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## **Report of the Scientific Committee on Antarctic Research to the SCOR 2019 Meeting**

### **Summary**

This paper presents the annual report of the Scientific Committee on Antarctic Research (SCAR) to the 2019 meeting of the Scientific Committee on Oceanic Research. SCAR is in the process of developing a new suite of Scientific Research Programs, currently being planned and to be formally approved in 2020 at the XXXVI SCAR Delegates meeting in Hobart, Australia. SCAR invites dialogue with all interested parties, especially in light of the importance of ensuring close coordination across those working on Southern Ocean and Antarctic questions.

### **Background**

The mission of SCAR is to advance research in, from and about Antarctica and the Southern Ocean, and to promote scientific knowledge, understanding and education on any aspect of the Antarctic and Southern Ocean regions. To this end, SCAR is charged with the initiation and international coordination of Antarctic and Southern Ocean research beneficial to global society. SCAR provides independent and objective scientific advice and information to the Antarctic Treaty System and other bodies, and acts as the main international exchange of Antarctic information within the scientific community.

Descriptions of SCAR's activities, and the scientific outputs and outcomes facilitated by SCAR are available at: <http://www.scar.org/>.

### **SCAR 2018 Highlights**

Among the many highlights of 2018 were SCAR's 60<sup>th</sup> birthday celebrations. SCAR was first established at the end of the International Geophysical Year of 1957-58 (a year before the Antarctic Treaty was signed) as a means of continuing the international Antarctic collaboration that the IGY had helped to build. To mark the occasion SCAR published a revised edition of its landmark book "Science in the Snow", which details the History of SCAR since from its inception up to its 60<sup>th</sup> birthday year. The actual date of anniversary – February 5<sup>th</sup> was marked during the International Conference for Southern Hemisphere Meteorology and Oceanography (ICSHMO) conference in Sydney which hosted the The Tinker-Muse Prize Award Ceremony for the 2017 recipient, Professor Matthew England, of the University of New South Wales. His

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acceptance lecture was entitled “Antarctic Water-Mass changes over the Last Four Decades” as one of the Keynote Lectures for the meeting.

### **2018 SCAR Delegates Meeting and Open Science Conference (OSC)**

The 2018 SCAR Open Science Conference was held in Davos, Switzerland from 15 – 26 June. These conferences are the largest gathering of Antarctic scientists globally, and are a central part of SCAR’s mission to facilitate international collaboration in Antarctic research. The theme of the 2018 meeting (which was a joint event with the International Arctic Science Committee) was ‘Where the Poles Come Together’. The conference was attended by over two thousand researchers and attracted over 2500 abstracts. Over 60 sessions took place during the conference, with poster presentations, side meetings, and exhibitions. Relevant sessions covered topics ranging from ocean circulation and sea level rise through to marine protected areas.

A number of high profile events and lectures throughout the Polar2018 had very strong oceanic themes. There were 4 days of the Southern Ocean Observing System (SOOS) business meetings prior to the OSC. There was also a mini-symposium dedicated to the Antarctic Circumnavigation Expedition (ACE) during the OSC.

Of the eight keynote plenary lectures at the meeting four were based primarily on oceanic research:

- The recipient of the 2018 Tinker-Muse Prize was Prof Mike Meredith and his acceptance lecture was titled “Changes in Southern Ocean circulation and properties: causes and consequences”.
- Prof Jan Strugnell explained the novel use of marine animal migration in “Dating West Antarctic ice sheet collapse using genomic data”.
- Dr Dake Chen gave his keynote on “China’s potential contributions to SOOS and MOSAiC”.
- Prof Anna Wahlin delivered the Antarctic Science lecture - “The Southern Ocean – globally important, surprisingly unknown”.

### **Science Priorities**

A key opportunity currently exists for discussions between SCAR and other organisations, such as SCOR, to ensure that science identified as critical by SCAR, and implemented to various degrees by its Members, can be further enhanced through appropriate collaborations.

SCAR’s current Scientific Research Programs, which are the main vehicles through which SCAR facilitates and coordinates science in, from and about Antarctica and the Southern Ocean, will draw to a close in 2020. Plans for a new suite of Scientific Research Programs are now being developed for consideration by the SCAR Delegates at the XXXVI SCAR Delegates meeting in Hobart, Australia, July 2020.

Following the XXXV SCAR Delegates meeting in Davos, Switzerland, June 2018, three Programme Planning Groups were proposed and approved, all of which are strongly dependent on oceanic issues:

***Integrated Science to Support Antarctic and Southern Ocean Conservation (Ant-ICON)***

The Ant-ICON SRP will answer fundamental science questions (as identified by the SCAR Horizon Scan), relating to the conservation and management of Antarctica and the Southern Ocean and focus on research to drive and inform international decision-making and policy change.

***Antarctic Ice Sheet Dynamics and Global Sea Level (AISSL)***

The AISSL SRP will address a first-order question about Antarctica's contribution to sea level. It encompasses geoscience, physical sciences and biological sciences, of the way in which interactions between the ocean, atmosphere and cryosphere have influenced ice-sheets in the past, and what expectations will be in the future with a special focus on quantifying the contributions to global sea level change. They aim to quantify the Antarctic ice sheet's contribution to past and future global sea-level change.

***Near-term Variability and Prediction of the Antarctic Climate System (AntClimnow)***

AntClimnow will investigate the prediction of near-term conditions in the Antarctic climate system on timescales of years to multiple decades. They will take an integrated approach, looking beyond climate projections of the physical system to consider the Antarctic environment as a whole.

Opportunity exists through 2019 and 2020 to interact with these groups to understand likely logistic needs for the Scientific Research Programs. The SCAR Secretariat can put interested parties in touch with those developing ideas for new proposals

**Recent Developments**

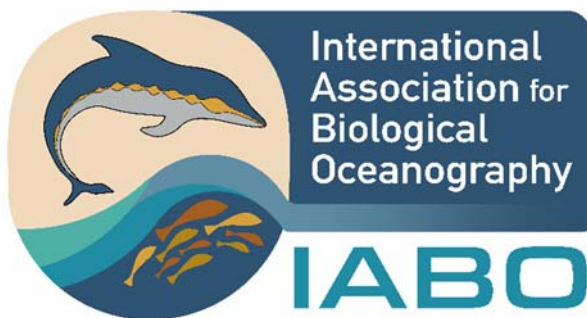
- SCAR notes the excellent relationship with SCOR in delivery of SOOS and the value of its continuing work in, for instance, the Workshop on the development of the SOOS regional group Wedell Sea – Dronning Maud Land held in Tromsø in January 2019.
- Following the appointment of Dr Chandrika Nath as Executive Director in June 2018, SCAR appointed its first Communications and Information Officer in December 2018.
- SCAR will hold its XXXVI Delegates meeting and Open Science Conference in Hobart, Australia in 2020 alongside the annual meeting of COMNAP. SCAR recognises the significance of holding the meeting in a location that is host to the CCAMLR and ACAP Secretariats. SCAR will seek to have a broad discussion of science, science priorities and evidence for policy as it highlights the achievements of its current Scientific Research Programs and makes formal decisions on the new suite of programs. SCAR looks forward in particular to the opportunity for close and productive interactions with COMNAP at this coming meeting, and in particular the ready opportunity for COMNAP Delegates to participate in the Open Science Conference and its associated activities.
- SCAR presented a poster entitled “Why the Southern Ocean Matters” to the UNFCCC Research Dialogue on June 20, 2019 in Bonn as part of Subsidiary Body for Scientific and Technological Advice 50 and at the invitation of the World Meteorological Organisation (WMO) and the Intergovernmental Panel on Climate Change (IPCC). One of the themes of the dialogue was the “Role of the ocean in the climate system”.
- SCAR is in discussions with IPCC, WMO and the International Science Council (ISC) to investigate ways SCAR could help promote the release of the IPCC Special Report on

Oceans and Cryosphere (SROCC) in September 2019. Many SCAR scientists have led chapters, edited and contributed to the Report. As the major international platform for climate related diplomacy, the UNFCCC Conference of the Parties 25 in Santiago, Chile, December 2019, will also be an important opportunity to reflect on SROCC and more generally the critical impact of Antarctica and the Southern Ocean on the issue of climate change.

