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CANADIAN OCEAN SCIENCE NEWSLETTER
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Bridging the gap between oceanography and ocean predator ecology

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Every day baleen whales need to consume 10^6 to 10^7 calories in zooplankton, which is the equivalent to several thousand Big Macs. It is not surprising, then, that the whales maximize their net energy gain by seeking out ultra-high density patches of zooplankton that are many orders of magnitude above the average bucketful you might scoop out of the ocean. Patches are formed through the interactions among zooplankton behavior and physiology, and the ocean currents and water masses. In my research, I study the processes that lead to formation of these patches, and I seek to explain why they appear to occur more regularly in some regions of the ocean than others. I also look at how this oceanographic variability relates to the migration patterns and habitat selection of baleen whales through their foraging ecology.

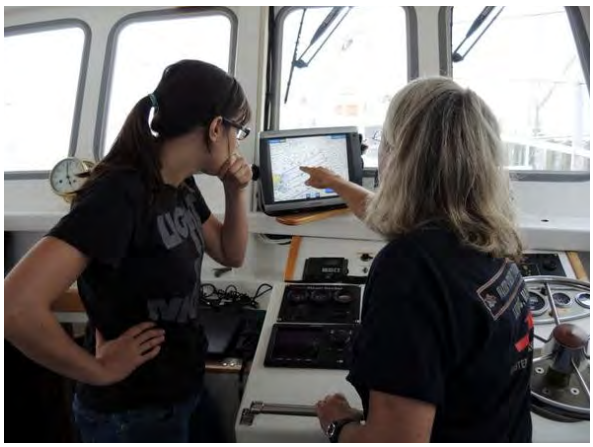
To advance the science on these issues, I focus on a fascinating predator-prey system in the North Atlantic; that of the endangered North Atlantic right whale and its main food, lipid-producing copepods of the genus *Calanus*. Right whales are specialist feeders on a particular life stage of *Calanus* that provides the high energy that right whales need through its unique physiology and life history strategy. *Calanus* spend their spring and early summer feeding and accumulating lipid-stores inside their bodies. These lipids make *Calanus* particularly energy rich and appetizing to right whales. Around the end of summer, *Calanus* enter a dormancy phase of their life cycle, when they sink down into deep depths and rest over the entire winter. On the continental shelf off Atlantic Canada, sinking *Calanus* accumulate in dense, vertically constricted layers near the seafloor within deep basins, particularly in the Bay of Fundy and on the western Scotian Shelf. Right whales dive up to 200 m to forage on these deep, energy-rich *Calanus* layers.

Endangered right whale mother-calf pair sighted in the Gulf of St. Lawrence in 2015. Right whale distributions appear to be changing and my research helps to find out if changes in food supply and ocean climate may explain the shift. Photo courtesy New England Aquarium / Canadian Whale Institute.

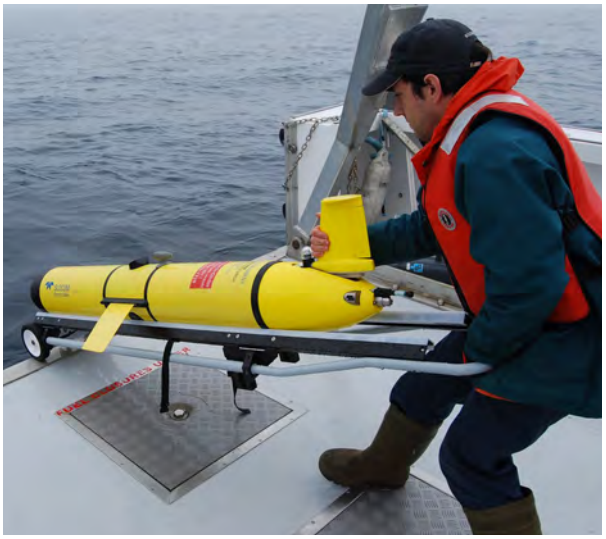
One of the main questions I ask in my research is: by what processes do these deep *Calanus* layers form into ultra-dense patches that whales need? Observations of right whales themselves provide some initial clues. In the Bay of Fundy, right whales move with the tide while making feeding dives, which suggests that the tide is involved in patch formation. In Roseway Basin, right whale sightings are clustered on the basin margin, which suggests that processes occurring over sloped bathymetry are also important. My field studies in Roseway Basin helped to demonstrate some links among tide, bathymetry and dormant *Calanus*. Dormant *Calanus* are neutrally buoyant in their water mass density-habitat near the seafloor. The volume of this density-habitat at the basin margin decreases when the water moves deeper on the downslope

(flood) tidal phase. Patches of the neutrally bouyant *Calanus* form consistently at every high tide, appearing to become wedged underneath the lighter density boundary of their habitat (they sink in lighter water) and above the bottom mixed layer on the sloped margin, which causes accumulation at this boundary. This process can benefit right whales who can rely on the predictability of the tide to help form food patches, and who need not dive as deep at the basin margins to forage on near-seafloor food aggregations as they would in the middle of the basin.

