ritchie, F. 1986. Spread monolayers of proteins. *Advanced Colloid Interface Science* 25, 341-385. Mao, L., Ritcey, A.M. 1996. Evaluation of molecular orientation in a polymeric monolayer at the air-water interface by polarization-modulated infrared spectroscopy. *Langmuir* 12, 4757-4759.
- Miñones, J., Rodriguez Patino, J.M. Conde, O., Carrera, C., Seoane, R. 2002. The effect of polar groups on structural characteristics of phospholipid monolayers spread at the air-water interface. *Colloid Surface A* 203, 273-286.
- Momzikoff, A., Brinis, A., Dallot, S., Gondry, G., Saliot, A., Lebaron, P. 2005. Field study of the chemical characterization of the upper ocean surface using various samplers. *Limnology Oceanography: Methods* 2, 374-386.
- Liss, P.S., 1975. Chemistry of the sea surface microlayer. In: Riley, J.P., Skirrow, G. (Eds.), *Chemical Oceanography*, Vol. 2. Academic Press, London, U.K., pp. 193-244.
- O'Dowd, C.D., Leeuw, G.D., 2007. Marine aerosol production: a review of the current knowledge. *Philosophical Transactions of the Royal Society A* 365, 1753-1774.
- Orellana, M.V., Matrai, P.A., Leck, C., Rauschenberg, C.D., Lee, A.M., Coz, E. 2011. Marine microgels as a source of cloud condensation nuclei in the high Arctic. *PNAS* 108, 13612-13617.
- Reinthal, T., Sintes, E., Herndl, G., 2008. Dissolved organic matter and bacterial production and respiration in the seasurface microlayer of the open Atlantic and the western Mediterranean Sea. *Limnology and Oceanography* 53, 122-131.
- Russell, L.M., Hawkins, L.N., Frossard, A.A., Quinn, P.K., Bates, T.S., 2010. Carbohydrate-like composition of submicron atmospheric particles and their production from ocean bubble bursting. *PNAS* 107, 6652-6657.
- Salter, M.E., Upstill-Goddard, R.C., Nightingale, P.D., Archer, S.D., Blomquist, B., Ho, T., Huebert, B., Schlosser, P., Yang, M., 2011. Impact of an artificial surfactant release on air-sea gas exchange during DOGEE II. *Journal of Geophysical Research* doi:10.1029/2011JC007023.
- Schmidt, R., Schneider, B. 2011. The effect of surface films on the air-sea gas exchange in the Baltic Sea. *Marine Chemistry* 126, 56-62.

- Sieburth, J. McN., 1983. Microbiological and organic-chemical processes in the surface and mixed layers. In: Liss, P.S., Slinn, W.G.N. (Eds.), *Air-Sea Exchange of Gases and Particles*. Reidel Publishers Co., Hingham, MA, pp. 121–172.
- Stolle, C., Nagel, K., Labrenz, M., Jürgens, K. 2009. Bacterial activity in the sea-surface microlayer: in-situ investigations in the Baltic Sea and the influence of sampling devices. *Aquatic Microbial Ecology* 58, 67-78.
- Stolle, C., Labrenz, M., Meeske, C., Jürgens, K., 2011. The bacterioneuston community structure of the southern Baltic Sea and its dependence on meteorological conditions. *Applied and Environmental Microbiology* 77, 3726-3733.
- Upstill-Goddard, R.C., Frost, T., Henry, G.R., Franklin, M., Murrell, J.C., Owens, N.J.P., 2003. Bacterioneuston control of air-water methane exchange determined with a laboratory gas exchange tank. *Global Biogeochemical Cycles* 17, 19.11-19.15
- Williams, P.M., Carlucci, A.F., Henrichs, S.M., Van Fleet, E.S., Horrigan, S.G., Reid, F.M.H., Robertson, K.J. 1986. Chemical and microbiological studies of sea-surface films in the Southern Gulf of California and off the West Coast of Baja California. *Marine Chemistry* 19, 17–98.
- Wurl, O., Holmes, M., 2008. The gelatinous nature of the sea-surface microlayer. *Marine Chemistry* 110, 89-97.
- Wurl, O., Miller, L., Röttgers, R., Vagle, S., 2009. The distribution and fate of surface-active substances in the sea-surface microlayer and water column. *Marine Chemistry* 115, 1-9.
- Wurl, O., Miller, L., Vagle, S., 2011a. Production and fate of transparent exopolymer particles in the ocean. *Journal of Geophysical Research* doi:10.1029/2011JC007342.
- Wurl, O., Wurl, E., Miller, L., Johnson, K., Vagle, S., 2011b. Formation and global distribution of sea-surface microlayers. *Biogeosciences* 8, 121–135.
- Zhang, Z., Cai, W., Liu, L., Liu, C., Chen, F., 2003. Direct determination of thickness of sea-surface microlayer using a pH microelectrode at original location. *Science China, Series B* 46, 339–351.
- Zhou, J., Mopper, K., Passow, U. 1998. The role of surface-active carbohydrates in the formation of transparent exopolymer particles by bubble adsorption of seawater. *Limnology and Oceanography* 43, 1860-1871.