## 7.2 Affiliated Organizations

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

Miloslavich



International Association for Biological Oceanography (IABO)

<http://www.iabo.org/>

To celebrate the 55<sup>th</sup> anniversary of the establishment of the International Association for Biological Oceanography, we have renewed the association's logo. Consistent with the original emblem, the new logo design and colors are inspired in the "Fresco of the Dolphins", a mural in the Knossos Palace in Crete which is estimated to have been created between 1800-1400 BC to represent the natural underwater world.

The goal of IABO is to promote the advancement of knowledge of life in the ocean through the study of marine biology, biological oceanography, and other related sciences.

Logo by The Turquoise Well

*IABO message to the International Union of Biological Sciences (IUBS) in its 100 anniversary*  
*The International Association for Biological Oceanography (IABO) was founded in 1964 and is one of the scientific members of the International Union of Biological Sciences (IUBS) under the umbrella of the International Science Council (ISC). IABO also serves the Executive Committee of the Scientific Committee for Oceanic Research (SCOR).*

*The goal of IABO is to promote and advance knowledge of life in the ocean through the study of marine biology, biological oceanography and other related sciences. IABO also promotes interdisciplinary*

*communication between marine biologists and other ocean stakeholders by organizing and supporting international forums such as the World Conference on Marine Biodiversity.*

*To celebrate the 55th anniversary of the establishment of IABO, we have renewed the association's logo. Consistent with the original emblem, the new logo design and colours are inspired in the "Fresco of the Dolphins", a mural in the Knossos Palace in Crete which is estimated to have been created between 1800-1400 BC to represent the natural underwater world.*

*IABO congratulates its parent organization, IUBS on its centenary year and wishes the organization success in continuing to achieve its mission of facilitating interdisciplinary cooperation among biological scientists under the principle of unifying biology through diversity.*

## **Summary of IABO activities 2018-2019**

### **(1) Organization and structure**

IABO has updated its terms of reference and the organizational structure to adapt it to the present times and needs. These have been reviewed and approved by the Committee.

### International Association for Biological Oceanography (IABO) Terms of Reference and organizational structure

#### Background and goals

The International Association for Biological Oceanography (IABO) was founded in 1964 and is one of the scientific members of the International Union of Biological Sciences (IUBS: <http://iubs.org/>) under the umbrella of the International Science Council (ISC: <https://council.science/>). IABO also works with the Scientific Committee on Oceanic Research (SCOR: <http://www.scor-int.org>) serving as a reporter for SCOR-related programs and as a liaison between SCOR's working groups and the SCOR Executive. In accordance with the objectives of IUBS of promoting the study of biological sciences and of facilitating interdisciplinary scientific research, the goal of IABO is to promote the advancement of knowledge of life in the ocean.

To address this goal, the main objectives of IABO are to:

- Promote the study of marine biology, biological oceanography and other related sciences
- Promote interdisciplinary communication between marine biologists and other ocean stakeholders by organizing and supporting international forums
- Encourage international networking and collaboration between organizations and individuals with similar aims and interests around the world
- Recognize and award outstanding accomplishments in marine biodiversity science

#### Organizational structure (as for April 2019)

IABO is composed by an Executive Committee, three Task Groups and a Community of Practice. The **Executive Committee** is formed by the President, Past-president, Secretary and the chairs/co- chairs of each of the three Task Groups.

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The **Task Groups** are:

- **Task Group 1 – Science:** responsible for reviewing the annual Working Group proposals submitted to SCOR and approved during SCOR's annual meeting.
- **Task Group 2 – Recognition:** responsible for seeking nominations for the annual Carlo Heip International Award for outstanding accomplishments in marine biodiversity science and of examining, discussing and evaluating the nominations.
- **Task Group 3 – Communication:** responsible for (1) linking to collaborating networks such as the GOOS Biology and Ecosystem Panel and its partners in biological observations, the Marine Biodiversity Observation Network of GEO BON, the Ocean Biogeographic Information System (OBIS), etc., (2) to keep the website (<http://www.iabo.org/>) updated and post relevant news, (3) to manage the MARINE-B list, and (4) to manage social media (Facebook, Instagram, Twitter, etc.)

The IABO **community of practice** is represented by the MARine Research Information Network on Biodiversity (MARINE-B), which communicates through an email list. The MARINE-B email list shares information on career opportunities (studies, scholarships, jobs, internships, etc.) related to marine biology and biological oceanography. The community of practice also shares news through the IABO Facebook page.

Members of the three task groups with the Executive will be responsible for the planning and organization of the World Conferences on Marine Biodiversity (WCMB) which are held every 3-4 years. The first WCMB was held in Valencia, Spain (2008), the second in Aberdeen, Scotland (2011), the third in Qingdao, China (2014), the fourth in Montreal, Canada (2018) and the fifth will take place in Auckland, New Zealand (13-16 December 2020).

The WCMB will be the official meeting venue of the IABO community. During this conference, an open assembly of the community of practice will be held to elect the Executive and Task Group members.

The executive will be elected taking account of the recommendations of a nominating Committee of three, consisting of the Past-President and two members of the executive. The terms of office of the President is the period between consecutive WCMB (~3-4 years) and is not eligible for re-election for a consecutive term. The terms of office of the Secretary and Task Group members are also 3-4 years (time between two consecutive WCMB) and they are eligible for re-election, providing that not more than two terms of office in the same category are served consecutively. After two consecutive periods in one category, members may be elected to serve on a different category. The organizing Chair and the immediate Past-Chair of the WCMB will be members of Task Group #3 on Communication.

**Note:**

Originally, national IABO representatives were nominated by their national science academies. IABO does not have a process to alternatively select national representatives, either by election or nomination, therefore, in this IABO re-structuring, the figure of “National representatives” disappears because the individuals are not nominated by any national academy nor official government organization, but supporting IABO on their own behalf without championing any institution or country. IABO aims to have a diverse composition of its Executive Committee so it broadly represents the international community in terms of nationality, ethnicity, gender, and culture. To broaden participation as much as possible, any person or individual scientist can be part of the community of practice and/or of the executive and task groups.

**Financial support**

IABO has no funding base or sources of revenue; therefore, the work of the executive and the task groups is entirely voluntary. This is a severe constraint on embarking on and supporting new initiatives. It is envisioned that funds will be raised through the organization of the WCMB that will allow to support at least basal activities of the Executive and Task Groups. IABO receives in-kind contribution from the Flanders Marine Institute (VLIZ) in providing the commemorative medal for the International Carlo Heip Award. SCOR also provides funding (around US\$ 3-5K in total) to co-support students from developing countries to attend the WCMB.

**Benefits of being involved in IABO**

As mentioned before, IABO has no funding and all work by its members is voluntary. However, some of the benefits of being involved in IABO are:



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- Increased opportunities for networking and scientific collaboration with international peers and groups, which may facilitate scientific and technological exchanges, capacity-building opportunities, and help access new sources of funding
- Increased opportunities to engage in SCOR working groups and research projects and participation in the selection process for new SCOR working groups
- Increased opportunities to engage in the organization of the WCMB and participation in the conference
- Increased opportunities to engage in the UN Decade for Ocean Science and Sustainability
- It can support and endorse (sponsor in-kind) scientific meetings and proposals as contributing to the IABO goals and as of scientific merit

## **(2) Collaboration**

IABO continues to encourage international networking and collaboration between organizations and individuals with similar aims and interests. Some of these are the GOOS Biology and Ecosystems Panel, the Marine Biodiversity Observation Network (MBON), the Ocean Biogeographic Information System (OBIS) and the World Register of Marine Species (WoRMS).

Some of the goals shared by IABO with these organizations are to:

- build a unified and globally consistent ocean observing system that includes biological measurements
- encourage open access and data sharing
- enhance existing observation capacity
- use the best available resources
- implement best practices and international standards
- enhance global capacity
- ensure continuity and sustainability of global marine biological and ecosystem observations

## **(3) Communication**

The IABO email list, MARINE-B, has over 1,350 subscribers. A Facebook page was launched in May 2018 and currently has 253 members and growing. MARINE-B provides news and relevant information related to biological oceanography, marine biology and biodiversity, including funding, job and studies opportunities, relevant papers and reports, conferences, etc. MARINE-B is administered by Mark Costello and Patricia Miloslavich; the Facebook page is administered by Suchana Chavanich and Patricia Miloslavich.

