

CANADIAN OCEAN SCIENCE NEWSLETTER

LE BULLETIN CANADIEN DES SCIENCES DE L'OCÉAN

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OCEAN SCIENCE PROGRAMS

Ocean Science in Canada: Meeting the Challenge, Seizing the Opportunity

A report from the Council of Canadian Academies

Submitted by R. Ian Perry, Fisheries & Oceans Canada, Pacific Biological Station, Nanaimo, B.C. (Ian.Perry@dfo-mpo.gc.ca)

The health and well-being of Canadian society, and the Canadian economy, are closely connected with the oceans. Canada has the largest marine coastline in the world, and ocean related activities employ over 300,000 Canadians and contribute more than \$26 billion a year to the economy. Yet the ocean, globally, is experiencing significant multiple and cumulative stresses. What are the coming challenges for the oceans, and how are Canada's marine science activities positioned to meet these challenges and seize the opportunities they present? This is the background to a request by the Consortium of Canadian Ocean Research Universities (CCORU) to the Council of Canadian Academies (CCA) to undertake an assessment of the state of ocean science in Canada.

The assessment was conducted in two phases. The first phase was the development, by a core group of 22 ocean experts, of a set of 40 priority research questions which, if answered, would have the greatest impact on addressing future opportunities and challenges relating to ocean science in Canada. This report was published in July 2012 (CCA 2012). It grouped these 40 questions into six themes: improving fundamental scientific understanding, monitoring, data and information management, understanding the impacts of human activities, and informing management and governance.

In phase two of this assessment, CCORU asked the CCA to evaluate the following question: "What are Canada's needs and capacities with regard to the major research questions in ocean science that would enable it to address Canadian ocean issues and issues relating to Canada's coasts and enhance its leading role as an international partner in ocean science?" In addition, CCORU asked three sub-questions, relating to the relevance of ocean science for Canadian society and internationally, the present infrastructure and its future requirements,

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The Canadian National Committee of the Scientific Committee for Oceanic Research (CNC-SCOR) fosters and facilitates international cooperation. It is a non-governmental body that reflects the multi-disciplinary nature of ocean science and marine technology.

Le Comité national canadien du Comité scientifique de la recherche océanographique (SCOR) favorise et facilite la coopération internationale. Il reflète la nature multidisciplinaire de la science océanique et de la technologie marine.

