



Scientific Committee on Oceanic Research

CANADIAN OCEAN SCIENCE NEWSLETTER LE BULLETIN CANADIEN DES SCIENCES DE L'OCÉAN

Newsletter Number 83, July 2015
Bulletin numéro 83, juillet 2015

Contents

OCEAN SCIENCE PROGRAMS	2
The Data Utilization and Applications Plan (DUAP) for the RADARSAT Constellation Mission	2
New SCOR Working Group Proposals	5
PERSONNEL.....	6
Timothy R. Parsons Medal (2015) / La médaille Timothy R. Parsons (2015)	6
CMOS Prizes in Ocean Sciences announced at the 2015 Annual Banquet / Prix en sciences de l'océan de la SCMO présentés au banquet annuel 2015.....	9
MEETINGS.....	10
MTS/IEEE Oceans '15 Conference, 19-22 October 2015, Washington DC	10
Sustainable Ocean Summit 2015 Singapore, 9-11 November 2015	10
CANADIAN JOBS and TRAINING.....	10
Research Scientist - Phytoplankton Ecologist	10
Chercheur - Écogiste du phytoplancton	11
GENERAL.....	11
Open Call for Applications to the SOLAS Scientific Steering Committee	11
The NSERC Ship Time Program / Programme de temps-navire du CRSNG	12
Ocean Innovation Centre to be Developed in Dartmouth Nova Scotia	12

OCEAN SCIENCE PROGRAMS

<p>This section of your newsletter provides an opportunity to highlight your research programs to the Ocean Science Community.</p> <p>Your are invited to send contributions to Michel Mitchell, michel.mitchell@dfo-mpo.gc.ca</p>	<p>Mettez en valeur vos programmes de recherche en publiant un article dans cette première section de votre bulletin.</p> <p>Faites parvenir vos contributions à Michel Mitchell, michel.mitchell@dfo-mpo.gc.ca</p>
---	--

The Data Utilization and Applications Plan (DUAP) for the RADARSAT Constellation Mission

Submitted by Dr. William Perrie, Bedford Institute of Oceanography, DFO (William.Perrie@dfo-mpo.gc.ca)

Following the success of the RADARSAT-1 & 2 missions , the Canadian Space Agency's RADARSAT Constellation Mission (RCM), planned for 2018, has objectives to provide greatly improved operational capability, and to add new applications. With three satellites, RCM will provide more frequent observations of Canada's territory and waters day and night under any weather conditions in support of national sovereignty and security, environmental monitoring, natural resources management and other government priorities. With daily coverage and fast revisit capability, RCM will significantly increase synthetic aperture radar (SAR) data acquisition, compared to current RADARSAT utilization by Government departments. The Data Utilization and Applications Plan (DUAP) is the framework to provide technical and financial assistance to federal departments in preparation for the new anticipated RCM capabilities. RADARSAT-1 gave 5000 images/year with data access via CDs, RADARSAT-2 gives 30,000 images/year, and RCM is expected to give possibly 300,000 images/ year.

One focus of DUAP is the project "Winds from SAR RCM Readiness Proposal" led by Environment Canada (EC), with DFO providing R & D support. The objective of this project is to *transition* the operational "National SAR Winds (NSW) Program" from RADARSAT-2 to RCM, to *integrate* the new capabilities offered by RCM, involving new radar beam modes, and higher geospatial coverage, and put new established wind speed algorithms into EC's operational production system. DFO is a supporting partner to this initiative, working with EC to *transitioning* DFO

CNC-SCOR

Members/ Membres

Céline Guégen (Trent)
Markus Kienast (Dalhousie)
Rob Macdonald – Past Chair (DFO-IOS)
Michel Mitchell – Secretary
Alfonso Mucci (McGill)
Paul Myers – Chair (U Alberta)
Ian Perry (DFO-PBS)
Paul Snelgrove (Memorial)
Bjorn Sundby (McGill)
Martin Taillefer (Maritime Way)
Len Zedel (Memorial)

Members Ex-Officio/ Membres d'office

Jody Klymak (IAPSO)
Keith Lennon (DFO-HQ)
Harinder Ahluwalia (CMOS)
Andrew Bell (CMOS)
Michael Scarratt (SOLAS)
Jean-Éric Tremblay (Québec-Océan)

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.

