



## OTN at two and a half years old: evolution and challenges ahead

In just over two years of operation, OTN has made huge progress. Researchers from the NSERC funded OTN Canada have accumulated an outstanding track record of first-rate science and developed an integrated Canada-wide research network with international reach, and the global infrastructure has made major strides forward in its development to meet the needs of the investigators. A key focus of the NSERC network is the training of students and postdoctoral fellows, as well as technicians and research assistants. At last count, OTN Canada was supporting, in whole or in part, the programs of over 90 of these trainees, and many more are involved in international projects.

Nevertheless, we still have some major upcoming milestones to accomplish, so there is still much work to do. As a result of an unsuccessful CFI Major Sciences Initiative (MSI) competition application, and also through internal recognition of our need to evolve to better meet the goals of a CFI International Joint Venture Fund initiative, OTN as a whole is undergoing revisions in both our governance structure and strategic planning. At the same time, the NSERC funded network must prepare and formalize research plans for phase II (years 2014–2016) for critical peer review. All these milestones, required by both granting councils, are expected to be completed by the end of 2012.

As part of the revised governance structure, OTN will have a single unified scientific leadership and an integrated research strategy which will involve the establishment of a new International Scientific Advisory Committee (ISAC) to complement the existing OTN Canada SAC. The ISAC membership will be drawn from the international scientific community, as well as from the Canadian SAC, in order to foster scientific integration across OTN. Both SACs will continue to focus on joint opportunities for training of HQP (highly qualified personnel) and the optimal sharing and use of the network infrastructure.

There will also be complete revision to the OTN Council structure to bring new skills to the Council that will help OTN grow and

prosper. As we develop OTN's required new strategic plan, we need the help and cooperation of all OTN members to allow OTN to best meet its potential and the expectations of our funders. We need to ask ourselves: What will be the best means for OTN partners and investigators to identify and integrate their work on major science questions that provide common benefits to both Canada and international partners? How can OTN best seek opportunities for international outreach and collaborations through such avenues as joint opportunities for the training of HQP? What are the avenues OTN could use to integrate Canadian and international efforts to inform policy and to transfer knowledge to end users?

The good news is that we have been given these challenges early in the development of OTN. With the help and participation of all OTN researchers, we have the time we need to change and evolve. Be ready to rally 'round!



Sara Iverson and Fred Whoriskey at the Second Annual OTN Canada Symposium

Sara Iverson,  
OTN Scientific Director

Fred Whoriskey,  
OTN Executive Director

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## OTN in the news:

[The Search for Smolt](#): tracking salmon in the Gulf of St. Lawrence

[Listen](#) to Dr. Fred Whoriskey 's interview on CBC's West Coast Morning

[OTN absorbs POST lines](#) on the West Coast

Tagged migratory species to be heard in the [Strait of Gibraltar](#)

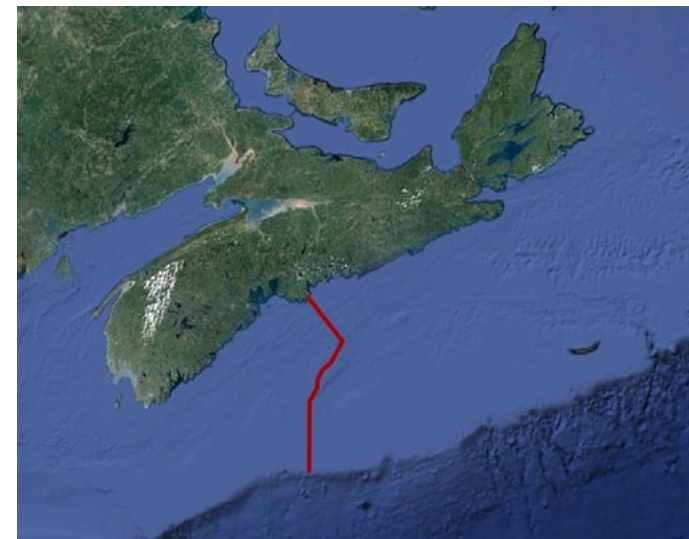
The New York Times blogs about [the glider mission](#)

## Growing the Network: across the pond and down under

Since our last newsletter, the OTN technical team has been extremely busy extending and servicing existing receiver arrays close to home and travelling around the globe to new deployments.

### Update on existing deployments

OTN's inaugural listening line, the Halifax Line, was completed in May, with a total length of ~205 km, extending to the edge of the continental shelf.



Halifax Line (in red) extending to the edge of the continental shelf

One hundred eighty-four new receiver stations were added in 2012, increasing the existing number from 73 to 257. Four new oceanographic monitoring "benthic pods" were also deployed, for a total of eight, with two more planned for July. The Halifax Line has a mix of VR3, VR4, and VR2W receivers, with 51 VR2Ws deployed in waters where they may be vulnerable to fishing operations and the final 90 stations deployed with VR4-UWMs. The intention is for long-term deployment with remote data offloads using the [Wave Glider](#), a technology that is currently being developed in

collaboration with Vemco and Liquid Robotics.

A full rollover of the 151 VR2W receiver stations on the Cabot Strait Line was achieved in mid-April. Of interest were detections of American eels tagged in the St. Lawrence River by OTN Canada researchers Julian Dodson and Martin Castonguay, which will hopefully help to clarify the migration of this elusive species.