A version of the new logo was also posted in the Fb page:



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From this list of people who expressed interest in participating in IABO, additional members to contribute to the Task Groups will be identified along with a Chair or Co-chairs for each of the groups and they will be invited to join IABO. Additionally, efforts are being made to expand subscription to the MARINE-B list in Africa through the West Indian Ocean Marine Science Association (WIOMSA), in the Indian Ocean through the International Indian Ocean Expedition-2 (IIOE-2) newsletter (The Indian Ocean Bubble), and in South America through the MBON Pole to Pole project.

## (5) Current composition of IABO

- President, Patricia Miloslavich – University of Tasmania (Australia) and Universidad Simón Bolívar (Venezuela)
- Past-President, Mark J. Costello – University of Auckland (New Zealand) (Past President, Past Secretary): Member of the Communication team as organizer and chair of the 2020 WCMB.
- Secretary, Suchana Chavanich - Chulalongkorn University (Thailand)

Other members and their Task Groups:

- Siew Moi Phang – University of Malaya (Malaysia): member of the Science team
- Matt Frost – Marine Biological Association (UK): member of the Communications team, linking with the European Network of Marine Stations (MARS) of the World Association of Marine Stations (WAMS).
- Tina Molodtsova – Shirshov Institute of Oceanology (Russia): member of the Science team
- Daniel Lauretta– Museo Argentino de Ciencias Naturales (Argentina): member of the Recognition team
- Isabel Sousa-Pinto – CIMAR, University of Porto (Portugal): member of the Communication team, linking with the Marine Biodiversity Observation Network (MBON) and Euromarine
- Sun Xiaoxia - Institute of Oceanology, Chinese Academy of Sciences (China): member of the Science team
- Philippe Archambault – Université Laval (Canada) (Past Chair of the 4th WCMB). Member of the Communication team as past chair of the WCMB.

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

*Penner*

Report will be posted on the meeting Website before the meeting.

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

*McDougall*

Report will be posted on the meeting Website before the meeting.

### 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.

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

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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.

## **2019 InterRidge Update for SCOR**

### **I. InterRidge – International Cooperation in Ridge-Crest Studies**

Since its creation in early 1990s, [InterRidge](#) has been an international forum for ocean ridge (MOR) scientists, expanded to other oceanic spreading centers and related processes. InterRidge promotes interdisciplinary studies by creating a global research community, planning and coordinating new science programs that no single nation can achieve alone, exchanging scientific information, and sharing new technologies and facilities. InterRidge plays a dual role. Its primary aim is to favor the emergence of new concepts and to make possible ambitious experiments at the international level. InterRidge also supports community-wide initiatives such as the definition and dissemination of a code of conduct for scientific studies in relation to chemosynthetic hot-spot ecosystems and their vulnerable environments. More recently, with the growing interest of countries and industries for deep-sea mineral resources, including seafloor massive sulfide (SMS) deposits at MOR, InterRidge has become a voice of expert scientists in different fora. Through its observer status at the International Seabed Authority (since 2012), particularly, InterRidge developed formal interactions with this organization created under the United Nations Law of the Sea (UNCLOS).

InterRidge scientific activities are currently led under the frame of the 3<sup>rd</sup> Decadal Plan 2014-2023 ‘From Ridge Crest to Deep-Ocean Trench: Formation and Evolution of the Oceanic Crust and Its Interaction with the Ocean, Biosphere, Climate and Human Society’ launched in 2012. Beside its affiliation with SCOR and its GEOTRACES programme, the InterRidge program has links with international research programs such as the International Ocean Discovery Program and the International Lithosphere Project. InterRidge activity includes meetings and workshops where the advancement of scientific knowledge, new issues, methodological improvements, and standardized protocols are discussed. InterRidge also dedicates itself to interact with the public, scientists and governments, and to provide a voice for ocean ridge researchers worldwide. While committed to the level of fundamental science, an increasing role for InterRidge is our involvement in compiling information and advice for policy makers. The multidisciplinary coverage of InterRidge working groups gives the organization a key role in expert discussions concerning the exploration and exploitation of mineral resources associated with ridges, volcanic arcs and back-arcs and associated hydrothermal systems.

InterRidge has a Steering Committee comprising representatives of the member countries and of working group chairs that are scientists nominated for their expertise in a particular field. The Steering Committee meets at least once per year. The 2018 meeting was held on 20-22 June 2018 in Bergen, Norway; the 2019 meeting took place on 13-14 June 2019 in Tokyo, Japan. The Steering committee considers updates to its Science Plan, endorses InterRidge memberships, approves the budget, decides on membership fees, oversees the operation of the InterRidge Office, reviews bids for the InterRidge Office, and nominates the Program’s chair. It also evaluates IR fellowship applications and working group progress, validates cruise bursaries, assesses and admits/rejects working group proposals, and nominates working group leaders.

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The InterRidge contribution is 25,000 US\$ for a Principal Member country and 5,000 US\$ for a Regular Member country. Considering the present membership (China, France and Norway as Principal members and Canada, Germany, India, Italy, Japan, South Korea and UK as Regular members) and the double contribution for the host country, the resulting annual budget is about 150,000 US\$.

## II. Achievements and changes during the last year

### 1. InterRidge Office

The InterRidge Office is hosted at the Institut de Physique du Globe de Paris (IPGP), which is responsible for the budget management and administration of the program. The French National Center for Scientific Research (CNRS) is the French institution affiliated to InterRidge and is paying the French host contribution. Jérôme Dymet ([jdy@ipgp.fr](mailto:jdy@ipgp.fr); IPGP - CNRS, marine geophysics) and Nadine Le Bris ([lebris@obs-banyuls.fr](mailto:lebris@obs-banyuls.fr); Sorbonne Université - CNRS, Marine ecology and marine environmental sciences) are the co-chairs of the program. Kamil Szafranski ([interridge@ipgp.fr](mailto:interridge@ipgp.fr)) has been the InterRidge Coordinator since 1 April 2017. Since the final establishment of an operational office in Paris in early 2017, all the activities of InterRidge have been restarted.

### 2. Steering Committee

The Steering Committee met on 20-22 June 2018 in Bergen (Norway) and discussed the different aspects of the InterRidge activity. The discussions and the decisions related to all matters of importance for the program (scientific strategies, actions to be taken, procedures, budget...). Below the summary of the discussions and the decisions taken:

- a) Ten representatives, both co-chairs and two Working Group leaders participated at the meeting. National and Working Group updates were presented by the national representatives. The coordinator summarized the activity of InterRidge Office in its report. Representatives of member countries and working group leaders presented their national updates.
- b) The InterRidge Steering Committee approved the creation of two new Working Groups on: (1) Mid-Ocean Ridge Islands and Seamounts and (2) Seafloor Massive Sulfides along Mid-Ocean Ridges. Both groups are working on their final organization following the recommendations of the Steering Committee. Their first workshops will be organized in September 2019.
- c) The applications for InterRidge Student and Postdoctoral Fellowship of Simone Pujatti (University of Calgary, Canada), A. Srinivas Rao (National Center for Antarctica and Ocean Research, India), Loes van Dam (The University of Rhode Island, USA) and Unyime Udouo Umoh (School of Ocean and Earth Science, Tongji University, China) were accepted for funding. Fellows are going to the laboratories in the Netherlands, France, Norway and UK, respectively.
- d) The applications for InterRidge Cruise Bursary program (Dominik Zawadzki, Elvira Latypova – Cocos-Nazca Rift Cruise and Thomas Guigère – SO293 cruise) have been endorsed by the Steering Committee.
- e) The Steering Committee accepted the budget of InterRidge for 2018 and the

- preliminary budget for 2019, pending some minor modifications to the proposed funding plans.
- f) The Steering Committee discussed the plans for next months (IR-SCOR interaction, IR-ISA interaction, Code of Conduct on responsible behavior at hydrothermal vents, organization of the Theoretical Institute, bid for the next IR Office) and possible improvements of InterRidge (big projects attracting new member countries, communities and scientists; highlighting achievements; encouraging new working groups; deep sea observatories).
  - g) In 2018, InterRidge attended both parts of the 24<sup>th</sup> session of the ISA Council on 5-9 March 2018 and of the ISA Council and Assembly on 16-26 July 2018. In 2019, the InterRidge representative attended the 25<sup>th</sup> session of the ISA Council from 25 February to 1 March 2019. The InterRidge observer status gives opportunity to discuss IR – ISA collaboration like the joint fellowships, report on IR activity, and contribute discussions about legal questions concerning research activity in the area of permits. Comments on the revised draft regulations on the exploitation of mineral resources in the Area have been a major point of the program of work of the ISA Council during recent meetings.
  - h) The rotation of InterRidge Office has been officially postponed to the end of 2019. This decision taken at the previous Steering Committee meeting has been endorsed by the French funding agencies.
  - i) An InterRidge Theoretical Institute will be organized in November 2019. The Office collected ideas for this meeting, presented the first draft of the agenda for discussion at the next Steering Committee meeting, and launched its organization in Banyuls-sur-Mer (France).
  - j) Japan invited the Steering Committee meeting to take place in Tokyo on 13-14 June 2019.