SAR-wind methodologies and models to the anticipated RCM data stream, *integrating* new RCM beam mode capabilities, and *optimizing* and *formatting* our SAR models, so that they can be specifically *implemented* within EC's NSW program.

For RADARSAT-2, recent studies show that the cross polarization synthetic aperture radar (SAR) data have promising ability for wind field monitoring, particularly for high-wind-speeds such as occur in hurricanes (Zhang and Perrie, 2012). The quad-polarization data allows a tremendous simplification in the wind retrieval model. For example, Figure 1a shows the family of curves that represent the normalized radar cross section (NRCS) as a function of wind speed from the *single – polarization data*. Not only are these curves a function of incidence angles, but they also saturate as winds reach about 30 m/s or so – that is they flatten out; for higher winds, NRCS starts to decrease, becoming double valued.

Moreover, Figure 1b shows the results for the cross-polarization data (HV); the relation is not only essentially independent of incidence angle, but it is almost linear. Thus, the retrieval model to get wind speed from NRCS; this is a simple linear relation to invert. And it does not appear to ‘saturate’ – that is, it does not appear to flatten out, or become double valued, for high winds.

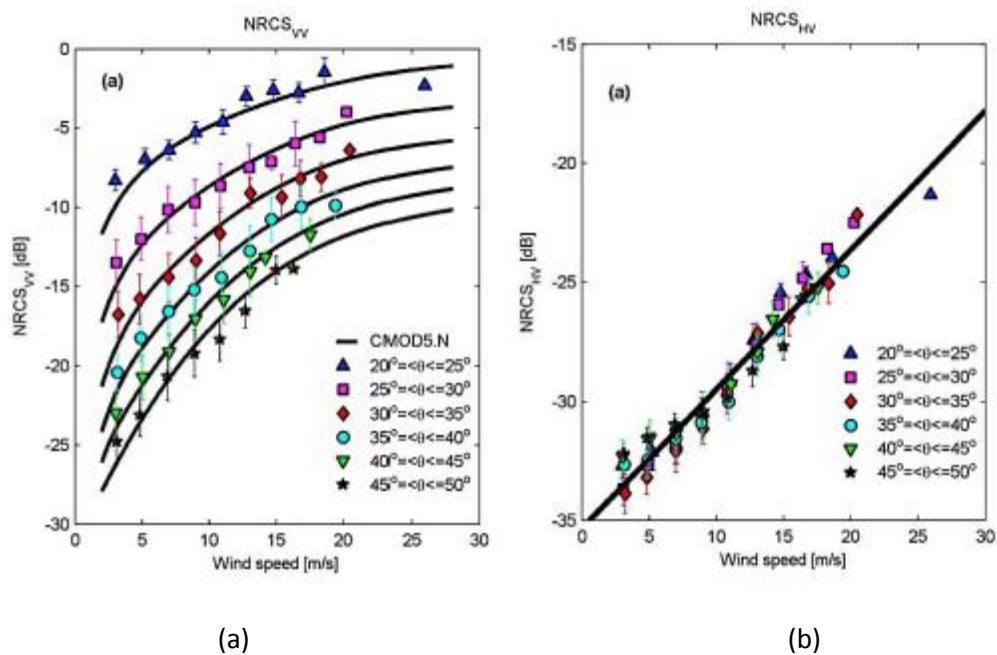


Figure 1. NRCS versus wind speed, for six 5° incidence angle bins between 20° and 50° for HH polarizations, as indicated. The black lines represent the CMOD5.N model for relating NRCS to wind speed, which is the previous state-of-the-art model for retrievals of wind speeds. Figure 1b is for HV polarization, and the black line is a linear fit with correlation coefficient 0.97. From Zhang et al. (2011).

More details are presented by Zhang and Perrie (2012). There, as a test of our wind retrieval model, we show images from hurricane Earl (2010). Not only do we present a better representation of the overall wind field for

Earl, but we verify that our wind retrieval method is better than the CMOD5.N model, in comparisons with high resolution aircraft data collected by stepped-frequency microwave radar (SFMR).

Moreover, analysis of the symmetry characteristics of the co- and cross- polarization channels respect to the wind direction, in comparison to NRCS for quad-polarization SAR images, allows determination of wind directions. Thus, fully polarimetric SAR measurements can provide high resolution vector ocean surface wind fields. An example is given in Figure 2.

