

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

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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.

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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.

Using ocean gliders to define whale habitat use of offshore waters of west coast Vancouver Island

Rianna Burnham

Whale Research Lab, Department of Geography, University of Victoria

Whales and dolphins use acoustics as their primary means for environmental imaging, navigation, and communication. Way-finding and foraging rely both on acoustics and other cues, for example, oceanographic conditions at the sub-meso, meso and macro scales to locate prey aggregations, and then more fine scale techniques are used to successfully feed. These assumptions underpin the work of the MEOPAR-funded Whale Habitat and Listening Experiment (WHaLE), a partnership between researchers from Dalhousie University, the University of Victoria (UVIC, P.I. D. Duffus), University of British Columbia (UBC, P.I. S. Waterman), Ocean Tracking Network (OTN), Ocean Networks Canada (ONC), Department of Fisheries and Oceans (DFO, P.I. T. Ross), JASCO Applied Sciences, Woods Hole Oceanographic Institute (WHOI), among others, to protect whales by mapping presence and abundance of species, defining important habitats in Canadian waters, and mitigating disruption from anthropogenic activity. We use a combination of bottom moored hydrophones and autonomous mobile acoustic and oceanographic data platforms to refine our understanding of whale spatial use, seasonality, and those variables that together describe habitat quality. The AUVs in particular are being used to survey remote offshore areas, allowing us to connect coastal and open-ocean systems.

Whale populations and distribution was much disturbed by prolific commercial whaling throughout the north Pacific. Although some populations have shown recovery, for others we have little evidence of recruitment or recolonization. For example, the sei whale, once the most abundant baleen whale species in Pacific Canadian waters, has had only a handful of possible sightings since the cessation of whaling in the late 1960s.

Little is known about the populations and habitat use of large whales on the west coast of British Columbia and much needed surveys are expensive and often weather limited. Our solution is to use autonomous ocean gliders to capture habitat features, and integrate oceanographic data, prey conditions, and whale presence, to create a picture of whale distribution patterns and ecology in the open ocean. This opens up the possibility to study remote and previously unexplored locales. Our team's gliders are buoyancy-driven autonomous underwater vehicles (AUV), which move at approximately 1km/hr to profile the water column as they descend and ascend in a see-saw motion. The glider periodically surfaces on a pre-programmed schedule to relay its position as well as sensor and diagnostic data.



Figure 1: Glider deployment from March 2016 (L) and February 2017 (R). The DMON is visible protruding ahead of the nose of the glider (Photo credit: Whale Lab, Uvic).

Spring 2016 saw our initial deployment on the BC coast. We deployed a single glider instrumented with a low-frequency (>1000 Hz) digital acoustic monitoring device (DMON, WHOI), as well as a CTD, and high frequency echosounder (Figure 1). The glider was tasked to explore the continental shelf and shelf break waters off Clayoquot Sound, west coast Vancouver Island. Whale presence was identified by vocalizations, each then annotated with habitat and prey conditions. It was a mission of exploration into an area of historic whale presence (Figure 2).

The mandate for this deployment was simple - cover as much ground as possible, with special reference to areas with topographical features or relief that may encourage prey aggregation. Indeed, analysis of the acoustics data shows whales focused around the submarine canyons, particularly the head of the canyons, and as expected, most vocalization is associated with zooplankton swarms.