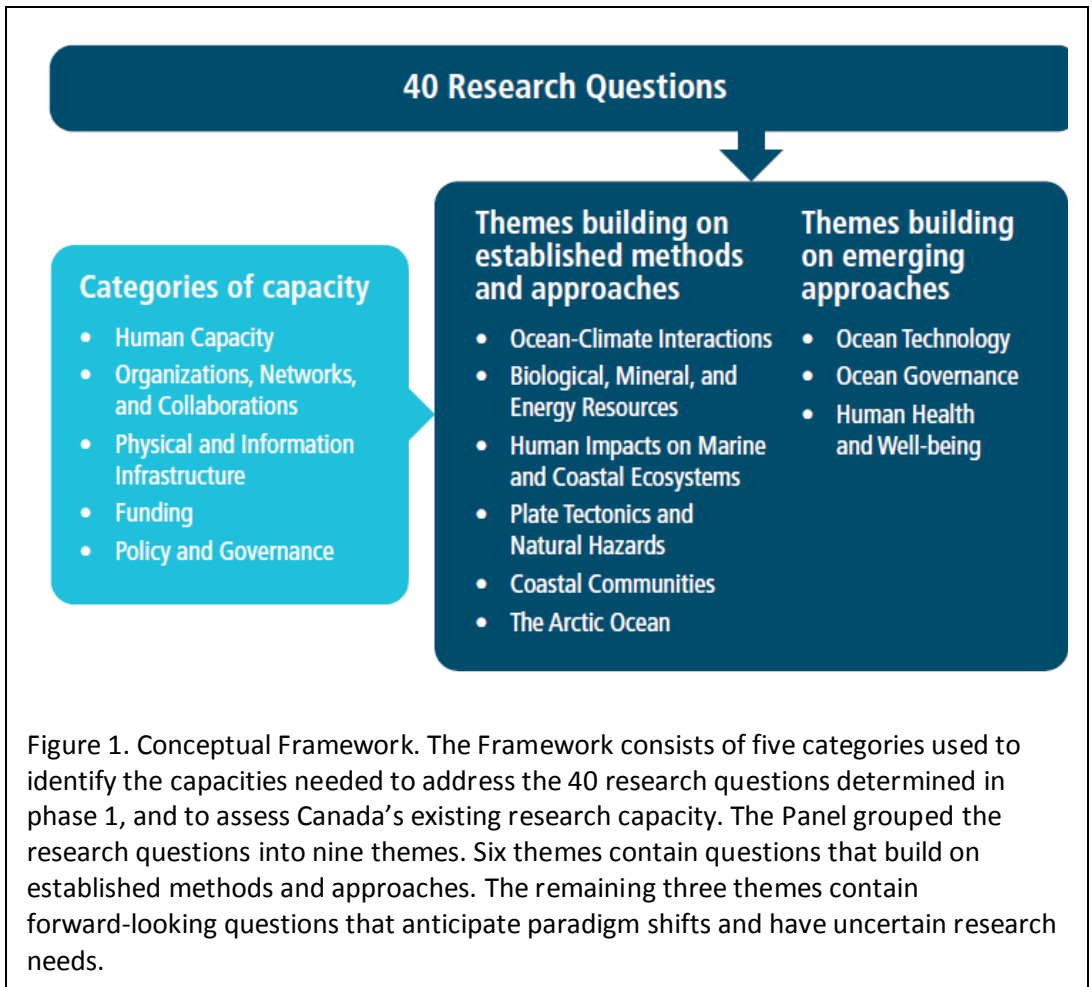
and the arrangements and new alignments that may be needed among stakeholders of ocean research.

The CCA convened a panel of eight experts from academia, government and industry: David Strangway (Panel Chair; Former President and CEO, Canada Foundation for Innovation among other activities); Louis Fortier (Université Laval); Jim Hanlon (Halifax Marine Research Institute); Peter Herzig (GEOMAR Helmholtz Centre for Ocean Research, Germany); Barbara Neis (Department of Sociology, Memorial University); Ian Perry (Fisheries and Oceans Canada); Martin Taylor (University of Victoria); and Wendy Watson-Wright (Executive Secretary and Assistant Director General, Intergovernmental Oceanographic Commission, Paris). The Panel received strong support from CCA core staff. The final report was released on 6 November 2013, and is available on-line (CCA 2013). The Panel developed a conceptual model that grouped the 40 research questions into six themes that can be addressed by building on existing approaches, and three themes that reflect new research approaches. Each of these themes was then examined with respect to five categories of capacity (Fig. 1). Since assessments conducted by the CCA are evidence-based, the data examined by the Panel included primary publications and

bibliometric analyses, Statistics Canada data on Highly Qualified Personal in ocean science, funding information from the National granting agencies, and other academic and grey literature sources.

Considerable care was taken to define ocean science to include all research disciplines relating to the study of the ocean: physical, biological, chemical, geological, fisheries (including monitoring and advice), hydrographic, engineering, health, social sciences,

humanities, and multi-disciplinary research on the relationships between people and the ocean. Ocean *science* was understood to be broader than *research*, and included activities that make use of ocean scientific knowledge such as monitoring, data integration and management, knowledge mobilisation, integration of local and traditional knowledge, and outreach. The Panel considered Canada's ocean environments as coupled