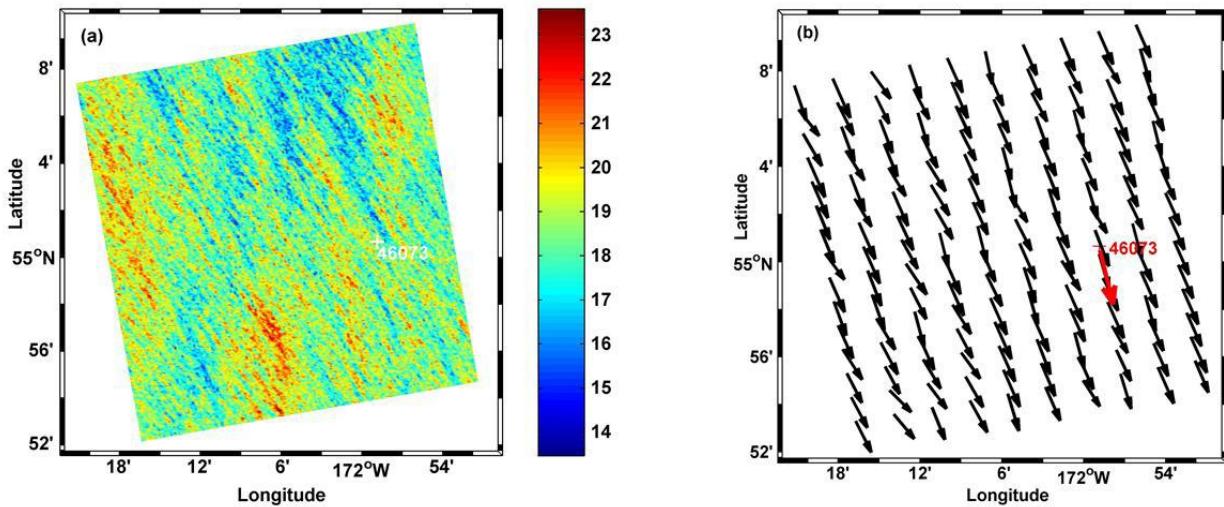


Figure 2. SAR-retrieved wind speeds from a VH-polarized SAR image without any external wind direction or radar incidence angle inputs, and (b) SAR-retrieved wind directions without ambiguities. From Zhang et al. (2012).

Motivated by these results dual-polarization (dual-pol) geophysical model functions (GMFs) were established by Shen et al. (2013). Similar to the quad-polarization results of Zhang and Perrie (2012), the results of Shen et al. (2013), are important because of their simplicity, and the ease with which winds can be inverted; they are simple functional relationships.

In the DUAP project on marine winds with EC, “Winds from SAR RCM Readiness Proposal”, DFO will first need to address the difference between dual-pol, quad-pol radar returns with respect to wind speed, and the necessity and methodology to *transition* present GMFs to new class of GMFs for new beam modes such as Compact Polarimetric (CP) images, available for RCM, for remote sensing of mesoscale wind processes, including severe storms such as hurricanes. This activity will involve an *evaluation* of new radar beam mode capabilities available from RCM.

Moreover, for compact polarized data, RCM enables 3 satellites working together, which means that the traditional SAR technical issue related to knowing wind directions *a priori*, before wind speed can be retrieved, could possibly be immediately solved. The new algorithm and SAR-wind model is to be deployed to retrieve wind vectors from RCM SAR directly.

A successful algorithm for wind retrieval, for RCM SAR, should have characteristics such as: *optimized* for efficient application, and *monotonic* increasing dependence on wind speed. We hope scatter will not be a

problem, particularly for high winds. Signal *saturation* can also be a problem; for quad-pol and dual-pol imagery, GMF formulations for high-wind-speed retrievals, for SAR imagery, for hurricanes, have not exhibited notable signal saturation or the speed ambiguity problems. These results are important for the potential future application of RCM SAR images for implementation of routine operational wind retrievals, in EC's NSW program.