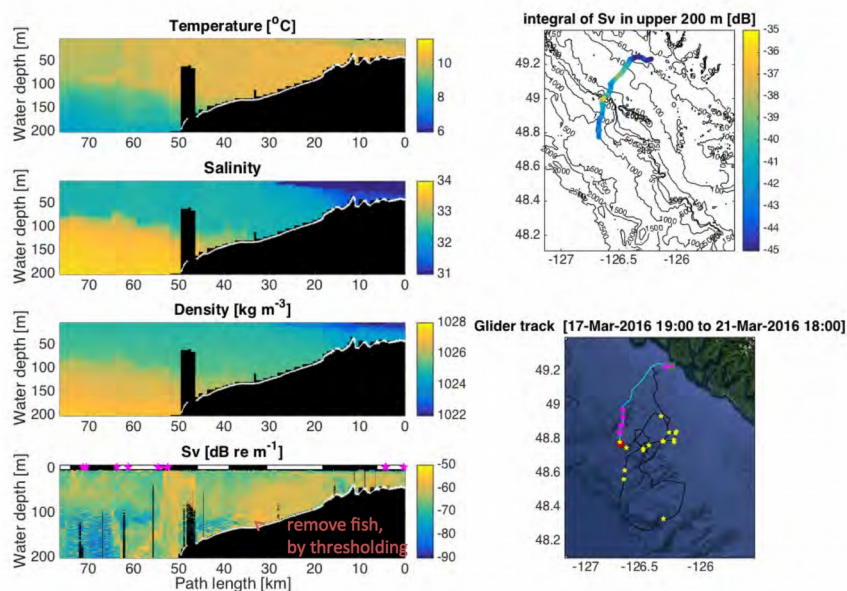


Figure 2: Example of a section of glider track analyzed: track shown on upper right, with water depth contours, and lower left with whale calls depicted with star icons. For whale calls indicated by purple stars on glider track (lower right) temperature, salinity, density and scattering volume measurements are shown (left).

This pioneering first mission was followed in spring 2017 by a more detailed survey of the Clayoquot Canyon by a co-ordinated glider ‘fleet’ (Figure 1, 3). The goals of this mission were two-fold: to confirm this area as a biological ‘hotspot’ attracting large whale species to forage, and to refine our understanding of the oceanographic processes that create good quality habitat. Three gliders were deployed with, between them, capabilities to: detect and record whale vocalizations, localize prey aggregations, measure irradiance and phytoplankton presence, and profile turbulence. Together this allows us to resolve transfers of energy along trophic levels, from mechanisms of mixing, upwelling and/or turbulence affecting phyto- and zooplankton species, to the apex whale predators. This deployment was also our first to test real-time whale detections using Iridium satellite systems to transmit a distilled version of whale vocalizations in the form of a frequency-contour, or ‘pitch track’, with species identity markers to on-shore analysts.



Figure 3: 'The fleet', from left to right: Slocum glider with Microrider, oxygen, fluorescence, and backscatter sensors, and CTD. Capacity to dive to 1000m; Slocum glider with irradiance, oxygen, and backscatter sensors, and CTD. Capacity to dive to 350m; Slocum glider with echosounder, CTD, and acoustic capabilities (DMON not shown, see Figure 1). Capacity to 200m. Note wings, to balance pitch and roll, are missing. (Photo credit Whale Lab, UVIC).

We focussed survey time in Clayoquot Canyon, transecting up and down the canyon as well as observing cross-canyon influence by zig-zagging perpendicular to the canyon walls. Transects outside the canyon were also conducted to allow for inside-outside comparisons. Being a slow-moving platform, at times the gliders were at the mercy of the coastal currents, or eddies at the canyon head, and were deflected from the planned route (Figure 4).

The analysis of the data will be multifaceted. Although individually each glider can tell a rich story, integration of the datasets is where this mission comes into its own. Here the sentinels do not just survey concurrently, but are designed to complement each other to inform the overall picture of the canyon region as whale habitat for recovering populations. Enhanced productivity of submarine canyons may result from prey aggregated by water movements and internal waves (Allen et al. 2001, Allen & Durrieu de Madron 2009), heightened nutrient loading due to greater mixing (Kunze et al. 2002), or upwelling (Bosley et al. 2004). The strength and depth of presence of upwelling processes will be determined from data collected on the surface, shelf and deep water flows in and surrounding the canyon. In addition, water masses identified by CTD measures can be overlaid on topographical elevation maps to outline regions of accumulation or transportation of organic matter. This high-resolution capture of the underwater regions of Clayoquot Canyon can go some way to explaining the apparent attraction to these areas by large whale species, mediated by zooplanktonic presence and abundance. Net tows from stations within and neighbouring the survey area during the deployment will aid species identification of backscatter data, with species of copepods, krill, mysids, swarming amphipods, and salp tunicates collected from the water column.

