

Annex 8 – Integrated Marine Biogeochemistry and Ecosystem Research (IMBER)
Project



Integrated Marine Biogeochemistry and Ecosystem Research

IMBER Annual Report to SCOR August 2008

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Major Activities and Achievements

Working groups

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

IMBER/SOLAS Carbon Working Group

IMBER and SOLAS have established a joint carbon implementation group (SIC!). The group is now chaired by Truls Johannessen (Norway) and works closely with the International Ocean Carbon Coordination Panel (IOCCP). Three sub-groups have been formed to move forward the implementation of the carbon research. A Joint SOLAS/IMBER Carbon Research implementation plan has been published electronically (February 2006) (http://www.imber.info/products/Carbon_Plan_final.pdf) and is currently being revised. A SIC! Group meeting is being planned for October 2008, in conjunction with the Ocean in High CO₂ Symposium in Monaco.

WG1 Surface Ocean System (SOS) (leader: Nicolas Metzl (France))

This year, the activities of the SIC-SOS group were focussed on decisions taken at the Surface Ocean CO₂: Variability and Vulnerability (SOCOVV) meeting last year in Paris. A *Deep-Sea Research* special issue is in preparation with thirteen papers now accepted for publication, including new CO₂ climatology, CO₂ variability and decadal changes, coastal regions, instruments, modelling, ecosystems variability and vulnerability. Two meetings of the Surface Ocean CO₂ Atlas (SOCAT) group were held this year, the first one evaluated the actuality of the global and regional synthesis and discussed on the quality control. The goals of the second meeting were to reach international agreement on 2nd-level quality-control procedures, to identify approaches for gridding and interpolation, to identify major science issues at basin and global scale, and to develop a short report for distribution to all relevant networks. This is done in close collaboration with IOCCP, CARBOOCEAN, CDIAC and with all contributors of surface pCO₂ data.

WG2 Ocean Interior (leader: Nicolas Gruber (Switzerland))

This group covers inventory and observations, natural variability, transformation, designing a strategy for leverage for the ARGO program, and interaction with modelling. They have developed the initiative “*The Oxygen-Argo Program (ARGO-O₂)*”.

This group also prepared a FP7 proposal entitled “*Towards Global Observatories for Oxygen Depletion (OXYWATCH O₂)*”. The proposed project would be 3-year project starting in 2009 and includes 15 partner organizations. The work packages themes are Coordination and Management, Oxygen Sensor Technology Development, Oxygen Float Pilot Study, Coastal Oxygen Glider Study, Atmospheric Oxygen Study, Synthesis, Modelling and Prediction, Outreach, Dissemination and Communication.

Another activity related to this sub-group is the CARbon dioxide In the North Atlantic (*CARINA*). *CARINA* was started in June 1999 with the objective to collect carbon-relevant data sets in the North Atlantic and form a consistent, quality-controlled database for the Atlantic Ocean (including the Southern Ocean and the Arctic). Regional working groups were formed during a meeting held in Iceland: North Atlantic (leader: Toste Tanhua), Arctic Mediterranean Seas (leader: Are Olsen) and Southern Ocean (leader: Mario Hoppema). The group is now finalising the synthesis analysis, and the publication of the product online is expected late 2008.

Finally, the Interior Ocean group has been allocated funds from the ESF Conference Program to organise a Global Carbon Synthesis Symposium. The title of the symposium is *Decadal Variations of the Ocean’s Interior Carbon Cycle: Synthesis and Vulnerabilities*. This symposium will be held at the Centro Stefano Franscini in Ancona (Switzerland) on July 13-17, 2009.

WG3 Carbon cycle climate sensitivities and feedbacks

Subgroup 3 is focused on understanding the climate feedbacks to the ocean, but is not yet active. This subgroup will play a role in coordination and synthesis of ocean acidification research. One proposed theme for this group is the impact of pH and its effects on biogeochemical cycles and ecosystems.

Global Ocean Ship-based Hydrographic Investigations Panel (GO_SHIP)

The Global Ocean Ship-based Hydrographic Investigations Panel (GO_SHIP) was formed in 2007. This group brings together interests from physical hydrography, carbon, biogeochemistry, Argo, OceanSITES, and other users and collectors of hydrographic data, to develop guidelines and advice for the development of a globally coordinated network of sustained ship-based hydrographic sections that will become an integral component of the ocean observing system. The approved membership of the group is Masao Fukasawa (JAMSTEC), Bernadette Sloyan (CSIRO), Greg Johnson (NOAA PMEL), Niki Gruber (ETHZ), Chris Sabine (NOAA PMEL), and Arne Koertzing / Toste Tanhua (IFM-GEOMAR). The terms of reference for the group include

1. To develop the scientific justification and general strategy for a ship-based repeat hydrography network, building on existing programs and future plans, that will constitute the core global network, post-CLIVAR;
2. To develop guidelines for a single global information and data center for ship-based repeat hydrography; and
3. To review and provide guidance on the need to update the WOCE hydrographic manual, including a review and update of data quality control issues.