References:

- Shen, H., Perrie, W., He, Y., and Liu, G., 2013: Wind Speed Retrieval From VH Dual-Polarization RADARSAT-2 SAR Images, *IEEE Transactions on Geoscience and Remote Sensing*. doi:10.1109/TGRS.2013.2293143
- Zhang, B. and W. Perrie, 2012: Cross-Polarized Synthetic Aperture Radar: A New Potential Measurement Technique for Hurricanes. *Bull. Amer. Meteorol. Soc.*, vol. 93, no. 4, pp. 531-541, Apr. 2012, DOI:10.1175/BAMS-D-11-00001.1.
- Zhang, B., W. Perrie, P. Vachon, X. Li, W. Pichel, J. Guo, and Y. He, 2012: Ocean vector winds retrieval from C-band fully polarimetric SAR measurements. *IEEE Trans. Geosci. & Remote Sensing*, 50, 4252 – 4261. doi:10.1109/TGRS.2012.2194157.
- Zhang, B., Perrie, W. and He, Y., 2011: Wind speed retrieval from RADARSAT-2 quad-polarization images using a new polarization ratio model. *J. Geophys. Res.*, 116, C08008, 13 pages, doi:10.1029/2010JC006522.

New SCOR Working Group Proposals

Ten working group proposals have been submitted to SCOR for review:

1. Towards a Global Comparison of Zooplankton Production: Measurement, Methodologies and Applications (ZooProd)
2. SEAmount Faunal vulnerability to impacts of Ocean Acidification and Mining (SEAFOAM)
3. BIOgeochemistry of COral REef systems (BIOCORE)
4. Changing Ocean Biological Systems (COBS): how will biota respond to a changing ocean?
5. A Functional Trait Perspective on the Biodiversity of Hydrothermal Vent Communities (FDvent)
6. Rheology, nano/micro-Fluidics and bioFouling in the Oceans (RheFFO)
7. Translation of Optical Measurements into particle Content, Aggregation & Transfer (TOMCAT)
8. Global Assessment of Nutrient Export Through Submarine Groundwater Discharge (NExT SGD)
9. International Quality Controlled Ocean Database: Subsurface temperature profiles (IQuOD)
10. The dynamic ecogeomorphic evolution of mangrove and salt marsh coastlines (DEMASCO)

The proposals can be accessed [here \(click\)](#). One or two of these will be funded at the Annual SCOR meeting in December. Comments from any interested scientist are welcomed: please send your comments to the CNC-SCOR committee (Paul Myers, pmyers@ualberta.ca, or Michel Mitchell, michel.mitchell@dfo-mpo.gc.ca.

PERSONNEL

Timothy R. Parsons Medal (2015) / La médaille Timothy R. Parsons (2015)

The Timothy R. Parsons Medal was established by Fisheries and Oceans Canada to recognize achievement in ocean sciences. It honours the outstanding contributions of Dr. Timothy R. Parsons to the field of ocean sciences.

La médaille Timothy R. Parsons a été créée par Pêches et Océans Canada afin de reconnaître les réalisations hors du commun dans le domaine de la recherche sur les océans. Elle rappelle l'excellence des contributions de Timothy R. Parsons au domaine de l'océanographie.

The recipient of the 2015 Timothy R. Parsons Medal is Dr. Christopher Harley for his work combining eco-physiological work in the laboratory with long-term monitoring and ecological experiments in the field to understand how various aspects of global change, alone and in combination, affect the ways in which species interact with one another and ultimately influence the distribution and abundance of marine plants and animals. The aspects of change he investigates include global warming, ocean acidification, and invasive species, which all threaten natural ecosystems and the benefits that they provide. Dr. Harley's work in establishing the importance of species interactions and multiple stressors in climate change effects on species and communities, and his mentorship of students was also recognized with this award.



Carmel Lowe (presenter), Christopher Harley with Zoe, Sam and Christina Harley

The award was presented by Carmel Lowe, Regional Director (Pacific), Science, Fisheries and Oceans Canada (DFO) at a luncheon during the CMOS congress in Whistler, BC. The citation is reproduced below.

Citation

Good afternoon honoured guests, ladies and gentlemen. Bonjour, chers invités, mesdames et messieurs.

I would like to begin by extending my sincere thanks to the Chair of the Local CMOS Committee, William Hsieh, and his team for organising today's event, as well as to the CMOS President Harinder

Ahluwalia. The first day and a half of the 2015 Congress has showcased exciting and important new research being done in oceanography and I extend my best wishes for an equally interesting and successful remainder of the Congress.

