

**CANADIAN OCEAN SCIENCE NEWSLETTER  
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## OCEAN SCIENCE PROGRAMS

### What I Want to Do in Canada – Doug Wallace

*Submitted by Doug Wallace, CERC Chair in Ocean Science & Technology, Dalhousie University*

It is an enormous privilege and opportunity to be awarded one of these Canada Excellence Research Chairs and at the same time I am aware of the responsibility conveyed. The responsibility is of course to Canadian taxpayers and requires that I make a positive difference to the scientific landscape in Canada, and through science help to increase knowledge and contribute to well-being and security. I also have a responsibility to the team at Dalhousie who put the initial proposal together and who worked with me on the 2<sup>nd</sup> round proposal. Of course I hope that the considerable funding, and my own work, can benefit not only my colleagues at Dalhousie but the broader marine science community in Canada. Given that much of my work will, initially, have a focus on the North Atlantic, I am keen to establish close contacts and joint projects with other investigators and institutions in eastern Canada, including Newfoundland.

The premises and context for what I plan to investigate are as follows:

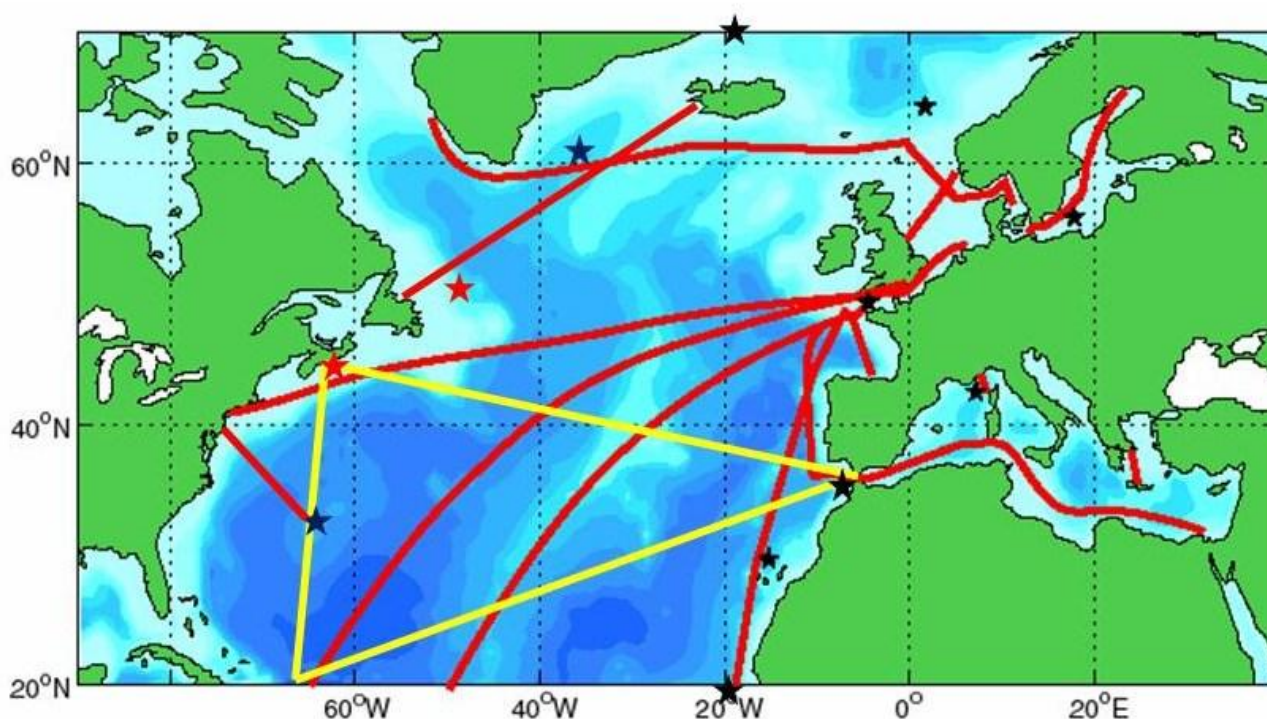
- (1) Humans, including Canadians, are exerting unprecedented pressures on the ocean, globally;
- (2) Canada's three oceans are subject to local pressures, impacts and threats. However increasingly Canada's waters are impacted by these growing global pressures.
- (3) As a developed country, with a strong scientific base, Canada has the scientific capacity to measure, understand and predict impacts on its three oceans. With a solid scientific foundation based on state-of-the-art observations and models, Canadian society can adapt, or set policy, to mitigate impacts.
- (4) As a developed country, Canada can contribute to international scientific endeavors to study and protect the world's oceans. Canada can, especially, work with developing countries to improve their scientific and technological capacity to assess threats from the ocean and deal with them. This will be of mutual benefit.

