

7.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

- 7.1 International Council for Science** *Sundby, Urban*
- 7.1.1 International Geosphere-Biosphere Program (IGBP), **p. 7-1** *Duce, Sundby*
- 7.1.2 World Climate Research Programme (WCRP), **p. 7-4** *Ryabinin*
- 7.1.3 Scientific Committee on Antarctic Research (SCAR), **p. 7-11** *Kuparinen*
- 7.1.4 Scientific Committee on Problems of the Environment (SCOPE),
p. 7-17 *Sundby, Pierrot-Bults*
- 7.2 Affiliated Organizations**
- 7.2.1 International Association for Biological Oceanography (IABO), **p. 7-18**
Pierrot-Bults
- 7.2.2 International Association for Meteorology and Atmospheric
Sciences (IAMAS), **p. 7-19** *MacCracken*
- 7.2.3 International Association for the Physical Sciences of the Ocean
(IAPSO), **7-22** *Mysak*
- 7.3 Affiliated Programs**
- SCOR-Affiliated Programs, p. 7-23*
- 7.3.1 Status of Affiliation for InterMARGINS, **p. 7-24** *Labeyrie*
- 7.3.2 Census of Marine Life (CoML), **p. 7-25** *Burkill*
- 7.3.3 International Antarctic Zone (iAnZone) Program, **p. 7-33** *Kuparinen*
- 7.3.4 PAGES International Marine Global Changes Study (IMAGES), **p. 7-34**
Labeyrie
- 7.3.5 InterRidge - International, Interdisciplinary Ridge Studies, **p. 7-35** *Labeyrie*
- 7.3.6 International Ocean Colour Coordinating Group (IOCCG), **p. 7-41** *Kuparinen*
- 7.4 Other Organizations**
- 7.4.1 Partnership for Observation of the Global Ocean (POGO), **p. 7-51** *Duce*
- 7.4.2 Arctic Ocean Sciences Board, **p. 7-52**

7.1 International Council for Science (ICSU)

7.1.1 International Geosphere-Biosphere Programme

IGBP update for the SCOR Annual Meeting 2007

Wendy Broadgate, Deputy Director, Natural Sciences, IGBP Secretariat

The International Geosphere-Biosphere Programme (IGBP) is entering its third decade of global change research. IGBP networks scientists around the world to conduct interdisciplinary research into Earth System science. IGBP is celebrating its 20th anniversary with a celebratory Symposium in Stockholm in September 2007. IGBP also participates in the *Earth System Science Partnership* (ESSP), a joint venture on global change research together with the World Climate Research Programme (WCRP), the International Human Dimensions Programme (IHDP) and DIVERSITAS (an international programme on biodiversity science).

IGBP and SCOR continued their fruitful collaboration during the past year, through the jointly sponsored international research projects - GLOBEC, IMBER and SOLAS - as well as the Fast-Track Initiative on *Past Ocean Acidification* and in the planning and organization of the 2nd Symposium on *The Ocean in a High-CO₂ World*. Below are some updates of IGBP issues that are not dealt with elsewhere in the SCOR Meeting Papers.

THE 4TH IGBP CONGRESS www.igbp2008.co.za

IGBP Congresses are major events occurring every four years. They bring together the leadership of the IGBP Community to discuss forward-looking scientific issues that cut across the programme and aid integration and synthesis. By 2008, IGBP will be well into its second phase of research and the 4th Congress is designed to aid the development of the scientific agenda for the period 2008-2013. It should initiate mid-term synthesis in light of the ICSU review of IGBP and comes at a key time when a higher level of integration within ESSP is being attempted. South Africa has been chosen as a Congress venue in order to help improve IGBP's research and networking on development issues such as risk, adaptation and vulnerability, important to Africa and other developing countries. The Congress is designed to broaden outreach efforts toward development agencies, corporations and civil society.

The agenda will include a mixture of plenary presentations, posters and working group discussions. Emphasis will be placed on integration across traditional boundaries and disciplines, and on interaction with the ESSP Joint Projects. Furthermore, the event will allow direct contact between the IGBP SSCs and IGBP National Committee representatives. Guests will be invited from ICSU, DIVERSITAS, IHDP, WCRP, SCOR, other partner organisations operating at regional level (such as IAI, APN and AfricanNESS) and local stakeholders (the public, the private sector and the policy community).

7-2

Goals of the 4th IGBP Congress

- To develop ways for IGBP to apply Earth System science and improve IGBP relevance to civil society, the private sector and the policy community;
- To provide a forum for cross-project interaction and integration across the breadth of the programme;
- To identify where IGBP work can better contribute to addressing mitigation and adaptation, large-scale pilot projects on sustainability science and institutional networking;
- To suggest pathways to sustainable solutions, including mitigation, innovation and adaptation;
- To address the challenges of Global Environmental Change and development in Africa (e.g., climate change as a stress factor to African development, water systems);
- To develop a lasting network linking the scientific, political and private enterprises, collectively engaged in developing a closer global-scale environmental management collaboration.

FAST-TRACK INITIATIVES

In 2003 the Scientific Committee of IGBP launched three 'Fast Track Initiatives' (FTIs) as a means to foster integration and synthesis of IGBP science. FTIs are short-lived activities designed to address cross-cutting topics of current interest in Earth System science. FTIs have a lifetime of maximum three years, and should result in a key product such as a review article, book, new activity or database. Below is a description of developments in the joint IGBP-SCOR FTI on *Past Ocean Acidification*.

Atmospheric CO₂ and Ocean Biogeochemistry: Modern Observations and Past Experiences
<http://www.pages.unibe.ch/science/scor/index.html>

This IGBP-SCOR initiative was launched in 2005 to investigate past changes in ocean biogeochemistry to better understand the consequences of ongoing ocean acidification. A workshop held in September 2006, involving 65 international participants, explored how palaeo-studies from periods of major changes in atmospheric CO₂ can shed light on the consequences of increasing CO₂ in the future. The group concluded that ocean acidification is taking place at a rate and magnitude that presents a major risk to at least some marine ecosystems in the coming decades. It is difficult to determine the effects of acidification over different marine environments with any certainty based on our current level of understanding. Thus, extended research is needed to assess the consequences of ocean acidification, particularly looking at past records, present and future changes in carbonate chemistry, and biotic responses. The group also noted the urgent need to improve the communication with policymakers on the risks associated with ocean acidification. A summary of the conclusions of the workshop has been published in the *PAGES Newsletter*. An article synthesizing the results will be published in a high-profile journal.

EARTH SYSTEM SCIENCE PARTNERSHIP (ESSP) www.essp.org

ESSP is a partnership of the four international global environmental change research programmes of ICSU: DIVERSITAS, IGBP, IHDP and WCRP. ESSP works towards an integrated study of the Earth System, the ways that it is changing, and the implications for global and regional sustainability. ESSP contributes to this endeavour through a number of activities: (i) joint projects on food, carbon, water, and health; (ii) integrated regional studies, (iii) capacity building, and (iv) open science conferences.

One of the big developments in 2006 was the strengthening of ESSP through the establishment of a governance structure and an ESSP Scientific Committee to be chaired by Rik Leemans of Wageningen University, the Netherlands. The ESSP SC will meet for the first time in October 2007.

Close collaboration of IGBP with the other ESSP programmes and with ESSP itself is a high priority. IGBP and WCRP thus initiated discussions in 2006 about a possible future merger of the two programmes. Commonalities and differences have been identified and during 2007 a joint working group will analyse ways to enhance collaboration and create a road map for a possible merger. There is an increasing sense that such merging and the evolution of the ESSP will determine the long-term success of the four global environmental change programmes in addressing critical societal needs.

The *ESSP Open Science Conference* “Global Environmental Change: Regional Challenges” took place in Beijing in November 2006. The conference attracted more than 900 scientists, policymakers, and journalists. The next generation of Earth system science researchers were also in attendance following the successful *Young Scientists’ Conference*, organised by START and the *China Meteorological Administration* (CMA). Major outcomes of the ESSP OSC included the launch of the new ESSP joint project on *Global Environmental Change and Human Health* (GECHH), and the *Monsoon Asia Integrated Regional Study* (MAIRS) initial Science Plan. The ESSP OSC delivered a message of urgency to governments to take action on issues of global environmental change and sustainable development.

7.1.2 World Climate Research Programme (WCRP)

World Climate Research Programme and SCOR

In accordance with the WCRP Sponsors' Agreement, approximately one-third of the Joint Scientific Committee (JSC) members have an oceanographic background. Their active participation in the discussions of the JSC helps to ensure that ocean research aspects of climate science continue to be one of the main drivers for WCRP's activities. The 28th Session of the JSC took place in Zanzibar, United Republic of Tanzania, on 26-30 March 2007 (JSC-28). It reviewed the progress of WCRP and the ways of delivering value to sponsors and other stakeholders through progress towards the two overarching goals set for WCRP: to determine the predictability of climate and the human impact on climate.

Human impact on climate

It is widely acknowledged that WCRP research has underpinned the conclusions of the WMO/UNEP IPCC Assessments, including its most recent Fourth Assessment Report (AR4), especially with respect to the physics of climate change. Assessment and detection of past changes and projection of future change in the ocean are covered in Chapters 5, 8-10 of the AR4 Working Group I report ("The Physical Basis of Climate Change"). WCRP results also underpin several chapters in the Working Group II report ("Impacts, Adaptation and Vulnerability").

To further strengthen WCRP's contribution to climate change research, including greater understanding of the role of the ocean in it, the JSC-28 agreed to establish a major crosscutting initiative on future research on **anthropogenic climate change (ACC)**. Three other major WCRP climate change-related initiatives the JSC agreed to proceed with are (i) an activity to address changes of atmospheric chemistry, which *inter alia* create the greenhouse effect on climate and lead to its warming (this initiative entitled **atmospheric chemistry and climate - AC&C** - is joint with the International Geosphere – Biosphere Programme, IGBP), (ii) a continuing WCRP effort aimed at getting more accurate and reliable estimates of future **sea-level rise**, and (iii) a major undertaking on better understanding and prediction of **extreme events in a changing climate**. The new major WCRP initiatives in this area will thus cover research on the causes of climate change (**AC&C**), detection of climate change and prediction of its future state (**ACC**) and a range of activities aimed at assessing the impacts of climate change including impacts on the ocean.

Analysis of the few available responses to the WCRP Questionnaire to IOC Member States shows that the respondents consider it important to not only understand the causes of and predict future climate change, but also to systematically address the impact of climate change on, in particular, ocean ecosystems, living and non-living marine resources and coastal regions. WCRP's climate change detection and prediction form the foundation for any program that addresses the full breadth of climate change impacts. The development of a

comprehensive *impacts* project would nevertheless go beyond WCRP's current mandate and it is therefore essential that WCRP partner with IOC and SCOR to adequately address these issues. The 2008 ICES/PICES/IOC Symposium on Effects of the Climate Change on the World's Oceans (Gijón, Spain 19-23 May 2008), to which WCRP and SCOR are actively contributing, will set the stage for discussion of how these needs can be most appropriately met.

During 2006, IOC hosted a major WCRP Workshop on Understanding Sea-level Rise and Variability. The book resulting from the conference will be completed later this year. The meeting was very successful, and as a result there is now a new initiative being formulated, in partnership with others, to hold a workshop on the impacts of sea-level rise on coastal areas and islands.

While expected changes in ocean physics are comparatively well represented in existing climate projections, the domains of ocean chemistry and biology are a fairly recent addition to the coupled models used for climate assessment. The SOLAS project (which WCRP co-sponsors with SCOR; see below) conducts innovative research on the complex nature of biogeochemical interactions between the oceans and atmosphere. Impacts of dust transport on algal blooms and the effectiveness of the ocean carbon sink mechanism, production of sea salt aerosols and their effect on the variations of the cloud cover, and reduced calcification of some organisms due to acidification of the ocean water are among the recent exciting results obtained by SOLAS researchers.

Predictability of climate

The ocean plays a key role in the variability of climate on a wide variety of time scales. Following the successful WCRP research on predictability of El Niño and development of its operational prediction at the seasonal scale, WCRP is extending significantly its work on predictability. Current WCRP crosscutting initiatives in this area include **seasonal prediction, decadal predictability and prediction of monsoons**.

Prediction of temperatures and precipitation on the seasonal scale is fast developing and has already shown its potential for being interpreted in terms of predictions of future crops, water availability and health conditions. Predictions of El Niño are of critical importance for Pacific fisheries. Further applications of seasonal forecasting serving other areas of societal benefit (e.g., severity of winters, strength and timing of monsoons, character of tropical cyclone seasons, implications for agriculture, the energy sector, coastal zone management, maritime transport, etc.) will become of increasing importance and value as prediction skill improves and these applications are further developed.