Ocean feeding hot spots often occur in areas where elevated phytoplankton biomass drives a productive local food web. One of the interesting implications of these deep dormant *Calanus* aggregations is that important feeding hot spots for zooplankton foragers can also occur far away in time and space from areas of high surface production. It also means that these deep hot spots are very difficult to find and to study, because data from deep in the water column is required. One of the projects I currently work on seeks to discover if autonomous profiling gliders can provide the remote-sensing data needed to identify and study deep *Calanus* hot spots, and therefore right whale feeding habitat, on the continental shelf. The gliders are equipped with hydrophones, echosounders and CTDs to concurrently and persistently monitor whales and measure their habitat over monthly time periods. Our studies focus on Roseway Basin on the western Scotian Shelf, and Orpheline Channel in the Gulf of St. Lawrence.



Dr. Moira Brown (right) and myself (left) revising field plans on the fly. In summer 2017, our groups are collaborating in field work to help determine why right whales have been sighted in the southern Gulf of St. Lawrence for the past three years. Her group focusses on monitoring whales, while our group handles plankton sampling & oceanographic monitoring with ocean gliders.



Adam Comeau of the Ocean Tracking Network prepares to launch a Webb Slocum glider on the Scotian Shelf. I use these gliders as tools to study space-time variation in baleen whale distributions, and search for feeding hot spots.

One of the really fascinating things we have learned from the gliders is that during the course of a whale feeding season (June – October), deep water masses below the sill depth in Roseway Basin (and the planktonic ecosystems each water mass contains) can change completely more than once. This basin 'flushing' may help explain why we sometimes observe several periods of whale presence and absence during the season. Being migratory, whales have the capability of sampling a feeding area, abandoning it to search elsewhere once the food is gone, then coming back later to check out if food supplies have increased again.

You can learn more about the glider research at our public outreach website http://apps.cwf-fcf.org/whales/ which has a blog and a simple map of where the gliders are, and what kind of whales they are hearing. Those who want to view this data in a more scientific format can also follow real-time baleen whale detections of the gliders here: http://dcs.whoi.edu and more glider data here: http://gliders.oceantrack.org .

Kimberley Davies 2nd CNC-SCOR Early Career Ocean Scientist Award winner

Kimberley Davies at Dalhousie University is the second winner of the CNC-SCOR Early Career Ocean Scientist Award. The award, presented to an early career oceanographer/marine scientist (within 10 years of completion of a Ph.D) for an outstanding contribution to marine sciences within Canada was presented by CNC-SCOR Chair, Paul Myers at the CMOS Congress in Toronto.

Kimberley was citied for her research, as reflected in publications, that has led to new oceanographic, marine-ecological and marine-mammal insights. They have some common themes related to ocean water mass variation (acidification, structuring of copepod and larval invertebrate aggregations, recruitment, and habitat connectivity); tidally forced aggregation mechanisms; and universal energy content relationships etc. This kind of oceanography has led to effective and practical conservation policy changes. Her success is a function of her breadth, as well as her depth.

More information: Davies KTA, Taggart CT, Smedbol RK (2014) Water mass structure defines the diapausing copepod distribution in a right whale habitat on the Scotian Shelf. Mar Ecol Prog Ser 497:69-85. https://doi.org/10.3354/meps10584.

Davies KTA, Ross T, Taggart CT (2013) Tidal and subtidal currents affect deep aggregations of right whale prey, Calanus spp., along a shelf-basin margin. Mar Ecol Prog Ser 479:263-282. https://doi.org/10.3354/meps10189.

Twitter: https://twitter.com/meoparwhale?lang=en.

Free CMOS membership for students extended

CMOS-SCMO
Canadian Meteorological and Oceanographic Society
Société canadienne de météorologie et d'océanographie

Last year, in a one year experiment, CMOS eliminated the fees for students. This brought a significant increase in student membership. This has now been extended for at least two years. Student membership at CMOS is open to full-time students in any Canadian or foreign institution. Student membership will be changed to regular upon an address change or after a maximum of five years. Students interested in applying for membership should consult the membership information page and fill out the form found on the application page.

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

World Conference on Marine Biodiversity

Montréal, Québec, Canada, May 13-16, 2018

The World Conference on Marine Biodiversity (WCMB) has become the major focal assembly to share research outcomes, management and policy issues, and discussions on the role of biodiversity in sustaining ocean ecosystems. Arranged on a 3 - 4 year cycle, prior WCMB meetings (Valencia, Spain; Aberdeen, Scotland; Qingdao, China) have each attracted leading specialists from around the world, and catalyzed numerous sidebar sessions on marine biodiversity issues.