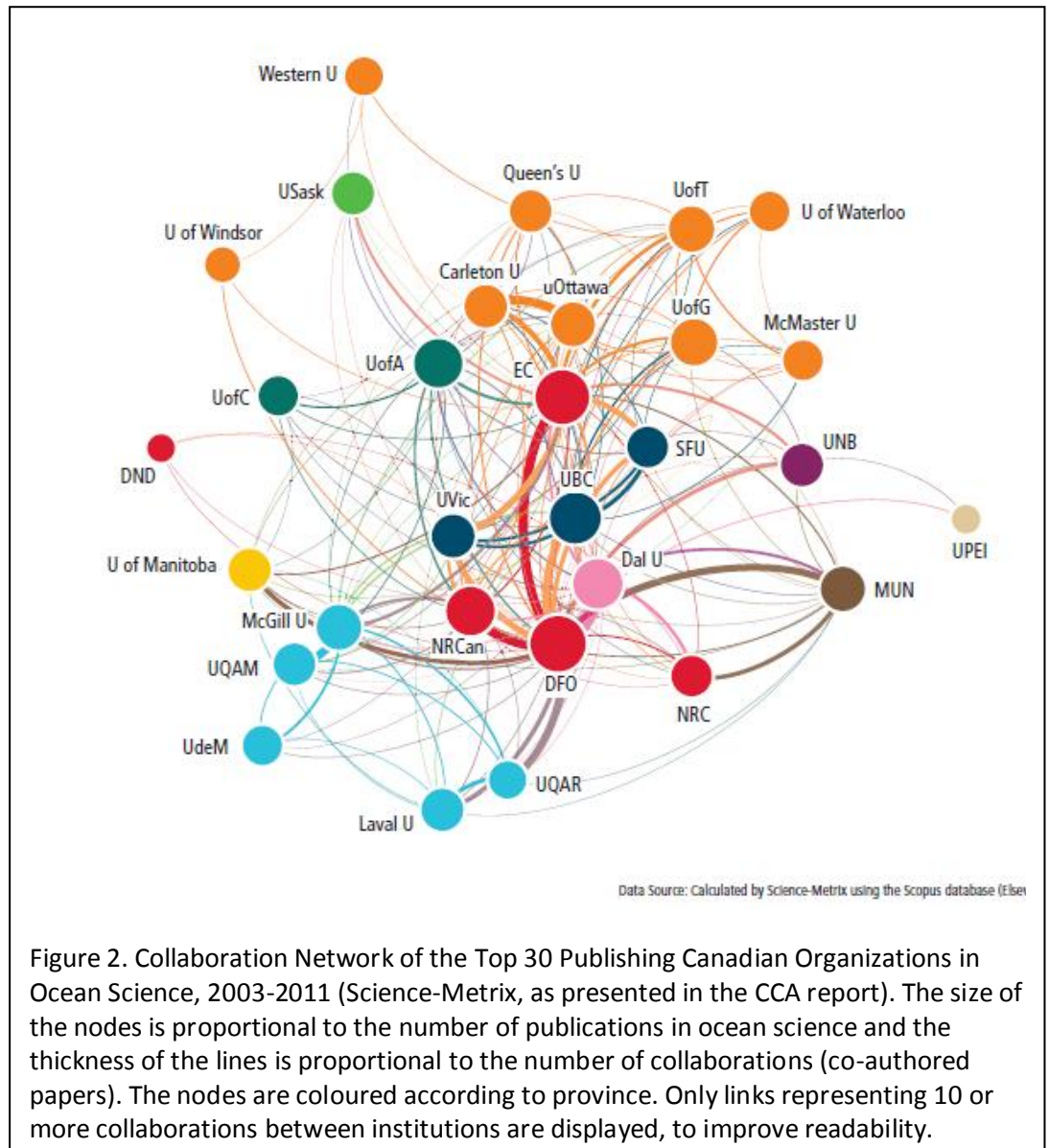


social-ecological systems in which the boundaries between human social and biophysical systems is often arbitrary.

The state of ocean science in Canada today

The Panel found that ocean science in Canada is organised into a network of regional clusters, each consisting of diverse organisations with different research interests and capacities. Several of these clusters are located on Canada's east and west coasts, but important clusters also exist in Ontario, Manitoba, and Alberta. At present, no such cluster exists in the Canadian Arctic. This style of organisation favours diversity and regional specialisation, but creates challenges for collaboration, alignment, and use of shared (national) resources. Bibliometric analyses (Fig. 2) illustrate that, historically, federal government organisations have acted as central nodes in these clusters. Also apparent are the strong roles played by universities, and the importance of provincial networks in Quebec, Ontario and B.C.