### 3. **InterRidge Working Groups**

InterRidge Working Groups build small task forces to meet, brainstorm on specific topics, and ultimately draft reports and plans. Working Groups convene group meetings and community-wide workshops, and promote and coordinate new cruises, experiments, and related work. They generally expand their interaction with the interested community by organizing an InterRidge Workshop or a session at an international conference. Working Groups should address emerging research themes or bridge communities working on a unique geographic setting along global ridge-crests and spreading centers. New proposals should be innovative in their objectives in regard to existing or former Working Groups. They are coordinated by two co-chairs and gather about ten active members reflecting the national and disciplinary diversity of InterRidge, which work closely with the InterRidge Steering Committee and the InterRidge Office. Working Groups convene group meetings and community-wide workshops, and promote and coordinate new cruises, experiments, and related work.

In 2017, the Steering Committee decided to support the creation of two new Working Groups, on (1) Oceanic Transform Faults and (2) Integrating Multidisciplinary Observations in Vent Environments (IMOVE). Those working groups have organized their first workshops. In 2018, the Steering Committee approved the creation of two new Working Groups, on (1) Mid-Ocean



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Ridge Islands and Seamounts and (2) Seafloor Massive Sulfides along Mid-Ocean Ridges. Both working groups will organize their first workshops in September 2019.

A review paper was published in *Frontiers in Marine Science* by the "Hydrothermal energy transfer and the ocean carbon cycle" SCOR-IR WG members in early 2019. This review has been initiated from the work of the SCOR-InterRidge working group 135 lead by N. Le Bris and C.R. German, with P. Lokabharathi, S.M. Sievert, and P. Girguis also being members. With this second review, the WG has finalized its activities.

*Le Bris N, Yücel M, Das A, Sievert SM, LokaBharathi P and Girguis PR (2019) Hydrothermal Energy Transfer and Organic Carbon Production at the Deep Seafloor. Front. Mar. Sci. 5:531. doi: [10.3389/fmars.2018.00531](https://doi.org/10.3389/fmars.2018.00531)*

## 4. Report on activities of the InterRidge Working Groups

### a. Working group on Oceanic Transform Faults

**Co-Chairs:** Marcia Maia (France, geophysics, tectonics), Barry Hanan (USA, isotope geochemistry), Daniele Brunelli (Italy, petrology)

This working group, would like to focus on five questions that are likely of large interest to the Earth sciences community:

- 1) How do large and mega-transform domains react to both far- and near-field stress changes?
- 2) How do transforms interact with the underlying mantle? What are the effects of temperature, rheology and composition?
- 3) What is the interplay between transform dynamics and magmatism?
- 4) Which relationships exist between oceanic transform faults and their counterparts on continental margins?
- 5) Are oceanic transform faults sites of intense fluid-rock interaction and biogeochemical exchange?

The first workshop of the InterRidge Working Group on Oceanic Transforms took place from 22 to 24 May in Brest/Plouzané (France). The workshop was attended by more than 40 international scientists from 7 specialties (geochemistry, petrology, geophysics, tectonics, structural geology, hydrothermalism, modelling). Participants dedicated the first day and one half to oral presentations and a poster session discussing the state of the art on transform faults (TF) and fracture zones (FZ) concerning all aspects of the mechanics, petrology, structure, morphology, and dynamics of these systems. The acronym Transform Fault System (TFS) has been proposed to identify the whole tectonic system from the active part to its prolongation into the drifting plates. Afterwards, the attendees discussed all aspects necessary to identify the key questions for a comprehensive understanding of TFS. Experiments were proposed on how to answer basic questions on imaging the TF to FZ transition and thermo-mechanical, compositional alteration and stress-strain relationships to constrain physical parameters that control the TFS evolution through time. A major point was to find appropriate target regions at which to apply these

experimental approaches. Two major needs of the workshop were identified: the need to systematically integrate modelers into the exploratory and experimental actions and the need for high-frequency investigation of TFS over long time periods. To achieve this aim, the participants proposed to launch a call for white papers addressing the different aspects putting together integrated experimental and modeling approaches to the main TFS problem. It also appears necessary to sustain the exchange in the community by dedicated workshops and/or sessions at AGU-EGU. The full text of the final report from the workshop can be found at: [http://interridge.org/files/interridge/Final\\_complete\\_report\\_OT\\_WS\\_Brest.pdf](http://interridge.org/files/interridge/Final_complete_report_OT_WS_Brest.pdf)

The members of the Working Group on Oceanic Transforms also organized a session at the European Geoscience Union (EGU) General Assembly in Vienna (Austria) on 7-12 April 2019: “Oceanic and continental transform faults: towards a multi-disciplinary approach”. João C. Duarte (Portugal) was the session convener, the co-conveners were: Daniele Brunelli, Barry Hanan, Marcia Maia, Mathieu Rodriguez.

This session, promoted by the Oceanic Transform Faults WG, aimed to present recent results on studies of these large features, especially on the rheology, deformation patterns, rupture processes, fluid circulation, and physical properties of transform faults. Scientists working on observational studies on strike-slip and transform faults (both continental and oceanic), on fracture zones and on transform continental margins (structural geology and tectonics, geophysical imaging of the crust and lithosphere, petrology and geochemistry, seismology, fluid circulation and rock alteration, geodesy) as well as on modeling studies (both analogue and numerical) were welcome to submit their abstracts and cross-disciplinary approaches were particularly encouraged.

#### **b. Working Group on Integrating Multidisciplinary Observations in Vent Environments (IMOVE)**

**Proponents board led by** Thibaut Barreyre, University of Bergen (Norway) and Marjolaine Matabos, IFREMER (France)

WG objectives and timeliness – IMOVE will contribute to the InterRidge research community by fostering and coordinating the integration of hydrothermal data from vent fields where observatory-style data have been acquired. A large set of temporally and spatially variable multi-disciplinary data have been collected from deep-sea vent fields at considerable cost to the international community, but to this point the datasets have mostly been analyzed in a piecemeal fashion. Systematic efforts to integrate data from different disciplines and synthesize these products into quantitative, cross-disciplinary models relevant to hydrothermal processes on the global MOR system have the potential to produce transformative scientific results, and are clearly needed at this point in time. This WG will provide an international framework for this effort, and the relatively modest funding required will effectively leverage all of the previous funding allocated (logistical and scientific) to gather and study this data by individual countries and organizations.

The inaugural workshop of the iMOVE working group took place on 6-8 February 2019 in Bergen, Norway. iMOVE aims to bring together ridge crest observatory operators and scientists

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to facilitate data and technology transfer and sharing, and develop new research ideas. The very successful Bergen workshop assembled 24 people from 6 countries, representing disciplines ranging from geophysics to microbiology, and for the first time, brought together representatives from the three ridge-crest seafloor observatories operated by the EMSO, OOI and ONC networks. The group spent two and one half days exchanging ideas, providing updates on observatory status and developing plans for future collaborations.

## **c. Working Group on Seafloor Massive Sulfides Resource along Mid-Ocean Ridges**

**Co-Chairs: Chunhui Tao (Second Institute of Oceanography, SOA, China), Georgy Cherkashov (VNIIOkeangeologia, Russia), Maurice Tivey (Woods Hole Oceanographic Institution, USA)**

The working group aims to address the following scientific problems:

- 1) Understand the geological factors that contribute for the formation, distribution and preservation of seafloor massive sulfide deposits, including geological and tectonic setting;
- 2) Characterize the geological, geophysical, and geochemical signatures that allow for the detection and documentation of inactive and buried sulfide deposits at Mid-Ocean Ridge-axis or off-axis settings;
- 3) Identify multi-scale observations that could be used to predict past, present, and possibly future hydrothermal deposit formation;
- 4) Determine the spatial distribution pattern and resource potential of mid-ocean ridges with various spreading rates;
- 5) Understand the timing and variations in the geological drivers for hydrothermal activity across mid-ocean ridge segment-scale systems;
- 6) Determine the dimensional structure and metal inventory for mid-ocean spreading ridges based on long-term heat flow, volcanism, fluid fluxes, and sedimentation rates;
- 7) Understand the processes of seafloor and sub-seafloor sulfide formation, weathering, and their impact on crust-to-water column exchange in metals.