## Appendix 4

### Proposal on Quality Control Procedures for Oxygen and Other Biogeochemical Sensors on Floats and Gliders

#### Rationale

The OceanObs'09 Conference (Venice, Italy, September 2009) brought together more than 600 scientists from 36 nations to build a common vision for the provision of routine and sustained global information on the marine environment sufficient to meet society's needs for describing, understanding and forecasting ocean variability. This common vision, as documented by 99 Community White Papers and 47 Plenary Papers, calls for significantly enhancing internationally coordinated provision of sustained observation and information of the world ocean, as a part of the larger Earth system observing effort, for public good and stewardship. The conference documented the state-of-the-art of observation technologies, highlighted the most promising observational approaches and provided concrete recommendations towards sustaining and enhancing the global ocean observation network.

Among the many breakthroughs in observational technology and capabilities the Argo float observatory is one of the most impressive and successful examples (Freeland et al., 2010). As Argo enters its second decade and chemical/biological sensor technology has improved significantly, it is becoming obvious that this observatory will be embraced by the ocean biogeochemistry community. An augmentation of the global float observatory, however, has to follow rather stringent constraints regarding sensor characteristics as well as data processing and quality control routines. Owing to the fairly advanced state of oxygen sensor technology and the high scientific value of oceanic oxygen measurements (Gruber et al., 2010), an expansion of the Argo core mission to routine oxygen measurements is perhaps the most mature and promising candidate (Freeland et al., 2010). But sensor technology also has reached a stage for other biogeochemical properties such as bio-optics (Claustre et al., 2010; Boss et al., 2008), nitrate (Johnson et al., 2009; 2010), pH (Martz et al., 2010) and CO<sub>2</sub> (Fiedler et al., *subm.*) that makes these sensors suitable for future integration into the float observatory.

While in terms of sensor characterization, calibration and assessment of field performance many studies have been performed and a lot of published information has become or is becoming available – particularly for float-based oxygen measurements – a coherent assessment of the overall status is lacking and firm recommendations and protocols for sensor calibration, data processing and data quality control have not yet been made. This situation calls for action and an effort to improve the situation should be made by a group of international experts. The establishment of a SCOR working group on this issue is timely and arguably the best, if not only, way to bring available information and expertise together and develop community-based and accepted procedures. The WG will put its main focus on the “Oxygen on Argo” topic but will also address float and glider-based observations of other biogeochemically relevant properties that have the potential to follow oxygen and hence require a concerted approach.

#### Scientific and Technological Background

The challenge of understanding the impact of global change on ocean biogeochemistry and major elemental cycles of carbon, oxygen, nitrogen etc. and any potential feedback to Earth's climate cannot be met with traditional oceanographic sampling techniques but requires a major expansion of observation capabilities in time and space. This, in fact, is calling for a revolution in observation technology which already is, or soon will, be at hand (Johnson et al., 2009). The rapid progress in both observation platform technology and chemical/biological sensor technology made during recent years is impressive and it is time now to bring the two strains together in a concerted fashion.