The Panel was unable to determine the human capacity in ocean science across Canada, because of data limitations. This was due, in part, to the multi-disciplinary and diverse nature of ocean science (one of its strengths), making it difficult to obtain information to assess overall trends and whether ocean scientists have the interdisciplinary skills needed to conduct the research to address the 40 priority questions.



Compared to its small population, Canada has a relatively large research fleet, with 20 Coast Guard vessels dedicated to research. Half of the vessels currently in service for science were built more than 25 years ago. Older vessels can lead to more frequent breakdowns with higher costs and more operational days lost to repairs and maintenance. The Panel noted, however, recent announcements by the Government of Canada regarding a substantial fleet renewal program.

Over the past several years, Canada has developed several innovative and world-leading systems for ocean observation and monitoring. These include the cabled undersea observatories of Ocean Networks Canada, the Ocean Tracking Network, and important contributions to the Argo program of deep-sea profiling floats and other international projects. These, and other, systems build upon the research expertise and technological skills of universities, small and medium sized companies, and funding consortia involving a variety of sources. However, Canada's vast geography compared to its population size, and the decentralised nature of ocean science, creates challenges to geographic coverage (in particular in the Arctic), coordination of investments in new systems and their use, and improved data integration and access. Funding for these large facilities has, over the past 10 years, largely come from federal granting agencies, resulting in a spiked pattern to interannual funding trends.

Bibliometric analyses, conducted on published papers indexed in the Scopus (Elsevier) data base, demonstrated that Canada ranks among the top countries in the output and impact of ocean science papers, although this position is at risk. Among the 25 leading countries in ocean science, Canada ranks 7th in output (as numbers of papers), 11th in impact (measured as the average relative citations per paper), and 25th in the growth index (the proportion of papers in ocean science in Canada in 2008-2011 compared with the proportion in 2003-2006). This implies that the output in ocean science is losing ground to other fields of science in Canada faster than any of the other 24 leading countries. However, the Panel noted that Canada's growth index was based on an already very high level of publications, making it difficult to grow dynamically.

Opportunities and challenges in addressing the major research questions – existing strengths

Ocean-climate interactions: Canada has substantial capacity in remote sensing and climate modelling which provides opportunities to advance research on ocean-climate interactions, particularly in addressing questions requiring better integration of ocean and sea ice in climate models. Realising this opportunity, however, requires sustained observations and monitoring of climate-related ocean data. This is a challenge for Canada, primarily due to its vast and remote coastline, much of which is in the Arctic where observation and monitoring are inherently more costly.

Biological, mineral, and energy resources: Canada has historical strengths in this theme largely related to government and university research, particularly in fisheries science and marine geology. The main challenges in this area are to prevent further loss of capacity in taxonomy and to continue the transition towards more holistic approaches such as ecosystem-based and social-ecological frameworks. Concerning mineral and energy resources, the main challenges are to better coordinate and align capacities held by private, government, and academic institutions, and to effectively integrate research on the environmental and societal impacts associated with ocean resource development.

Human impacts on marine and coastal ecosystems: Research in this theme also benefits from historical strengths in government departments and universities. The challenge is to adapt existing capacity to the changing context and priorities of this research, including research on invasive species as well as on monitoring and understanding the behaviour of contaminants, in particular novel contaminants and known contaminants under new and changing conditions (e.g., oil spills under sea ice).

Plate tectonics and natural hazards: Past achievements in geological and hydrographic surveying and recent investments in cutting-edge cabled observatories offer major opportunities in this theme. These investments also create challenges in ensuring long-term coverage of costs to operate and use these platforms for research.

Coastal communities: Canada has an active community of scientists from various disciplines that performs research in this theme. Interdisciplinary networks that cut across the natural and social sciences and engineering are essential to mobilizing this potential.

The Arctic Ocean: Recent and upcoming investments in icebreakers and research labs in the Arctic will create opportunities to address research questions in the Arctic Ocean. Challenges arise in prioritising research on specific impacts of human activities in the Arctic so that research can keep pace with development in the Arctic.