The first workshop organized by the InterRidge Working Group on Seafloor Massive Sulfides Resource along MOR will be held between 19 and 21 September 2019, in Hangzhou, China. The theme is “Hydrothermal ore-forming processes and the fate of SMS deposits along slow and ultraslow spreading MOR”. This workshop aims to understand several key scientific questions related to hydrothermal circulation mechanisms and the geological factors that contribute to the formation, distribution, and preservation of SMS deposits along different spreading MOR. The Working Group hopes to capture the known/unknown BIG questions and identify future ways to address them through this workshop. This workshop will provide partial financial support to several excellent early-career scientists (international and Chinese) to help cover their flight fares and accommodations.

d. **Working Group on Mid-Ocean Ridge Islands and Seamounts**

**Leading proponents:** Neil Mitchell (Manchester, UK), Rui Quartau (Instituto Hidrográfico, Lisbon, Portugal), Christoph Beier (GeoZentrum Nordbayern, Friedrich-Alexander Universität Erlangen-Nürnberg; Department of Geosciences and Geography, University of Helsinki)

The working group aims to address the following scientific problems (preliminary set of questions to be addressed, which will be refined with the input of participants of the workshop and other meetings, and online contributions):

- 1) How frequent is catastrophic failure in submarine slopes? How important are small compared with large movements in terms of net volume? What are the implications of these disturbances for ecosystem functioning on island slopes? Does it lead to significant burial of organic carbon? Can we link faults already mapped on land with signs of recent deformation in shallow-marine geophysical data to improve estimates of earthquake risk to local populations?
- 2) Can we relate changes in plate tectonic regime with changes in magmatic extrusion in an individual magmatic system? How do mantle plumes affect a mid-ocean ridge where the mantle buoyancy flux is small? To what extent do tectonic processes affect formation and movement of melts? How do magmatic activity and styles of eruption relate to mantle composition, tectonic setting, and local geology?
- 3) How do fauna and flora vary from deep spreading centres to shallow depths of ocean island shelves and coasts, in response to varying temperature, pressure, substrate geology, currents and ambient light? How do seabed populations change with time after catastrophic events and with other changes, such as associated with climate change? How do topographically controlled fluid dynamics and sediment disturbances affect the distribution of Fe-Mn crusts on island and seamount slopes? How do the depths and distributions of sedimentary deposits on the shelves of volcanic islands relate to ocean physical conditions, in particular, waves? What roles do island shelves and, in particular, rhodolith beds have in carbon cycling and regulating water properties?

The first workshop organized by the InterRidge Working Group on MOR Islands and Seamounts will be held between 19 and 21 September 2019, in Lisbon (Portugal). The workshop aims to identify priority areas for research in all aspects of islands and seamounts located near to ridges, including geological, oceanographic, and biological aspects. Participation in the workshop is open to anybody outside the WG and will involve an extended poster session on the first day. Working Group on MOR Islands and Seamounts received 5,000 US\$ generously provided by the Scientific Committee on Oceanic Research (SCOR) for bursaries to support the attendance of a small number of developing-country early-career researchers to the workshop.

Full information on the activity of all Working Groups can be found on the InterRidge website: [www.interridge.org](http://www.interridge.org)

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## 5. **SCOR - InterRidge Meeting on "Mid-Ocean Ridges and Other Geological Features of the Indian Ocean"**

Both the Ridge community and the Marine Geology and Geophysics community have been only marginally involved in the International Indian Ocean Expedition - 2 (IIOE-2) and therefore one of the major goal was to develop new international collaboration and programs on geology and geophysics of the Indian Ocean, under IIOE-2. The following seven themes cover the main peculiarities of the Indian Ocean ridges and geology:

- 1) Indian Ocean mid-ocean ridges: hydrothermalism, fragile ecosystem, and deep-sea mining exploration
- 2) Indian Ocean mid-ocean ridges: tectonics and magmatism in a wide range of spreading rates
- 3) Evolving lithosphere of the Indian Ocean: from mid-ocean ridges to basins to active or passive margins
- 4) Complex physical and geochemical aspects of the Indian Ocean mid-ocean ridge system
- 5) Aseismic ridges, oceanic plateaus, micro-continents and seamounts of the Indian Ocean
- 6) Implications of the collision and subduction on the complex history of the Indian Ocean
- 7) Submarine fans and sedimentation history in the Indian Ocean

The Meeting on "Mid-Ocean Ridges and Other Geological Features of the Indian Ocean" organized jointly by Scientific Committee on Oceanic Research and InterRidge, hosted jointly by CSIR-National Institute of Oceanography and ESSO-National Centre for Polar and Ocean Research took place on 14-16 November 2018 in Goa (India). The workshop was attended by 128 scientists. Ten international attendants and 17 young scientists from India were supported with travel awards funded jointly by SCOR and InterRidge. Thirty oral presentations have been organized in 7 thematic sessions and completed with 42 posters presented at a 'Poster Talk' session. Both the Scientific Committee on Oceanic Research and InterRidge supported the organization of the meeting (10,000 US\$ each) and allowed students, young scientists, or other scientists to participate by covering travel costs.

The abstract book and more details about the meeting can be found under the following link: [http://interridge.org/files/interridge/ABSTRACT\\_SCOR-InterRidge\\_2018-1.pdf](http://interridge.org/files/interridge/ABSTRACT_SCOR-InterRidge_2018-1.pdf).

6. **InterRidge Info** is a e-newsletter sent to subscribers on the InterRidge-members mailing list, and is published every 2-3 weeks. It contains current and most important information to be disseminated within the InterRidge community. In 2018, 21 newsletters and 2 special issues on "Mid-Ocean Ridges and Other Geological Features of the Indian Ocean" organized jointly by Scientific Committee on Oceanic Research and InterRidge, have been sent to the mailing list of about 1600 e-mail addresses. Past issues can be consulted in the InterRidge Info archive at: <http://interridge.org/publications>.

7. **Cruise Information** is a section of the InterRidge website promoting the exchange of information, technologies and facilities among international research groups. All scientists are continuously invited to provide InterRidge with any details on recent or upcoming ridge-related cruises to feed the InterRidge Cruise Database.

## 8. **InterRidge actions for early-career scientists**

a. InterRidge Fellowships promote the involvement of young scientists in international, collaborative, and interdisciplinary studies of oceanic spreading centers. The fellowships are designed to encourage international collaboration on any aspect of InterRidge science by graduate students or postdoctoral researchers, fostering long-standing partnerships for their future careers.

InterRidge announced the next edition of call for proposals for the Student and Postdoctoral Fellowship Program in May 2018. The Fellowships of up to 5,000 US\$ each can be used for any field of research identified in the InterRidge 3<sup>rd</sup> decade plan (<http://interridge.org/thirddecade>). Applications were submitted to the IR Office by 17 June 2018. Six applications were received, including 1 to the IR/ISA Endowment Fund fellowships. Fellowships have been awarded to 4 young scientists.

In 2019, up to 6 IR Fellowships including can be granted. The Office is currently waiting for evaluations of applications received in April 2019.

### b. InterRidge Cruise Bursaries

These bursaries are awarded for travel and subsistence costs to encourage new collaborations among InterRidge member nations and to enable early-career scientists to participate to research cruises. Bursaries of up to 2,000 US\$ may serve for travel costs to join the cruise. Applicants should have a clear role on the research cruise and not be part of the original research team. Preference is given to applicants from InterRidge member countries and from countries other than those of the cruise leader. The call for IR Cruise Bursaries was launched in May 2017, candidates can apply at all time. Five bursaries were granted in 2018.

### c. Support to InterRidge Workshop on Oceanic Transform Faults

The Organizing Committee has awarded travel grants (300 - 700€) to encourage the participation of young scientists. Five attendants were supported: 3 from USA, 1 from China and 1 from Germany.

d. Spare berths information is a section of InterRidge website informing about any berth availability for young scientists, that could eventually led to support request by the Cruise Bursary program. All members are asked to notify the IR Coordinator about any berths available.