Preliminary findings from the 2017 deployment data again show whale calls focussed in the canyon, and along the shelf break. These are predominantly large baleen whale calls, likely fin whale (Figure 5), with some calls from this and the previous deployment tentatively identified as sei and blue whales. In more coastal waters humpbacks dominate the soundscape, with migrating gray whales also heard. Full verification of real-time whale calls is upcoming over the next few months from the UVIC team. Team members from UBC, DFO, and ONC will likewise be filling in the blanks on oceanographic systems from physical and chemical structure to planktonic response. They will explore further the role of canyons as regions of enhanced biological productivity, and as a conduit of exchange between the open ocean and continental shelf systems. We will meet at the middle to shape and fine tune our knowledge of the whale ecosystems on the coast.

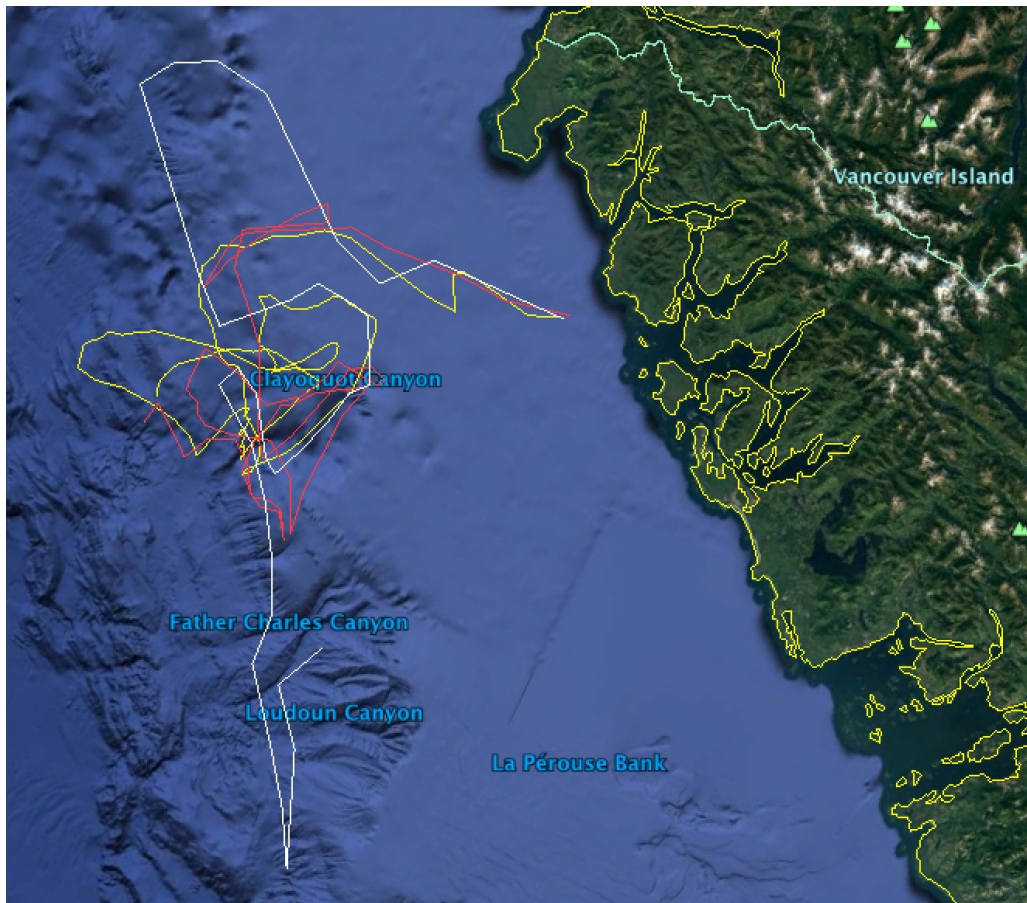


Figure 4: Final survey routes of the three gliders from February 2017 deployment. White track is the 1000m capable glider (375km), red track is the 350m capable glider (360km), yellow track is the 200m capable glider (328km). Source Google Earth, R Burnham.