As part of its cross-cutting activity on seasonal prediction, WCRP is organizing a coordinated experiment using coupled ocean-atmosphere models to test the hypothesis that there is as yet untapped seasonal predictability in the climate system due to the interactions among its various elements (atmosphere, ocean, land, ice). The experiment was launched at a major

7-6

WCRP international workshop on seasonal forecasting (Barcelona, Spain, 4-8 June 2007), which also summarized our current understanding of, and capabilities in, seasonal prediction.

Decadal predictability is a new initiative of the WCRP aimed at exploring the possibilities for prediction of the most significant modes of variability in the ocean – atmosphere system on decadal time scales. Such modes of variability as the Pacific Decadal Oscillation, North Atlantic Oscillation and some others have significant impact on national economies. These modes tend to be associated with large-scale anomalies in the ocean thermocline, and they may have different manifestations in each of the world oceans. Detection of the thermal and current anomalies in the thermocline by ocean data assimilation and subsequent production of the ocean reanalysis fields (see below) makes it possible for WCRP to conduct experiments, which will give, for the first time, estimates of the impact of changing ocean conditions on long-term variability of atmospheric circulation so that its predictable modes could be identified. This innovative oceanographic research has the potential to contribute to the welfare of many nations.

Building on its past work in this area and a number of upcoming regional programmes, WCRP is enhancing its efforts in understanding and predicting monsoons and their variability on all continents, which themselves impact approximately one-third of the world's population. In this context, WCRP is working to enhance the ocean observing system in the Indian Ocean as well as in the Atlantic and Pacific Oceans to benefit monsoon prediction and seasonal prediction more widely.

Other overarching new initiatives

One of the key impacts of climate change is the increasing vulnerability of the world to extreme events. Based on this understanding, the JSC-28 considered in detail and endorsed the initial scoping of a WCRP crosscutting activity on **climate extremes**. Not only will WCRP contribute to better assessment of extreme events, such as heat waves, droughts and floods, frequency and intensity of tropical and extra-tropical cyclones, extreme sea levels and storm surges, and extreme precipitation events associated with climate variability, but it will also facilitate the use of predictions of future climate change in decision making. Coastal impacts will constitute an inherent part of this initiative.

WCRP is contributing a significant effort into the science program of the International Polar Year 2007-2009 (IPY) and climate research is high on the IPY agenda. Approximately 30 IPY projects are affiliated with WCRP. Many of them are of oceanographic character. For example, WCRP provides the lead for the Climate of Antarctica and the Southern Ocean IPY project. WCRP was instrumental in developing the concept of the interagency IPY polar satellite snapshot, which will provide, for the first time, a full image of the polar regions during IPY. WCRP is leading the Group on Earth Observations task on IPY legacy in terms of data and observations. IPY has already been successful at forming connections – between scientists in different disciplines – and with the public perception. People are more aware now of the important links between the polar regions and the other parts of the global climate

system. Record low summer time Arctic sea ice extents have been observed over recent years, with some models predicting a complete loss of summer time Arctic sea ice cover by the end of this century. Such an event would have major impacts on Arctic ecosystems, including fisheries, as well as regional and global climate more widely. Greenland is melting at an unprecedented rate, and will directly impact sea levels around the world, with significant impacts for coastal regions and small island states. It is therefore critical that the future of the Greenland Ice Sheet is understood if we are to adequately respond to rising sea levels. The impact of the Greenland melt on ocean thermohaline circulation is less clear and needs further observations and study. IPY and the recent IPCC report have put this issue on center stage and highlights the need for increased research in predictions of ice sheet and glacier melting.

WCRP approach to better climate predictions, with focus on the oceans

WCRP works individually and with relevant partners to improve climate-related observations, including those for the oceans, encourage their use in data assimilation, improve the understanding of relevant processes and represent them in climate models used in numerical prediction. An outline of recent developments in this area is as follows.

Observations—Together with the Global Climate Observing System (GCOS) and the Global Ocean Observing System (GOOS), WCRP is a sponsor of the GOOS/GCOS/WCRP Ocean Observations Panel for Climate (OOPC), which held its 12th Session at IOC Headquarters in Paris on 2-5 May 2007, at which it reviewed the state of ocean climate observations. During 2006 and 2007 WCRP worked actively to update requirements for ocean observations in the planned contribution of the Committee on Earth Observation Satellites to the GOOS Implementation Plan. WCRP works with satellite agencies to ensure the continuity of ocean observing sensors on Earth satellites. WCRP is a member of Group on Earth Observations and leads work on several items in the Global Earth Observation System of Systems Work Plan for 2007-2008.

WCRP will be one of the organizations, with OOPC, leading the preparations of a new major international conference on Ocean Observations, probably in 2009.

WCRP, especially its CLIVAR project, develops pilot studies and research arrays which are the seed bed for future operational ocean platforms. Excellent examples include TAO/TRITON, Argo, PIRATA, and surface drifters. Significant progress has been achieved recently with planning and implementation of observing system in oceans surrounding Africa, including support for an extension to PIRATA in association with the Tropical Atlantic Climate Experiment, now underway, which has the goal to advance the understanding of coupled ocean-atmosphere processes and improve climate prediction for the Tropical Atlantic region. CLIVAR, in collaboration with IOC and Indian Ocean GOOS is continuing to provide coordination of the implementation of an integrated observing system for the Indian Ocean. Developments to the Indian Ocean observing system are described in the October 2006 edition of *CLIVAR Exchanges*, which was devoted to the subject of Indian

7-8

Ocean climate and is obtainable from the CLIVAR website www.clivar.org. In the Pacific, the TOA/TRITON array provides essential data for predictions of ENSO. CLIVAR coordinates with the Tropical Moored Buoy Implementation Panel (an action group of the WMO/IOC JCOMM Data Buoy Cooperation Panel), which plays a key role in overseeing the development and maintenance of the tropical buoy networks. Using the opportunity of IPY, WCRP CLIVAR and Climate and Cryosphere projects are fostering the development of new observing systems in the Arctic and Southern Oceans (with SCOR, IASC, AOSB and SCAR). The role of these systems for future climate prediction, including monitoring and prediction of the Meridional Overturning Circulation, cannot be overestimated. With the rapid reduction in Arctic sea ice extent, Arctic shipping is expected to increase significantly. Safety, management of ecosystems, tourism, lifestyles of Arctic residents and erosion of coastal zones will all require reliable predictions of sea ice and ocean conditions. At the same time, the challenge of observing the ocean temperature and salinity under the remaining sea-ice cover requires novel technical solutions.

GODAE (ocean) reanalyses and data synthesis—Meteorological reanalysis has revolutionized atmospheric studies and enabled multiple data applications. Building on the achievements and experience of the OOPC's Global Ocean Data Assimilation Experiment (GODAE), WCRP has been actively engaged in coordinating the development and assessment of systems for ocean reanalysis. The CLIVAR Global Synthesis and Observation Panel is overseeing this process. Ocean reanalysis provides the potential and is intended to become the main means of detecting changes in the ocean, providing initial conditions for climate prediction at various scales and serving as an ocean model verification and development tool. Approximately 15 research groups participate in these ocean reanalysis activities. Both atmospheric and ocean reanalysis are necessary steps towards full climate system reanalysis.

A 3rd WCRP Reanalysis Conference is planned to take place in Tokyo, Japan, on 28 January - 1 February 2008 to take stock of developments in this area. Recent completion of the Japanese reanalysis project, updates on the ECMWF and NCEP/NCAR reanalyses, emerging regional reanalyses, and the availability of new estimates of oceanographic forcing parameters offer unprecedented opportunities for running ocean circulation, wind wave and other models to provide improved estimates of ocean parameter trends with increased certainty and detail.

The first Atlas of the WOCE Hydrographic Program for the Southern Ocean was published in 2005. The work on the Atlases continues. The final version of the Atlas for Pacific and draft for the Indian Ocean are now accessible online (http://www-pord.ucsd.edu/whp_atlas) and WCRP plans their publication in 2007.

Ocean and Climate Model Development—Through the concept of 'coordinated ocean and sea ice reference experiments', the WCRP/CLIVAR Working Group on Ocean Model Development (WGOMD) is using a commonly accepted standard for forcing of ocean and

sea ice models to assess their quality against standard metrics. A workshop on Numerical Methods in Ocean Models and a 7th meeting of the group will take place in Bergen, Norway, on 22-24, and 24, 25 August 2007, respectively. The WGOMD provides guidance on the development of ocean circulation models, on global, ocean basin and high resolution regional scales.

Ocean modeling as well as climate modeling will be on the agenda of a WCRP Modeling Summit, which is tentatively planned for 2008. The WCRP Working Group on Coupled Modeling (WGCM) will continue its role in the development of a wide range of coordinated coupled model climate experiments with continuing focus on coordination of IPCC model runs. Indeed the IPCC AR4 motivated the formulation of the largest international global climate model experiment and multi-model analysis ever attempted. This was organized through the WGCM Climate Simulation Panel with the help of the Program for Climate Model Diagnosis and Intercomparison (PCMDI), USA. The resulting WCRP archive of climate model runs for IPCC AR4 held at PCMDI (which contains 33 Terrabytes of data in 76000 files) continues to attract huge interest by the scientific community. Already more than 200 Terrabytes of data has been downloaded by participants in 553 diagnostics subprojects. A significant portion of these projects focuses on interpretation of model projections in terms of studying the changing ocean in a warming climate.

Climate Prediction and Projection—Advances in observations, process understanding and modeling form the foundation for future climate prediction. WCRP has started its work with IPCC in preparing for a fifth IPCC assessment: WCRP will actively contribute to formulation of climate change forcing scenarios, model development, coordination of model runs and archiving and analysis and interpretation of results. A WCRP/GCOS/IGBP Workshop on Anthropogenic Climate Change is planned in Sydney, Australia on 4-6 October 2007. WCRP actively works with UNFCCC and the Subsidiary Body on Scientific and Technological Advice (SBSTA) for the Conference of its Parties, supplying them with requirements for continuing science research.

Recent examples of other ocean research—relevant developments in WCRP core projects and working groups

CLIVAR is the main WCRP project dealing with oceans. In addition to the information given in this document, there are multiple advances in other areas of CLIVAR ocean research - please refer to the project website (<http://www.clivar.org>), including the CLIVAR SSG's Report to JSC-28 which can be found at <http://www.clivar.org/organization/ssg/ssg.php>.

GEWEX (<http://www.gewex.org>) is the main WCRP project focusing on the cycle of energy and water. It has recently achieved advances in reproducing ocean fluxes using satellite data (through its SeaFlux Project). Multiple GEWEX data sets on global and regional hydrological cycle have become available, some of them including oceanographic data, for example, the BALTEX project.

7-10

CliC (Climate and Cryosphere project, <http://clic.npolar.no>) has completed, in partnership with its cosponsor, the Scientific Committee on Antarctic Research (SCAR), an IGOS Theme report on cryospheric observations (including sea ice, ice shelves, icebergs and polar marine observations - see <http://igos-cryosphere.org>). It has also initiated a project on Southern Ocean Physical Oceanography and Cryospheric LinkagES (SOPHOCLES). Such projects are necessary to study complex process in the climate system and existing feedbacks in it, for example, the ice–albedo feedback.

SOLAS (<http://www.solas-int.org>) is a project sponsored by SCOR and WCRP together with the International Geosphere – Biosphere Programme (IGBP) and Commission on Atmospheric Chemistry and Global Pollution (CACGP). This project held its second international science conference in Xiamen, China, on 6-9 March 2007.

In collaboration with the WMO/CAS WCRP *Working Group on Numerical Experimentation*, the WCRP *Working Group on Surface Fluxes* has reinvigorated a project SURFA that intercompares air-sea fluxes produced by numerical weather prediction models with observations at buoys, aimed at assessing and helping to improve the quality of simulation of ocean-atmosphere interactions in predictive models.

Work with other partners

WCRP ocean climate research is conducted under the sponsorship of IOC. Other partners include IOCCP and GOOS, GCOS, IGBP, SCAR, AOSB, IASC and other international organizations and groups.

Direct links between WCRP and SCOR need to be strengthened. A JPS staff member Dr. Vladimir Ryabinin is assigned to be WCRP contact point for IOC, its bodies, and Member States. He is planning to attend the forthcoming Executive Committee of SCOR in Bergen, August 2007 to discuss the development of cooperation between WCRP and SCOR.

7.1.3 Scientific Committee on Antarctic Research (SCAR)

SCOR and SCAR cooperate in several areas of joint interest. The largest area of cooperation presently is the SCAR/SCOR Group of Experts on Oceanography (described in greater detail below). However, the two organizations have also sent two letters in the past year, one on the need for nations to submit Southern Ocean data to recognized databases and the other specifically related to collection and submission of bathymetry data. The second letter resulted from the SCOR Project Summit in December 2006, in which Colin Summerhayes, the SCAR Executive Director, participated. SCOR and SCAR are involved in parallel efforts on capacity building, which might usefully be linked in some way in the future.