The group held its first meeting during the PICES 16th Annual Meeting, November 1-2, 2007 in Victoria. The group is developing a “blueprint” for a coordinated network of ship-based repeat hydrography that will be circulated widely for consultation and consensus on the way forward.

Continental Margins Task Team

LOICZ and IMBER have formed a joint IMBER/LOICZ Continental Margins Task Team. The task team consists of 10 members and is co-chaired by Jack Middelburg (The Netherlands) and Nancy Rabalais (USA). The group organized a Continental Margins Open Science Conference at the East China Normal University in Shanghai on 17-21 September 2007 (<https://www.confmanager.com/main.cfm?cid=792>). The aims of the Conference were to estimate the relative importance of changing forcings (global, local, and human) and to determine how much of the changes in shelf ecosystems can be attributed to the respective forcings. Invited speakers delivered keynote presentations at the beginning of the sessions. This was followed by high-standard

oral and poster presentations, with discussion session wrapping up each session. A total of 110 scientists from 25 countries attended this conference. The major outcome was the identification of research foci for the development of an implementation plan of collaborative research efforts on continental margin biogeochemistry and ecosystems, its responses to global changes and its feedback effects on the Earth System and human society. Oral and poster sessions were instrumental in highlighting the new findings and new directions in continental margins research. A meeting report was published in *EOS* (Kelly-Gerreyn et al., see publication section). A list of IMBER and LOICZ themes have been identified that include sources and sinks of CO₂, coupled model of ecosystems and biogeochemistry for continental margins, coupling of element cycles, regeneration, modeling of coupled ocean-seafloor systems, and ocean-shelf exchange. The task team is preparing a draft Science Plan and Implementation Strategy for IMBER and LOICZ continental margins biogeochemistry and ecosystems research.

Capacity Building Task Team

The IMBER Capacity Building Task Team is now chaired by Jing Zhang. This group has developed a capacity building strategy and implementation plan for IMBER to guide capacity building issues (http://www.imber.info/products/Capacity_Building_final.pdf). One objective of the strategy is to enhance research capabilities in developing countries, especially those geographically close to interesting biogeochemical/ecosystem provinces. Another objective is to enhance research capabilities globally in those IMBER activities that have few practitioners but are crucial for optimal implementation of the *IMBER Science Plan and Implementation Strategy*. IMBER is represented on the SCOR Committee on Capacity Building where by Jing Zhang (please visit <http://www.scor-int.org/capacity.htm> for details).

IMBER is organizing (in collaboration with EUR-OCEANS) a Summer School on End to end Food Webs in Ankara, Turkey, on 11-16 August 2008. Prof. Temel Oguz, a member of the Capacity Building Task Team, is the organizer of this Summer School. The IMBER IPO supported the organizers and prepared a website (http://www.imber.info/E2E_EcoModel_programme.html). Participants will be PhD students and young post-docs working with biogeochemical cycles and end to end food webs. Confirmed lecturers are Icarus Allen (UK), Temel Oguz (Turkey), Mike St. John (Germany), and Jing Zhang (China). The programme consists of lectures, discussions, practical work/experiments and poster sessions. The formal lectures will be webcast live and will allow scientists around the world hear the lectures and ask questions.

Data Management Committee

The IMBER Data Management Committee (DMC) met in Victoria (Canada) on June 10-11, 2007. It is chaired by Raymond Pollard (UK). The DMC recommended promoting a cooperative data management approach. This implies

- to involve data specialists from the start,
- to strongly recommend that a person with data management experience be appointed, delegated or hired to serve as the Project Data Specialist
- to train young scientists to conduct this task (useful on their CVs, educate them to do DM better) and
- to promote “carrots” rather than “sticks” (e.g., facilitating).