There are compelling scientific arguments for the addition of robust oxygen sensors to the global Argo observing system. Gruber et al. (2010) have summarized many of these scientific reasons for undertaking detailed global-scale measurements of the temporal evolution of the ocean's oxygen distribution. These include:

- Detect and document the ocean's deoxygenation (Keeling et al., 2010);
- Predict and assess anoxic or hypoxic events (Stramma et al., 2008);
- Determine seasonal to inter-annual changes in net community and export production;
- Improve atmospheric O<sub>2</sub>/N<sub>2</sub> constraint on the oceanic uptake of anthropogenic CO<sub>2</sub>;
- Aid interpretation of variations in ocean circulation/mixing;
- Provide constraints for ocean biogeochemistry models;

- Aid in interpretation of sparse data from repeat hydrographic surveys;
- Determine transport and regional air-sea fluxes of oxygen.

Quite a number of showcase studies employing oxygen floats have been performed successfully (e.g., Kihm & Körtzinger, 2010; Körtzinger et al., 2004; Martz et al., 2008; Prakash et al., 2012; Riser & Johnson, 2008; Tengberg et al., 2006) illustrating both the feasibility and the high and manifold utility of high-quality float-based oxygen measurements. However, several such studies (e.g., Czeschel et al., 2011; Fiedler et al., *subm.*; Körtzinger et al., 2005; Uchida et al., 2008) identified significant accuracy issues with the oxygen optode sensor that required dedicated post-calibration and correction exercises and call for the development of explicit pre-deployment calibration routines and facilities (e.g., Bittig et al., *subm.*). All this information needs to be cast into a coherent approach to data quality assurance and control procedures which then can be disseminated within the community and implemented into standard Argo routines. This is particularly important as a “global” system is developed. Each investigator needs to be able to compare oxygen data seamlessly from each float, just as is done with Argo temperature and salinity. To a large extent, that is not possible for oxygen today because of varying standard processes for sensor calibration and data reporting (Thierry et al., 2011).

The “Oxygen on Argo” initiative may in fact serve as a model case which provides the blueprint for data quality assurance and assessment procedures for other biogeochemical sensors. Some of these, for example, bio-optical (Claustre et al., 2010) and nitrate sensors (Johnson et al., 2010), are already available off the shelf in float-adapted versions, which have undergone serious testing and produced impressive showcases. Other sensors such as the Durafet® pH sensor (Martz et al., 2010) are approaching float-readiness and may soon provide much sought-after access to the marine CO<sub>2</sub> system. Undoubtedly the implementation process of any of these other biogeochemical sensors into a float observatory will benefit from the lessons learned and the procedures established for the model case oxygen.

#### Statement of Work/Terms of Reference

The proposed working group would

- (1) Summarize and assess the current status of biogeochemical sensor technology with particular emphasis on float-readiness (pressure and temperature dependence, long-term stability, calibration accuracy, measurements time constant, etc.) -- Year 1.
- (2) Develop pre- and post-deployment quality control metrics and procedures for oxygen and other biogeochemical sensors deployed on floats and gliders providing a research-quality synthesis data product -- Years 2+3.
- (3) Collaborate with Argo and other data centers to implement these procedures in their standard routines -- Years 3+4.
- (4) Disseminate procedures widely to ensure rapid adoption in the community -- Year 4.

**Pre-Briefing:** The 4<sup>th</sup> Argo Science Workshop (ASW-4), which is entitled “Argo – 10 Years of Progress – A new decade to prepare” and takes place in Venice, Italy on September 27- 29, 2012, would represent an ideal occasion for a pre-briefing among the members of the proposed SCOR WG and further discussion with the Argo community.