### Scientific Program

My own personal research program will have a strong focus on in-situ measurement, particularly with respect to the ocean's carbon and nitrogen cycles. However I recognize that it is essential to more closely integrate measurement-based and modeling approaches for the investigation of oceanic change.

*Carbon:* The problem of the oceanic uptake of CO<sub>2</sub> is of obvious significance because of its impact on future climate forcing and the forcing of ocean acidification. However it is recognized increasingly that international and national efforts to reduce CO<sub>2</sub> buildup in the atmosphere require an assessment capability. This should be capable of allocating short-term changes in the atmospheric growth rate of CO<sub>2</sub> to the effectiveness of policies related to emission control or deliberate carbon sequestration versus changes which involve more "natural" components of the carbon cycle such as terrestrial biosphere changes or changes in ocean uptake. Measurement-based estimates of the air-sea flux of CO<sub>2</sub>, coupled with extrapolation/interpolation using data assimilation methods, can play a key role for such assessments.

Within Europe, a common approach for characterizing terrestrial, atmospheric and oceanic carbon reservoirs is being established under a large infrastructure program called the Integrated Carbon Observing System or ICOS. The oceanic component of ICOS will include a mix of carbon measurements from Volunteer Observing Ships (VOS) and time-series measurements made at fixed-location ocean observatories. I will initiate measurements of surface and atmospheric pCO<sub>2</sub> on a VOS line in the North Atlantic that can complement the European lines and help to define the size and variability of the basin-scale CO<sub>2</sub> sink. I will also work with colleagues across Canada to explore whether a network of coordinated carbon observations (including ocean, atmosphere and terrestrial) similar to ICOS can be established in Canada and linked to related US and European initiatives.



Map illustrating the Volunteer Observing Ship routes (*red lines*) and ocean observatories (*black/blue stars*) on which surface and atmospheric pCO<sub>2</sub> will be measured in the North Atlantic by ICOS investigators and by collaborators in the USA and Bermuda. Intended measurement locations for my own group as well as those of close collaborators in Halifax (Helmuth Thomas; Kumiko Azetsu-Scott) are denoted by the yellow lines and the red stars.

*Nitrogen:* The nitrogen cycle of the Northern Hemisphere ocean is also subject to major anthropogenic disturbance. Nitrogen deposition to open ocean areas is of growing importance, and is superimposed on ongoing massive changes to coastal nitrogen cycling due to riverine and groundwater inputs. Climatic influences on nitrogen cycling are also possible, for example via changes to factors limiting oceanic nitrogen fixation (e.g. iron supply) or changes in oceanic oxygen. The cycling of nitrogen in the oceans is important, complex and poorly understood. This is evidenced by regular fundamental discoveries (e.g. discovery of new metabolisms), and by the fact that measurements of rates and pools are the subject of continual methodological advance and refinement (e.g. applications of molecular biology, mass and optical spectroscopy). My approach to this will be to work with colleagues to measure, systematically, the spatial and temporal distributions of key nitrogen pools,

as well as characteristics of key organisms responsible for nitrogen cycling. In the context of the spatial-temporal measurements, we will conduct short-term manipulative experiments (e.g. bioassays) to investigate factors underlying these distributions and measure metabolic rates. I am convinced that the joint analysis of distributions (based on abundant data) and experiments will lead to major new understanding of both nitrogen cycling and its sensitivity to change.

This work will be conducted primarily by establishing measurements along surface transects of research vessels covering large geographical distances, and therefore sampling across a wide variety of oceanic regimes. Given that ocean transit voyages by Canadian research vessels are rare, I will construct a suite of self-contained, containerized laboratories that can be deployed rapidly to take advantage of “cruises of opportunity” such as the seasonal repositioning of polar research vessels. Ideally, the work should also be conducted at ocean observatories where a temporal context for the measurements and experiments can be established.

### **Opportunities and some Concerns**

The Chair offers a set of amazing possibilities and I am very much looking forward to returning to Canada after 22 years absence. Inevitably I also have a few reservations and regrets about leaving Germany, and the IFM-GEOMAR in Kiel, as well as the astonishingly integrated European research environment where I have worked for the past 12 years. On viewing the Canadian marine research scene from afar, there are a couple of issues I am keen to discuss with my new colleagues.