The SCAR/SCOR Expert Group on Oceanography

Background information on the SCAR/SCOR Oceanography Expert Group (EG-Ocean), including terms of reference, membership, reports etc., can be found at:

<http://www.clivar.org/organization/southern/expertgroup/index.htm>

The **Terms of Reference** of the Group are:

- (i) to encourage an inter-disciplinary approach to Southern Ocean observations, modeling and research, recognizing the interdependence of physical, chemical and biological processes in the ocean at present and in the past;
- (ii) to facilitate coordination between the physical oceanographic research groups currently active and those planning research in the Southern Ocean;
- (iii) to identify historical and reference data sets of value to researchers, focusing initially on physical oceanography data; and
- (iv) to encourage the exchange of information with operational agencies

The membership follows:

Eberhard Fahrbach (co-chair)	Alfred-Wegener Institute, Bremerhaven, Germany
Eileen Hofmann (co-chair)	Center for Coastal Physical Oceanography, Old Dominion University, Norfolk, United States
Isobel Ansorge	Oceanography Department, University of Cape Town, South Africa
Heine de Baar	Marine Chemistry, Royal NIOZ, Den Burg, The Netherlands
Julie Hall	National Institute of Water and Atmospheric Research, Hamilton, New Zealand
Karen Heywood	School of Environmental Sciences, University of East Anglia, Norwich, UK
Alexander Klepikov	Arctic and Antarctic Research Institute, St Petersburg, 199397, Russia
Mike Meredith	British Antarctic Survey, Cambridge, United Kingdom

7-12

Steve Nicol	Australian Antarctic Division, Kingston, Australia
Philippe Pondaven	Institut Universitaire European de la Mer, Plouzane, France
Christine Provost	Université P. et M. Curie, Paris, France
Manfred Reinke	Alfred-Wegener Institute, Bremerhaven, Germany
Steve Rintoul	CSIRO Marine Research and the Antarctic Climate and Ecosystems Cooperative Research Centre, Hobart, Australia
Mike Sparrow	National Oceanography Centre, Southampton, UK
Ilana Wainer	Dept. of Physical Oceanography, University of São Paulo, São Paulo, Brazil
Hans-Werner Schenke	Alfred-Wegener Institute, Bremerhaven, Germany
Enrico Zambianchi	Istituto di Meteorologia e Oceanografia, Università "Parthenope", Naples, Italy

The EG-Ocean had its most recent meeting in Hobart on July 10-11, 2006. The report is available directly from:

http://www.clivar.org/organization/southern/expertgroup/Expt_group_2.pdf

Several different issues were tackled during the meeting. For example, as a direct result of a recommendation made by the EG-Ocean the Southern Ocean READER portal of temperature, salinity and ocean current data is now on-line

(http://www.antarctica.ac.uk/met/SCAR_ssg_ps/OceanREADER/). Further developments are planned for the future. The group also maintains a website devoted to linking together projects and cruises of an interdisciplinary nature:

http://www.clivar.org/organization/southern/SCAR_SCOR/index.htm. Requests were made to the community at large (including SCAR, SCOR, IOC and CLIVAR contacts) for information to populate the pages.

One of the main outcomes from this meeting was the decision that the EG-Ocean should take the lead in developing a post-IPY sustained Southern Ocean Observing System (SOOS), something that is also seen as a priority by the CLIVAR/CliC/SCAR Southern Ocean region panel as well as being a direct recommendation of the XXX Antarctic Treaty Consultative Meeting (Delhi, April 30-May 11, 2007). As a result of this a SOOS planning workshop is being held in Bremen on 1-3rd October 2007

(http://www.clivar.org/organization/southern/expertgroup/SOOS_workshop.htm). A draft SOOS plan developed during the workshop will be available for discussion by March 2008.

Presentation and further discussion of the plan will occur at an expanded meeting of the SCAR/SCOR Oceanography Group during the SCAR Ocean Science Conference in St Petersburg (July 2008).

WORKSHOP TO PLAN A SOUTHERN OCEAN OBSERVING SYSTEM (SOOS)

An activity of the SCAR/SCOR Oceanography Group

1-3 October 2007, Haus der Wissenschaften, Bremen, Germany

1. Scientific Organising Committee (SOC)

E. Fahrbach (EG-OCEAN) Eileen Hofmann (EG-OCEAN & GLOBEC) (Co-Chairs), Colin Summerhayes (Secretary), Julie Hall (IMBER), Steve Rintoul (CASO), Graham Hosie (CPRAG), Dan Costa (SeaOS), Peter Dexter (JCOMM), Mike Meredith (POGO), Michael Stoddart (CAML), Edith Fanta (CCAMLR).

2. Methodology

2.1 In advance

Each observing/research group to complete a questionnaire detailing for example:

- (i) what observations of interest to them are currently made in the Southern Ocean
- (ii) what observing systems of interest to them are currently in place
- (iii) what are the gaps (a) technological, (b) process understanding, (c) geographic, (d) temporal and historical, (e) modelling, in areas of interest to them
- (iv) how can research activities contribute to a sustained observing system
- (v) what priorities can they suggest (a) for the short term; (b) for the long term
- (vi) other comments that may be relevant for our purposes.

Each user group to provide a table of requirements:- what measurements are needed, for what purpose by what means, at what geographical and temporal spacing, to what precision/accuracy.

Questionnaires and Tables of Requirements to be provided to Secretariat (executive.officer@scar.org) by August 1.

September 1. Secretariat to:

- (a) Make completed questionnaires and statements of requirements available to attendees;
- (b) Circulate extracts from key GOOS documents, describing what is needed for an observing system.

7-14

2.2 The Meeting

Day 1; Monday October 1; 1000-1800

Each **observing/research group** to **briefly** present its systems/ideas/plans/relevance to users, focusing on highlighting the key points and future observing requirements.

Each **user group** to state its observation products requirements.

Brief presentation of GOOS recommendations

Discussion of key points raised in presentations

Discussion of development of possible SOOS plan structure

Day 2; Tuesday October 2; 0900-1800

Three break-out groups to develop sections of a SOOS plan

Review of break-out groups' work

Day 3; Wednesday October 3; 0900-1700(or earlier)

Revision of plans developed on Day 2 (cross membership of working groups)

Review of revised detailed plan outline (sections and pages per section)

Identification of post-session Writing Assignments, with strict attention to page length

2.3 Post Meeting Completion

- 4 Months Later (end Feb 2008): Completion of writing assignments
- 5 Months Later (end March 2008): Completion of draft plan, Circulation of plan to the wider community for feedback
- 8 Months Later (beginning of July 2008): Presentation of the plan, and discussion, at expanded meeting of the SCAR/SCOR Oceanography Group, and as part of the SCAR Ocean Science Conference (St Petersburg, Russia) to obtain more feedback
- 9 Months Later (August 2008): Inclusion of feedback to finalise plan
- 10 Months Later (September 2008): Publish the plan

Attendees (as of 20/6/07):

	Project	Representative	Country	Discipline	Reply
1	SOLAS	Richard Bellerby	Nor	Biogeochem	Y
2	IMBER	Julie Hall	NZ	Bio	Y
3	SOIP/CASO	Steve Rintoul	Aus	Phys	Y
4	IPAB	Christian Haas	Ger	Phys	No - will
5	GEOTRACES	Hein De Baar	NL	Chem	Y
6	IOC	Keith Alverson	Fra	Phys	Y
7	iAnZone	Eberhard Fahrback	Ger	Phys	Y
8	CAML	Michael Stoddart	Aus	(Bio)	Y
9	GEBCO/IBCSO:	Hans Werner Schencke	Ger	Geo	Y
10	CLIVAR/Argo	Kevin Speer	USA	Phys/Model	Y
11	CliC/IGOS Cryo	Vladimir Ryabinin	Swi	Phys	Y
12	OOPC	Ed Harrison	USA	Phys	?
13	ASPeCT	Tony Worby	Aus	Glac	No - will
14	SCOR	Ed Urban	USA	Phys	Y
15	GOOS	Detlef Stammer	Ger	Phys	Y
16	CPR-AG	Graham Hosie	Aus	Bio	Y
17	JCOMM	Etienne Charpentier	Aus	Met	Y
18	POGO/AGCS	Mike Meredith	UK	Phys	Y
19	SEaOS	Dan Costa	USA	Bio	Y
20	ICED	Eugene Murphy	UK	Bio	Y
21	GLOBEC	Eileen Hoffman	USA	Bio/Phys/Model	Y
22	ESA	Pierre-Philippe-	Ita	Rem/Sens	Y
23	CNES	Eric Thouvenot	Fra	Colour/Rem/Sens	prob?
24	IWC	Greg Donovan	UK	Bio	?
25	SCAR	Colin Summerhaves	UK	General	Y
26	WMO	Qin Dahe	Chi	Met	No - rep. to be
27	COMNAP	Hartwig Gernandt	Ger	Admin	Y
28	ATS/ATCM/CEP	Neil Gilbert	NZ	Bio	?(rep)
29	IPY	Dave Carlson	UK	Phys	Y
30	CCAMLR	Edith Fanta	Bra	Bio	Y(?)
31	IAATO	Denise Landau	UK	Admin	?(rep)
32	WMO/IPY	Ed Sarukhanian	Swi	Met/IPY	Y

7-16

33	NOAA	Steve Piotrowicz	US	Ocean	Y
34	GOODHOPE	Isabelle Ansorge	S. Africa	Ocean	Y
35	AGCS	Shigeru Aoki	Japan	Ocean	Y

7.1.4 Scientific Committee on Problems of the Environment (SCOPE)

The major area of cooperation between SCOR and SCOPE is the project entitled: “PACKMEDS - Dynamics of semi-enclosed marine ecosystems: the integrated effects of changes in sediment and nutrient inputs from land.” The PACKMEDS activity is based on a workshop held in Delmenhorst, Germany on 2-5 April 2007. The workshop included short presentations of background material, but focused primarily on cross-cutting interdisciplinary discussions. The workshop will result in a book published by Island Press in the SCOPE series. The editors are Jerry Melillo (for SCOPE), Paola Rizzoli (for IUGG/IAPSO), and Bjørn Sundby and Ed Urban (for SCOR). The outline follows.

“Dynamics and Vulnerability of Semi-enclosed Marine Systems: The Integrated Effects of Changes in Sediment and Nutrient Input from Land”

Outline at 06 July 2007

1. **Introduction:** Paola Rizzoli, Bjørn Sundby, Jerry Melillo, Ed Urban

Cross-cutting Themes

2. **Disturbance Pathways Important for Coastal Seas and Semi-Enclosed Marine Systems:** Elva Escobar Briones, Michael MacCracken; Denis Gilbert, Gennady Korotaev, Wajih Naqvi, Gerardo Perillo, Tim Rixen, Emil Stanev, Helmuth Thomas, Daniela Unger, and Edward Urban
3. **Threshold Effects in Semi-Enclosed Seas:** J van de Koppel and Paul Tett; Wajih Naqvi, Temel Oguz, Gerardo Perillo, Nancy Rabalais, Maurizio Ribera d’Alcalà, Su Jilan, and Jing Zhang
4. **Governance and Management of Ecosystem Services in Semi-Enclosed Marine Systems:** Paul V.R. Snelgrove, Michael Flitner; Ed Urban, Werner Ekau, Marion Glaser, Heike K. Lotze, Katja Phillipart, Penjai Sompongchaiyakul, Edy Yuwono, Jerry Melillo, Michel Meybeck, Nancy Rabalais, Bjørn Sundby, and Jing Zhang
5. **Integrating Tools to Assess Changes in Semi-Enclosed Marine Systems:** Carolien Kroeze, Jack Middelburg, and Rik Leemans; Elva Escobar Briones, Wolfgang Fennel, Marion Glaser, Akira Harashima, Kon Kee Liu and Michel Meybeck, and others

7-18

Background Chapters

Physics

6. **Physical Processes and Changes:** Wolfgang Fennel, Jilan Su, and Denis Gilbert

Land-Water Linkages

7. **Land to ocean linkage : cascading filters of river material from headwaters to regional seas:** M. Meybeck, H.H. Dürr, and G.M.E. Perillo
8. **Nutrients and Other Chemicals:** Kon-Kee Liu, Josette Garnier, Sybil Seitzinger, and Venugopalan Ittekkot

Marine Ecosystem Responses

9. **Biogeochemical cycling and microbiology:** Helmuth Thomas, Daniela Unger, Jing Zhang, and Kon-Kee Liu
10. **Dynamics and Vulnerability of Marine Food Webs in Semi-Enclosed Systems:** Katja Philippart and Werner Ekau
11. **Distribution and Consequences of Hypoxia:** Nancy Rabalais and Denis Gilbert
12. **Ecosystem Services of Semi-Enclosed Marine Systems:** Heike Lotze and Marion Glaser

The current plan is for the book to be reviewed and submitted to Island Press in December 2007.