## 9. **Update of the IR website and Vent Database**

The InterRidge website ([www.interridge.org](http://www.interridge.org)) and vent database (<http://vents-data.interridge.org/>) are running at IPGP and are updated regularly since April 2017.

The InterRidge Vents Database (<http://vents-data.interridge.org/>), upgraded to Version 3.4 and revised by Stace Beaulieu ([stace@whoi.edu](mailto:stace@whoi.edu)) (supported by the [NSF Grant “Metacommunity Dynamics at Hydrothermal Vents”](#)) and in relation with the InterRidge Office, has more than 700 records – confirmed or inferred active vent fields in the database and the corresponding kml file for visualization in Open Ocean Maps. The InterRidge coordinator is responsible for the Database management and updating. Since October 2017, during weekly Skype calls with Stace

Beaulieu (WHOI, USA), 20 new sites have been added to the database, 41 records have been edited, and 1 site was merged with another one.

### III. **Bridges between the scientific community and society**

#### 1. **A scientific voice to international/national agencies, policy makers, etc.**

InterRidge has built a privileged relationship with the International Seabed Authority (ISA). It is affiliated to the Scientific Committee on Oceanic Research (SCOR) and has developed specific interactions through joint working groups and conferences. Through these specific relationships and new partnerships to be developed, InterRidge should be recognized as one voice of the scientific community, providing expert advice on societal topics such as environmental impacts of seafloor massive sulfides (SMS) exploration or exploitation.

The peculiar ecosystems found at MOR hydrothermal systems are important with respect to biodiversity, and several of such systems have been recognized as Ecologically and Biologically Significant Areas (EBSA) and are or may be later proposed as Marine Protected Areas (MPAs). InterRidge supports innovative interdisciplinary works and collaborations to provide decision-makers with the most accurate and recent knowledge and identify knowledge gaps to help consider the need for conservation and/or management with the necessary scientific exploration and provide relevant scientific information in the design and regulations of such MPAs.

#### 2. **24<sup>th</sup> and 25<sup>th</sup> annual sessions of the International Seabed Authority**

InterRidge co-chairs (Nadine Le Bris and Jérôme Dymont) attended the 24<sup>th</sup> Session of the ISA in Kingston (Jamaica). This time, the InterRidge observer status allowed these representatives to emphasize the importance of up-to-date knowledge bases, interdisciplinary integration, and international cooperation as proposed by InterRidge in supporting best available evidence and expertise for the assessment of risks, elaboration of norms and management plans in this context. InterRidge reminded the Council of "the crucial need of fundamental knowledge to answer questions on the vulnerability of ecosystems, the scales and intensity of environmental perturbations, the cumulative impacts of climate change and exploitation. This should involve all willing research teams, beyond those associated with the permit holders".

InterRidge was represented by its co-Chair Jérôme Dymont at the first part (25 February – 1 March 2019) of the 25<sup>th</sup> session of the International Seabed Authority (ISA). The Council of the ISA met to continue its examination of the Draft regulations for exploitation of mineral resources in the Area. Documents prepared by the Secretariat addressed several crucial points such as the financial model, standards, and guidelines, decision making processes, precautionary approach, inspection mechanisms, the Regional Environmental Management Plans (REMPs), and their independent assessment. On the latest point, InterRidge was satisfied to note that the Authority considers the involvement of independent scientific experts and expressed its interest in helping it to access the international scientific community in its diversity. InterRidge hosts and maintains a list of many scientists who may be happy to provide independent expertise on topics related to solid earth sciences, oceanography, ecology, and biology.

#### IV. Outreach

Although InterRidge does not have the resources to produce its own outreach material – a task that would be hampered by the diversity of languages in which this material should be produced – the office can play a role in facilitating attempts by Working Groups, member countries or any third party to produce media material related to MOR and ABA (e.g., papers for the general press, movies, websites...).

#### V. Plans for future development of InterRidge

- maintain and reinforce **InterRidge as an efficient scientific forum of experts**
- ensure the **transition of the Office** to the new host country
- open new **InterRidge Working Groups**
- co-organize **workshops** with current Working Groups in September 2019
- organize an **InterRidge Theoretical Institute** in November 2019
- attract member countries, communities, individual scientists by **new big projects**

### 7.3.2 International Ocean Colour Coordinating Group (IOCCG) (Affiliated in 1997)

Yoo

IOCCG Annual Report to SCOR  
Venetia Stuart (IOCCG Project Coordinator)  
**Reporting Period: May 2018 – April 2019**

The International Ocean-Colour Co-ordinating Group (IOCCG) was established in 1996 to promote communication and co-operation between the space agencies and the ocean-colour user community. IOCCG is an Affiliated Program of SCOR, and an Associate member of CEOS (Committee on Earth Observation Satellites). The IOCCG has a wide-ranging mandate addressing technological and scientific issues through its scientific working groups and task forces, promoting capacity building through advanced training courses, and helping to ensure continuity and quality of the ocean-colour data stream through the CEOS Ocean Colour Radiometry-Virtual Constellation (OCR-VC) and Ocean Colour Radiometry-Implementation Team (OCR-IT). SCOR has been instrumental in helping the IOCCG secure funding from NASA for the IOCCG program, and also helps to support students from developing countries to attend IOCCG training courses or the International Ocean Colour Science (IOCS) meetings. The group is currently chaired by Cara Wilson (NOAA, USA) and the IOCCG Project Office is located at the Bedford Institute of Oceanography, Canada, staffed by Project Coordinator, Venetia Stuart.

#### 1. IOCCG Scientific Working Groups and Task Forces

IOCCG scientific working groups are relatively short-lived (2-4 years), and generally publish their findings in an IOCCG report upon completion. Currently there are five active IOCCG working groups in various stages of progress, plus one working group which has recently published their findings (see summary below). In addition to the short-lived scientific working groups, the IOCCG also has a semi-permanent Task Force on *Satellite Sensor Calibration*, to



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help facilitate inter-agency collaboration on an ongoing basis. Calibration experts from various space agencies meet regularly to exchange ideas, information and data under this inter-agency framework. Another *Hyperspectral Task Force* may be established by IOCCG in the near future. The progress of the IOCCG working groups is summarised below.

## 1) **Working group on Earth Observations in Support of Global Water Quality Monitoring**

The final report from the IOCCG working group on *Earth Observations in Support of Global Water Quality Monitoring* (edited by Steven Greb, Wisconsin DNR; Arnold Dekker, CSIRO, Australia; and Caren Binding, ECCO, Canada), was recently published by the IOCCG (September 2018) and is now available for download from the IOCCG website. This report aims to strengthen linkages between data providers and end users by providing detailed information needed to support the development of an EO-based global water quality monitoring service. Current knowledge and gaps regarding coastal and inland water quality, and associated use of remote sensing data are described. Existing space-based and *in situ* observing capabilities are also assessed. The report identifies user needs and requirements, observing capabilities, data streams and products, mission requirements and best practices. The report was printed by the State Key Laboratory of Satellite Ocean Environment Dynamics, SIO, China, and hardcopies of the report are available free of charge.

## 2) **Joint GlobalHAB/IOCCG WG on Harmful Algal Blooms** (Chair: Stewart Bernard, CSIR, South Africa).

This joint working group between the IOCCG and the GlobalHAB programme of IOC-SCOR was established several years ago but the Chair of the group has been over-committed, so a post-doc student has been re-hired to help bring the report to conclusion. Recommendations will form an important part of the report and will include agency focussed sensor aspects (NIR bands, hyperspectral), as well as the importance of atmospheric correction. For intense blooms, Rayleigh-corrected reflectance can be used to determine Chl-a thus circumventing atmospheric correction problems associated with turbid waters and the correction of aerosol absorption. Ocean colour is effective in detecting high biomass blooms, but does not work well for low biomass blooms, so examples of indirect approaches will also be shown. Science validation aspects and user driven aspects will be addressed, and a section on policy and economics will be added. It is anticipated that a full draft report will be completed by the end of the year, with publication in 2020.