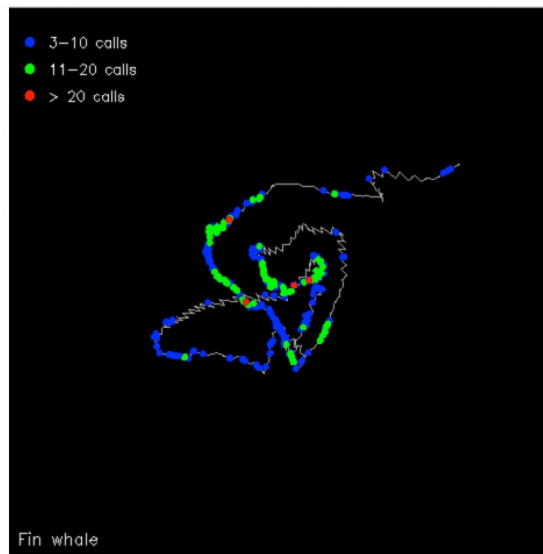


Figure 5: Real-time time whale detections from 2017 deployment, showing here those identified by the detection system as fin whale calls along the 200m capable glider path. Source M. Baumgartner, WHOI.

For large whale species to recover we need to know the current situation with the remaining populations, and more about the influence of shipping noise, vessel traffic and ecological conditions. Physical ocean forces create the canvas on which our “particles”, from micrometers

to tens of metres in size, interact, and this integration from measuring turbulence eddies to fin whales is a unique way to explore and better manage the whale ecosystems. At its most basic we are re-forming an idea of baseline whale populations and presence, with the use of acoustically equipped gliders. The ultimate vision is for gliders to become part of a monitoring network that could be used in real-time as a means to minimize disturbance of whales in critical habitat and mitigate vessel strikes.

ACKNOWLEDGMENTS

Thanks to the work of all those that made the multi-glider deployment possible, in particular Tara Howatt, Rowan Fox, and Steve Mihaly as well as Adam Comeau, Sue L'Orsa and Richard Davis from the OTN Group. We also acknowledge logistical and field support from Keith Clarke, Rod Palm, Marcel Theriault and the crew of CCGS *J.P. Tully*.

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CNC-SCOR Western Tour Speaker

The 2016-2017 Western annual CNC-SCOR tour speaker is **Dr. C.J. Mundy** from the University of Manitoba. He will presenting a talk titled: ***Arctic spring: key processes influencing timing of primary production in ice-covered waters.***



Dr. Mundy seeks to understand variability and change in the Arctic marine ecosystem due to climate change and the resulting loss of sea ice. In particular, he studies physical and biological processes controlling the timing, location, magnitude, and fate of primary producers in the ice-covered environment.

Climate warming and the rapidly disappearing Arctic sea ice cover have imposed new variability and likely directional change on the Arctic marine ecosystem. Improving our understanding of variability and change in the polar marine ecosystem in the face of a rapidly changing environment underpins my current research goals. My research has a particular focus on primary

producers in the Arctic marine ice-covered ecosystem, which include sea ice algae, ice melt water (brackish) flora and phytoplankton. My most recent endeavours include: biological oceanographic studies of the central Canadian Arctic, Canadian Beaufort Sea (investigating phytoplankton bloom dynamics, sea ice bio-optics and ice algal productivity, photophysiology and taxonomy) and Hudson Bay (investigating freshwater and dissolved organic carbon input and export), and biophysical modeling of the ice algae ecosystem. ([C.J. Mundy Web Page](#))