7.2 Affiliated Organizations

7.2.1 International Association for Biological Oceanography (IABO)

No written report was received.

7.2.2 International Association for Meteorology and Atmospheric Sciences (IAMAS)

International Association of Meteorology and Atmospheric Sciences 2007 Annual Report to SCOR 24 June 2007

The key IAMAS activities over the past year have been: (1) planning for the IAMAS-organized scientific symposia at the IUGG General Assembly in Perugia, 2-13 July 2007; (2) planning for the IAMAS General Assembly, including the election of officers for the upcoming four-year term; (3) assisting in finalizing the assessment report prepared by the International Aerosol-Precipitation Assessment Group (IAPSAG) that has been co-sponsored by IAMAS and WMO; (4) representation of IAMAS with other organizations; (5) consideration of possible statute changes; and (6) improving communication via the Web and newsletters.

1. Planning for the Scientific Program for the IUGG (IAMAS) Assembly in Perugia, 2-13 July 2007

The set of symposia making up the IAMAS scientific program for the Perugia Assembly was agreed to at the IUGG Executive Committee meeting in Perugia in September 2005. Since that time, conveners have been identified, the scheduling for the sessions has been determined, the call for papers has gone out, abstracts have come in, sessions have been organized, and session chairs have been appointed. Joint Symposia (led by IAMAS, but with other Associations) are set, with no more than four parallel sessions. Up to four additional parallel sessions have been arranged to accommodate the IAMAS Inter-Commission and Commission symposia (IAMAS has 10 active commissions). One additional parallel session will be necessary in the second week for the IAMAS-sponsored Symposia of the Union Commission of Cryosphere Science (UCCS).

Two special IUGG events are being organized by IAMAS: (1) Presentation of the results of the IPCC's Fourth Assessment Report; and (2) Presentation of the results of the IUGG/WMO IAPSAG (International Aerosol-Precipitation Assessment Group) report.

IAMAS will also be organizing a series of noontime lectures into the Mysteries of the Atmosphere.

As for previous periods, virtually the entire IAMAS budget, which is derived from IUGG and a head tax on registrants at our meetings, goes to support participation by scientists from developing countries.

2. Planning for the IAMAS General Assembly (i.e., the IAMAS Administrative Meetings)

The IAMAS General Assembly, made up of representatives of the nearly 50 IUGG member states, meets every four years on the occasion of the IUGG General Assembly. The main

activities include: (1) Reviewing the status of each of the 10 commissions of IAMAS; (2) Planning for future meetings; and (3) Election of officers for the term 2007-11.

Most of the activities of IAMAS are directed by its 10 commissions. In addition to helping to coordinate activities in their topical area, about half of the commissions, in addition to sponsoring symposia at the biennial scientific assemblies, have their own international meetings during each four-year quadrennium, and these international meetings (e.g., of the International Ozone Commission, the International Radiation Commission, etc.) typically attract several hundred participants each.

Planning of the scientific symposia to be organized at the 2009 joint assembly of IAMAS, IAPSO, and the UCCS (at Perugia likely to be elevated to the International Association for Cryospheric Sciences) to be held in Montreal, Canada from 19-29 July 2009 will be considered in Perugia. This scientific assembly will be just after the conclusion of the international polar year activities, so should provide a significant opportunity for presentation of results on polar as well as other global change science. The IAMAS assembly in 2011 will be co-located with the IUGG General Assembly, which is expected to be held in Australia (the vote takes place in Perugia).

The nominating committee has put forward the following slate for consideration as IAMAS officers for the coming quadrennium:

President:	Prof. Guoxiong Wu (China)
Secretary-General:	Dr. Hans Volkert (Germany)
Vice-President (2):	Dr. Anne Thompson (USA)
	Dr. M. A. F. da Silva Dias (Brazil)
Members at Large (4):	Prof. T. Yasunari (Japan)
	Dr. V. Kattsov (Russia)
	Prof. S. Stefan (Romania)
	Dr. E. H. Berbery (Argentina)

3. Assessing the Effects of Pollution on Precipitation

IUGG/WMO jointly established the *International Aerosol-Precipitation Science Assessment Group, IAPSAG*, following the 2003 IUGG General Assembly, asking them to prepare an assessment of the effects of smoke and other aerosols on precipitation. The draft report was completed in 2006 under the inspired leadership of Prof. Zev Levin of Israel and Prof. William R. Cotton of the United States. This was followed by the thoughtful input of a Review Committee under the leadership of Dr. George Isaac of Canada. The report, 483 pages long, has recently been completed, and it should be extremely useful to national and international agencies and for teaching at the graduate level. Worth mentioning is the sad fact that three of the key authors died during the preparation of the review: Prof. Peter Hobbs (honorary chair), and Drs. Yoram Kaufman and Brian Ryan.

4. IAMAS Representation

IAMAS scientists serve as liaisons to a number of groups, including SCOR, WCRP, WMO, and others. It is expected that for the next few years, Dr. Guoxiong Wu will be IUGG and IAMAS representative to WCRP, and Dr. Michael MacCracken, as IAMAS past-president, will continue as IUGG/IAMAS liaison to SCOR.

5. IAMAS Statutes and Changes of Statutes

The French version of the IAMAS Statutes was finalized during 2006 and now contains all the past Statute changes.

The IAMAS Executive Committee, meeting in Beijing, 2005, established a Committee to consider possible Statute changes. Although many possible changes were discussed, the outcome of the proposal was, in recognition of the growth of IAMAS over recent decades, to formerly establish the position of “Deputy Secretary General.”

6. IAMAS Communications: Web site/Newsletter

Deputy SG Dr. John Turner and Dr. Gareth Marshall, both from the British Antarctic Survey, have significantly upgraded the IAMAS Webpage and have been responsible for preparing the biannual IAMAS newsletter.

Michael C. MacCracken, President of IAMAS, and Roland List, Secretary-General of IAMAS

7-22

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

7.3 Affiliated Programs

SCOR-Affiliated Projects and Programs

SCOR sponsors many, but not all, of the major international ocean research projects and programs. Some projects not co-sponsored by SCOR can gain benefits from association with SCOR, such as (1) increased visibility; (2) participation in SCOR activities, such as project coordination meetings and annual SCOR meetings; (3) opportunities to provide comments on working group proposals and membership; (4) access to national SCOR contacts; and (5) opportunities to apply for SCOR funding for travel of scientists from developing countries and countries with economies in transition to their workshops and symposia. In 1995, SCOR developed the option of formal affiliation of relevant projects/programs with SCOR. Unlike projects sponsored by SCOR, affiliated projects and programs receive funding from organizations besides SCOR and do not need staff support from SCOR.

SCOR's role in relation to affiliated projects and programs is one of advice and regular review. SCOR gives advice about appropriate balances on the projects' steering committees and adequate rotations of these committees to renew the committees' memberships regularly. SCOR's national contacts can be used to find new members in regions where there is a need, or to entrain new countries into projects. SCOR can also provide an independent mechanism for the review of planning documents such as science or implementation plans.

Application for SCOR Affiliation

Application to SCOR for program affiliation should be initiated with a proposal of 2 to 5 pages, sent to SCOR at least three months before an annual SCOR meeting. The proposal should include an outline of the program's science plan, the terms of reference, current membership of the steering committee, and rotation procedures and schedule. The proposal for SCOR affiliation should also address the following criteria, accepted at the 1995 SCOR Executive Committee meeting (see *1995 SCOR Proceedings*). The Executive Committee agreed that in order to become a SCOR-affiliated project/program, an activity must

- be truly international, with a committee membership that rotates on a regular basis;
- show evidence of existing financial and/or organizational support;
- demonstrate a benefit from SCOR affiliation;
- have a scientifically well-integrated theme;
- show that it is in SCOR's interests to establish this affiliation;
- be of broad scale and global importance;
- show, as appropriate, that any scheme of membership dues includes some nominal level so as to encourage the widest possible international participation by all countries; and
- be willing to adhere to the SCOR Publication Policy.

7-24

After a program is affiliated with SCOR, annual reports are required, and scientific presentations may be requested at any annual SCOR meeting, as a basis for the decision on continuing the relationship between SCOR and each project/program. The Chair of each affiliated project/program serves as an ex-officio member of SCOR as a Scientific Rapporteur (see SCOR Constitution, paragraph 4). Continued affiliation with SCOR depends on the project meeting the guidelines specified above, and maintaining high scientific quality and adequate rotations of committee members and chairs.

Reports to SCOR

Annual reports to SCOR should answer the following questions and present any additional information that the project/program would like to transmit to SCOR:

- What scientific accomplishments have been achieved by the project/program in the past year?
- How has the project's steering committee membership changed in the past year?
- What is the financial status of the project?
- What is the status of the project's secretariat?
- What are the plans for the scientific development and implementation of the project over the next two to three years?
- How is the project interacting with and contributing to other SCOR activities?

In addition, projects/programs should communicate regularly with their SCOR Executive Committee Reporter regarding their activities and progress.

7.3.1 Status of InterMARGINS application

We have heard no more about the InterMARGINS application since the 2006 meeting.

7.3.2 Census of Marine Life (CoML) (affiliated in 2002)

Mission:

Assess and explain the changing diversity, distribution, and abundance of marine species from the past to the present, and project future marine life.

Chair:

J. Frederick Grassle
Director and Professor
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Vice-Chair:

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Other Members:

Vera Alexander	USA	Poul Holm	DENMARK
D. James Baker	USA	Yoshihisa Shirayama	JAPAN
Patricio Bernal	FRANCE	Myriam Sibuet	FRANCE
D. Chandramohan	INDIA	Michael Sinclair	CANADA
David Farmer	USA	Song Sun	CHINA-Beijing
Serge Garcia	ITALY	Meryl J. Williams	MALAYSIA
Carlo Heip	NETHERLANDS		

Executive Committee Reporter: Annelies Pierrot-Bults

Census of Marine Life Annual Report to SCOR

June 2007

The Census of Marine Life (CoML) was formally established in 2000 and became an Affiliated Program of SCOR in 2002. In 2010, this international research program will release its first report on the status of knowledge of marine biodiversity. In 2007, we are keenly aware of this approaching deadline and have begun implementing plans for integration, synthesis and visualization of marine biodiversity information, as well as the management needs to achieve them. This information is actively being collected by our 14 Ocean Realm Field Projects and three cross-cutting initiatives in historical studies (HMAP – History of Marine Animal Populations), modeling and prediction (FMAP – Future of Marine Animal Populations), and data management and accessibility (OBIS – Ocean Biogeographic Information System). The following report provides an update on the program's status and plans in 2007.

Scientific Accomplishments

All of CoML's global-scale Realm Projects are currently working in the field and analyzing data. This year is a particularly big year for our projects in the Arctic (ArcOD) and Antarctic (CAML), as March marked the beginning of the International Polar Year and the major phase of CoML's polar research at sea. In the past year, HMAP and FMAP have also revealed some new and exciting insights into changes in marine biodiversity over time and the importance of biodiversity in marine ecosystems. Some highlights from CoML expeditions and research analyses include the following.

Species discoveries

The CoML Corals project (CReefs) explored the Northwestern Hawaiian Islands (NWHI) French Frigate Shoals, one of the healthiest and least disturbed atolls in the world, lying within the recently established NWHI (U.S.) National Marine Monument. Discoveries included 100 potential new species of crabs, corals, sea cucumbers, sea squirts, worms, sea stars, snails, and clams. For some species collected, while not unknown to science, this was the first time they were recorded in the French Frigate Shoals.

The SANTO 2006 Survey, which provides a deep reefs component to CReefs, documented the fauna and flora of the South Pacific island Espiritu Santo in Vanuatu. Philippe Bouchet and Bertrand Richer de Forges led the marine biodiversity component, which involved 97 scientists, students, support staff and volunteers, from 18 countries. The number of species inventoried was remarkable, including 1,100 species of decapod crustaceans (crabs, shrimps and hermit crabs) and around 4,000 species of molluscs. Hundreds of new species - possibly over a thousand - were discovered.

Charles Griffiths, scientist from the near-shore project (NaGISA) and chair of CoML's African Committee, and colleagues discovered and identified a new and impressively large species of rock lobster from the Madagascar Ridge. The lobster, *Palinurus barbarae*, is 50 cm long and

already attracting the interests of commercial fishers in international waters.

Researchers Yousria Soliman and Mary Wicksten from the Continental Margins project (COMARGE) described a new species of amphipod, *Ampelisca mississippiana*, which inhabits the head of the Mississippi canyon around 460m depth in the deep Gulf of Mexico. Although small (less than 6 mm in length), these tube-building crustaceans carpet the seabed, with densities up to 12,000 individuals per square meter. Based on its abundance and the stabilizing effects of the tube mats on sediments, this amphipod is likely of great ecological importance.