Opportunities and challenges in addressing the major research questions – emerging issues

Ocean technology: Canada's diverse and dynamic ocean technology sector has ample capacity to develop tools and technologies for advancing ocean science in Canada and abroad. A key challenge is to align the research-driven technology development in the science sector with opportunities for commercial technology development, and to improve access to international markets for science instruments.

Ocean governance: This theme faces growing uncertainty in both ecological and social elements of social-ecological systems, and increasingly requires the integration of knowledge from multiple sources.

Human health and well-being: Research on the relationship between the ocean and human health and well-being is undergoing a shift from a focus on contaminants and disease towards a more holistic understanding of the social and environmental determinants of health. The main challenges relate to integrating research capacities in ocean-specific determinants of health with research framed by a broader population health perspective.

In conclusion, the Panel identified three important gaps:

- A vision gap: there is no overarching national strategy or vision for the entire ocean science community in Canada;
- A coordination gap: there is insufficient coordination among the regional clusters of ocean science activities;
- An information gap: there is insufficient information about ocean science activities and capacities across the country.

Due to its geography and historic capacity, Canada not only has remarkable opportunities in ocean science, but has a need to seize these opportunities to use and protect the ocean. Addressing the vision, coordination, and

information gaps is essential if Canada is to unlock these opportunities. This requires a national effort involving the entire ocean science community as well as its users in government, the private sector, and civil society.

CCA (Council of Canadian Academies). (2012). 40 Priority Research Questions for Ocean Science in Canada. Ottawa, ON: CCA, The Core Group on Ocean Science in Canada.

CCA (Council of Canadian Academies). (2013). Ocean Science In Canada: Meeting the Challenge, Seizing the Opportunity. Ottawa, ON: CCA, The Expert Panel on Canadian Ocean Science.

MEETINGS

Oceans 2014 MTS/IEEE, 14-19 September 2014, St. John's, Newfoundland

Jointly sponsored by the Marine Technology Society (MTS) and the Oceanic Engineering Society of the Institute of Electrical and Electronic Engineers (IEEE/OES), OCEANS '14 is a major international forum for scientists, engineers, and responsible ocean users to present the latest research results, ideas, developments, and applications in Oceanic Engineering and Marine Technology.

OCEANS 2014 features tutorials on special interest topics, a comprehensive technical program of lectures and presentations, a student program, and a large exhibit hall with products from over one hundred companies.

The [call for abstracts \(click here\)](#) has been issued and the deadline for abstract submissions is 26 March 2014. For full details of this conference please visit the [Oceans'14 web page \(click\)](#).

2nd International Ocean Research Conference (IORC), 17-21 November 2014, Barcelona, Spain

The *2nd International Ocean Research Conference (IORC)* is an opportunity for the scientific community to come together to plan the coming decade of international collaboration in marine science and technology, with a view to improving ocean governance. The inaugural IORC was held in June 2005, when the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO), together with The Oceanography Society (TOS), brought attendees together to discuss expected developments in marine sciences in the decade that followed. Now, almost ten years later, the same institutions are convening the 2nd IORC to review progress made in ocean science in the last twenty years, and plan ahead in light of important policy developments such as The Future We Want (UNCSD Rio+20) and Future Earth.

The conference will provide excellent opportunities to gain insight into the latest oceanographic research through which are outlined below. Keynote speakers will further expand upon the main themes. The IORC will demonstrate global impact of ocean research and its fascinating contributions in terms of new knowledge on pressing issues, change, ocean governance and capacity building. Please check the conference website for more details.

The deadline for submission of abstracts ([click here](#)) is 31 May 2014. Full details on the conference are available [here \(click\)](#).

Third International Symposium on "Effects of climate change on the world's oceans", 23-27 March 2015, Santos, Brazil

This symposium will provide opportunities for the international science community to bring the latest information, understanding and assessment of the impacts of climate change on our oceans. Twelve sessions covering different but interconnected themes have been selected, from physical processes and their interaction with ecosystem dynamics, to resource provision and ocean governance. The latest developments in predicting changes in biodiversity, phenology, fisheries and ecosystems as well as in the physical systems that sustains these, will inform discussions on the risks and opportunities that climate change will bring to coastal communities and to society at large. The symposium will also highlight knowledge gaps to stimulate the development of the new generation of science of climate change impacts on our oceans.