Venues and times of Dr. Mundy's talks

City	Date, Time	Location	Contact
Vancouver	March 20 1:30	Earth Science Building 5104 University of British Columbia	Philippe Tortell ptortell@eoas.ubc.ca
Patricia Bay	March 21 2:00	Central Board Room, Rm 2100 Institute of Ocean Sciences	Bill Williams Bill.Williams@dfo-mpo.gc.ca
Victoria	March 22 3:30	Room C118 David Strong Building, University of Victoria	Diana Varela dvarela@uvic.ca
Edmonton	March 23 12:30	Tory 3-36 University of Alberta	Paul Myers pmyers@ualberta.ca
Calgary	March 24 3:00	Earth Sciences 443 University of Calgary	Brent Else belse@ucalgary.ca

This section of your newsletter provides an opportunity to highlight your research programs to the Ocean Science Community.

*Your are invited to send contributions to David Greenberg,
david.greenberg@dfo-mpo.gc.ca*

Mettez en valeur vos programmes de recherche en publiant un article dans cette première section de votre bulletin.

*Faites parvenir vos contributions à David Greenberg,
david.greenberg@dfo-mpo.gc.ca*

MEETINGS

CMOS Congress - update

June 4 - 8, 2017, Toronto

The CMOS Congress website now has accommodation and travel recommendations.

CMOS offers undergraduate and graduate scholarships to students in atmospheric sciences, meteorology, climate, oceanography and related fields (e.g., mathematics, hydrology, limnology). The deadline for the undergraduate scholarship has passed. The graduate scholarship is \$10,000. Information about scholarships and how to apply can be found on the CMOS [website](#). You do not have to be a member of the Society to receive a scholarship. The



application deadline for the graduate scholarship is **April 20th**. Keep checking Facebook: [f](#) [cmostoronto2017](#), Twitter: [@cmostoronto2017](#) and the [congress website](#) for meeting updates.

3rd Student Workshop on Ecology and Optics of Coastal Zones

July 10-13 2017, Kaliningrad, Russia

The 3rd Student Workshop on Ecology and Optics of Coastal Zones will be a 4-day education and training event with a focus on optical oceanography and remote sensing of coastal waters. It follows a [workshop at the Museum of the World Ocean in 2016](#), and a [first workshop at the White Sea, Republic of Karelia, in 2014](#). The Workshop is intended for master and PhD students dealing with natural sciences and addresses the principles, methods and results of optical methods for measuring environmental parameters. It offers students the opportunity to meet international researchers and to gain first-hand experience in hydrography and coastal ecology, in environmental optics and remote sensing. Dates: Registration - **April 1 2017**, Workshop fee - **June 1**, Submission of Contributions - **May 15**. [Details](#)



MEOPAR Annual Scientific Meeting

June 21-22, 2017 in Montreal

Established in 2012 through Canada's federal Networks of Centres of Excellence Program, the Marine Environmental Observation Prediction and Response (MEOPAR) Network is a national network of academic researchers and students, government scientists, and partners in the private, NGO and community sectors working together to reduce vulnerability and strengthen opportunity in Canada's marine environment. A primary focus is developing new tools to anticipate, plan and adapt to changing patterns of marine emergencies and extremes of the future. MEOPAR's 2017 ASM will be held at the Westin hotel in Montreal. The group rate is available until **May 19th, 2017**.

IMUM 2017

Aug 28 - Sep 1, 2017, Stanford, California

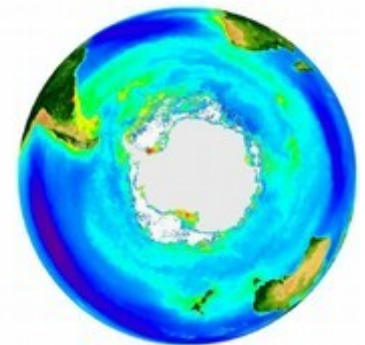


The 16th International workshop on Multi-scale (Un)-structured mesh numerical Modeling for coastal, shelf, and global ocean dynamics (IMUM 2017) will be held at Stanford University from August 29 to September 1, 2017. The IMUM workshops bring together researchers working on the development and implementation of unstructured-grid methods for simulation of oceanic processes over a wide range of scales ranging from global ocean modeling to small-scale, nonhydrostatic modeling. Topics of discussion range from application of unstructured-grid models to numerical methods and computational algorithms, as well as grid generation, graphical visualization, data analysis, and implementation of software packages. Presentations will be held during Tuesday through Thursday with the possibility of holding a discussion session on tools and methods on Friday morning. A conference dinner will be held on Wednesday evening. Abstracts and early registration **June 15, 2017**. [Details](#)