**Kick-off Meeting:** In order to provide good international visibility (and assure high attendance) the idea would be to piggyback this meeting onto a major relevant international conference. A thematically suitable and internationally visible such platform could be the IMBER IMBIZO III (January 2013, Goa, India). An alternative and similarly appropriate meeting would be the 2013 EGU General Assembly (April 2013, Vienna, Austria).

**Further Meetings:** Two further working group meetings will be held – one about half-way through and the other one towards the end of the WG lifetime. Potential candidates for the first meeting are the AGU fall meeting in 2014 or an expected 5<sup>th</sup> Argo Science Workshop in 2015. Candidate for the final meeting could be the 2016 Ocean Sciences Meeting or the 2016 AGU fall meeting.

**Products:** The WG will write an article for EOS after its first meeting to inform the community about the objectives and further plans of the SCOR WG. Also, a written document will be produced from each meeting. As the final product some kind of "best practices" manual is envisaged which will provide the community with a consistent approach to data handling and quality control of oxygen data from autonomous platforms and form the basis

for the implementation of oxygen measurements in the Argo program. The final product and recommendations from the group will also be highlighted within a group article.

**Capacity Building:** Many of the major science issues of biogeochemical cycles in a changing ocean (e.g., ocean acidification, deoxygenation, eutrophication and changes in primary productivity) take place near and are socioeconomically highly relevant for developing countries. Modern autonomous observatories could potentially provide scientists from these countries with both cost-effective ways of mounting their own observational programs and open access to relevant high-quality data. This important aspect is reflected by having two distinguished scientists from developing countries on the list of proposed (full or associated) members. Also, a close contact will be established between this WG and the Argo capacity building activities. Building necessary capacities in developing countries can be fostered by providing access to “best practices” documents which specifically address the often limited financial and infrastructural resources that are available to them. The aspect of capacity building could be further augmented by hosting a session (in conjunction with a WG meeting) to discuss the needs and capabilities of developing countries with respect to using the Argo observatory and other suitable programs. Similarly a group article on this topic could be written for and presented to the relevant audiences. Finally, the WG plans to get in contact with the Partnership for Observation of the Global Oceans, POGO, to see if the WG products and procedures could be added to POGO’s portfolio of training & education activities.