More details are available at the symposium web site: <http://www.pices.int/climatechange2015.aspx>.

The scientific community is also invited to propose workshops (from half-day to 2 full days) to be held March 21–22 (Saturday and Sunday immediately prior to the symposium) or March 28 (Saturday immediately after the symposium). A proposal must be sent to the PICES Secretariat (secretariat@pices.int) by April 14, 2014, and include the following information: (1) title, (2) convenors, (3) rationale, (4) description and objectives, (5) anticipated outcomes/products (e.g., manuscripts, white papers, forecasts, workshop report), (6) anticipated number of participants, (7) workshop format (e.g., invited talks, selected talks, breakout session groups, working groups), and (8) AV requirements. Notification of proposal acceptance will be sent by May 12, 2014.

PERSONNEL

Jason Darcy Chaffey



December 5, 1970 - February 4, 2014

Colleagues and friends of the late Jason Chaffey at the Bedford Institute of Oceanography (BIO) were shocked and saddened to learn of his unexpected passing on 4 February 2014. Jason first worked at BIO as a summer student in the Atlantic Geoscience Centre from 1992 to 1994, while obtaining a B.Sc. with Honours in Physics at Dalhousie University (1994). He then obtained a Diploma in Meteorology from Dalhousie (1995) and, later, a M.Sc. in Earth and Ocean Sciences at the University of Victoria (2000). Jason did contract work in the Coastal Ocean Sciences Section at BIO in 1996-97 and 2000-01, before being appointed in November 2001 to a Physical Scientist position in the now Ocean and Ecosystem Sciences Division.

Jason's role evolved over his career and he became the go-to guy at BIO for Linux computer support, scientific software development (e.g. WebTide) and coastal model applications, particularly with finite-element and finite-volume methodologies in the coastal zone. He was also a key player in collaborative work with these models, among DFO labs and with other oceanographic groups. Jason was a talented and most obliging co-worker who will be remembered for his quiet and efficient dedication and high-quality help whenever needed.

CANADIAN JOBS and TRAINING

Canada Research Chair (Tier II) in Ocean Chemistry at Dalhousie University

The Department of Oceanography at Dalhousie University in Halifax, Nova Scotia (www.oceanography.dal.ca) is looking for applicants in all fields of observational/field-oriented ocean chemistry that complement existing strengths. The candidate should have a PhD degree, postdoctoral experience and a research track record that is exceptional for his/her career stage. It is anticipated that the appointment will be tenure-stream and made at the Assistant or Associate Professor level. The successful candidate will be expected to teach undergraduate and graduate classes in marine science and/or environmental chemistry and to develop a vigorous and creative research program with external funding.

Applications can be submitted at any time, preferably before March 15, 2014 and consist of a curriculum vitae, list of publications, a summary of research interests, a research proposal (no more than 3 pages), a statement of teaching interests and experience, and names and contact information of at least three referees.

Mode details are available [here \(click for pdf file\)](#).

Tenure-track teaching position at the rank of Instructor I at University of British Columbia

The Department of Earth, Ocean and Atmospheric Sciences (EOAS) at the University of British Columbia invites applications for a tenure-track teaching position at the rank of Instructor I. The position provides the rare opportunity to pursue a career based on teaching excellence in one of Canada's largest and most diverse earth sciences departments. Appointment at a tenured rank may be considered for applicants with exceptional qualifications and experience. The anticipated start date for this position is July 1, 2014. Visit the EOAS Employment Opportunities [website \(click here\)](#) for more information.

Applications may be submitted online [here \(click\)](#). The website will remain open for submissions through the closing deadline of **March 21, 2014**. The website may remain open past the deadline at the discretion of the recruiting committee. All applications submitted while the website remains open will be considered.