Further, I wish to thank all of you for making the time to be here today to join me in acknowledging the accomplishments of an outstanding scientist who has contributed much to the field of ocean science.

I am aware that many of you in the audience know of Dr. Parsons, for whom the award is named. For those who do not know his work, perhaps some of you that are just beginning your career, let me take a moment to introduce you to Timothy Parsons who today is enjoying a well-deserved, but very busy, retirement. Dr. Parsons had a distinguished career as a researcher with the Fisheries Research Board of Canada, as a university professor, a mentor, and a broadly-read author. Throughout his career, he adopted a holistic approach to ocean ecology, and in particular, to understanding how pelagic organisms are interconnected in the oceanic food-web. He is regarded around the world as a major contributor to the development of biological oceanography and is personally responsible for many of the standard analysis methods used in the field.

The Parsons Award is presented annually and all applicants are evaluated, by a committee of their peers, on the basis of these five criteria:

- *Significant contributions to multidisciplinary ocean sciences*
- *Contribution of significant ideas*
- *Impact of significant publications*
- *Leadership through teaching / mentoring; and*
- *Program, disciplinary and interdisciplinary leadership activities*

In addition the candidates are evaluated for:

- *Distinguished accomplishments in multidisciplinary facets of ocean sciences while working for Canadian Institutions or for the benefit of Canadian Science; and*
- *Excellence during the lifetime of the recipient or for a recent outstanding achievement, both being equally eligible.*

I would now like to introduce to you, the recipient of this year's award. This year's winner was nominated both for his research and for his exceptional mentoring of interdisciplinary scientists which together have made significant contribution to the field of ocean science. Distinguished guest, Ladies and Gentlemen, it gives me great pleasure to introduce to you the 2015 recipient of the Timothy R. Parsons Medal, Dr. Christopher Harley.

Dr. Harley received his B.Sc. degree in Aquatic Biology from Brown University and his Ph.D. in Zoology from the University of Washington. After post-doctoral positions at Stanford and at University of California, Davis, he came to UBC as a Professor, where he runs the Harley Lab, which focuses on coastal marine ecology and the impacts of climate change.

The Adjudication Committee noted that Dr. Harley's work combines eco-physiological work in the laboratory with long-term monitoring and ecological experiments in the field to understand how various aspects of global change, alone and in combination, affect the ways in which species interact with one another and ultimately influence the distribution and abundance of marine plants and animals. The aspects of change he investigates include global warming, ocean acidification, and invasive species, which all threaten natural ecosystems and the benefits that they provide. The Adjudication Committee also cited Dr. Harley for his work in establishing the importance of species interactions and multiple stressors in climate change effects on species and communities, and his mentorship of students.

Letters of support for Dr. Harley's nomination cited many examples of his important contributions, but I would like to highlight a few:

- *His research is ground-breaking in that it scales up from the direct physiological and behavioural impacts of climate change on individual organisms to the indirect effects mediated by altered trophic and disease interactions between species.*
- *Climate change affects not only ocean temperature, but also acidity, dissolved CO₂, wave strength and salinity (via altered freshwater discharge). Dr. Harley has studied not only the effects of each of these stressors individually, but also in combination. In a landmark study (Harley and Paine 2009), he has shown that the chance alignment of multiple stressors can cause abrupt change to marine populations, even though each stressor individually predicts only gradual change. Detection of such multiple-stressors thresholds is challenging, but Dr. Harley and colleagues have developed robust models for their prediction and detection.*
- *Dr. Harley complements his experimental work with long-term and regional datasets, providing unique insights that elude either method in isolation.*
- *The biological effects of ocean acidification (OA) are much less understood than warming effects. Dr. Harley's lab is conducting ground-breaking research here, such as the first study of OA impacts on fertilization under realistic conditions and one of the first studies to document potential adaptive responses to OA*

On behalf of Fisheries and Oceans Canada, it gives me great pleasure to present him with the Timothy R. Parsons award for excellence in multidisciplinary ocean sciences.

CMOS Prizes in Ocean Sciences announced at the 2015 Annual Banquet / Prix en sciences de l'océan de la SCMO présentés au banquet annuel 2015

J.P. Tully Medal in Oceanography / Médaille de J.P. Tully en océanographie: Ann Gargett

The J.P. Tully Medal in Oceanography is awarded each year to any person whose scientific contributions have had a significant impact on Canadian oceanography.