## 3) **Uncertainties of Ocean Colour Remote Sensing** (Chair: Frédéric Mélin, JRC, Italy).

The IOCCG working group on *Uncertainties of Ocean Colour Remote Sensing* aims at presenting the state of the knowledge in the field, describing the sources of uncertainties affecting ocean colour data, how they propagate through data processing, and the techniques proposed to provide uncertainty estimates. The final report on the topic has a broad authorship and is almost complete (7 chapters in total). The last chapter presents important recommendations in three broad categories:

- Promoting dialogue and transparency between communities - includes adopting an appropriate terminology, providing full documentation and source codes for the whole processing chain, and distribution of non-calibrated TOA data.
- Distributing complete and clear uncertainty fields, including uncertainty estimates associated with each datum, ensuring a clear description of the uncertainty fields distributed with satellite data, and encouraging dialogue between data providers to promote consistency between distributed uncertainty fields.
- Strategy and methodological developments to obtain improved uncertainty estimates, including further development of techniques to estimate uncertainties of ocean colour products and comparison between these approaches.

It is anticipated that this report will be published before the end of the year once the last-minute contributions and feedback have been integrated. The EC Joint Research Centre (JRC) will tentatively cover the cost of printing this report.

#### 4) **Intercomparison of Atmospheric Correction Algorithms Over Optically-Complex Waters** (Cédric Jamet, LOG, Wimereux, France).

The goal of the working group is to inter-compare and evaluate existing atmospheric correction algorithms over turbid waters, in order to understand the advantages and limitations of each algorithm and their performance under certain atmospheric and oceanic conditions. The focus is on atmospheric correction algorithms that deal with non-zero NIR water-leaving radiances, and is not sensor specific (MODIS-A is an application). A total of nine atmospheric correction algorithms were taken into consideration and a simulated dataset was used for sensitivity studies.

This report is more technical than a traditional IOCCG report, but the authors would nevertheless like it to be published as an IOCCG document. The IOCCG Committee recommended that another chapter be added to cover research on atmospheric correction using different sensors and approaches, and that results from projects such as the ESA Project on Extreme Case-2 Waters (Case2X) also be included. The report will provide recommendations for improving and selecting the optimal atmospheric correction scheme for various water types, along with the range of validity and limitations of each algorithm. The Committee recommended that the final report be published online as an IOCCG Technical Report since it deals primarily with methodology.

#### 5) **Role of Ocean Colour in Biogeochemical, Ecosystem and Climate Modelling** (Chaired by Stephanie Dutkiewicz, MIT, USA).

Working group members have completed a full draft of the report entitled “Synergy between Ocean Colour and Biogeochemical/Ecosystem Models”. The draft report has been reviewed by external reviewers as well as IOCCG Committee members and contains a total of nine chapters. The overall goal of the WG is to bridge the gap between the ocean colour community and the biogeochemical/climate modelling communities by providing a better understanding of ocean colour products, the different types of models available, and the mismatches to model outputs. Numerical modellers are frequent users of ocean colour products, but many modellers need better information about using satellite data, for example, chlorophyll in a model is not the same as the chlorophyll ocean colour product. Recommendations encourage agencies to examine how

additional information can be presented alongside satellite products to help modellers make informed choices and interpretations. Important developments in numerical models over the last few years include components that directly link to ocean colour products (e.g., remotely sensed reflectance). As such, numerical models can now be used to explore uncertainties in ocean colour products as well as potentially for algorithm development. Details of these new developments are provided in the report which will be of specific interest to the ocean colour community looking to expand their use of the ocean colour data stream, as well as the numerical modelling community.

**6) Long-Term Vicarious Adjustment of Ocean Colour Sensors** (Chaired by Christophe Lerebourg, ACRI-ST, France).

One of the major challenges in ocean colour radiometry is to ensure that the data obtained from different satellite sensors meets the accuracy requirements for satellite climate quality data. An IOCCG working group was formed to help define the best practices to reach a high standard of precision and accuracy for *in situ* measurements necessary to fulfill the system vicarious calibration (SVC) requirements. Vicarious calibration i.e., the indirect sensor calibration based on ground targets of known radiometry (such as instrumented buoys or stations) is fundamental to reach the accuracy requirements for ocean colour Level-2 products, for the creation of Climate Data Records. In this context different projects have been established, including the ESA FRM4SOC (Fiducial Reference Measurements for Satellite Ocean Colour), and the EUMETSAT OC-VCAL project, to define detailed requirements for an ocean colour vicarious calibration infrastructure for the European Copernicus Programme. The working group intends to build on these results to define the best practices for all ocean colour missions. Activities have been on hold due to a heavy work load of the chairs, but they have started discussing the content of an IOCCG report. The working group hopes to resume in mid-2019. Membership includes 15 institutions from the EU, USA, Korea, Japan and China.

## 2.0 IOCCG Protocol Series

The IOCCG recently established the IOCCG Protocol Series to publish peer-reviewed Ocean Optics & Biogeochemistry Protocols online. *In situ* optical and biogeochemical in- and above-water measurements are critical for calibration and validation of satellite ocean colour radiometry data products, and for refinement of ocean colour algorithms. Over the past few years NASA and IOCCG have sponsored several international workshops with the aim of updating and developing new community consensus protocols for ocean colour sensor validation. These new protocols are posted on the IOCCG webpage for a period of time for testing, public comment and review, before they are accepted as international reference standards. Two protocols were recently published by the IOCCG and are available on the IOCCG website:

- Volume 1.0 - [Inherent Optical Property Measurements and Protocols: Absorption Coefficient](#) (November 2018)
- Volume 2.0 - [Beam Transmission and Attenuation Coefficients: Instruments, Characterization, Field Measurements and Data Analysis Protocols](#) (April 2019)

Two other revised draft protocols are currently under review by the Editorial Review Board: (i) Best Practices for Ship-Based Underway Flow-Through Optical Data and, (ii) In situ Optical Radiometry. Recently, the NASA PACE project and IOCCG co-sponsored an international workshop to establish standard, community-consensus field protocols for carrying out *in situ* measurements of primary productivity and related parameters in coastal and ocean waters. The resulting protocol document will also be published in the IOCCG Protocol Series.

### 3.0 2019 International Ocean Colour Science (IOCS) Meeting

The IOCCG recently convened the very successful 4<sup>th</sup> [International Ocean Colour Science](https://iocs.ioccg.org/) (IOCS) meetings in Busan, South Korea (9-12 April 2019) in partnership with, and thanks to sponsorship from KIOST, NASA, EUMETSAT and Airbus. Over 250 researchers from 29 different countries participated in the four-day meeting, including ocean colour research scientists from around the world, as well as representatives from all the major space agencies with an interest in ocean-colour radiometry. The overall goal of IOCS-2019 was to engage and strengthen the Asian remote sensing community and maintain interaction with the broader ocean colour user community by improving communication between research scientists and space agency representatives. Keynote speakers informed participants about cutting edge research while agency members presented their mission plans as well as emerging applications and science. Breakout workshops collectively agreed upon requirements for sustained OC research and operations, focussing on the impact of new research avenues and providing advice for future action. Four poster sessions allowed participants to present their own research and converse with professional colleagues, and a Town Hall enabled participants to directly address space agency representatives. The meeting was preceded by the NASA Ocean Color Research Team (OCRT) meeting as well as three training workshops. There is much community interest in these biennial IOCS meetings, which are gathering momentum since they provide important community feedback to the space agencies. All presentations, poster abstracts and the proceedings of the meeting are available on the IOCS-2019 meeting website at: <https://iocs.ioccg.org/>.

### 4.0 Capacity Building

The successful [fourth IOCCG Summer Lecture Series](http://ioccg.org/what-we-do/training-and-education/ioccg-sls-2018/) took place at the Laboratoire d'Océanographie de Villefranche (LOV, France) from 25 June – 6 July 2018. This training course was dedicated to high-level training in bio-optics and ocean colour, and focussed specifically on current critical issues in ocean colour science. A total of 131 applications were received, of which 22 students from 15 different countries were selected, a very difficult task considering the high standard of all applications. The majority of the trainees were PhD students and post-doctoral students, and came from a broad range of backgrounds. SCOR sponsored three students to attend the training course (from South Africa, India and Nigeria), which is gratefully acknowledged. Thirteen prominent scientists delivered a comprehensive program including lectures, discussions and hands-on tutorials. Because of the high demand for the course, all the lectures were video recorded and are available on the IOCCG website together with the PowerPoint lecture presentations (see <http://ioccg.org/what-we-do/training-and-education/ioccg-sls-2018/>). This material provides a valuable teaching resource for all the students that were not selected to attend the course, as well as other researchers from around the world.