Seventh International Symposium on GIS/Spatial Analysis in Fishery and Aquaculture Science

August 21-25 2017, Hokodate, Hokkaido, Japan

This is the call for papers for the 'Seventh International Symposium on GIS/Spatial Analyses in Fishery and Aquatic Sciences (August 21-25, 2017)'. The 'International Fishery GIS Society' will again be the main organizer and the venue and the local co-organizer will be Hakodate Research Center for Fisheries and Oceans, Hakodate (<http://www.hakodate.travel/en>), Hokkaido, Japan. For participants who wish to present their work, there are three ways, i.e., by oral presentation, poster presentation or PC based demonstration of GIS software, hardware and related systems. Duration of oral presentations will depend on number of presenters, but we tentatively set them for 20 minutes (15 minutes for presentation and 5 minutes for questions and answers) (subject to change by number of participants). For poster presentations and PC demonstrations, particular sessions will be set up. The final duration of oral presentations and details of poster and PC demonstrations will be stated in the final announcement to be circulated by April, 2014. Deadline for abstracts **May 30**. [Details](#)



Third International Ocean Colour Science Meeting

May 15-18 2017, Lisbon, Portugal

The third International Ocean Colour Science (IOCS) meeting will take place from 15 to 18 May 2017 in Lisbon, Portugal, followed by two training events on 19 May 2017: a [Copernicus marine data stream training event](#) and a [SeaDAS training event](#). The primary



focus of the IOCS meetings is to serve as a venue for the ocean colour community to communicate their views, ideas, concerns and issues with the satellite agencies. The programme for the IOCS-2017 meeting will include invited keynote lectures, agency talks, several breakout workshops, community discussions, NASA, Copernicus & VIIRS town halls, and poster sessions. All submitted abstracts will be presented as posters. Abstracts are only being accepted for poster presentations, although you may be approached by a Breakout Workshop Chair to give a short oral presentation within one of the relevant Breakout Workshops. Oral presentations in Plenary are limited to a few invited keynote speakers. Abstract deadline **April 1 2017**. [Details](#)

Please send meeting announcements to
David Greenberg,
david.greenberg@dfo-mpo.gc.ca

SVP faites parvenir vos annonces de réunion à
David Greenberg,
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JOBS and TRAINING

Modélisation réaliste de la marée interne et de sa signature de surface

Realistic modelling of the internal tide and its surface signature

L'objectif principal de la thèse consiste à développer les méthodologies et les outils propres à améliorer la modélisation et l'assimilation de données pour la marée interne, et ce dans la perspective de sa correction dans les observations de la mission SWOT. Scientifiquement, l'objectif est de progresser dans notre connaissance encore très incomplète, et très mal quantifiée, de la marée interne. Le développement d'un modèle de marée barocline réaliste devra permettre d'avoir accès à la fois à la composante stationnaire des ondes internes de marée mais aussi à leur composante non-stationnaire qui reste aujourd'hui mal connue et quantifiée. L'approche privilégiée sera d'exploiter les possibilités du modèle T-UGOm pour la modélisation/assimilation dans l'espace des fréquences des marées internes et/ou sur des grilles à résolutions variables (à l'instar de ce qui a été implémenté pour la marée barotrope pour laquelle cette approche a démontré sa très grande efficacité). Les principaux atouts de cette approche sont son coût de calcul extrêmement réduit en comparaison des modélisations time-stepping, la possibilité d'étudier facilement la modification de la marée interne due aux changements de stratification océanique et sa capacité d'assimilation robuste de données harmoniques. Néanmoins, d'autres approches plus standard pourront être également évaluées en collaboration avec la communauté nationale et internationale, notamment pour en évaluer les limitations découlant de sa formulation spectrale.