New insights into marine animal distribution and diversity

The Antarctic project (CAML) explored the biological diversity of an oceanic region alongside the Antarctic Peninsula, where the Larsen A and B ice shelves collapsed 12 and five years ago, respectively. Fast-growing sea squirts observed at Larsen A site may be an indication of a first step towards a biodiversity change after the collapse. Among their other findings were 15 potential new amphipod species, including one of the largest ever collected; four presumed new species of cnidarians; and deep-sea species (sea cucumbers and stalked feather stars) at unusually shallow depths.

Researchers from the CoML Abyssal Plains project (CeDAMar) also sailed to Antarctica to collect deep biological samples from the Weddell Sea. They focused on cataloging the overall biodiversity and studying connections between organisms found in shallow and the much deeper waters. Looking at evolutionary adaptations, such as the absence of eyes in deep-water organisms, they believe some species moved from the deep ocean to the much shallower shelf. The Southern Ocean has changed little in the past 40 million years, giving these organisms ample time to evolve. Another exciting discovery was the existence of nearly identical species of foraminifera in the Weddell Sea and the Arctic Ocean, strengthening the awareness of the significant link between the Southern Ocean and other oceans, including the Atlantic.

Scientists from the Top Predators project (TOPP) made a scientific breakthrough as they tracked the sooty shearwater in its journey of more than 40,000 miles in 200 days – the longest animal migration distance ever electronically recorded. The tags, small enough to fit on these little sea birds, revealed that the sooty shearwater flew in a giant figure-eight pattern, traveled 40,000 miles annually in search of food, and crossed the equator twice and covered the entire Pacific Ocean.

Loren McClenachan, Jeremy Jackson, and Marah Newman, researchers from the HMAP project, employed 163 historical sources to map the loss of nesting sites and the long-term decline in populations of green and hawksbill turtles in the Caribbean over the last 1000 years. They reported that 20% of historic nesting sites are completely gone, and another 50% support only remnant nesting populations. Modern populations of green and hawksbill turtles in the Caribbean have declined more than 99.5% from numbers once described as “infinite,” which has had a significant negative impact on seagrass beds and coral reefs. While populations of nesting green and hawksbill turtles have risen on protected beaches over the past 30 years, those results are still sobering when compared to historic levels of abundance and distribution.

FMAP scientists reported that the loss of large sharks in the oceans, due to overfishing, is impacting bay scallops and other shellfish. The removal of the largest predatory sharks (bull, great white, dusky, and hammerhead) along the U.S. Atlantic coast has led to an explosion of their ray, skate and small shark prey species that, in turn, have preyed on scallops and have wiped them out.

Novel technologies and approaches

The Marine Microbes project (ICoMM) demonstrated a revolutionary DNA technique called “454 tag sequencing” and found that marine microbial diversity may be 10 to 100 times more than expected and that the vast majority of species are previously unknown, low-abundance organisms theorized to play an important role in the marine environment as part of a “rare biosphere.” The ICoMM team discovered more than 20,000 kinds of bacteria in a single liter of seawater when they expected to find just 1,000 to 3,000. This discovery is important because microorganisms are vital to our survival, and these rare ones have as yet unknown roles in the ecosystem and can be significantly impacted by global change. The “454 tag sequencing” requires only small snippets of genetic code to identify an organism. ICoMM is now inviting proposals from the microbial oceanographic community to further demonstrate tag sequencing of samples from diverse marine habitats and biogeographic provinces of the world’s oceans.

On Georges Bank, Nick Makris of the Gulf of Maine Area program (GoMA) tested his Ocean Acoustic Waveguide Remote Sensing (OAWRS) technology, which can track movements of fish schools at a continental shelf scale. The technology imaged an area over 100 km in diameter, where a school of herring, possibly consisting of 10 billion individual fish, was observed.

The Ocean Tracking Network, a Canadian project led by CoML Senior Scientist Ron O’Dor, received funding to globalize the tagging and tracking technologies developed in the Pacific by CoML’s Top Predators (TOPP) and Shelf Tracking (POST). The OTN will serve as a legacy project of CoML after 2010, giving scientists and resource managers a highly detailed picture of marine conditions and the migrations of fish and ocean animals throughout the world.

Contributions to the community

The Ocean Biogeographic Information System (OBIS) is currently serving more than 13 million data records covering 81,000 species from 210 databases. Many of the newly added data sets were contributed by the network of Regional OBIS Nodes and cover the understudied southern oceans, particularly the waters around Africa, Australia, Antarctica, and South America.

The Shelf Tracking (POST) project studied whether salmon that have struggled to reach the river mouths through many dams might be less likely to survive in the open ocean than those that swam a free-flowing river on their journey to the ocean. Findings indicated that survival of stocks was not impacted by dams.

The Seamounts project (CenSeam) produced a report on “Seamounts, deep-sea corals, and fisheries: Vulnerability of deep-sea corals to fishing on seamounts beyond areas of national jurisdiction,” which was published by the UN Environment Programme’s World Conservation

Monitoring Centre. The Executive Summary was distributed in New York in October 2006 to the negotiators involved in the first round of the UN General Assembly's fisheries resolution negotiations. CenSeam has also published protocols for collection of deep-sea corals. These protocols were peer-reviewed and prepared as a NOAA Technical Memorandum by the U.S. National Oceanic and Atmospheric Administration's (NOAA's) Office of Habitat Conservation.

Led by Boris Worm, FMAP researchers published a study that found current trends in overfishing and pollution are projected to result in collapse of all currently fished seafoods before 2050. The real impacts of species loss, however, were shown to go beyond declines in seafood. Human health risks emerge, as depleted coastal ecosystems are vulnerable to invasive species, disease outbreaks and noxious algal blooms, which create human health risks and negative impacts on human economy dependent on healthy oceans. The positive side was that the data showed ocean ecosystems to hold great ability to rebound, but change needs to happen soon.

FMAP researchers also published a study that examined ways to aid the recovery of North Atlantic right whales. Right whales are virtually extinct in Europe, but exist in a small population of about 350 individuals on the east coast of North America. A leading threat to the species is lethal entanglement by fishing gear, primarily from lobster fishing gear. The FMAP team compared the Nova Scotian and Maine lobster fisheries and found that Maine lobstermen could substantially reduce the number of traps, shorten the fishing season by as much as six months and still catch the same number of lobsters – at lower cost and reduction of risk of right whale entanglements.

Education and Outreach

The Mid-Atlantic Ridge project (MAR-ECO) received the 2006 Descartes Prize for Science Communication in recognition for its “innovative action for science communication.” The award was given in March 2007 at a ceremony at the European Commission in Brussels. MAR-ECO is a shining example of the outreach efforts taken on by the CoML projects.

The Top Predators (TOPP) project teamed up with Yahoo!, Conservation International, the Leatherback Trust and the Costa Rican Ministry of Energy and the Environment for The Great Turtle Race, an outreach effort aimed at raising awareness of the endangered Leatherback turtle. TOPP deployed tags on 11 Leatherback turtles in Costa Rica and tracked them on their journey to the feeding grounds of the Galapagos Islands. The race was followed online by school students and the general public, and was remarked on frequently by Stephen Colbert, who had a turtle named for him, on his television show *The Colbert Report*.

CoML continues to work closely with Galatée Films on production of *Oceans*. The film is currently scheduled for release in May 2009.

Program Governance and Administration

The international CoML Scientific Steering Committee (SSC), the governing body of CoML, includes 16 members from around the world:

7-30

Dr. J. Frederick Grassle (*Chair*), Rutgers University, USA
Dr. Victor Ariel Gallardo (*Vice Chair*), University of Concepcion, Chile
Dr. Ian Poiner (*Vice Chair*), Australian Institute for Marine Science, Australia
Dr. Vera Alexander, University of Alaska Fairbanks, USA
Dr. D. James Baker, Science and Management Consultant, USA
Dr. Patricio Bernal, Intergovernmental Oceanographic Commission, France
Dr. Dorairajasingam Chandramohan, National Institute of Oceanography (Retired), India
Dr. David Farmer, University of Rhode Island, USA
Dr. Serge Garcia, Food and Agriculture Organization, Italy
Dr. Carlo Heip, Netherlands Institute of Ecology, The Netherlands
Dr. Poul Holm, Roskilde University, Denmark
Dr. Yoshihisa Shirayama, Kyoto University, Japan
Dr. Myriam Sibuet, Ifremer (Retired), France
Dr. Michael Sinclair, Bedford Institute of Oceanography, Canada
Dr. Song Sun, Institute of Oceanology, China
Dr. Meryl J. Williams, Future Harvest Alliance Office, Malaysia

The program also has ten National and Regional Implementation Committees (NRICs) that are building local programs to address national research priorities. The intention is that, after the first CoML report in 2010, the NRIC programs will contribute regional syntheses of the known, unknown and unknowable about marine biodiversity and continue to promote CoML's proven technologies and approaches to surveying marine biodiversity in research and monitoring programs and ocean and coastal observation systems. National committees are located in Australia, Canada, China, Indonesia (funded 2007), and the United States. Regional committees are located in the Caribbean, Europe, the Indian Ocean, South America, and Sub-Saharan Africa. Though not formal committees at this time, organized activities for CoML are also taking place in Japan and in the Arabian Sea region.

CoML's international Secretariat is located at the Consortium for Oceanographic Research and Education in Washington, DC. In April 2006, it received renewed funding to continue administering the program through March 2008.

We estimate total commitments to the CoML, including ship-time and other contributions, now exceed \$400 million. These funds come from traditional sources, including governments and private organizations, and support scientific research, outreach and education, and project management.

Plans for 2008-2010

The CoML, under the guidance of its SSC, has established and implemented a complete suite of international projects and other planned activities and is guiding them toward reporting their key findings in 2010. By the end of 2007, CoML will have put in place writers, a management team and a plan to achieve global synthesis of CoML-collected marine biodiversity findings that will carry the program through 2010. CoML is also focusing on its legacies and potential for ongoing marine biodiversity science and observations in the next decade.

For the SSC and Secretariat, the work plan for the next few years emphasizes identification of the key questions to be addressed in the 2010 report, information integration and synthesis, innovative visualizations of findings, and increased participation and partnerships to address societal needs and implement regional programs. While the primary concern of the SSC is the body of work concluding in 2010, it does have an eye to the future and will be calling upon a group of leading scientists from the NRICs and the marine science community in general to consider options for a “Census of Marine Life II.” The SSC is also actively promoting CoML methodologies and technologies to the ocean observing community, namely the Global Ocean Observing System (GOOS) and the Global Earth Observing System of Systems (GEOSS). The broader strategy for post-2010 will involve increased partnerships with a variety of stakeholders and potential user groups that need marine biodiversity information for resource management, conservation, industry practices, and education.

Recognizing the breadth of potential user groups in both government and private realms, the SSC wishes to ensure that the information and insights of CoML will address a variety of needs and issues. It established a working group, led by Paul Snelgrove (Memorial University of Newfoundland), to develop the framework of the 2010 report in consultation with CoML projects and the user community. These recommendations will be presented to the CoML community in November 2007 at its 3rd All Program meeting. The 2010 report will also recommend a plan for future research by identifying remaining knowable gaps in information.

CoML is closely integrated with the Barcode of Life initiative. There is now a marine barcoding initiative, in which CoML scientists are strong participants. The marine barcoding group will meet in Taipei, Taiwan in September 2007, in conjunction with the 2nd International Barcoding Conference.

CoML is also working closely with the recently launched Encyclopedia of Life (<http://www.eol.org>), which has the goal to produce species biographies for all known species on the planet. CoML will help ensure pages for all known marine species.

Relationship to other SCOR activities

CoML has ongoing collaboration with the SCOR Panel on New Technologies for Observing Marine Life. This Panel makes recommendations to the CoML projects regarding technologies that are applicable to their research and more broadly communicates the benefits and potential of novel technologies for studying marine life. It has reviewed the suite of CoML field methodologies and has made recommendations of additional technologies and approaches to consider. The Panel met in October 2006 in Japan, in conjunction with meetings of the CoML SSC and near-shore biodiversity (NaGISA) project. It will meet again in conjunction with the November 2007 All Program meeting in New Zealand.

In December 2006, CoML participated in the SCOR-organized meeting to build synergy between major international ocean research and observation projects and programs. This was a follow-up meeting to the one held in September 2004, in which CoML also participated. CoML

7-32

is a supporter of these forums for communication among the large ocean science programs because it reduces redundancy in activities and increases the spirit of and knowledge of opportunities about collaboration, thus making more efficient use of limited resources. CoML endorses efforts to strengthen the community through better data management and interoperability between systems, ocean observing technologies, and the development of a cruise database. The 2004 SCOR Summit made a recommendation to coordinate activities in the Southern Ocean towards a Southern Ocean Observing System (SOOS). CoML was well represented at the initial meeting toward coordination, which took place in conjunction with the 2006 SCAR annual meeting. A follow-up SOOS meeting will be held this year.