The main priorities for this year are

- complete data policies and Web guides
- contact each IMBER project to encourage development of their data management policy
- develop the IMBER data web pages
- contact the GCMD

The data management committee is organizing a workshop entitled “*BEER - Being Efficient and Environmentally Responsible*” to be held before the IMBER IMBIZO on Sunday, November 9 in Miami (USA). This workshop and discussion will present the benefits of adding a Data Integration Scientist to all projects, and will introduce the various data integration and handling techniques illustrated in the IMBER Data Integration

Cookbook. Scientists of all experience levels are invited to participate in this workshop and contribute to the discussion. Confirmed lecturers are Raymond Pollard, Todd O'Brien (NOAA) and Gwen Moncoiffe (BODC).

Human Dimension

IMBER is exploring a collaborative approach with other IGBP core projects to bring together natural and social science communities to develop the issues and questions for Theme 4 in the IMBER SP/IS. Julie Hall met with the Chair of IHDP (Oran Young) who encouraged IMBER to build on the activities of GLOBEC and LOICZ rather than start a new activity. IMBER was a co-sponsor of a GLOBEC Focus 4 (Human Impacts) workshop that was held in Rome (Italy) on July 8-11, 2008.

End to end Food Web Task Team

The End to end food web Task Team, a joint activity with GLOBEC, was co-chaired by Coleen Moloney (South Africa) and Mike St. John (Germany). The group prepared two papers. The first one was a review paper focused on the concept for end to end food web research submitted to *Trends in Ecology and Evolution* (St. John et al.). The Task Team also prepared a longer paper (Moloney et al.) for publication in *Ecosystems*. This second manuscript captures much of the detailed discussion from the meeting of the Task Team in December 2005 in Hamburg, and attempts to provide a framework for future end-to-end food web research. As a result of the discussions from this group, further end to end activities are being lead by IMBER.

CLIOTOP Symposium: IMBER sponsored Coleen Moloney to attend the first CLIOTOP Symposium (La Paz, Mexico, December 3-7, 2007). The symposium aimed to stimulate international scientific collaboration among researchers studying the responses of oceanic top predators to climate variability and change and to intensive fishing pressure. One of the interesting topics was the link between oceanic mesoscale features and the movements and distributions of top predators, often linked to "hot spots" and high-use areas. Links to climate change were also elaborated in a number of presentations, highlighting the advantages of using highly mobile top predators to integrate ecological signals in the ocean. Publications emanating from the symposium will be assembled in a special issue of *Progress in Oceanography*.

The End to End Task Team is involved with in the organisation of the Summer School on "Analyses of the interactions between end to end marine food webs and biogeochemical cycles", to be held in Turkey.

Coleen Moloney, Mike St. John and Astrid Jarre organised a topic session on *End to end food webs in marine ecosystems* during the IGBP Congress in Cape Town on May 8, 2008. The format of the session consisted of three 20-minute presentations, followed by an hour of structured discussion. The presentations were

- Bridging gaps by weaving marine food webs from end to end (Coleen L. Moloney, South Africa)
- Looking at the end-to-end food web through copepod *Neocalanus* (Hiroaki Saito, Japan)
- Benguela food webs in relation to global change (Lynne J. Shannon, South Africa)

Coleen Moloney and Mike Roman are co-chairing one of the three IMBER IMBIZO workshops on *Ecological and Biogeochemical Interactions in End to End Food Webs*.

(<https://www.confmanager.com/main.cfm?cid=1185&nid=8821>). A plenary speaker (Hiroaki Saito, Japan) will introduce the workshop topic to the IMBIZO. The workshop will be considering two perspectives:

- material cycles related to high trophic level species - what are the relative impacts of change on material cycles through predator-prey interactions (looking from the top down)?
- transformations of elements linked to low trophic level species - what indices should be used to describe material transfer from photosynthesis to fisheries (looking from the bottom up)?

Regional Projects

Integrating Climate and Ecosystems Dynamics (ICED)

ICED is a new international multidisciplinary initiative launched in response to the increasing need to develop

integrated circumpolar analyses of Southern Ocean (SO) climate and ecosystem dynamics (<http://www.iced.ac.uk/>). ICED has been developed in conjunction with GLOBEC and EUR-OCEANS. ICED submitted a Science Plan and Implementation Strategy, which was reviewed jointly by IMBER and GLOBEC in 2007. This document was approved by the joint GLOBEC and IMBER SSCs and will be published later this year. A list of SSC members was proposed and also reviewed by the joint SSCs. Recommendations for gender and geographical balances were forwarded to the ICED Interim Steering Committee.