The main objective of the PhD is to develop methodologies and numerical code for internal tide simulation and data assimilation (in the context of the SWOT mission data processing) needed to improve our qualitative and quantitative knowledge of internal tides. Both stationary and non-stationary components of tides will be investigated. The non-linear frequency-domain, unstructured grid, vertically-Lagrangian approach, using the T-UGOm model, which has proven to be very efficient for barotropic tides, will be preferred because of its reduced numerical cost, its great potential for studying effect of changing stratification and robust data assimilation framework. However, more conventional approaches will possibly be carried out in parallel, in collaboration with the French or international community, in particular the assessment of limitations of frequency-domain methods.

Détails de/details from - [CNES](#)

Répondre à l'offre pour le **31 mars 2017**. Application deadline **March 31, 2017**.

Ocean Modeller

The Hakai Institute seeks applications for an ocean modeller who will work to set up the FVCOM model for British Columbia's central coast. The Hakai Institute offers this position, based in Sidney, British Columbia, as a 6-month term with the possibility of renewal. A background in physical oceanography and ocean modelling is essential and previous experience with FVCOM would be an asset. If interested, applicants are requested to send a CV and cover letter to careers@tula.org by **March 31st , 2017**. [Details](#)



Fellowships Opportunities

SCOR International informs us of the following:

POGO-SCOR Visiting Fellowship programme for 2017--This program is designed to promote training and capacity building leading towards a global observation scheme for the oceans, and is aimed at scientists, technicians, postgraduate students (preferably PhD) and post-doctoral fellows involved in oceanographic work at centers in developing countries and countries with economies in transition. Deadline for applications: **7 April 2017** [More information](#) [Flyer](#)



Call for SCAR 2017 Visiting Professor Applications--The SCAR Visiting Professor Scheme is designed to encourage the active involvement of scientists and academics in Antarctic research, and to strengthen international capacity and cooperation in Antarctic research. Deadline for applications: **31 May 2017** [More Information](#)

POGO-PML Visiting Fellowship for training on-board an Atlantic Meridional Transect (AMT) cruise in 2017-- This is a training program providing hands-on, sea-going experience to young scientists from developing countries, giving them the opportunity to be involved in an internationally renowned scientific program. Deadline for Applications: **31 March 2017** [More information](#) [Flyer](#)



IOCS-2017: Training courses and scholarships --The 2017 International Ocean Colour Science meeting (IOCS-2017) will take place from 15-18 May 2017 in Lisbon, Portugal. Two training courses are offered following the meeting (Friday 19 May 2017) and will run concurrently: i) the Copernicus marine data stream and ii) SeaDAS updates and future directions. Deadline for applications: **31 March 2017** More information [here](#) and [here](#)

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

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

GENERAL

NSERC Synergy Prizes

NSERC is looking for nominations for its Synergy Awards. These 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. The nominated partnership must be in the natural sciences and/or engineering and be between a Canadian university professor, or group of professors, or a Canadian college, and a Canadian-based company or companies with commercial activities in Canada, such as R&D and/or manufacturing. The University winners (principal nominee) in each of three category will receive a \$200,000 NSERC research grant. Industrial partners will each receive a \$30,000 voucher valid towards the cash portion of their required contribution in a new Collaborative Research and Development Grant (CRD). Details of the grant and the nomination process can be found at http://www.nserc-crsng.gc.ca/Prizes-Prix/Synergy-Synergie/About-Apropos_eng.asp. The deadline for nominations is **April 18, 2017**.



SCOR International happenings

Newsletter #34



SCOR [Newsletter #34](#) is now available. This issue includes information about new developments related to SCOR-sponsored projects, sections added to the SCOR Web site, the 2017 group of SCOR Visiting Scholars, SCOR's recent work on science for the G7 Science Ministers and the UN Ocean Conference, SCOR plans for Ocean Sciences 2018, and more.