Dr. Ann Gargett (Institute of Ocean Sciences) is the 2014 recipient for her pioneering research on the turbulence and microstructure in the oceans.



Harinder Ahluwalia (presenter)
and Ann Gargett

La Médaille J.P. Tully en océanographie est décerné chaque année à quiconque dont la contribution scientifique dans le domaine de l'océanographie canadienne a été jugée exceptionnelle.

Dr. Ann Gargett (Institut des sciences de la mer) est la récipiendaire de la médaille de 2014 pour sa recherche de pointe en turbulence et microstructure dans les océans.

ASL Environmental Sciences Best Student Poster Prize in Oceanography / Prix ASL Environmental Science de la meilleure affiche d'étudiant(e) en océanographie

The prize was awarded to Tara Howatt, McGill University, for her poster entitled: Examining transport of freshwater across the Labrador shelf-break using gliders



Harinder Ahluwalia, Tara Howatt and
David Fissel (presenter)

MEETINGS

MTS/IEEE Oceans '15 Conference, 19-22 October 2015, Washington DC.

Once again, the OCEANS North America conference and exposition returns to the exciting and historic Washington, DC area, bringing together scientists, engineers, educators, industry leaders and policy makers. Four days in October 2015 will be packed with technical presentations, tutorials, workshops, networking opportunities and an exhibition highlighting state-of-the-art developments in technologies related to exploring, monitoring, protecting, and wisely using the world's ocean resources. Over 2,500 attendees, with a broad international representation, are expected.

Registration is now open. For more details please visit www.oceans15mtsieewashington.org.

Sustainable Ocean Summit 2015 Singapore, 9-11 November 2015

"Sustainable Development and Growing the Blue Economy - the Next 50 Years"

The Sustainable Ocean Summit (SOS) is the only global, multi-sectoral platform for leadership companies and organizations to advance the development and implementation of industry-driven solutions to ocean sustainability challenges. With Singapore celebrating its 50th anniversary in 2015 and continuing to advance its significant role in the global maritime economy, SOS 2015 will bring together the diverse ocean business community to plan for the next 50 years of Blue Growth, a sustainable ocean economy and responsible ocean business opportunities.

For more information please visit www.oceanCouncil.org/site/summit_2015

CANADIAN JOBS and TRAINING

Research Scientist - Phytoplankton Ecologist

Ocean and Ecosystem Sciences Division of Fisheries and Oceans Canada, Maritimes Region requires a biological oceanographer to examine planktonic primary producers and lower trophic level production in the Northwest Atlantic Ocean for the purpose of developing an understanding of their impact on Canada's marine resources and coastal communities. This scientist will be a key team member in long-term DFO monitoring programs which include the Atlantic Zone Monitoring Program (AZMP), the Atlantic Zone Off-shelf Monitoring Program (AZOMP) and the Bedford Basin Monitoring Program (BBMP). This scientist will collaborate with experts in other regions and elsewhere as necessary and expedient. The challenge is to develop scientific theories, novel techniques, or integrated approaches representing an advance in phytoplankton ecology/microbial oceanography, which demonstrates innovation as well as solution-oriented science. This scientist will be expected to engage clients to develop questions which support decision-making and policy development.

For more information and please visit the **Jobs.gc.ca** web site ([click here](#)). The closing date is 31 July.

Chercheur - Écogiste du phytoplancton

La Division des sciences de l'océan et des écosystèmes de Pêches et Océans Canada, région des Maritimes, recherche un océanographe biologique afin d'examiner les producteurs primaires de phytoplancton et la production au niveau trophique inférieur dans l'Atlantique Nord-Ouest dans le but d'acquérir une compréhension de leur influence sur les ressources maritimes et les collectivités côtières du Canada. Ce scientifique sera un membre clé de l'équipe des programmes de surveillance à long terme du MPO, ce qui comprend le Programme de monitorage de la zone Atlantique (PMZA), le Programme de monitorage de la zone Atlantique au large du plateau continental (PMZAO) et le programme de surveillance du bassin de Bedford (BBMP). Il collaborera avec des experts d'autres régions et ailleurs, au besoin et si c'est opportun. Le défi consistera à élaborer des théories scientifiques, de nouvelles techniques ou des approches intégrées, ce qui représentera une avancée dans l'écologie du phytoplancton ou l'océanographie microbienne, faisant preuve d'innovation et de solution à vocation scientifique. Il devra mobiliser les clients afin de formuler des questions qui appuient la prise de décisions et l'élaboration de politiques.