The 4th World Conference on Marine Biodiversity will be held at the Palais des congrès de Montréal, Québec, Canada, from May 13-16, 2018. This meeting will bring together scientists, practitioners, and policy makers to discuss and advance our understanding of the importance and current state of biodiversity in the marine environment. Through a mix of keynote sessions, contributed talks and posters, and bookable venues for focused meetings, the conference program will address marine biodiversity across a deliberately wide range of relevant sectors. Participation will be encouraged from the broadest possible range of stakeholder groups from academics to industry.

Important deadlines: *Abstract submission*: October 1, 2017, *Early registration:* March 4, 2018, *Registration:* May 5, 2018.

2018 Ocean Sciences Meeting

Portland, Oregon, USA, February 11-16, 2018

The 2018 Ocean Sciences Meeting will be held at the Oregon Convention Center in Portland, Oregon. Topics covered include all aspects of oceanography, especially multidisciplinary topics, as well as presentations that reflect new and emerging research on the global ocean and society, including science education, outreach and public policy. The OSM originated in 1982 as a joint effort between the American Geophysical Union (AGU) and the Association for the Sciences of

Limnology and Oceanography (ASLO); The Oceanography Society (TOS) joined as a regular co-sponsor in 2004.

Important deadlines: *Abstract submission*: September 6 2017, *Early registration:* January 3 2018.

2018 OCEAN SCIENCES MEETING

AGU • ASLO • The Oceanography Society

11–16 February • Portland, Oregon, USA

CMOS Congress 2018

Halifax, Nova Scotia, Canada, June 10-14, 2018.

The 52nd annual CMOS Congress will be held at the brand new Halifax Convention Centre, June 10-14, 2018. Start making you plans now.

Details coming soon on the CMOS website.

Please send meeting announcements to David Greenberg, david.greenberg@dfo-mpo.gc.ca	*SVP faites parvenir vos annonces de réunion à David Greenberg, david.greenberg@dfo-mpo.gc.ca*

POSITIONS AVAILABLE

Postdoctoral and Ph.D. openings in Sopot Poland

The Institute of Oceanology Polish Academy of Sciences in Sopot has POGO related openings for a Ph.D. student and a Postdoctoral Fellow.

Ph.D. program opening. This is an open call. The applicants will undergo a regular recruitment process, in justified cases, via online interview. The recruitment will take place at 10:00 a.m., on 19 September 2017 in Sopot, Poland. They are looking for outstanding young graduates interested in cooperating with researchers from the Institute of Oceanology Polish Academy of Sciences in the area of marine physics, carbonate chemistry in sea water and ecology of benthic organisms. The research will be conducted within the activities of the Institute of Oceanology Polish Academy of Sciences (IO PAN; www.iopan.gda.pl).

Details

Deadline for application: 31 August 2017.

Postdoctoral opening. This is an open competition call and results will be announced by 30 October 2017. They are looking for outstanding young scientists interested in cooperating with researchers from the Institute of Oceanology Polish Academy of Sciences in the area of marine physics, marine chemistry, and marine ecology. The research will be conducted within the activities of the Institute of Oceanology Polish Academy of Sciences (IO PAN; www.iopan.gda.pl). This is a 3 to 6 month grant and it must be completed by the end of June 2018.

Details

Deadline for application: 31 September 2017.

Postdoctoral opening in Kiel Germany

Geochemistry of Marine Carbon Capture and Storage - GEOMAR

STEMM-CCS (http://www.stemm-ccs.eu/) is a multi-disciplinary EU-funded project concerned with Carbon dioxide Capture and Storage (CCS). CCS has been identified as an important mitigation strategy to reduce anthropogenic carbon dioxide (CO2) emissions and thereby combat the rising levels of atmospheric CO2 responsible for global climate change and ocean acidification. The task of the advertised position is to assist in the development of monitoring strategies of CO2 seepage from seafloor using benthic lander measurements in combination with water column observations (e.g. geochemistry, current regimes). Results will be used to help define baseline scenarios for best practice methodologies and tools for baseline environmental monitoring relevant to offshore CCS. Spatial and temporal variability at all relevant scales with respect to physical, chemical and biological parameters will be determined.

Details

Deadline for application: 31 August 2017.