Sign up for the SCOR Newsletter and other communications from their [homepage](#).

SCOR Annual Meeting 2017

The 2017 SCOR Annual Meeting will take place in Cape Town, South Africa from Monday, 4 September through Wednesday, 6 September 2016. National SCOR Committees and other international organizations are invited to be represented at the meeting at their own expense. A detailed agenda, logistical information, and a preliminary list of meeting participants in early July. [Registration](#)

Acronyms

Having trouble with all the acronyms of large international programs? The SCOR newsletter lists the following:

GOOS	Global Ocean Observing System	POGO	Partnership for Observation of the Global Oceans
iCACGP	International Commission on Atmospheric Chemistry and Global Pollution	SCOR	Scientific Committee on Oceanic Research
IIOE-2	Second International Indian Ocean Expedition (co-sponsored by SCOR, IOC, and IO-GOOS)	SOLAS	Surface Ocean - Lower Atmosphere Study (co-sponsored by SCOR, Future Earth, WCRP, and iCACGP)
IMBeR	Integrated Marine Biosphere Research project (co-sponsored by SCOR and Future Earth)	WCRP	World Climate Research Programme
IOC	Intergovernmental Oceanographic Commission	WG	working group
IQOE	International Quiet Ocean Experiment (co-sponsored by SCOR and POGO)		

2017 Call for SCOR Working Group Proposals

The [SCOR Secretariat](#) will accept proposals for new working groups from now until **15 April 2017**. They will be evaluated at the Annual Meeting Sept 4-6 in Capetown (see above). The guidelines, a template, and word limits are available on the instructions [webpage](#), including a PowerPoint presentation explaining the proposal process. 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 play a key role in reviewing working group proposals and in seeking new funds to support working group activities. In addition, the review of working group proposals is open worldwide to partner organizations and individuals who would like to provide comments.

A.G. Huntsman Award for Excellence in the Marine Sciences

The A.G. Huntsman Award is presented annually by the Royal Society of Canada to recognize excellence of research and outstanding contributions to marine sciences. Until 2013, the A.G. Huntsman Award had been presented in one of three categories: Marine Geoscience, Physical/Chemical Oceanography, or Biological Oceanography and Fisheries Science. Recognizing there is often a considerable degree of overlap among these fields of study, more recent awards have no such categorical distinction and are simply awarded for excellence in marine sciences. The intent is not to



exclude candidates that focus on single disciplines, but to acknowledge that some research defies such categorization, since it spans multiple disciplines. The overarching aim is to find and recognize truly exceptional marine scientists.

Nomination information is available at <http://www.huntsmanaward.org/Nomination.htm>.

The deadline for nominations is **April 15, 2017**.

GEOTRACES Summer School 2017

August 20-26 2017, Brest, France

The first GEOTRACES summer school will be held in Brest, France, between the 20th and 26th August 2017. It will bring together over 60 students and 20 world-leading international scientists. This summer school aims at teaching the skills and knowledge necessary for a good understanding of the biogeochemical cycles of trace metals. It will allow PhD students and early career researchers to see how their work fits within the international community of GEOTRACES. General lectures will be given by international experts in the field of the GEOTRACES program and practical workshops in the laboratory will be ran throughout the week. Pre-registration is open until **April 15th** and applications will be subject to selection. Successful applicants will be notified by April 30th.



More information can be found at: <https://geotraceschool.sciencesconf.org/>

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

Previous newsletters may be found on the [CNC/SCOR](#) web site.

Newsletter #94 will be distributed in **May 2017**. Please send contributions to David Greenberg david.greenberg@dfo-mpo.gc.ca

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Les bulletins antérieurs se retrouvent sur le site web du [CNC/SCOR](#).

Le Bulletin #94 sera distribué en **mai 2017**. Veuillez faire parvenir vos contributions à David Greenberg, david.greenberg@dfo-mpo.gc.ca

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