Pour en savoir plus, consultez le site **Emplois.gc.ca** ([cliquez ici](#)). La date limite est le 31 juillet.

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

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

GENERAL

Open Call for Applications to the SOLAS Scientific Steering Committee

SOLAS is calling for applications from scientists to serve on its Scientific Steering Committee (SSC) from January 2016. SOLAS is looking for scientific excellence and a high level of commitment towards SOLAS goals, but is also seeking to achieve a balance of expertise, nationalities, gender and career stages across its SSC.

The SSC provides the overall scientific guidance on all aspects of SOLAS activities. It functions as the central decision-making body for SOLAS and sets the scientific direction and priorities of the project. The SSC is supported by the SOLAS International Project Office in its tasks. Members are appointed for a 3-year term, renewable once and meet in person at least once per year. More info is available [here \(click\)](#).

SOLAS encourages suitable and highly motivated scientists to be nominated or apply themselves directly. Please [click here](#) to read the minimum qualifications required and instructions on how to apply (in case of self-nomination) or to nominate.

The deadline for applications is **31 July 2015**.

The NSERC Ship Time Program / Programme de temps-navire du CRSNG

The [Ship Time Program](#) allows those holding an NSERC [Discovery Grant](#) to apply for additional funds to access vessels in support of their research programs. The deadline for applications is 1 September. For more information and the application procedure please [click here](#).

Le Programme de temps-navire permet aux chercheurs qui sont titulaires d'une [subvention à la découverte](#) du CRSNG de demander des fonds supplémentaires pour avoir accès à des navires dans le cadre de leurs programmes de recherche. La date limite pour faire une demande est le 1^{er} septembre. Pour plus de détails consulter le site web ([cliquez ici](#)).

Ocean Innovation Centre to be Developed in Dartmouth Nova Scotia

In a positive development for the ocean-related industry in Nova Scotia, the former Canadian Coast Base on the Dartmouth waterfront will be home to an ocean innovation centre.

The Nova Scotia provincial crown corporation **Waterfront Development** has received approval from the Nova Scotia government to purchase a 9.5-acre site on the Dartmouth waterfront from the federal government. The \$6.5 million plot used to belong to the Canadian Coast Guard before the organization moved to its current base of operations to the Bedford Institute of Oceanography. Today, this land is home to several buildings, two 100-metre piers and more than 850 metres of wharf, all of which make it the perfect site for ocean technology researchers and private-sector marine businesses to set up shop.

The crown corporation will work with the provincial government, industry and post-secondary schools to develop the centre, where ocean technology research and private sector marine businesses can work together to drive more investment, commercialization, exports and growth.

To read more, please [click here](#).

CANADIAN OCEAN SCIENCE NEWSLETTER LE BULLETIN CANADIEN DES SCIENCES DE L'OCÉAN

Previous newsletters may be found on the CNC/SCOR web site.

Newsletter #84 will be distributed in September 2015.

Please send contributions to Michel Mitchell,
michel.mitchell@dfo-mpo.gc.ca

If you wish to subscribe to this newsletter, please send an email to listserv@lists.mcgill.ca with the following message:

SUBSCRIBE OCEAN-NEWSLETTER

If you wish to cancel your subscription, please send an email to listserv@lists.mcgill.ca with the following message:

SIGNOFF OCEAN-NEWSLETTER

Les bulletins antérieurs se retrouvent sur le site web du CNC/SCOR.

Le Bulletin #84 sera distribué en septembre 2015.

Veuillez faire parvenir vos contributions à Michel Mitchell,
michel.mitchell@dfo-mpo.gc.ca

Si vous désirez vous abonner à bulletin, veuillez envoyer un
courriel à listserv@lists.mcgill.ca avec le message suivant:

SUBSCRIBE OCEAN-NEWSLETTER

Si vous désirez annuler votre abonnement, veuillez envoyer un
courriel à listserv@lists.mcgill.ca avec le message suivant:

SIGNOFF OCEAN-NEWSLETTER

WWW.CNCSCOR.CA