Odd Aksel Bergstad, Principal Investigator of the Mid-Atlantic Ridge project (MAR-ECO), has been invited to make a presentation and represent CoML at the 2007 SCOR annual meeting in Bergen, Norway. CoML will also participate in the SCOR 50th Anniversary meeting in 2008 and has been keeping abreast of the planning.

There is natural cross-over between CoML and SCOR through their vast networks of scientists. CoML shares active personnel with both SCOR-sponsored programs IMBER and GLOBEC. Ann Bucklin, Principal Investigator of the CoML Zooplankton project (CMarZ) and leader of CoML's integrative initiative in DNA barcoding, is a former member of the IMBER SSC. Mike Roman, a former member of the CoML U.S. Committee, is a current member of the IMBER SSC. Dave Karl, of the CoML ICoMM project, and Rory Wilson, of TOPP, are on the joint IMBER-GLOBEC working group for "end-to-end food webs." Ruben Escibano, former chair and current member of the CoML South American regional committee, is a member of the GLOBEC SSC. Additional personnel from CMarZ, TOPP, MAR-ECO, and the Gulf of Maine projects are active in GLOBEC regional science activities, such as CLIOTOP.

Additionally, many of the individual CoML projects have partnerships with other programs of interest to SCOR. The ChEss project collaborates with InterRidge, a SCOR-affiliated program, on cruises, workshops and database development. The CoML projects in the Arctic and Antarctic, ArcOD and CAML, respectively, are the lead coordinating projects for marine biology in the International Polar Year. CoML as a whole is seeking greater participation and input into GOOS, particularly through OBIS, POST, TOPP, and the Gulf of Maine project. Jim Baker, a member of the CoML SSC and promoter of U.S. GOOS in his former position as NOAA Administrator, is leading this charge.

7.3.3 International Antarctic Zone Program - iAnZone (Affiliated in 1996)

Goal and Objectives:

The primary goal of the international Antarctic Zone (iAnZone) program is to advance our quantitative knowledge and modeling capability of the seasonal cycle and interannual variability of the ocean and its sea ice cover, with emphasis on climate-relevant fluxes that couple the Antarctic Zone to the atmosphere and to the global ocean. The iAnZone group has been involved in the development and coordination of three large Antarctic zone projects and also organizes meetings intended to inform others of national research and field programs for the purpose of “value-added” linkages among the participants.

Terms of Reference

- To identify, develop, and coordinate research projects meeting the iAnZone goal.
- To provide a forum for the exchange of iAnZone research plans, results, and data.
- To participate in and assist with the coordination between Antarctic Zone and global climate research programs, with other Southern Ocean programs, and with colleagues.
- To advise SCOR on the development of appropriate observing system (e.g., for GOOS, GCOS), data sets, and modeling strategies needed to understand the scales and mechanisms of climate variability within the Antarctic Zone.

For more detailed information on iAnZone’s scientific programs, see their Web site at <http://www.ldeo.columbia.edu/physocean/ianzone/>

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7-34

7.3.4 International Marine Global Change Study (IMAGES) (affiliated in 1995)

IMAGES (International Marine Global Change Study) is a program of Past Global Changes (PAGES), a core project of the International Geosphere-Biosphere Programme (IGBP), and is affiliated with SCOR. IMAGES was initiated to respond to the challenge of understanding the mechanisms and consequences of climatic changes using oceanic sedimentary records. The overriding IMAGES science issue is to quantify climate and chemical variability of the ocean on time scales of oceanic and cryospheric processes; to determine its sensitivity to identified internal and external forcings, and to determine its role in controlling atmospheric CO₂. In order to achieve these scientific objectives, IMAGES proposes to coordinate a global program to collect and study marine sediment records to address three fundamental questions:

1. How have changes in surface ocean properties controlled the evolution of global heat transfer through the deep and surface ocean and thereby modified climate?
2. How have changes in ocean circulation, ocean chemistry, and biological activity interacted to generate the observed record of atmospheric pCO₂ over the past 300 kyr?
3. How closely has continental climate linked to ocean surface and deep-water properties?

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7.3.5 InterRidge - International Ridge Studies (affiliated in 1996)

Terms of reference:

- To build and maintain an interactive international ridge-research community
- To identify, through InterRidge working groups and the workshops and conferences they organize, the most compelling questions in ridge research and develop program plans to address these questions
- To continue to develop scientific, technical and logistical co-operation among nations and to strengthen international foundations for innovative research.
- To provide current information about research activities through the InterRidge website and *IR News*.
- To encourage participation of smaller oceanographic countries and individual scientists from non-seagoing countries.
- Through education and outreach, to communicate the importance and excitement of ridge research to the general public and decision makers worldwide.
- To act as a representative body for international ridge scientists in policy discussions.

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Coordinators: Rhian Waller (program), Kristen Kusek (education outreach)

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InterRidge Report for SCOR (June 3, 2007)

InterRidge (www.interridge.org) promotes interdisciplinary, international studies of oceanic spreading centers through scientific exchange and the sharing of new technologies and facilities among international partners. InterRidge is dedicated to sharing knowledge amongst the public, scientists and governments and to provide a unified voice for ocean ridge researchers worldwide.

The InterRidge Office in Woods Hole

After three successful years under the leadership of Colin Devey at IFM-GEOMAR in Kiel, Germany, the InterRidge (IR) program office has moved to the Woods Hole Oceanographic Institution (WHOI), Cape Cod, Massachusetts, USA. The IR office will remain here for the next three years (2007-2009) and is being run by a multi-disciplinary team of four individuals: Jian Lin (IR Chair, marine geophysics/tectonics/geodynamics), Chris German (IR Co-Chair, geochemistry/ocean chemistry/hydrothermal activity), Rhian Waller (IR Coordinator, marine biology), and Kristen Kusek (IR Education/Outreach Coordinator, science journalist). The IR Office will continue to work closely with the InterRidge community, Steering Committee, and Working Groups to promote and coordinate multi-disciplinary research of the geophysical, geological, hydrothermal, and biological processes active at mid-ocean ridges.

- InterRidge biweekly news re-installed

The electronic IR bi-weekly news has been up and running continuously since January 2007. The IR news, which is published biweekly on Mondays, reaches more than 2,700 subscribers in many nations. Any member of the international community can sign up to receive the IR news using the interactive Mailman account (mailman.who.edu/mailman/listinfo/interridge-mail). This system allows users to log on, look at archived posts, update their details and submit messages to be posted to the community. Moving to the Mailman account makes disseminating news posts quick and easy for users and readers.

We welcome any submissions for the biweekly news from the international ridge research community on (but not limited to) the following categories: upcoming meetings; upcoming cruises; opportunities and requests for research/cruise collaborations; graduate student/postdoctoral/job opportunities; education and outreach events and opportunities; and any other news articles that would be of interest to the community.

- New InterRidge webpage up and running at WHOI

After a smooth transition from Germany the new office has just completed the task of updating the IR website (www.interridge.org). This new site has been created in Drupal, a free open-source software that can be easily transferred and updated as the IR offices move to other countries in another three years. This new website represents a turning point in access to InterRidge information; we hope this site will be used as a portal where we can easily and quickly get information to the community as well as have the community involved in its evolution and upkeep. In the coming weeks there will also be an updated membership database and an updated cruise database.

- InterRidge co-sponsored an International Data Exchange Workshop, May 9-11, 2007, Kiel, Germany

InterRidge co-sponsored an international data exchange workshop, “Building a Global Data Network for Studies of Earth Processes at the World's Plate Boundaries”, which was held May 9-11, 2007 in Kiel, Germany (<http://www.nsf-margins.org/Dataworkshop07/>). This international workshop, co-sponsored by MARGINS, InterMARGINS, Ridge2000, and InterRidge, was designed for scientists, data managers, and data policy makers to explore new opportunities for scientific research that take advantage of recent rapid growth in digital data collections and data systems technology. Current international efforts in geoinformatics relevant for studies of continental margin and mid-ocean ridge processes were highlighted and approaches - technical as well as political - for enhanced open exchange of key data of broad scientific interest were explored. The workshop consisted of presentations from scientists on data access and visualization needs; from data center managers on existing data systems available for academic research; and from information technologists on emerging technologies for interoperability and data sharing. Working group discussions focused on defining science user needs as well as on current obstacles to and potential solutions for enhanced database interoperability and connectivity. The meeting aimed for the development of new partnerships among marine geoscientists and data centers within the broader international community to establish improved access and exchange of data sets for research targeted at active processes along global plate boundaries.

- Call for proposals for new InterRidge Working Groups announced

In mid-May, the IR Steering Committee announced a call for proposals from the international community to establish new IR Working Groups (WGs) in 2007, requesting the proposals to be received by IR office <interridge@whoi.edu> by Friday, June 29, 2007. This invitation is open to any member - or groups of members - of the international community. All proposals will be reviewed and the new WGs will be recommended by the IR Steering Committee.

The IR WGs play an essential role in promoting, facilitating, and coordinating new research that follows a focused theme of emerging scientific promise, or is conducted in a unique geographic setting along global ridge crests where advances in science will benefit significantly from InterRidge coordination. Working closely with the IR Steering Committee and the IR Office, the new WGs will discuss issues related to focused science themes and/or geographic regions, convene group meetings and community-wide workshops, and promote and coordinate new international research cruises and related work.

In 2006 the IR Steering Committee recommended the following generic plan for how a WG should operate:

7-38

1. A group of up to 10 international proponents submit a proposal to IR Office for the formation of a WG.
2. Each proposal is considered by the IR Steering Committee. If accepted, the IR program will provide US \$2,000 "leverage money" to help a maximum of 10 people to meet, possibly flanking another major congress. The aim of the meeting is for these proponents to finalize a plan for a workshop.
3. The workshop plan is submitted to the IR Steering Committee. If accepted, US \$3,000 is given for workshop support/leverage.
4. The WG may have two end-member outcomes: either it produces a clear plan for how InterRidge can help push forward science through a coordinated effort, or it concludes that national programs are dealing with the burning issues at present and so InterRidge involvement is not absolutely necessary at the time. The former outcome could lead to a proposal to InterRidge to continue the WG, the latter outcome leads to the WG disbanding.

By the end of 2006, two IR WGs had completed their intended missions: Ridge-hotspot interactions and Back-arc spreading centers. That leaves five currently active IR WGs: 1) Biogeochemical interactions at deep-sea vents; 2) Biology; 3) Deep Earth sampling; 4) Monitoring and observatories; and 5) Ultra-slow spreading ridges (go to www.interridge.org for details).

Upcoming InterRidge Events

- InterRidge Theoretical Institute "Biogeochemical interaction at deep-sea vents", Sept. 10-14, 2007, Woods Hole, Massachusetts, USA

The goal of this Theoretical Institute is to encourage multidisciplinary convergence in the study of interactions occurring at deep-sea vent sites between the biological and chemical components of the environment, and to increase collaborative efforts to develop new techniques for making key measurements to achieve this goal.

This InterRidge Theoretical Institute will be comprised of two parts: 2 days of Short Courses and Advanced Lectures; and 3 days of Workshop. It is organized by the Biogeochemical interactions working group of the InterRidge program. Go to www.interridge.org for more information and registration. This conference is co-sponsored by InterRidge, US Ridge 2000, IFREMER, JAMSTEC, and DOEI (WHOI).

- Mid-Ocean Ridge special sessions at 10th International Congress of the Brazilian Geophysical Society, Nov. 19-23, 2007, Rio de Janeiro, Brazil

In an effort to strengthen participation of researchers and students from South American countries in ridge-crest research, two InterRidge special sessions have been set up at the 10th International Congress of the Brazilian Geophysical Society in Rio de Janeiro, Brazil. The InterRidge special sessions, which are scheduled for Nov. 20, 2007, include the following two themes:

1. Tectonic & Volcanic Processes at Mid-Ocean Ridges (co-chairs: Marcia Maia - IUUM/UBO, France, Sidney Mello - LAGEMAR/UFF, Brazil, and Jian Lin - WHOI, USA); and
2. Deep-Sea Hydrothermal Vents & Biology (co-chairs: Nadine Le Bris - IFRMER, France, Françoise Gaill - CNRS, France, Paulo Suguio - IOUSP, Brazil, and Chris German – WHOI, USA). Go to <http://congresso.sbgf.org.br> and www.interridge.org for more information.

The next InterRidge Steering Committee meeting will be held immediately before the above conference in Brazil on Nov. 17-18, 2007, and will be hosted by Dr. Sidney Mello of LAGEMAR/UFF, Brazil.

- Other international workshops and meetings

There are many more workshops and meetings listed on the InterRidge website. Go to www.interridge.org and check “Upcoming Events” for more information.