In October 2019, the IOCCG, in conjunction with EUMETSAT and the Second Institute of Oceanography, State Oceanic Administration, China (SIO/SOA), will organize an international ocean colour remote sensing training course in Hangzhou, China. The course will include training on the Sentinel-3 OLCI marine data stream, introducing participants to the latest satellite data available from EUMETSAT, as well as training on the SatCO<sub>2</sub> marine satellite data online analysis system. This system can simultaneously fulfill visualization and calculation of multiple sources of data on a three-dimensional virtual Earth for applications such as water quality monitoring, red tide detection, marine carbon cycling and climate change investigations. The course will be open to participants from east and south-east Asia. SCOR support to sponsor a few students from outside China to attend this training course is greatly appreciated.

### 5.0 IOCCG Committee Meetings

The IOCCG Committee meets once a year to coordinate the activities of the group as a whole, discuss plans for the year ahead and review the progress of the various working groups. The Executive Committee also meets to approve the budget for the coming year. This year the annual IOCCG-24 Committee meeting took place in Hanoi, Vietnam (4-6 April 2019), hosted by the Vietnam Academy of Science and Technology (VAST). The full minutes of the meeting are available on the IOCCG website at: <http://ioccg.org/what-we-do/committee-meetings/>. A mid-year IOCCG Executive meeting took place in conjunction with Ocean Optics, in Dubrovnik, Croatia (9-11 October 2018). The next IOCCG Committee meeting is scheduled to take place from 24-26 March 2020 in Tokyo, Japan, hosted by the Japan Aerospace Exploration Agency (JAXA).

### 6.0 IOCCG Membership (2019)

The IOCCG Committee consists of members drawn from space agencies as well as the scientific ocean-colour community. Rotation of members is being implemented according to a roster: members marked with an asterisk are new members for 2019. The IOCCG Executive Committee consists of all representatives from the sponsoring agencies, plus the IOCCG Chair and past-Chair.

Bernard, Stewart (past Chair)	-	CSIR, South Africa
Bontempi, Paula	-	NASA HQ, USA
Boss, Emmanuel	-	University of Maine, USA
Brando, Vittorio*	-	CNR-ISMAR, Italy
Chauhan, Prakash	-	ISRO, India
Ciotti, Aurea*	-	Universidade de São Paulo, Brazil
Devred, Emmanuel	-	Bedford Institute of Oceanography, Canada
Dogliotti, Ana	-	IAFE/CONICET, Argentina
Franz, Bryan	-	NASA GSFC, USA
Giardino, Claudia*	-	CNR-IREA, Italy
Giugni, Laurent*	-	CSA, Canada
He, Xianqiang	-	Second Institute of Oceanography, China

Hu, Chuanmin	-	University of South Florida, USA
Kampel, Milton	-	INPE, Brazil
Kim, Wonkook	-	Pusan National University, South Korea
Kwiatkowska, Ewa	-	EUMETSAT, EU, Germany
Lifermann, Anne	-	CNES, France
Loisel, Hubert	-	Université du Littoral, France
Malthus, Tim	-	CSIRO, Australia
Mélin, Frédéric	-	EU Joint Research Center, Italy
Murakami, Hiroshi	-	JAXA EORC, Japan
Rio, Marie-Hélène*	-	ESA/ESRIN, Italy
Ryu, Joo-Hyung	-	KIOST, South Korea
Wang, Menghua	-	NOAA/NESDIS/STAR, USA
Wilson, Cara (Chair)	-	NOAA/NMFS, USA

## 7.0 IOCCG Sponsors

The IOCCG is sponsored and supported by contributions from various national space agencies and other organisations listed below:

- Canadian Space Agency (CSA)
- Centre National d'Etudes Spatiales (CNES, France)
- Commonwealth Scientific and Industrial Research Organisation (CSIRO, Australia)
- Department of Fisheries and Oceans (Bedford Institute of Oceanography, Canada)
- European Space Agency (ESA)
- European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)
- National Institute for Space Research (INPE, Brazil)
- Indian Space Research Organisation (ISRO)
- Japan Aerospace Exploration Agency (JAXA),
- Joint Research Centre (JRC, EC)
- Korea Institute of Ocean Science and Technology (KIOST)
- National Aeronautics and Space Administration (NASA, USA)
- National Oceanic and Atmospheric Administration (NOAA, USA)
- Scientific Committee on Oceanic Research (SCOR)

The Bedford Institute of Oceanography (Canada) provides in-kind support, providing office space and informatics support, while SCOR provides infrastructure support and manages the NASA funds. SCOR also sponsors students from developing countries to attend IOCCG training courses and/or the IOCS meetings.

**Global Alliance of Continuous Plankton Records Surveys (GACS) – report of activities**

Anthony J. Richardson, Chair of the Board of Governance

[anthony.richardson@csiro.au](mailto:anthony.richardson@csiro.au)

[GACS@mba.ac.uk](mailto:GACS@mba.ac.uk)

The Sir Alister Hardy Foundation for Ocean Science (SAHFOS), which has previously run the North Atlantic Continuous Plankton Recorder (CPR) Survey, has now merged with the Marine Biological Association of the UK (see <https://www.mba.ac.uk/fellows/cpr-survey>). The most recent GACS meeting was held in November 2018 at the Marine Biological Association of the UK (Plymouth, UK). The key highlights from the annual meeting and our work since include:

- In June 2019, Sonia Batten led a GACS paper on “A global plankton diversity monitoring program” published in *Frontiers in Marine Science*. This is a contribution to the OceanObs’19 conference coming up soon and outlines what a global plankton survey would look like and how to get there. It builds on the years of the last decade of work by GACS
- In April 2019, Anthony J. Richardson reported at the 10th Session of the JCOMM Ship Observations Team, 1-4 April 2019, Hong Kong, China. The presentation was about what GACS does, the challenges of working with SOOPs, and the evolution of the data dissemination strategy in GACS
- Engagement with the POGO continues, with Dr Sophie Seeyave attending the last GACS meeting and POGO sponsoring GACS training workshops in 2019, including a molecular workshop
- Dr Sanae Chiba is promoting the use of GACS indicators through the Biodiversity Indicators Partnership
- GACS is included as an operating network for the GOOS Biology and Ecosystems Panel, and two GACS members are on the Panel
- The Southern African CPR survey, towing since 2011, is now run by Jenny Huggett (Department of Environmental Affairs). The survey continues to collect data in the South African sector of the Southern Ocean and on the Agulhas Bank.
- The SCAR Southern Ocean CPR survey (SO-CPR), towing since 1991, is run by Kunio T. Takahashi (National Institute of Polar Research, Japan), and in Australia by So Kawiguchi (Australian Antarctic Division, Australia) and Kerrie Swadling (University of Tasmania, Australia). SO-CPR has accessed new funding to regularly count phytoplankton samples. SO-CPR collected 50 CPR tows during the season from research vessels from several countries. There is a training workshop this year to help India initiate Southern Ocean CPR work
- The Australian CPR survey, initiated in 2009, has secured funding until 2023. Data are being used to underpin model development and inform ecosystem assessments
- The Brazilian CPR survey, initiated in 2009, continues to collect tows in the Atlantic sector of the Southern Ocean for GACS

- The North Pacific CPR survey, started in 1997, continues to collect data in the North Pacific six times per year. Sonia Batten (Marine Biological Association of the UK) and Sanae Chiba (Japan Agency for Marine-Earth Science and Technology, JAMSTEC, Japan) have contributed to global efforts to include plankton in ecological indicators
- France has towed CPRs annually once per year during the Austral in the Indian part of the Southern Ocean between the French Southern Antarctic Territories. CPR surveys continue to monitor the Marine Reserve in the Crozet, Kerguelen and New Amsterdam EEZ region
- The NZ-CPR survey has been running officially since 2008, as part of the SCAR SO-CPR. We have also carried out CPR runs around NZ, across to Val Paraiso, and the Falkland and Sandwich Islands via the Pacific Ocean. These latter ones are currently still unanalysed. We have recently received new funding for our Southern Ocean work for another 5 years. Included in this, is funding for recording microplastics observed in the CPR samples
- The MedCPR survey had completed several years of successful tows in the Eastern Mediterranean Sea, but is now faced with funding uncertainty
- The next annual GACS meeting will be in November 2019 in Hobart, Tasmania. This will include a one-week training program on the CPR for technicians from South Africa and Brazil

## **7.4 Other Organizations**

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

Report will be posted on the SCOR meeting Website before the meeting.

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