*Infrastructure:* Of some concern to me is the situation with respect to infrastructure for the support of ocean-going science. Germany presently operates four modern research vessels capable of working in the distant open ocean including Arctic and Antarctic waters (*Meteor*, *Merian*, *Sonne* and *Polarstern*). This is despite the fact that Germany “owns” only a minimal amount of oceanic real estate (all of it bordering shallow, marginal seas). There is a national plan for fleet use and replacement which is the subject of national and international peer-review. There are well-established mechanisms regulating access of researchers from both academia and government research institutions to the fleet. The corresponding situation in Canada looks problematic to me, and if this concern is valid and shared, I would be eager to initiate a dialogue concerning ways to improve the situation with respect to research vessel infrastructure, financing, access, etc.

Also relating to research infrastructure: there are interesting Europe-wide discussions and projects underway aimed at establishing, coordinating and “harmonizing” ocean observing capability (e.g. ocean observatories). I would be interested to work with the broader community involved in ocean observations in Canada’s three oceans to explore whether a national strategy can be developed. Such a plan would need to recognize that “one size does not need to fit all”, that there are differing needs as well as different opportunities across Canada’s Pacific, Arctic and Atlantic sectors. Any such planning should ideally have very close involvement of the private sector as there are a range of potential partnerships and opportunities that can be of mutual benefit. However a national dialogue and strategy concerning such capability seems timely given developments in the USA and Europe and the strong technological advances and capabilities within Canada. This dialog should, from the beginning, involve Canada’s very strong Earth System and regional ocean modeling communities so that observation and modeling communities can continue to mutually inform each other.

*Internationalization.* Canada has an impressive cadre of internationally-renowned researchers working on the marine environment and I am very much looking forward to joining the group (many of whom I already know well). Given this, it may be worth working together to promote new ways in which this community can benefit from, and contribute to, international marine science. Issues such as CO<sub>2</sub> uptake, nitrogen cycle and productivity changes, climate change, exploitation of fish resources, development of oil and gas in deepwater, tsunami hazards, threats to biodiversity, changes in the Arctic, and other ocean-related issues of importance to Canada are also of concern to a wide range of other nations. There are several issues that Canadian scientists and policy-makers have addressed in the past, including issues relating to ocean pollution and preservation of fish stocks and biodiversity, which are of immense importance to some developing countries where expertise is still lacking. Here, Canadian expertise and technology could be of especial benefit given the right funding opportunities. As examples, there are likely to be numerous developing countries interested in applications of Canada's Ocean Tracking and undersea vehicle technology.

There are many existing and excellent examples of how Canadian expertise has been linked to international teams investigating the Pacific, Atlantic and Arctic Oceans. Nevertheless, I believe international linkages could be strengthened and that Canadian ocean-related research could become even more international. Facilitating ties to major European research programs via the establishment of joint funding opportunities would be one obvious possibility to explore. Broader international networking would, I believe, create new opportunities to demonstrate and market Canada's excellent marine technology and expertise.

### **IMBER picking up from GLOBEC**

IMBER (Integrated Marine Biogeochemistry and Ecosystem Research) has picked up two initiatives that would otherwise have become orphaned when GLOBEC ended last March. These programmes, Ecosystem Studies of Sub-Arctic Seas (ESSAS) and Climate Impacts on Top Oceanic Predators (CLIOTOP), already have a legacy of important science results and are at a mid-point in their science activities. Both programmes are revising their science goals and objectives to fit within those of IMBER. Also carrying on is the Integrating Climate and Ecosystem Dynamics (ICED) programme, which IMBER developed for the southern ocean in collaboration with GLOBEC.

Alida Bundy (DFO-BIO) is the co-chair of a new IMBER working group on Human Dimensions. The general goals will be to promote understanding of the multiple feedbacks between human and open ocean systems, and to clarify what human institutions can do, either to mitigate human-caused perturbations in the ocean systems, or to adapt to system changes; specific objectives will be developed over the next few months. The group is presently being formed with a first meeting planned for early 2011. Comments, interest and ideas are welcome ([click](#)).

### **New Google Earth Layer for Argo floats**

There's a new kml file for locating Argo floats in Google Earth ([click](#) – requires Google Earth to be installed). The tool loads the last reported location. Three layers are available: active floats, inactive floats, and planned releases. Clicking on a float's location provides statistics on the number of successful profiles it has made, its launch date and location, and the responsible agency. The trajectory of individual floats can be displayed. Additional information, such as whether the float has an oxygen probe, is also available.