InterRidge Education and Outreach Updates

The E&O program, which InterRidge launched in 2004, continues to expand. IR focused a great deal of its 2006 efforts on reaching out to international media groups thanks to the unveiling of the IR “Statement of Responsible Research Practices,” which is available on the IR website. We presented the statement—along with other “hot topic” research areas—to media groups both at the American Association for the Advancement of Science (AAAS) meeting in Missouri and the EuroScience Open Forum (ESOF) in Germany, where we also hosted a week-long public exhibition. The statement itself was covered perhaps most comprehensively in *Science News* (October 7, 2006; “Venting Concerns: Exploring and Protecting Deep-sea Communities” by Janet Raloff, pp. 232-234). Kristen Kusek, IR’s E&O coordinator, continues to field media calls about IR and the statement as a result of the media outreach last year. Current E&O highlights include the following:

- Special InterRidge issue of *Oceanography* magazine

InterRidge was proud to publish a special issue of *Oceanography* magazine in March 2007. The 208-page volume reflects months of hard work and commitment by an international suite of contributing authors, including many from the Ridge 2000 community. As stated in the introduction to the issue by guest editors Colin Devey, Chuck Fisher and Kristen Kusek, our hope is that the issue communicates the diversity and excitement of the latest in oceanic spreading-center research and reflects the interdisciplinary spirit of InterRidge. In addition to a spate of the latest science topics, special features on education outreach, policy and technology were also featured. The issue is especially timely, as 2007 marks the 30th anniversary of the discovery of hydrothermal vents, and we invite you to check it out by visiting the InterRidge website (www.interridge.org) or The Oceanography Society website (www.tos.org). The issue was supported by NSF, NOAA’s Ocean Exploration program, the IR member nations, the Biogeography of Deep-Water Chemosynthetic Ecosystems (ChEss) program of the Census of Marine Life, the German DFG, WHOI, and Ridge 2000. We are sending copies of the magazine to science funding agencies in InterRidge member countries and several colleagues to showcase the energy and value of InterRidge to the international research community. Please help us spread the word!

- ChEss Galapagos meeting in honor of the 30th anniversary of vent discovery

7-40

ChEss (the Biogeography of Deep-Water Chemosynthetic Ecosystems program) and the Census of Marine Life are holding their annual meeting in the Galapagos Islands on June 27-29, 2007 in honor of the 30th anniversary of vent discovery along the Galapagos Spreading Center. They will discuss plans for the future of vent-related science, outreach and education, as well as links with management, conservation and policy-makers, and will devote an entire day (29th) to a public exhibition highlighting the past, present and future of hydrothermal vent investigations. ChEss has invited InterRidge to help plan and host the public event, which will feature hands-on exhibits, video and poster displays, a showing of the giant-screen film “Volcanoes of the Deep Sea,” and public talks (also presented in Spanish) by Fred Grassle (The Discovery of Hydrothermal Vents - an explorers perspective), Emory Kristof (The Discovery from the eye of a lens), Cindy Van Dover (The exotic fauna of deep-sea oases), and Chris German (Modern vent investigations and links with space exploration, and Launch of 30th Anniversary of Vent Discovery Website).

- *Science Writer-at-Sea*

Science Writer-at-Sea is IR’s flagship E&O program, which it pilot-tested in 2005. The training and outreach program immerses the world’s future storytellers – science journalism students – on ocean science expeditions, and broadcasts the stories they write in a diverse spate of informal learning environments, having the potential to reach literally millions of people. Kristen Kusek (IR’s E&O coordinator) has delivered two presentations and published three articles about the program, and is actively seeking long-term funding. Since the pilot test, the partner list has grown exponentially. Partner commitments currently include MOSI (Museum of Science and Industry in Tampa, FL), ASTC (Association of Science-Technology Centers, 540 member museums in 40 countries), NOAA Teacher at Sea, *Natural History* magazine, *The Tampa Tribune*, *Oceanus* magazine, Michigan State University’s Knight Center for Environmental Journalism, Columbia University’s Earth & Environmental Science Journalism program, and The Society of Environmental Journalists. For more information, please contact Kusek (kristenkusek@aol.com) and/or visit the Science Writer-at-Sea link on the E&O section of the InterRidge website (www.interridge.org).

All of us at the InterRidge Office hope to hear suggestions, comments from the broad ocean research communities.

Jian Lin (Chair) and *Chris German* (Co-chair)
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Kristen Kusek (Education/Outreach Coordinator)

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7.3.6 International Ocean Colour Coordinating Group (IOCCG) (Affiliated in 1997)

IOCCG is an international group of experts in the field of satellite ocean colour that acts as a liaison and communication channel between users, managers, and agencies in the ocean colour arena.

Terms of Reference:

- To serve as a communication and coordination channel between data providers and the global user community of satellite ocean-colour data, and so to maximize the benefits that accumulate from international investments in ocean-colour science and technology.
- To construct a partnership, at the international level, between the space agencies and the users of satellite ocean-colour data to develop and coordinate data utilization.
- To work closely with the appropriate international bodies (including CEOS, IOC and SCOR), international scientific programs (such as IGBP and GOOS), satellite ocean-colour mission offices and other agencies (such as environmental and fishing agencies) to harmonize the international effort and advance ocean-colour science and its applications.
- To develop a collective voice for the community of users of ocean-colour data and to articulate this voice to the appropriate international bodies, international scientific programs and space agencies.
- To promote the long-term continuity of satellite ocean-colour data sets; the development of operational, ocean-colour data services and new generations of ocean-colour sensors; and the integration of data from complementary ocean sensors.

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Executive Committee Reporter: Bjørn Sundby

International Ocean-Colour Co-ordinating Group (IOCCG) Report of Activities 2006 - 2007

Venetia Stuart (IOCCG Project Scientist)

1. Background

The International Ocean-Colour Co-ordinating Group (IOCCG) was founded in 1996 under the auspices of the IOC (Intergovernmental Oceanographic Commission), and has been an Affiliated Program of SCOR since 1998. It is also an Associate Member of CEOS (Committee of Earth Observation Satellites). The group was established to encourage communication and international co-operation between the providers of ocean colour data (various space agencies that possess ocean-colour sensors), and the users of ocean-colour data (scientists, researchers and program managers). Information retrieved from ocean-colour remote sensing can contribute to our understanding of the planetary carbon cycle and climate research, as well as other biological and biogeochemical processes in the oceans. Ocean-colour data also has many other applications, including management of marine resources and coastal zone management.

The IOCCG is currently chaired by Prof. James Yoder (Woods Hole Oceanographic Institution, USA), and maintains a Project Office at the Bedford Institute of Oceanography (Canada), staffed by Project Scientist, Dr. Venetia Stuart. The Committee is comprised of experts in the field of satellite ocean colour, with representatives from various space agencies as well as the scientific user community. The activities of the group are supported by a number of national space agencies and other organisations.

The activities of the IOCCG can be divided into four broad categories:

- ❖ Deliberations of specialised IOCCG scientific working groups that investigate various aspects of ocean-colour technology for the benefit of the user community. The end result of these working groups is usually the publication of an IOCCG report, which is distributed free of charge to the user community.
- ❖ Capacity-building initiatives (intensive training courses, IOCCG Scholarships and Fellowships, sponsored workshops, etc.).
- ❖ Coordination activities, both within the IOCCG, as well as with other international bodies (CEOS, GEO and POGO).
- ❖ Advocating importance of ocean colour (outreach, IOCCG web site, quarterly newsletter on ocean-colour related topics, conference sessions, articles in magazines etc.).

2. IOCCG Scientific Working Groups

Two monographs have been published by IOCCG scientific working groups over the past year, bringing the total number of monographs in the IOCCG Report series to six. Five other scientific working groups are in various stages of progress, one working group (Ocean-Colour Remote Sensing in the Coastal Zone) has been discontinued due to a number of new initiatives with potential overlap, and a new IOCCG working group on Argo Floats was proposed at the last IOCCG meeting. Below is a summary of the activities and status of the various IOCCG working groups.

2.1 IOCCG Report 5: “Remote Sensing of Inherent Optical Properties: Fundamentals, Tests of Algorithms, and Applications” (ed. ZhongPing Lee)

IOCCG Report 5 was published by the IOCCG in late 2006 and printed by the GKSS Research Centre in Geesthacht, Germany, which is gratefully acknowledged. This report represents the final product of the IOCCG working group on ocean-colour algorithms, chaired by Dr. ZhongPing Lee (Naval Research Laboratory, USA). The objectives of this working group were to assess the performance of nine different ocean-colour algorithms, using a synthesized data set, as well as a database of *in situ* measurements. After carrying out a number of intercomparisons, the group concluded that the most stable and robust properties obtained from ocean-colour data, regardless of the algorithm used, were the total absorption and backscattering coefficients. Inherent Optical Properties (IOPs) can thus provide important indices for our water environments and open new doors for oceanographic studies. The datasets, as well as the software for the various algorithms, are freely available on the IOCCG website, and can be used by all members of the ocean-colour user community to test their ocean-colour algorithms (see <http://www.ioccg.org/groups/lee.html>). IOCCG Report 5 has been distributed free of charge to all subscribers on the IOCCG Ocean-Colour Mailing List, and PDF copies can also be downloaded from the IOCCG website at: http://www.ioccg.org/reports_ioccg.html#Reports.

Status: This working group has completed its tasks and is now closed.

2.2 IOCCG Report 6: “Ocean-Colour Data Merging” (ed. Watson Gregg)

IOCCG Report 6 was published by the IOCCG in early 2007, and was prepared by the working group on “Co-ordination of Merged Data-Sets”, co-chaired by Drs. Watson Gregg and Paula Bontempi (NASA HQ, USA). The objectives of this working group were to develop a procedure to be used by agencies to merge ocean-colour data from various ocean-colour sensors to produce a self-consistent, long-term time series of satellite-derived ocean biogeochemical observations. Significant improvements in spatial coverage and temporal resolution can be achieved by combining data from several missions. While the IOCCG does not have the resources to produce a large, merged, data set, it has helped to implement a strategy to achieve this. Recommendations by the group leading to high-quality public archives of merged ocean-colour data include production of Level-3 data by all ocean-colour missions, establishment of

international *in situ* datasets for validation of merged data, knowledge of sensor characteristics and data performance, using a comprehensive set of merger evaluation criteria to evaluate merged products in a consistent and objective fashion, and defining the source data (sensor and processing version). IOCCG Report 6 has been distributed free of charge to all subscribers on the IOCCG Ocean-Colour Mailing List, and PDF copies can also be downloaded from the IOCCG website at: http://www.ioccg.org/reports_ioccg.html#Reports.

Status: This working group has completed its tasks and is now closed.

2.3 Working Group on Requirements for an Ocean-Colour Sensor in the Coastal Zone (Co-chairs: Curtiss Davis, NRL, USA and Arnold Dekker, CSIRO, Australia).

This working group was established in principle two years ago, but has not yet got off the ground. A number of recent publications and several initiatives with potential overlap led the group to reconsider whether there was still the need for an IOCCG working group on this topic. At the last IOCCG meeting in January 2007, Committee members agreed that it was important for IOCCG to have a report on remote sensing in coastal waters, and proposed forming a new WG to address the issues related to ocean colour from a geostationary orbit. Because of funding limitations it was decided to postpone this working group until next year, and to look for a suitable Chair.

Status: The working group on “Requirements for an Ocean-Colour Sensor in the Coastal Zone” has been disbanded, with a proposal to form a new working group to examine ocean colour in the coastal zone from a geostationary platform.

2.4 Working Group on Global Ecological Provinces (Co-Chairs: Mark Dowell, JRC, Italy and Trevor Platt, BIO, Canada)

The aim of this working group is to review the utility of ocean partitions as a tool for the interpretation and application of ocean-colour data. In addition, the group will review the application of these partitions to oceanographic problems such as the ocean carbon cycle, climate change and resource management. WG activities over the past year saw Trevor Platt representing the IOCCG at a GEO Ecosystem classification meeting in Paraguay (October 2006), and informal discussions being carried out with participants at the GOOS/GEO Chlorophyll workshop in Plymouth (September 2006). To date, the text for the report is more or less complete, apart from the final chapter on recommendations and conclusions.

Several WG participants have expressed interest in continuing the discussions on ecological provinces after completion of the report. Suggestions for continuation include an IMBER Research Project endorsement or a proposal to EU’s Seventh Framework Programme (FP7). In addition, a “live” Mapserver version of the report could be hosted by the EU Joint Research Centre, using some of the datasets presented in the report. A number of recommendations to space agencies and the scientific community will be made in the report, for example, a

commitment to a sustained, long-term time series of ocean-colour data, and a requirement for continued investment in developing ocean-colour data merging methods. The complete version of the draft report will be sent out to working group members later this year, and the final report, entitled “Using Ocean Colour to Elucidate the Functional Structure of Marine Ecosystems”, should be published by the IOCCG early next year.