## References

- Bittig, H.C., B. Fiedler, T. Steinhoff & A. Körtzinger (2012). A Novel Electrochemical Calibration Setup for Oxygen Sensors. *Limnol. Oceanogr.: Methods*, submitted.
- Boss, E., D. Swift, L. Taylor, P. Brickley, R. Zaneveld, S. Riser, M.J. Perry & P.G. Strutton (2008). Observations of pigment and particle distributions in the western North Atlantic from an autonomous float and ocean color satellite. *Limnol. Oceanogr.* **53**, 2112–2122.
- Claustre, H. & Co-Authors (2010). "Bio-Optical Profiling Floats as New Observational Tools for Biogeochemical and Ecosystem Studies: Potential Synergies with Ocean Color Remote Sensing." in Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 2), Venice, Italy, 21-25 September 2009, Hall, J., D.E. Harrison & D. Stammer, Eds., ESA Publication WPP-306, doi:10.5270/OceanObs09.cwp.17.
- Czeschel, R., L. Stramma, F.U. Schwarzkopf, B.S. Giese, A. Funk & J. Karstensen (2011). Middepth circulation of the eastern tropical South Pacific and its link to the oxygen minimum zone. *J. Geophys. Res.* **116**, C01015, doi:10.1029/2010JC006565.
- Fiedler, B., P. Fietzek, N. Vieira, P. Silva, H.C. Bittig & A. Körtzinger (2012). In situ CO<sub>2</sub> and O<sub>2</sub> measurements on a profiling float. *J. Atm. Ocean. Techn.*, submitted.
- Freeland, H. & Co-Authors (2010). "Argo - A Decade of Progress" in Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 2), Venice, Italy, 21-25 September 2009, Hall, J., D.E. Harrison & D. Stammer, Eds., ESA Publication WPP-306, doi:10.5270/OceanObs09.cwp.32.
- Gruber, N. & Co-Authors (2010). "Adding Oxygen to Argo: Developing a Global In Situ Observatory for Ocean Deoxygenation and Biogeochemistry" in Proceedings of OceanObs'09: Sustained Ocean Observations and Information for Society (Vol. 2), Venice, Italy, 21-25 September 2009, Hall, J., D.E. Harrison & D. Stammer, Eds., ESA Publication WPP-306, doi:10.5270/OceanObs09.cwp.39.
- Johnson, K.S., W.M. Berelson, E.S. Boss, Z. Chase, H. Claustre, S.R. Emerson, N. Gruber, A. Körtzinger, M.J. Perry & S.C. Riser (2009). Observing biogeochemical cycles at global scales with profiling floats and gliders: Prospects for global array. *Oceanography* **22**, 216-225.
- Johnson, K.S., S.C. Riser & D.M. Karl (2010). Nitrate supply from deep to near-surface waters of the north Pacific subtropical gyre. *Nature* **465**, 1062-1065.
- Juranek, L.W., R.A. Feely, D. Gilbert, H. Freeland & L.A. Miller (2011). Real-time estimation of pH and aragonite saturation state from Argo profiling floats: Prospects for an autonomous carbon observing strategy. *Geophys. Res. Lett.* **38**, L17603, doi:10.1029/2011GL048580.
- Keeling, R., A. Körtzinger & N. Gruber (2010). Ocean deoxygenation in a warming world. *Annu. Rev. Mar. Sci.* **2**, 463-493.
- Kihm, C. and A. Körtzinger (2010). Air-sea gas transfer velocity for oxygen derived from float data. *J. Geophys. Res.* **115**, C12003, doi:10.1029/2009JC006077.
- Körtzinger, A., J. Schimanski, U. Send & D.W.R. Wallace (2004). The ocean takes a deep breath. *Science* **306**, 1337.
- Körtzinger, A., J. Schimanski & U. Send (2005). High-quality oxygen measurements from profiling floats: A promising new technique. *J. Atm. Ocean. Techn.* **22**, 302-308.
- Martz, T.R., K.S. Johnson & S.C. Riser (2008). Ocean metabolism observed with oxygen sensor on

- profiling floats in the South Pacific. *Limnol. Oceanogr.* **53**, 2094-2111.
- Martz, T. R., J.G. Connery & K.S. Johnson. 2010. Testing the Honeywell Durafet® for seawater pH applications. *Limnol. Oceanogr.: Methods* **8**, 172-184.
- Prakash, S., T.M. Balakrishnan Nair, T.V.S. Udaya Bhaskar, P. Prakash & D. Gilbert (2012). Oxycline variability in the central Arabian Sea: An Argo-Oxygen Study. *J. Sea Res.*, in press.
- Riser, S. & K. Johnson (2008). Net production of oxygen in the subtropical ocean. *Nature* **451**, 323–325.
- Stramma L., G.C. Johnson, J. Sprintall & V. Mohrholz (2008) Expanding oxygen-minimum zones in the tropical oceans. *Science* **320**, 655-58.
- Tengberg, A., J. Hovdenes, H.J. Andersson, O. Brocandel, R. Diaz, D. Hebert, T. Arnerich, C. Huber, A. Körtzinger, A. Khripounoff, F. Rey, C. Rönning, J. Schimanski, S. Sommer & A. Stangelmayer (2006). Evaluation of a lifetime-based optode to measure oxygen in aquatic systems. *Limnol. Oceanogr. Methods* **4**, 7-17.
- Thierry, V., D. Gilbert & T. Kobayashi (2011). Processing Argo oxygen data at the DAC level (version 1.2), 12 pp.
- Uchida, H., T. Kawano, I. Kaneko & M. Fukusawa (2008). In situ calibration of optode-based oxygen sensors. *J. Atm. Ocean. Tech.* **25**, 2271-2281.



## Appendix 5

### 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 Velosuares (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.