## Census of Marine Life Report Released

The Census of Marine Life (CoML) released its final report this month ([click](#)). Begun in 2000 and supported by a combination of private and public funding, CoML was built on more than 540 expeditions to all parts of the global ocean to learn more about the diversity, abundance and distribution of marine organisms.

The Census encountered an unanticipated riot of species, the currency of diversity, for which Australia's National Geographic website shows a small collection of beautiful photos ([click](#)). CoML upped the estimate of known marine species from about 230,000 to nearly 250,000. Among the millions of specimens collected in both familiar and seldom-explored waters, the Census found more than 6,000 potentially new species and completed formal descriptions of more than 1,200 of them. The expeditions commonly encountered rare species.

With its digital archive of almost 30 million observations, the Census has compiled the most extensive regional and global comparisons of marine species diversity. It has helped create the first comprehensive list of the known marine species, already passing 190,000 in September 2010, and helped compose Web pages for more than 80,000 of them in the Encyclopedia of Life ([click](#)).

Although CoML has formally ended, the program leaves important legacies in knowledge, technology and collaboration, including the extensive database. More than 2,600 papers have been published, many freely accessible online. Participants created and used the latest in technology to push observational capabilities to new areas. The Census brought scientists with different interests from different nations together to use standard protocols for sampling marine life from the deep sea to the near shore, to speed the adoption of good techniques, to build capacity economically, and to jump start initiatives in marine research. It strengthened partnerships of scholars in the humanities and natural and social sciences to use archival research to build the picture of life in oceans past and assess changing diversity, distribution, and abundance.

One Canadian CoML study by Boris Worm and Heike Lotze at Dalhousie University looked at historical records to see how life in the ocean has changed over time. They studied catches, sightings and even restaurant menus and photographs of family fishing trips to see how the population of large fish species, marine mammals and birds have changed, as well as archaeological finds and historical records that show what people were hunting and eating. This study of around 100 species, including sharks, seals and cod, showed that, on average, numbers of large marine animals have declined by 89% since records began, and that individuals being caught now are smaller than in the past.

## PERSONNEL

### Jean-Claude Brêthes

L'Université du Québec à Rimouski a annoncée ce mois qu'elle se voit accorder une Chaire UNESCO dans le secteur des sciences de la mer. « Au Canada, c'est la première fois qu'une Chaire UNESCO voit le jour dans le domaine des milieux marins, » a affirmé le recteur de l'UQAR, Michel Ringuet. « Nous sommes très fiers de cette réussite. Il s'agit d'un atout de plus pour illustrer la vocation maritime de la région. »



Cette Chaire portera sur l'« Analyse intégrée des systèmes marins ». Elle fera appel aux spécialistes en océanographie et en gestion des ressources maritimes. Le premier titulaire de la Chaire sera M. **Jean-Claude Brêthes**, chercheur à l'Institut des sciences de la mer de Rimouski (ISMER-UQAR).

« La Chaire que nous avons proposée, » a expliqué M. Brêthes, « répond aux priorités de l'UNESCO et de sa Commission océanographique intergouvernementale (COI) dans la protection de la biodiversité et de l'environnement marins. Notre objectif est d'appuyer, par la formation et la recherche, la mise en place de politiques pertinentes qui permettront de renforcer les capacités dans l'analyse des systèmes marins et de leur fonctionnement. »



*Lors du lancement de la Chaire, le député Patrick Huot (adjoint parlementaire au ministre du développement durable du Québec), le recteur Michel Ringuet, le titulaire de la chaire Jean-Claude Brêthes et Mme Ariane Plourde, de Pêches et Océans Canada, ont pris la parole.*

## MEETINGS

### **Katja Fennel and Roger François to be CNC-SCOR's 2010/11 Tour Speakers**

The CNC-SCOR tour speaker going east this year will be Roger François, from UBC. The title of Roger's talk is *Sediment 231Pa/230Th as a recorder of the rate of the Atlantic meridional overturning circulation: Insights from a 2-D model*; timing will be in the window Nov 20 – Dec. 1, with the itinerary currently being assembled.

The CNC-SCOR tour speaker going west will be Katja Fennel, from Dalhousie. She will be talking about coastal geochemistry and modelling between Nov. 29 and Dec. 6. Again, her itinerary is in preparation.

Please watch for further announcements.

## JOBS & TRAINING

### **Remote Sensing Scientist/Manager**

An internationally recognized environmental sciences organization seeks a remote sensing scientist/manager to provide a broad spectrum of specialized consulting services to an international client base. Due to growth the organization is seeking to appoint a suitably qualified and experienced professional to play an integral role in client project management, the implementation of new applications, and the development of new markets. Use your PhD and 10 years experience to advance in this progressive environment, offering excellent scope for

personal growth and career advancement. [Click here](#) to learn more, using the password **remotesensing** to access the details.