Status: Working group is on track, and should provide a draft report for review by year end.

2.5 IOCCG Working Group on Comparison of Atmospheric Correction Algorithms (Chair: Dr. Menghua Wang, University of Maryland, USA)

The objective of this group is to quantify the performance of the various atmospheric correction algorithms used by SeaWiFS, MODIS, OCTS, GLI and MERIS missions, so that derived products from these ocean-colour missions can be meaningfully compared and possibly merged.

The various algorithms were evaluated and compared a few years ago, using simulated data sets, although the final report has not yet been completed. Recently, a draft outline was circulated to WG members, along with detailed results from the algorithm comparison exercises. All WG members expressed an interest and commitment to completing the final report, a draft version of which should be ready by the end of this year. Since mission algorithms have evolved over the past 4-5 years, the report would present a comparison of different approaches to the same problem.

Status: Comparison exercises complete, draft report expected shortly.

2.6 Working Group on Operational Ocean-Colour (new Chair: Nicolas Hoepffner, JRC, Italy)

The objectives of this working group are to prepare a report aimed at policy makers interested in societal benefit areas, and to explain the important applications of ocean colour, both real and potential. The group was originally chaired by Dr. Chris Brown of NOAA (USA), but he recently resigned as Chair of the WG due to other work commitments. Dr. Nicolas Hoepffner of JRC (Italy) has agreed to complete the report, with the help of Dr. Trevor Platt. Of the ten proposed chapters, five are in good shape, four are half complete and one (Ocean Colour as an Avenue to Exploration and Discovery) has a rough outline. Since there is much international interest in coordinating Earth observations, the IOCCG feels it is critical to have the report published. The Canadian Space Agency has indicated that it would fund the publication of a short version of the report (brochure/pamphlet) that reflects the outcomes in policy-making language.

Status: Several chapters of report still need work, draft report expected shortly.

7-46

2.7 Working Group on Radiometric Calibration of Satellite Ocean-Colour Sensors (Chair: Dr. Robert Frouin, Scripps, USA)

This working group set out to examine the various approaches used for pre- and post-launch calibration of different ocean-colour sensors. This year, two chapters were submitted to the IOCCG Committee for review: “Definitions and Requirements”, and “Calibration Using Natural Earth Targets”. It is expected that the final two chapters on “Calibration Using On-board Devices” and “Recommendations” will be submitted to the IOCCG later this year for review, after which the report will be published.

Status: Two chapters complete, two more chapters to be finalised this year.

2.8 Working group on Phytoplankton Functional Types (PFTs) (Chair: Cyril Moulin, CEA/CNRS, France)

PFTs are conceptual groupings of phytoplankton species which have an ecological functionality in common, for example, nitrogen fixers or calcifiers. PFTs are of interest to the biogeochemistry community because they are relevant proxies of ecosystem function. Potentially, they can be derived from ocean-colour remote sensing through direct or indirect effects. The first meeting of the group took place at the CNES Headquarters in France, on 6-7 July 2006. Members of the WG exchanged ideas and agreed upon the outline for an IOCCG report. A follow-up meeting took place in Montreal, Canada, just after the Ocean Optics Conference (October 2006), where the outline of the report was discussed (six chapters) and authors assigned to various chapters. The group has made much progress in a short space of time, and has a rigorous schedule.

Status: Outline of report complete, various chapters assigned to authors.

2.9 Working group on Deployment of Optical and Bio-optical Sensors on Argo Floats (Chair: Hervé Claustre, Laboratoire d'Océanographie de Villefranche, France).

Argo floats are used for profiling temperature and salinity. Currently, there are 2,768 floats in the global ocean, performing temperature and salinity profiles every 10 days. Data acquisition is near-real time and there is rigorous data control in a well-organised system. Potentially, Argo floats could be implemented with bio-optical sensors for an extension of calibration/validation activities, and for bio-optical/bio-geochemical interpretations. The advantages would include validation at a relatively low cost, access to remote areas of the ocean, and long-term monitoring with almost real-time response. In addition, data could be obtained in high latitudes or under cloudy conditions. At the last IOCCG meeting (January 2007), the Committee noted that this was a very important and timely issue, and they were supportive of forming a new IOCCG working group to address the deployment of bio-optical sensors on Argo floats. Hervé Claustre (LOV, France) was proposed as a potential WG chair, and a number of proposals for working group members were received. NASA agreed to provide extra funding to support the formation of this WG, which will be initiated as soon as the funding from NASA has been approved.

Status: Working group approved, pending supplementary funding from NASA.

3. Capacity-Building Initiatives

The IOCCG has a strong interest in capacity building and has sponsored and coordinated numerous advanced training courses in many parts of the world. This year the IOCCG conducted an intensive training course on “Analysis and Applications of Satellite-Derived Ocean-Colour Data” in St. John's, Newfoundland, Canada, from 7-11 May 2007. The course was funded by the Canadian Space Agency, and took place at Memorial University of Newfoundland. The computing facilities were excellent and we received exceptional support from the computing personnel. A total of 19 students attended the course, including 16 from across Canada and 3 from overseas (China, France and Portugal). Two students cancelled at the last minute. The course was an outstanding success and we received many letters of thanks from the students, who indicated that they had learned a lot in a short space of time, and that the course presented a great opportunity for participants to network with specialists in the field. The large number of applications received (more than two-thirds of the applicants had to be turned away) indicate the real need for this type of training for scientists from Canada and other countries.

The IOCCG also supported the ChlorOGIN meeting (Chlorophyll Ocean Global Integrated Network), which took place in Plymouth, UK (18 - 22 Sept 2006). The ChlorOGIN Network is an extension of the South American Antares Network, previously established by IOCCG and POGO. This network meets one of the goals of IOCCG, which is to promote the use of ocean-colour data worldwide. The ultimate aim of the ChlorOGIN network is to deliver maps of ocean chlorophyll and sea surface temperature, as indicators of the state of the ecosystem needed for ecosystem and fisheries management, using a number of national and regional centres. This initiative forms one of the specific tasks proposed as part of the 10-year implementation plan of GEOSS (Global Earth Observation System of Systems).

4. Coordination and Liaison

The IOCCG Committee meets once each year to coordinate the activities of the group, and to review the progress of the various working groups, discuss plans for the year ahead and propose new working groups and training initiatives. These meetings are organised and coordinated through the IOCCG Project Office. The last meeting of the IOCCG Committee took place in Swakopmund, Namibia (16-18 January 2007). The meeting was attended by a total of 26 Committee members and invited guests and provided an excellent opportunity for all parties to come together to share ideas and discuss issues facing the ocean-colour community in various parts of the world, as well as to plan a number of new initiatives. The minutes of the meeting are available on the IOCCG website at: http://www.ioccg.org/reports/ioccg_meeting12.html. The Executive Committee also meets once a year to discuss the finances of the group. The next IOCCG Committee meeting is scheduled to take place at the IOC Headquarters in Paris, on 12-14 February 2008.

7-48

Over the past year, IOCCG has provided information, advice and representation at various international meetings and workshops. IOCCG continues to contribute scientific advice to ESA's GlobCOLOUR Project, whose aim is to develop a satellite-based ocean-colour data service to support global carbon-cycle research and operational oceanography. Further information on the project goals and milestones are provided on the GlobColour web-site (<http://www.globcolour.info/>)

CEOS' role is to coordinate Earth observation satellites and act as the main implementation body for the GEOSS space segment through SIT (Strategic Implementation Team). As far as IOCCG is concerned, the highest priority for GEOSS is GCOS, which has specified ocean colour as one of its key measurements. Climate is one of the nine societal benefit areas defined by GEOSS, and this gives IOCCG an opportunity to promote continuity of ocean-colour satellite missions. IOCCG is thus using its membership in CEOS to advocate for the ocean-colour component of the Global Climate Observing System (GCOS). Several IOCCG Committee members were sponsored to represent IOCCG at various SIT, CEOS and GCOS meetings over the past year. Furthermore, IOCCG plans to submit a scoping paper to CEOS for an "Ocean-Colour Constellation" at the upcoming SIT-20 meeting in Italy (19-20 June 2007). The concept of the "CEOS Constellations" has been agreed by CEOS agencies as a potential means to better address space-based Earth observation needs on a global basis, without eroding the independence of individual agencies. SIT-20 is an important milestone in space agency efforts to develop an Implementation Plan for the GEOSS Space Segment, and will confirm the way forward for the CEOS Constellations.

IOCCG is also a member of an informal discussion forum called Ocean United to help the ocean community to speak with a common voice within GEO.

5. Outreach

IOCCG connects with the global user community through a variety of outreach information schemes including a comprehensive website, newsletters, training courses and relevant sessions at conferences and workshops. The IOCCG web site (<http://www.ioccg.org>) provides a wealth of information on many aspects of ocean colour, including ocean-colour data sources, free software, training opportunities, workshops and conferences, an extensive bibliography, employment opportunities and status of current and future ocean-colour sensors. The web site is well maintained and frequently updated via the IOCCG Project Office. In addition, the Project Office distributes a quarterly electronic newsletter to over 900 subscribers, keeping the ocean-colour user community informed of important events, research activities, training initiatives and instrument news.

In addition, the IOCCG hosted an “IOCCG Town Hall” session at the recent NASA Ocean Colour Research Team meeting in Seattle, to review recent activities and to solicit feedback from the user community on emerging needs and priorities related to ocean-colour observations.

6. Current Membership of the IOCCG

The IOCCG Committee consists of about 20 members drawn from Space Agencies and the ocean-colour community, selected to reflect a balance of both providers and users of ocean-colour data, as well as geographical location. The term of service is usually three years, except where the members’ participation is governed by a Space Agency nomination. Rotation of members is being implemented according to a roster (two members, marked with an asterisk, are expected to step down after the next Committee meeting). In addition, NOAA recently nominated a new representative on the IOCCG Executive Committee (Paul DiGiacomo). The group is currently chaired by Dr, James Yoder (Woods Hole Oceanographic Institution, USA).

IOCCG Committee Members (2007/2008)

Ahn, Yu-Hwan	Korea Ocean Research and Development Institute, Korea
Antoine, David	Laboratoire de Physique et Chimie Marines, France
Bernard, Stewart	University of Cape Town, South Africa
Bontempi, Paula	NASA HQ, USA
Crevier, Yves	Canadian Space Agency, Canada
Davis, Curtiss	Naval Research Lab, USA
Delu, Pan*	Second Institute of Oceanography, China
DiGiacomo, Paul	NOAA, USA
Doerffer, Roland	GKSS, Germany
Dowell, Mark	JRC, Italy
Hoepffner, Nicolas	Joint Research Centre, Italy
Ishizaka, Joji	Representing JAXA, Japan
Kampel, Milton	INPE, Brazil
Kumar, Srinivasa	INCOIS, India
Lavender, Samantha	Univ. Plymouth, UK
Lynch, Mervyn*	Curtin University, Australia
Murakami, Hiroshi	JAXA EORC, Japan
Navalgund, Rangnath	ISRO, India
Platt, Trevor (past Chair)	Bedford Institute of Oceanography, Canada
Regner, Peter	ESA/ESRIN, Italy
Sosik, Heidi	Woods Hole Oceanographic Institution, USA
Thouvenot, Eric	CNES, France
Yoder, James (Chairman)	Woods Hole Oceanographic Institution, USA

7-50

7. List of Sponsors

Activities of the IOCCG are dependent upon financial contributions from national Space Agencies and other organisations, and upon infrastructure support from SCOR. Representatives from the funding agencies form members of the Executive Committee. This year the IOCCG received new sponsorship from KORDI (Korea). Sponsors now include

- BIO (Bedford Institute of Oceanography, DFO, Canada)
- CNES (Centre National d'Etudes Spatiales, France)
- CSA (Canadian Space Agency)
- ESA (European Space Agency)
- GKSS (Germany)
- JAXA (Japanese Aerospace Exploration Agency)
- JRC (Joint Research Centre, EC)
- KORDI (Korean Oceanographic Research Institute)
- NASA (U.S. National Aeronautics Space Administration)
- NOAA (U.S. National Oceanic and Atmospheric Administration)

The Bedford Institute of Oceanography has been providing in-kind support since the project's inception (office space, computer, informatics support, fax, phone and postage). GKSS and JRC also provide in-kind support for various IOCCG activities (printing reports, funding workshop meetings etc.). SCOR provides logistic support and also manages the NASA and NOAA funds. The IOCCG has benefited from the efficient and professional manner in which its funds have been managed by SCOR, and it has also been strengthened by having visible links with one of the major international and intergovernmental organizations in the marine sphere.

7.4 Other Organizations

7.4.1 Partnership for Observation of the Global Ocean (POGO)

7-52

7.4.2 Arctic Ocean Sciences Board

See following report.