## Appendix 6

### Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Project

#### **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
- 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 pCO<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 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 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). 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.

### **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>.)

#### **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-organic-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<sub>4</sub>) 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.

#### *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 IndOOS 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.

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

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.; Spörl, 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 (BIOCOPE)
- [www.obs-vlfr.fr/proof/vt/op/cc/biosope/bio.htm](http://www.obs-vlfr.fr/proof/vt/op/cc/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://wwwz.ifremer.fr/lpo/SO-Argo-France>.
- Novel Argo Ocean observing System (NAOS) <http://wwwz.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://wwz.ifremer.fr/biarritz\\_2011\\_eng/](http://wwz.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 <sup>234</sup>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 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.aoi.u-tokyo.ac.jp/english/aoi\\_news/meeting/2012/20120604.html](http://www.aoi.u-tokyo.ac.jp/english/aoi_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 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., Kruhmaliev 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 Shkirmikova 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., Shkirmikova 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., Shkirmikova 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).
- 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 Aristegui 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.who.edu/workshops/ocbworkshop2012](http://www.who.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.
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. Ommer R E, Perry I, Cochrane K L, Cury P (eds.) (2011) Fleets, Sites and Conservation Goals: Game Theoretic Insights on Management Options for Multinational Tuna Fisheries. In: *World Fisheries: a Social-Ecological Analysis*. Wiley-Blackwell. 60-88



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.

## Appendix 7

### Surface Ocean – Lower Atmosphere Study (SOLAS)

#### *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 Konradowitz. 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 Rafel	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

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.

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, ONTROC, 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 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:

- **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  $f\text{CO}_2$  values in a uniform format, which has undergone 2nd-level quality control; and
2. A global, gridded product of monthly mean surface water  $f\text{CO}_2$ , with no temporal or spatial interpolation, and individual cruise files with recalculated  $f\text{CO}_2$  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, Euro-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  
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 Konradowitz (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.

## Appendix 8

### 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 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.

#### ***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

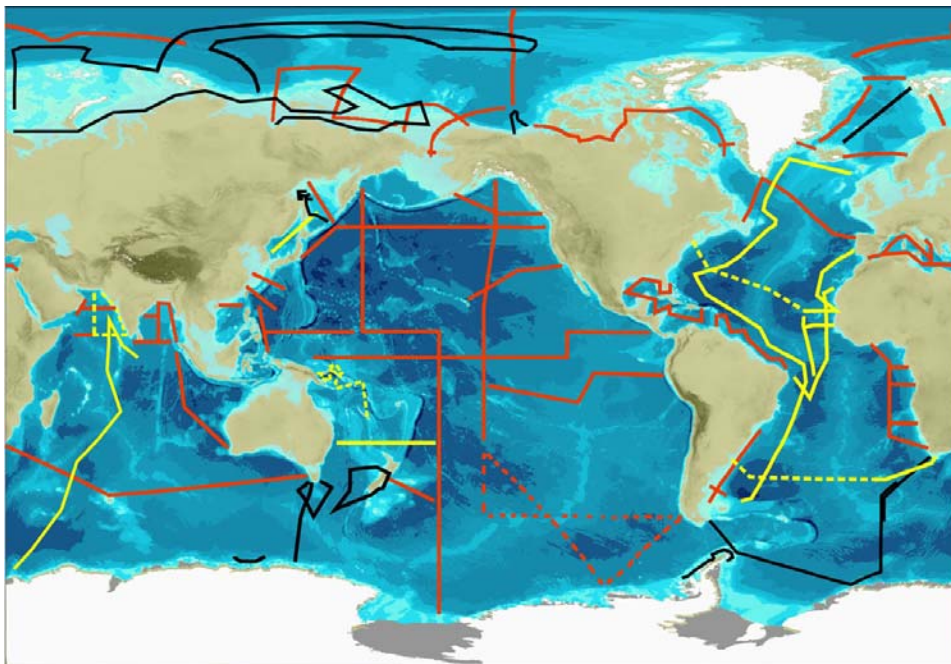
Pacific Ocean	GP13	2 cruises: Australia and New Zealand
Pacific Ocean	GP03	1 cruise: Japan
Indian Ocean	GI04	1 cruise: Japan
Atlantic Ocean	GA02	3 cruises: Netherlands
Atlantic Ocean	GA10	2 cruises: UK
Atlantic Ocean	GA06	1 cruise: UK
Atlantic Ocean	GA11	1 cruise: Germany
Atlantic Ocean	GA03	2 cruises: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

*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.