ICED held their first ICED model development workshop on April 16-18, 2008 at CCPO/ODU in Norfolk, Virginia, USA. Approximately 30 participants working in biogeochemical modeling, food web, fisheries and physical modeling attended the workshop. The meeting structure consisted of plenary presentations and breakout groups. The workshop was aimed at initiating the process of developing a basis for generating models of circumpolar SO ecosystems. The focus was put on SO food web models (structure of SO food webs and SO food web response to climate change). Further products from the workshop will be a workshop report, GLOBEC/IMBER newsletter articles, and an overview paper on SO food webs for peer-reviewed journals such as *Marine Ecology Progress Series* (MEPS).

Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER)

A second workshop was convened by Raleigh Hood and Wajih Naqvi at the National Institute of Oceanography (NIO) on 27-30 November 2007, to write the SIBER Science Plan. As SIBER is designed to be a regional initiative under the auspices of IMBER and GOOS, IMBER has been actively involved in its planning. Brief presentations by all participants were followed by working group and plenary discussions. The following six major themes have been identified, keeping in view the unique features of the Indian Ocean biogeochemistry and ecosystem dynamics:

- (1) Boundary current dynamics, interactions and impacts;
- (2) Equatorial circulation and Indonesian Throughflow, including climate and circulation phenomena such as MJO, IOD, Wyrтки Jets, etc.;
- (3) Controls and fate of primary production in the Indian Ocean, including marginal seas;
- (4) Biogeochemical differences between the Arabian Sea and Bay of Bengal;
- (5) Global change and anthropogenic impacts; and
- (6) Role of higher trophic levels in ecological processes and biogeochemical cycles.

The different working groups have been assigned tasks for preparing a detailed Science Plan and Implementation Strategy. The objective of the writing team is to submit the plan for review at the IMBER Executive Committee meeting in November 2008.

North Pacific Marine Science Organization (PICES)

PICES is developing a new interdisciplinary programme named **F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems (FUTURE). The vision of FUTURE is to understand and forecast responses of North Pacific marine ecosystems to climate change and human activities at basin-wide and regional scales, and to broadly communicate this scientific information to members, governments, resource managers, stakeholders and the public. During the last annual meeting in Victoria (Oct. 2007), an open forum on FUTURE was held and comments on the science plan were received from the PICES community. There are many overlaps in the science plan between FUTURE and IMBER, for example, studying the mechanisms underlying ecosystem response to natural and anthropogenic forcing, developing effective ways to communicate complexity to policy makers, resource managers, and society, etc. The new FUTURE project is a natural and appropriate venue for collaboration between IMBER and PICES. The importance of the collaboration with external projects such as IMBER was accepted by the workshop attendees. The science plan of FUTURE was approved by the PICES Governing Council early this year (http://www.pices.int/members/scientific_programs/FUTURE/FUTURE_final_2008.pdf).

New Endorsed Projects

An Early Warning System Using Seabirds to Detect Ecosystem Change in the High and Low Arctic, leading applicant: William Montevecchi (funding 2007-2009)

Marine resources are vital to many northern communities. Climate changes that have been underway for several decades are influencing marine life in Arctic waters. These changes will affect resource use and traditional harvesting practices and will present challenges as well as opportunities. Information on ongoing change in marine ecosystems is important in planning for future adaptation.

Biological responses to climate change can be expected to be most evident near the limits of species ranges where physiological tolerances are most challenged. The research focuses on top seabird predators in High and Low Arctic Canadian regions linked through the Labrador Current in the North Atlantic. It will capture “downstream” (Labrador Current) influences of High Arctic changes and variability. Changes in the biology of seabirds have already been noted (altered breeding times, deterioration in nutrition and chick condition) with dietary changes involving switches from ice-associated and polar fish to Low Arctic species.

Diving and surface-feeding seabirds (murre, fulmars, gannets, storm-petrels) will be studied when foraging over regional scales during summer and when migrating throughout the High and Low Arctic during fall, winter and spring. The project will use previous surveys of seabird diets throughout Nunavut and Newfoundland and Labrador during the 1970s and 1980s to assess changes that have occurred in High and Low Arctic marine food webs and to establish a current baseline against which future change can be assessed. (Contact: mont@mun.ca)

Pressure effects On marine prokaryoTES (POTES), leading applicant: Christian Tamburini (funding: 2005-2008)