Postdoctoral Fellowship in Applied Mathematics at University of Waterloo

Applications are invited for a postdoctoral fellowship in the Department of Applied Mathematics at the University of Waterloo, with an anticipated start date of September 1, 2014. This is a one-year fellowship with the possibility of renewal for another year. More details are available [here \(click\)](#).

Candidates should submit a cover letter, curriculum vitae and a one-page research statement to <http://www.MathJobs.org>. Applicants should also arrange for three letters of recommendation, with at least one letter addressing the candidate's teaching abilities, to be submitted through www.MathJobs.org website. Review of applications will begin April 30, 2014 and will continue until the position is filled.

Looking for work? Try the CMOS site ([click](#))

Vous recherchez un emploi? Visitez le site SCMO ([click](#))

GENERAL

2014 Call for SCOR Working Group Proposals

The Scientific Committee on Oceanic Research ([SCOR](#)) will accept proposals for new SCOR working groups until **15 April 2014**.

Each proposal will be evaluated by national SCOR committees in terms of scientific merit and quality, timeliness, and achievability of the proposed terms of reference. National SCOR committees are an important aspect of SCOR's operation and can play a key role in reviewing working group proposals and in seeking new funds to support working group activities.

SCOR approves new working groups each year at its annual meeting. The number of proposals funded each year depends on both the results of the proposal review process and the availability of funding. In recent years, 1-3 proposals have been funded in any given year. SCOR is an organization that promotes science that comes from

the "bottom up" from the ocean science community and working groups are an important vehicle to bring attention to the important ocean science issues identified by the global community of ocean scientists.

You can download the guidelines for submitting proposals from [here \(click\)](#). You can also get information on current SCOR working groups [here \(scor-int.org/wkgroups.htm\)](http://scor-int.org/wkgroups.htm).

2014 A.G. Huntsman Award - Call for Nominations

The A. G. Huntsman Foundation is inviting you to submit a nomination for the 2014 A. G. Huntsman Award for Excellence in Marine Sciences. Please refer to the [call letter \(click here\)](#) which provides background information about the award. The nomination form can be downloaded from [here \(click\)](#). The deadline for submissions is 11 April 2014.



Call for Nominations – NSERC Synergy Awards for Innovation

The annual Synergy Awards for Innovation recognize examples of collaboration that stand as a model of effective partnership between industry and colleges or universities.

The Synergy Awards for Innovation honour outstanding research and development (R&D) partnerships between a university or a college, and industry, in the natural sciences and engineering. Since 1995, the Awards have showcased the benefits of pooling university and industry resources to make the most of Canadian research excellence and Canadian industrial expertise.

In addition to the four categories for universities, the Awards now include a category for colleges, to highlight the impact and lasting benefits of their applied R&D collaborations with industry partners. Only nominations in the natural sciences and/or engineering will be considered.

The deadline for nominations is 15 April 2014. Please visit the [award web site](#) for more details.

An open invitation to participate in the 5th Primary Production Algorithm Round Robin focused on the Arctic Ocean

Do you estimate marine photosynthesis using a model? Would you like to quantify the performance of the model you use in the Arctic Ocean? Would you like to know how your model compares with other models? This is your chance!

In the last decade, it appears that primary productivity (PP) in the Arctic Ocean has increased considerably, as estimated from remotely-sensed observations. However, consensus about the relative importance of variables and processes controlling PP in the Arctic Ocean at different times and in different regions is lacking. Sea ice,

colored dissolved organic matter, persistent cloud cover and stratification are major controls of the light regime for phytoplankton while winter wind mixing, upwelling, eddies, river discharge and stratification are involved in nutrient replenishment. Given the projected high sensitivity of the Arctic Ocean to climate change, combined with the observed contemporary changes, a regional Arctic Ocean PP assessment will provide an essential step forward in this region.

A study to compare models that estimate PP in the Arctic Ocean from either ocean-color based models, biogeochemical ocean circulation models, or earth system models, is being conducted thanks to funding from NASA's Ocean Biology and Biogeochemistry Program. This project continues previous comparison studies (Primary Production Algorithm Round Robins, PPARR). PPARR-4 included over 50 investigators running ~22 distinct satellite-based PP models or model variants and 14 coupled physical-biogeochemical circulation models. This fifth round robin study (PPARR-5) will be the first one to focus on the Arctic Ocean.