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

\*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 housing, Seabird Rosette	24 X 12-L GO-Flo	3000 m; conducting Vectran
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 University	Complete	Seabird Rosette. SBE-19plusV2 CTD unit. Powder coated aluminum with Ti parts and pressure housing. Fires at pre-programmable depths	12 X 5-L Teflon-lined Niskin-X	2000 m 0.5-inch Kevlar wire
USA – Polar Programs	Complete	Powder coated aluminum with titanium pressure housings and fittings	12 X12-L Niskin-X	3000 m; conducting Kevlar

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August 2012

Appendix 9

Post-Audit Financial Statement for 2011 (discretionary funds in USD)

Income	Revised Budget as Approved in Helsinki	Actual Income & Expense Jan 1 - Dec 31, 2011
Membership	304,149	312,037
NSF Funding for WGs & Projects	125,837	96,576
Contributions from other organizations for WGs	5,000	5,000
Miscellaneous		17
<b>Total Discretionary Income</b>	<b>434,986</b>	<b>413,630</b>
<b>Expenses</b>		
<b>Working Groups</b>		717
WG 125 - Zooplankton	3,000	-
WG 129	1,317	1,317
WG 131 - Iron	7,000	-
WG 133 - OceanScope - with IAPSO	3,428	7,295
WG 134 - Microbial Pump	13,408	13,408
WG 135 - Hydrothermal	12,000	16,000
WG 136 - Agulhas - with IAPSO, IUGG & WCRP	30,213	29,449
WG 137 - Phytoplankton Time Series	18,548	12,885
WG 138 - Forams - with IGBP	15,000	5,765
WG 139 - New group formed in 2011		1,517
<b>Large-scale Programs</b>		
GEOHAB	800	799
GLOBEC	-	1,794
GEOTRACES	(25)	(25)
SOLAS	14,657	14,499
<b>Miscellaneous Scientific Activities</b>		
SCAR/SCOR Expert Group	31	4,202
High CO2 Planning	8,136	5,382
Data Publication Activity	5,000	1,886
Capacity Building	10,000	5,966
Outreach	5,030	5,030
SCOR Lecture at UD	-	-
<b>Administrative Expenses</b>		
Salaries and Benefits	178,051	187,965
Salary charges to grants	(20,222)	(7,858)
Outside Services	12,000	10,431
Audit and Accounting Services	26,255	17,216
Representation	10,000	18,712
Meeting Management Expenses	3,567	1,901
GoToMeeting	3,500	3,079
Publications	6,000	463
Annual Meeting	29,839	38,687
Postage, courier, telephone	2,338	3,693
Office Equipment	2,500	1,619
UD overhead charges	25,728	20,536
Insurance	2,419	2,360
Miscellaneous, office supplies,	5,400	4,517
<b>Total Discretionary Expenses</b>	<b>434,918</b>	<b>431,207</b>
<b>Beginning Cash Balance</b>	<b>169,763</b>	<b>169,763</b>
Income - Expenses (Discretionary Accounts)	68	(17,577)
<b>Ending Cash Balance</b>	<b>169,831</b>	<b>152,186</b>
Less Commitments	-	(2,274)
<b>Discretionary Cash Available</b>	<b>169,831</b>	<b>149,912</b>