The POTES program (Pressure effects On marine prokaryoTES) project concerns the role of marine micro-organisms in the mineralization of particulate (POM) and dissolved (DOM) organic matter and on the regeneration of biogenic compounds (silicates, carbonates) in the meso- and bathypelagic zones of the ocean. Currently, most of the information regarding these processes comes from the epipelagic zone and/or does not take into account the effect of increasing pressure with depth. Yet, it is essential to integrate effects of hydrostatic pressure forcing (as well as the associated decrease in temperature) when studying oceanic organic matter (OM) mineralization. POTES participants have not only a thorough knowledge but also the required equipment (hyperbaric bottles and samplers, sinking particles simulator) developed in collaboration with a private society (Métro-Mesures SA) that make it one of the leading international laboratories on hyperbaric topics. The major aim of the POTES project is to determine the effect of pressure on prokaryote community structure and on their activities related to the OM transformation and mineralization, using an innovative dual approach based on both laboratory experiments and in situ studies (ANTARES and DYFAMED sites, Northwestern Mediterranean Sea). Due to the high inputs of anthropogenic OM in the ocean (through wind inputs, rainfall, maritime transport, used waters), we will focus on the fate of both biogenic and anthropogenic OM. In this context, petroleum hydrocarbons will be considered as a model, as their fate in the meso- and bathypelagic zones remains unknown. The proposed experiments specifically allow us to characterize and quantify the effects of an increase in hydrostatic pressure and a decrease in temperature on:

- (i) The processes of OM mineralization (transformation of POC into DOC, hydrocarbon biodegradation, respiration) and on the regeneration of biogenic compounds (silicates, carbonates) in intermediary and deep oceanic waters;
 - (ii) The structural ((phylo)genetic) and functional (activities) dynamics of prokaryotic communities;
 - (iii) The flux of POM in the water column and the kinetic of particle transformation in the mesopelagic zone ; these information will be incorporated into a model describing the transformation of particles by micro-organisms in the entire water column.
- (website: www.com.univ-mrs.fr/LMGEM/potes) (Contact: tamburini@univmed.fr)

Outreach activities

IMBER website

The IMBER IPO insures that the IMBER website (www.imber.info) is always up to date and is the major communication tool for IMBER. This year the IMBER web site was visited 15,600 times over a period of 12 months. The number of visits has doubled since last year. A curve of the number of visit per day over the last two years showed peaks of hits generally following announcements for IMBER activities. The National Contact page http://www.imber.info/national_activities.html and a portal for highlighting the activities of the Joint Carbon Research Group have been developed.

The IMBER website is also used to advertisement small meetings and conferences that don't require the use of a registration package. A very good example this year is the webpage developed for the CLIMECO Training for young scientists (http://www.imber.info/CLIMECO_home.html). All information regarding the event are communicated through those pages. We have developed a similar page for the IMBER Summer School planned for August 11-16 in Ankara, Turkey.

IMBER update

Ten issues of the electronic newsletter "*IMBER update*" were published since 2005, including the latest in July 2008. The newsletter includes IMBER science highlights, reports from the activities of the IMBER working groups, summaries from IMBER-endorsed and contributing projects, reports from regional and national programmes, and a list of the upcoming IMBER related conferences and workshops. In 2007, the format of the *IMBER update* was modified to be easily readable online. All issues are downloadable from the IMBER website, <http://www.imber.info/newsletters.html>.

eNews

Considering the growing number of requests for circulation of information regarding activities happening in the IMBER scientific network, the IMBER IPO started in April 2007 the publication of a monthly eNews bulletin. This publication includes a list of upcoming IMBER activities, funding calls, job opportunities, conferences and workshops.

IPO Report to SSC

In an effort to keep the IMBER SSC aware of the development of IMBER activities throughout the year, and not only at SSC meetings, the IMBER IPO started to circulate an IPO report to IMBER SSC members and sponsors. This document reports on IPO activities, news from the IMBER working groups, IMBER meetings, workshops and conferences, IMBER contributing, regional and national projects, sponsored activities, communication and interactions with our sponsors.

Brochure and Poster

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

Training

CLIMECO

IMBER, CLIVAR, GLOBEC and EUR-OCEANS jointly organised training for young scientists entitled "Climate-driven ecosystem changes" on April 21-24, 2008. The motivation came from the need to make the connection between climate and ocean scientists to better understand the sensitivity of the ocean to climate change. The goals were to bring together young marine scientists working on biogeochemistry and ecosystems research (grad students, postdocs) with climate scientists and upscale the climate drivers of ocean processes that are relevant for impact on the marine environment. We received 190 applications from young marine scientists

and the selection of the 30 candidates was a challenge. The numerous applications have allowed us to choose a group of high-level science PhD and post-docs and lead us to expect a productive training.