Senior Research Associate in Norwich UK

Postdoctoral Research Associate in ocean biogeochemical processes using autonomous vehicles (University of East Anglia, UK)

Applications are invited for a Senior Research Associate to undertake studies of ocean biogeochemical processes on the European continental shelf using autonomous vehicles. The SRA will work with Professor Jan Kaiser and others on the NERC-funded project "AlterEco: An Alternative Framework to Assess Marine Ecosystem Functioning in Shelf Seas". The SRA will participate in the design and delivery of ocean glider campaigns in the North Sea, calibrate and analyse the resulting observations, derive relationships between them, calculate rates of relevant biogeochemical processes and disseminate the work to academic audiences, stakeholders and policymakers. The successful candidate will have a minimum of a Ph.D in oceanography or equivalent independent research experience, and be able to fulfil all the essential elements of the person specification. This full time post is available from 1 October 2017 for a fixed term period until 30 April 2020.

Details

Deadline for application: 31 August 2017.

Looking for work? Try the CMOS site (click).	*Vous recherchez un emploi? Visitez le site SCMO (click).*

GENERAL

GEOTRACES Intermediate Data Product 2017

GEOTRACES is an international programme which aims to understand biogeochemical cycles and large-scale distributions of trace elements and their isotopes (TEIs) in all major ocean basins. They are releasing and sharing hydrographic and marine geochemical data acquired as part of their programme to strengthen and intensify the collaboration within the broader ocean research community. At the same time, they seek feedback from the community to help us improve future data products.

The first GEOTRACES Intermediate Data Product (IDP2014) released in 2014 demonstrated the key importance of high-resolution data on TEIs for marine research. The new GEOTRACES Intermediate Data Product (IDP2017) will include increased hydrographic and marine geochemical data, present a more complete coverage of the global ocean and a larger range of biogeochemical parameters.

The GEOTRACES Intermediate Data Product will be available on-line. It will consist of: (1) publicly accessible digital data available from (https://webodv.awi.de/geotraces), (2) an on-line eGEOTRACES Electronic Atlas (eGEOTRACES.org) showing the distribution of these data such as the figures above. **Note**: *The above hyperlinks are currently pointing to the IDP2014. These sites will be updated to include the IDP2017 data after the public release*. In addition to the anticipated usage for marine research, eGEOTRACES and the contained visual material can help in teaching and outreach activities and can also facilitate conveying societally relevant scientific results to interested laymen or decision makers.

The GEOTRACES IDP2017 will be publicly released Wednesday, 16 August 2017, 12h45 - 14h15 at the 2017 Goldschmidt Conference (Paris, France).

L'Institut Maurice-Lamontagne célèbre ses 30 ans

Doté de plus de 70 laboratoires – dont un laboratoire humide à la fine pointe de la technologie –, l'Institut Maurice-Lamontagne (IML) fête cette année ses 30 ans d'existence. Polyvalentes, compétentes et expérimentées, ses équipes y mènent depuis maintenant trois décennies des recherches sur plusieurs espèces marines ainsi que sur les écosystèmes aquatiques. Une activité très prisée du grand public sera de retour à l'automne, soit du 12 au 15 octobre 2017. Il s'agit des journées « portes ouvertes » qui, nous le souhaitons, favoriseront les échanges avec nos équipes et illustreront le lien entre nos travaux et les événements de la vie quotidienne. Nous vous y attendons en grand nombre! Plus d'informations à Infocéans.

Open houses are also being held at the St Andrews Biological Station, September 22,23, 2017 and at the Bedford Institute of Oceanography September 21-24, 2017, all part of Canada 150 celebrations. The Institute of Ocean Sciences in Sidney on Vancouver Island was the first past the post, holding an open house June 1-4.

AGU Issues challenge for open data and open science

AGU has long been a proponent and leader in open data and open science, not only in our own publications and meetings, but also within the broader research community. We are pleased to announce that we have taken that commitment to the next level today by launching an Application Program Interface (API) that will open the door for scientists, developers, and others to create innovative applications that advance science and our mission. We are celebrating this development with our first API Challenge. The Challenge provides access to Fall Meeting data drawn from the scientific program and invites participants to develop web-based tools that add value, such as, but not limited to, aiding serendipitous discovery of relevant research, finding new collaboration opportunities, and identifying emerging areas of science.

Entries will be judged by a panel of experts, with up to three winning solutions selected for recognition with cash prizes of $15,000, $10,000, and $5,000. The winners will be announced in November and recognized at the December 2017 Fall Meeting. Their applications will be made available for use before and at the meeting.

More information here and here.

Deadline to Request API Access: 11 September, 11:59 P.M. EDT

Submission Deadline: 2 October, 11:59 P.M. EDT

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Previous newsletters may be found on the CNC/SCOR web site. Newsletter #**96** will be distributed in **September 2017**. Please send contributions to David Greenberg david.greenberg@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 #**96** sera distribué en **septembre 2017**. Veuillez faire parvenir vos contributions à David Greenberg, david.greenberg@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

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