from 2010 audit  
agrees with 2011  
audit  
agrees with 2011  
audit

## Appendix 10

### SCOR-Related Meetings (2012-2015)

#### 2012

18-19 February	SCAR-SCOR Southern Ocean Observing System Scientific Steering Committee	Salt Lake City, USA
25 February	SCOR WG 139 on Organic Ligands – A Key Control on Trace Metal Biogeochemistry in the Ocean	Salt Lake City, USA
7-10 May	<a href="#">SOLAS Open Science Conference</a>	Cle Elum, Washington State, USA
11-13 May	SOLAS Scientific Steering Committee	Washington State, USA
29-31 May	GEOHAB Conference on Progress in interpreting Life History and Growth Dynamics of Harmful Algal Blooms in Fjords and Coastal Environments	Victoria, British Columbia, Canada
12-14 June	IMBER Scientific Steering Committee	La Paz, Mexico
21-23 August	<a href="#">GEOHAB Conference on Advances and challenges for understanding physical-biological interactions in HABs in Stratified Environments</a>	Moss Landing, California, USA
26-28 August	SCOR WG 134 on The Microbial Carbon Pump	Delmenhorst, Germany
24-27 September	<a href="#">Third Symposium on The Ocean in a High-CO<sub>2</sub> World</a>	Monterey, California, USA
8-10 October	SCOR/IODE/MBLWHOI Library Data Publication Committee	Woods Hole, USA
8-12 October	<a href="#">AGU Chapman Conference on The Agulhas System and its Role in Changing Ocean Circulation, Climate, and Marine Ecosystems</a>	Stellenbosch, Western Cape, South Africa
12-14 October	Joint SCOR WG 137/PICES Workshop and WG 137 Meeting	Hiroshima, Japan
21-24 October	<a href="#">SCOR General Meeting and Related Events</a>	Halifax, Nova Scotia, Canada
29 October-2 November	GEOTRACES Data Management Committee and Scientific Steering Committee	India

#### 2013

28-31 January	<a href="#">IMBER IMBIZO III</a>	Goa, India
16 February	SCOR WG 139 on Organic Ligands – A Key Control on Trace Metal Biogeochemistry in the Ocean	New Orleans, Louisiana, USA
16 March	WG 140 on Biogeochemical Exchange Processes at the Sea-Ice Interfaces	Ventura, California, USA

11 April	WG 141 on Sea-Surface Microlayers	Vienna, Austria
22-23 April	International Ocean Carbon Coordination Project Scientific Steering Group	Norwich, UK
25-27 April	<a href="#">GEOHAB Open Science Meeting</a>	Paris, France
20-24 May	SOOS Scientific Steering Committee and Asian Workshop	Shanghai, China
27-31 May	SOLAS Scientific Steering Committee	Tsukuba, Japan
17-19 June	IMBER Scientific Steering Committee	Canary Islands, Spain
19-22 June	<a href="#">WG 138: Two Parallel Workshops on Planktonic Foraminifera</a>	Prague, Czech Republic
1-5 September	SCOR/IAPSO/IAPWS Joint Committee on the Properties of Seawater	London, UK
30 September-4 October	GEOTRACES Scientific Steering Committee, Data Management Committee, and Standards and Intercalibration Committee	Bremerhaven, Germany
2-4 November	WG 137 on Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observation	San Diego, California, USA
25-28 November	<a href="#">SCOR Executive Committee Meeting</a>	New Zealand
3-5 December	GEOHAB Scientific Steering Committee	Barcelona, Spain

## 2014

23 February	WG 139 on Organic Ligands: A Key Control on Trace Metal Biogeochemistry in the Ocean	Honolulu, Hawaii, USA
16 March	WG 140 on Biogeochemical Exchange Processes at the Sea-Ice Interfaces	Hobart, Tasmania
16-20 June	SOLAS Scientific Steering Committee Meeting	Israel
June	SOOS Scientific Steering Committee	Tromsø, Norway
23-27 June	IMBER Open Science Meeting	Bergen, Norway
	SCOR General Meeting	Bremerhaven, Germany

## 2015

15-18 September	SOLAS Open Science Conference	Kiel, Germany
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