The CLIMECO training workshop was a combination of scientific plenary sessions on defined themes followed by discussions and "hands-on" sessions where young scientists with a marine biogeochemistry/ecosystems background learned how to use climate data. This included sourcing relevant data, scrutinising its quality and knowing how to make use of it. Eight invited lecturers presented plenary sessions on the following topics:

- Ocean physics, patterns of climate variability and biogeochemical cycles
- The contribution of the ocean observing system to investigate ocean variability
- Modelling ocean circulation and variability
- Combining ocean observations and circulation models
- Patterns of climate variability and change forcing the ocean
- From Physics to Fish and bioclimate feedbacks
- Physical ocean processes upwelling, mixing, surface forcing, nutrients and fish
- Future changes in the atmosphere - ocean system
- Marine ecosystems lecture

Due to the interest shown in the CLIMECO Training for Young Scientists, a live webcast of the plenary lectures throughout the week using the EUROCEANS Web Conference tool were provided. All candidates were asked to prepare a poster presenting their research. A poster session was held on the first day during the icebreaker and the posters stayed up for the duration of the workshop to allow exchange between workshop participants and the local students and scientists. Outcomes from the training will include a meeting report, articles in IMBER, CLIVAR and GLOBEC newsletters, and a public outreach film (collaboration with Oceanopolis). All PowerPoint lectures are available from the IMBER website.

Summer School in Ankara

IMBER is organising with EUR-OCEANS a summer school entitled *Analyses of end to end marine food webs and biogeochemical cycles* that will be held at the Middle East Technical University, Ankara (Turkey) on August 11-16, 2008. The summer school aims to provide participants with an overview of methods, models and approaches for analyzing the interactions between marine biogeochemical cycles and end to end food webs studies. It will introduce to participants recent research foci on the interactions of end to end marine food webs and biogeochemical cycles to better understand and predict changes in marine ecosystems. The summer school will be organized around two lectures series on *Main processes controlling marine food webs* and *Advances in end-to-end food web modelling*. For each topic, a combination of theoretical lectures and practical workshops will be given. The discussion and poster sessions will be organized to stimulate interactions among student and also between students and the lecturers. The organizers are also planning debates on hot topics pertinent to end-to-end ecosystem research and participants presentations. Lecturers will be Icarus Allen, Temel Oguz, Mike St. John, and Jing Zhang. Further information can be found on the summer school website: http://www.imber.info/E2E_EcoModel_home.html.

International Project Office (IPO)

The IMBER IPO is located in Brest, France at the Institut Universitaire Européen de la Mer. The IPO is funded by Centre National de la Recherche Scientifique (CNRS), Institut de Recherche pour le Développement (IRD), Université de Bretagne Occidentale (UBO) and the Brittany Region. The IPO is primarily responsible for carrying out the decisions of the Scientific Steering Committee, searching for funding to support the program's activities, providing support to the different working groups and task teams, providing administrative support for the program's activities, maintaining communication inside and outside the program, and maintaining a data and information archive.

In 2007-2008, IMBER's activities and international office were sponsored by

- IGBP: support for SSC meeting (16K USD; yearly);
- SCOR: and support from NSF (50K USD; 2006-2009) and occasional support for developing country scientist to participate in IMBER-related meetings;
- CNRS: support for activities and travel (32K USD; 2006-2008), for salary (80K USD, 2006-2008);
- IRD: support for salary (33K USD, 2006-2008);
- Region of Brittany: support for salary (22K USD, 2006-2008);
- University of Brest (UBO and IUEM: support for rooms and stationary costs (10K USD, 2006-2008), plus in kind support.

Discussion started with the current funders of the IPO regarding the refunding of the IPO for 2008-2011. A meeting to bring together funders, the IMBER Executive and sponsor representatives was planned in conjunction with the IMBER Executive meeting in early October 2007. A second meeting was held in Paris on April 14, 2008 to finalise the supporting agreements from the French consortium. Funding for the IMBER IPO was renewed for 2008-2011 for the three full-time positions. For this new cycle, the IPO sponsors will include the University of Brest, IUEM, the region of Brittany, CNRS, IRD, Ifremer, the Conseil Général de Bretagne (Department authorities) and the City of Brest. During a meeting with the French consortium, a two-phase approach was proposed for the IMBER IPO for the next 3 years (2008-2011): from July 2008 until March 2010, as the GLOBEC IPO is scheduled to close in March 2010, and from April 2010 until July 2011. In response to this proposed way forward, the French consortium agreed to find further funding for hiring two more staff to support the increased workload of the IPO after April 2010. The French consortium decided to hold another meeting in April 2009 to discuss a proposed way forward for the IPO from the GLOBEC/IMBER Transition Task Team.