### **M.Sc. and Ph.D. Bursaries at U. Capetown**

Cape Town and South Africa are among the most exciting locations in the world for marine and climate research, situated at the southern tip of Africa with ready access to the South Atlantic, Indian and Southern Oceans. As part of the expansion of interdisciplinary marine research and earth system science in South Africa, The Marine Research Institute at the University of Capetown is investing in some 15 M.Sc. and Ph.D. bursaries in study areas that focus on global change (including climate change and variability), with a strong marine emphasis and an interdisciplinary scope. The bursaries range from \$8,900 to over \$13,000 per year. The application deadline is October 31, and further information is available here ([click](#)).

### **Centre of Excellence Student Training in Observational Oceanography**

Applications are open for a 10-month student training program in Bermuda beginning in August, 2011. Training will be funded by the Nippon Foundation-POGO Centre of Excellence in Observational Oceanography, which will cover the travel and living expenses of selected candidates. The syllabus focuses on observational oceanography and core scientific skills and includes time at sea ([click](#)).

The course is aimed primarily at applicants from developing countries, but strongly-motivated applications from those in developed countries will also be considered. In order to promote networking around the world ocean, we anticipate accepting about eight students from developing countries and two from developed countries including Japan. Trainees must have at least a first degree in science. The application deadline is November 20<sup>th</sup>.

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

## **GENERAL**

### **The Maury Project**



The Maury Project promotes understanding of the physical foundations of oceanography through training offered to school teachers. In 2010, CNC-SCOR and CMOS jointly sponsored a Canadian teacher to attend a two-week summer workshop at the US Naval Academy in Annapolis, Maryland. The successful applicant was Grant Badgero, from the Kalamalka Secondary School, in Coldstream, BC.

The workshop included a wide range of topics: a) information on Earth's individual



oceans; b) currents (wind-driven and  
*photo: Grant Badgero*

density-driven); c) waves (shallow and deep water); d) tides; e) coastal upwelling; f) El Niño and La Niña; g) satellite remote sensing of the sea level; and h) ocean sound. Material was covered extensively on-site (classroom and lab) and off-site. Off-site activities included tours of the National Oceanic and Atmospheric Administration's (NOAA) Science Center and research library, the National Centers for Environmental Prediction, the National Ice Center, along with a "hands-on" beach study and a research cruise on a naval vessel (using oceanographic instruments).

Mr. Badgero reports that he'll be able to use his new knowledge in parts of several high-school science classes and that he's gained access to an excellent network of like-minded teachers and instructors.

### **Arctic Ice Extent Continues to Trend Downwards**

The melt season for Arctic sea ice came to an end around September 19<sup>th</sup> this year. The 4.6 million km<sup>2</sup> minimum extent was the third lowest recorded ([click](#)). Comparing the 2010 seasonal minimum to 2007, the National Sea Ice Data Center reported less ice in the northern Beaufort Sea region this year, in the East Greenland Sea and in the western Laptev Sea. However, there was much more ice in the East Siberian Sea in 2010 compared to 2007.

Satellite imagery for September 18-20 showed only trace quantities of multi-year ice in the Northwest Passage ([click](#)) and in the Northeast Passage by September 13 ([click](#)). Though the National Ice Center was careful to point out that some multi-year ice might have been obscured from its analysis, two sailing yachts had almost completed a counter-clockwise circumnavigation of the North Pole in a single season by the end of September ([click](#)), departing from and returning to Norway. Another expedition with a bit more horsepower, cruised from St. John's, NF to Pauluktuk, NWT in 21 days starting in mid-August, including a complete transit of the Northwest Passage from east to west ([click](#)).

At the other end of the planet, Antarctic sea ice has recently been increasing in extent ([click](#)). Model simulations have suggested that the increase is related to the ozone hole over the Antarctic through the latter's effects on atmospheric circulation during the austral summer, but it's still unclear why sea ice trends in the northern and southern hemispheres are different.

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

Newsletter #54 will be distributed on December 8, 2010. Please send contributions to Bob Wilson, [wilson@telus.net](mailto:wilson@telus.net)  
Bulletin #54 sera distribué le 8 décembre 2010. Veuillez faire parvenir vos contributions à Bob Wilson, [wilson@telus.net](mailto:wilson@telus.net)

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