PPARR-5 will include comparisons to high quality in situ primary productivity data, over a broad array of locations, which will allow a comprehensive assessment of model estimates of PP, and their associated uncertainties. In this study, input data (chlorophyll, SST, PAR, and mixed layer depth for specific locations and dates) are provided by the organizers to the participating modeling groups, who in turn estimate integrated net primary productivity and, if possible, depth-resolved profiles of primary production and chlorophyll *a*. These results are sent back to the organizers, who compare and analyze the results. We are preparing to distribute the PPARR-5 Arctic Ocean data set shortly.

Satellite-based PP model users (or developers), coupled physical-biogeochemical modelers and earth system modelers, who estimate productivity rates in the Arctic Ocean are all welcomed to participate.

Please write to pmatrai@bigelow.org and ylee@bigelow.org if you are interested in participating in this comparison or if you have further questions about the PPARR-5 Arctic Ocean project.

SmartATLANTIC Herring Cove Buoy

The first SmartATLANTIC Inshore Weather Buoy was successfully deployed on November 7, 2013 in Herring Cove, Nova Scotia, by the Canadian Coast Guard vessel CCGS Sir William Alexander. The Buoy, a scientific ODAS buoy (Ocean Data Acquisition System), is a new weather forecasting tool and platform for scientific research/education. The meteorological and oceanographic data transmitted from the buoy is used to generate – for the first time in Halifax – real-time high resolution weather and wave forecasting.

The SmartATLANTIC buoy website (www.smartatlantic.ca) is powerful and simple to use, and available for a wide variety of uses by the commercial marine industry, recreational mariners and researchers.

CMOS Arctic Special Interest Group Newsletter

The Canadian Meteorological and Oceanographic Society's Arctic Special Interest Group has published its first newsletter which is now available on the CMOS website (<http://cmos.ca/SIGs.html>).

Scholarship Supplement for Ocean Sciences

In 2006 CNC/SCOR established, in partnership with DFO and CMOS, a new NSERC Scholarship Supplement for Ocean Sciences in the amount of \$5,000/year to a deserving student for a period of two years. Only those students who had succeeded in winning an NSERC Postgraduate Scholarship or a Canada Graduate Scholarship were eligible. The initial award of \$5,000 was renewable for the second year provided that the student continued to hold the NSERC postgraduate scholarship.

Due to restrictions on usage of the current funding from DFO, the scholarship has been suspended and will not be available for the period 2013-2015 at which point it will be reviewed.

Supplément à une bourse pour les sciences de la mer

En 2006, le CNC/SCOR a établi, en partenariat avec le MPO et la SCMO, un nouveau supplément à la bourse du CRSNG pour les sciences océanographiques d'un montant de 5 000 \$ par année à un étudiant méritant pour une période de deux ans. Seuls étaient admissibles les étudiants ayant obtenu une bourse d'études supérieures du CRSNG ou une bourse d'études supérieures du Canada. Le supplément initial de 5 000 \$ était renouvelable pour la seconde année à condition que l'étudiant détenait encore la bourse d'études supérieures CRSNG.

En raison de nouvelles restrictions sur l'applications des fonds provenant du MPO, cette bourse n'existera pas pendant les années 2013-2015, période après laquelle nous espérons réexaminer la situation.

CANADIAN OCEAN SCIENCE NEWSLETTER

LE BULLETIN CANADIEN DES SCIENCES DE L'OCÉAN

Previous newsletters may be found on the CNC/SCOR web site.
Les bulletins antérieurs se retrouvent sur le site web du CNC/SCOR.

Newsletter #76 will be distributed on 16 May, 2014. Please send contributions to Michel Mitchell, michel.mitchell@dfo-mpo.gc.ca
Le Bulletin #76 sera distribué le 16 mai 2014. Veuillez faire parvenir vos contributions à michel.mitchell@dfo-mpo.gc.ca

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