Interactions with other projects and programmes

SOLAS

Joint SOLAS/IMBER Carbon Research group: IMBER and SOLAS have established a joint carbon implementation group. The group is chaired by Truls Johannessen (Norway) and works closely with the IOCCP (International Ocean Carbon Coordination Panel). (See section on IMBER/SOLAS Carbon Working Group).

LOICZ

Joint IMBER/LOICZ Continental Margins task team: LOICZ and IMBER have formed a joint LOICZ/IMBER Continental Margin Task Team. The task team consists of 10 members and is co-chaired by Jack Middelburg (The Netherlands) and Nancy Rabalais (USA). The team organized a Joint Continental Margins Open Science Conference that was held at the East China Normal University in Shanghai in 17-21 September 2007, (<https://www.confmanager.com/main.cfm?cid=792>). (See section on Continental Margins Task Team).

GLOBEC

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

IMBER/GLOBEC Transition Team

The sponsors of both GLOBEC and IMBER (IGBP, SCOR) have agreed that preparations should be made for a single ocean research project in the IGBP structure after 2009. The *IMBER Science Plan and Implementation Strategy* was written for a 10-year lifetime and will need an addendum to address the results of the GLOBEC programme, new scientific findings in the IMBER programme and projects within GLOBEC that will continue past 2009. A Transition Task Team (TTT) has been appointed jointly by SCOR and IGBP and tasked with the preparation of this addendum to the *IMBER Science Plan and Implementation Strategy* that will define the additional science to be included in the IMBER project after the conclusion of GLOBEC. In preparing this supplement to the *IMBER Science Plan and Implementation Strategy* the Task Team will consider:

- New developments in marine ecosystem science,
- Key new scientific questions arising from GLOBEC,
- Scientific results of IMBER to date,
- Projects currently within GLOBEC that are planned to continue after 2009.

The Transition Task Team may include recommendations for mechanisms to facilitate the transition, including representation in programmatic structures.

The timetable for this activity will be as follows:

- Nov 2007-April 2008: discussion/drafting within TTT by email
- July 2008: first meeting of TTT in Plymouth (UK)
- Sept 2008: report on activities to IGBP and SCOR Officers
- Dec 2008: 2nd meeting of the TTT with input from the Execs
- Jan-Feb 2009: public posting of draft (e.g., on websites)
- May 2009: presentation at GLOBEC OSC
- Jun-Jul 2009: final touches based on OSC and other comments
- Aug 2009: review by IGBP and SCOR
- Sep 2009: presentation of final report to GLOBEC, IMBER, IGBP and SCOR
- Oct 2009 Discussion/Approval by the IGBP and SCOR officers

The first meeting of this group will be held on 30 July to 1 August 2008 (3 days) at the University of Reading, UK.

CLIVAR

IMBER, CLIVAR, GLOBEC and EUR-OCEANS organized jointly on April 21-24, 2008 a training for young scientists entitled “Climate driven ecosystems changes”. (See section on training and CLIMECO.)

EUR-OCEANS

IMBER co-sponsors with EUR-OCEANS activities focused on marine biogeochemical and ecosystem research including:

- End-to-End food webs task team activities;
- International Symposium on “Parameterization of trophic Interactions in Ecosystem Modelling”, (March 2007);
- ICED, joint international multidisciplinary initiative launched in response to the increasing need to develop integrated circumpolar analyses of Southern Ocean climate and ecosystem dynamics.
- Climate driving of marine ecosystem changes...*Training for young marine scientist* (CLIMECO), April 21-24, 2008;
- Summer School on *Analyses of end to end marine food webs and biogeochemical cycles* at the Middle East Technical University, Ankara (Turkey) on August 11-16, 2008;
- End to end fob web workshop at the IMBER IMBIZO in Miami (USA) on November 9-13, 2008.

CARBOOCEAN

CARBOOCEAN is a European integrated project that aims at an accurate scientific assessment of the marine carbon sources and sinks with special emphasis on the Atlantic and Southern Oceans on a time scale -200 to +200 years from now. A Memorandum of Understanding was signed between IMBER and CARBOOCEAN and discussions are underway to develop joint activities.

GODAE

A joint IMBER/GODAE task team was formed and held a workshop in Paris on June 12-13, 2007. The aims of this workshop were to review the present biogeochemistry and ecosystem development within GODAE systems and related issues, to identify common interests between IMBER and GODAE, to evaluate real time datasets and assimilation schemes required for biogeochemistry and ecosystem applications and to provide a report to IMBER and GODAE useful for further actions. As an outcome of this workshop, the group is developing an implementation document for future joint activities.

National activities

IMBER activities are starting in many countries (e.g. Chile, P.R. China, Finland, France, Germany, India, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Taiwan, Turkey, UK, USA). China has 5 years of funding IMBER/GLOBEC programme and will be hosting the Second Large Marine Ecosystems Conference; IMBER-JAPAN was established under the Science Council of Japan, chaired by Hiroaki Saito. A North West Pacific cruise has been funded for Summer 2008. France has funded the CYBER programme "CYcles Biogéochimiques, Ecosystèmes et Ressources". Spain has many projects and activities that are closely related to IMBER goals and will contribute significantly. In the United Kingdom, the Oceans 2025 programme (a partnership of seven leading UK marine centres) aims to improve understanding of how the ocean behaves, how it is changing, and what this means for society. There are nine science themes within Oceans 2025 (www.ocean2025.org), of which most are relevant to IMBER.

Future Activities

IMBER IMBIZO 2008

IMBIZO is a Zulu word that means “gathering” or “meeting”. IMBER will conduct a series of IMBIZOs over the next decade, with the first gathering planned for November 9 -13, 2008 in Miami, Florida. (<http://www.imber.info/IMBIZO.html>).

The first IMBER IMBIZO will consist of three interdisciplinary workshops, held in parallel, that will facilitate interactions among scientists from a range of disciplines to discuss current knowledge and future research directions in biogeochemical cycles and ecosystems: *End-to-end Food Webs*, *Mesopelagic*, and *Bathypelagic*. Each workshop will include oral presentations to showcase the current state of knowledge in each area and discussion sessions to identify key science questions to be addressed as part of IMBER over the next 10 years. Through the gathering, the workshops will meet jointly for plenary, poster and reporting sessions. To facilitate effective discussion, each workshop will be limited to 40 participants. Some funding will be available for scientists from developing countries to attend. Each participant is also encouraged to present one poster on their research area. The posters will be up for the duration of the IMBIZO. The knowledge advanced at the workshops will be reported as publications and synthesis papers in peer-reviewed journals.

The confirmed invited speakers for the end to end, mesopelagic and bathypelagic workshop are Hiroaki Saito (Japan), Richard Lampitt (UK) and David Karl (USA), respectively.

IMBER/ EUR-OCEANS Summer School: *Analyses of end to end marine food webs and biogeochemical cycles* (Ankara, Turkey, August 11-16, 2008)

BEER: *Data integration training* (Miami, November 9, 2008)

Invited speaker: Todd O'Brien (NOAA, Marine Ecosystems Division, USA) and Gwenaëlle Moncoiffé (British Oceanographic Data Center, Liverpool, UK)

This IMBER Data Management Committee-sponsored workshop and discussion will present the benefits of adding a Data Integration Scientist to any project, and will introduce the various data integration and handling techniques illustrated in the IMBER Data Integration Cookbook. Scientists of all experience levels are invited to participate in this workshop and contribute to the discussion. Further information about the Miami IMBIZO and draft programs for each workshop can be found on the IMBIZO website

(<http://www.imber.info/IMBIZO.html>).

Global synthesis Symposium 2009

Decadal variations of the ocean's interior carbon cycle: synthesis and vulnerabilities (Centro Stefano Franscini in Ascona, Switzerland, July 13-17, 2009). (See section on WG2 Ocean Interior (leader: Nicolas Gruber, Switzerland))

IMBER-sponsored meetings

- Joint meeting of the SIC group with the IOCCP SSG next to the Ocean in a High-CO₂ World symposium (October 2008)
- PICES XVII Annual Meeting (Dalian, China, Oct. 23 - Nov.2, 2008) IMBER topic session entitled "End to End food webs: Impacts of a Changing Ocean"
- ICED first Scientific Steering Committee meeting (late 2008)
- Transition Task Team: Second meeting (Brest, December 2008)
- Second GO_SHIP meeting (early 2009)
- ICED Workshop on biogeochemical modelling and ecosystem links (early 2009)
- Summer School in Brest (Institut Universitaire Européenne de la Mer, August 2009)
- IMBER IMBIZO 2010