The OTN Minas Passage Line recovery was under way when our last newsletter went to press. Results of the recovery were rather disappointing when four of the 12 stations failed to surface. Based on the wear and tear on the hardware of recovered moorings, it was decided that an eight-month deployment in the extreme tidal currents in the area was unrealistic. The line was redeployed in late April with plans for retrieval and redeployment in July.

OTN technician Duncan Bates traveled to South Africa this spring to assist with servicing of the OTN South African Array. Receiver Lines in Algoa Bay and Mossel Bay, which were deployed near the end of 2011, were retrieved for data download and redeployed. An important technical issue was the large amount of biofouling on the equipment after only eight months in the water.

### New deployments

Duncan also spent time in the Azores early this year for the first deployment of the OTN Azores Array. Thirteen VR2W receiver stations with EdgeTech acoustic releases and rock anchors were deployed on the seamount chain west of Faial Island. The scientific goal is to document the use of seamounts by important benthic and pelagic fish species. The array includes other receivers owned by OTN collaborators at the Institute of Marine Research, University of the Azores. Four OTN VR4 receiver stations will be deployed later this year.

OTN technician Ian Beveridge was sent down under early this year to assist with phase I deployment of the Tasmania Array. Twenty-six VR2W stations were deployed between the east coast of Tasmania and Maria Island and extend seaward to the 200m isobath. An additional 40 receivers are planned for deployment around Cape Barren Island north of Tasmania in the Bass Strait later this year.

Deployment of the OTN Hawaii Array is underway with the deployment of six VR2W stations near Waikiki at the end of April. This array will consist of four receiver lines off the island of Oahu and will be part of the larger Pacific Coast Ocean Observing System (PACOOS).

The Northern Strait of Georgia Line of the OTN Vancouver Array was deployed in early January, consisting of 26 VR3 and VR4 stations. The line was deployed in collaboration with the now retired Pacific Ocean Shelf Tracking (POST) program, which has maintained a series of lines off the west coast of North America cooperatively with various partners since 2001. OTN will be assimilating POST data and maintaining some infrastructure in support of continuing international research objectives in the NE Pacific.

### Upcoming deployments

OTN technician Ian Beveridge has traveled to southern Spain twice so far this year in preparation for the deployment of OTN's Strait of Gibraltar Array. In April, he deployed four VR4 test moorings, which were recovered in June. Full deployment of the 35-station line will be underway as soon as the test data are evaluated. Read more about the Strait of Gibraltar test deployment in OTN Tech Talk.

## Tech challenges: extreme environments and biofouling

### Strait of Gibraltar

OTN, in collaboration with the University of Barcelona and the Instituto Español de Oceanografía, is planning to install an acoustic curtain of VR4-UWM receivers across the Strait of Gibraltar from Spain to Morocco. One of the big questions regarding this deployment was whether or not acoustic communication with the VR4-UWM would be possible.

The Strait of Gibraltar is a very dynamic oceanographic environment, with physical characteristics that pose several potential challenges to acoustic communication and tag detection. These characteristics include a permanent pycnocline at a depth of about 100m, a seasonal thermocline, and strong tidal currents. To better understand how these factors could affect the operation of this line, we conducted acoustic communication tests during two cruises in April and June 2012 from the Spanish oceanographic vessel Ramón Margalef. We also deployed eight moorings for two months to assess VR4-UWM floatation collar performance and tag detection range.



Figure 1. ROMOR prototype elliptical float with VR4-UWM

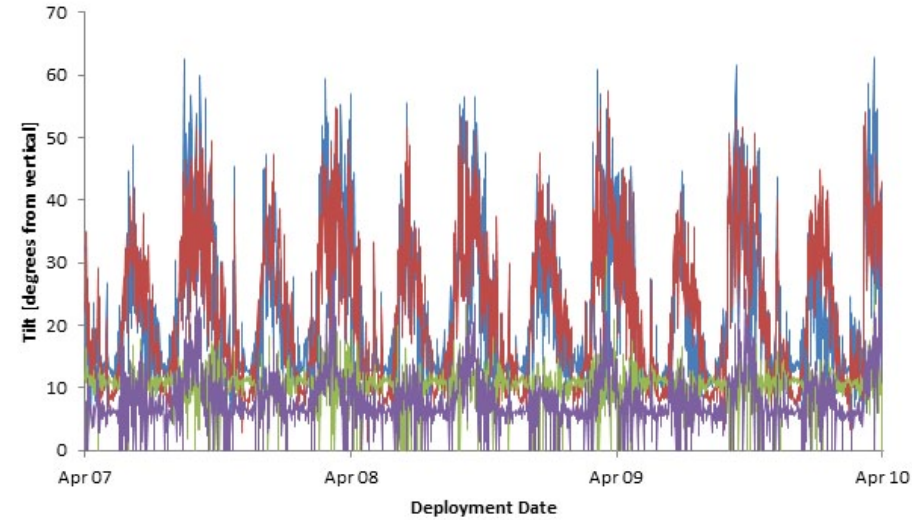


Figure 2. Degrees tilt for four VR4-UWMs deployed in different floatation collars at ~280 m depth in the Strait of Gibraltar

Our first challenge was the strong surface current; during acoustic tests, our drifts reached average speeds of 1.1–5.5 knots. We were unable to hold station against this current with the surface transducer in the water. All of our communication tests were conducted while the ship drifted eastward over the deployed VR4-UWM receivers. We were able to establish communication and offload data during each drift. This was a very positive result and demonstrated that VR4-UWM communication is possible through the permanent pycnocline.

Another challenge in the Strait of Gibraltar is the strong bottom currents. These strong currents can affect the orientation or tilt of the VR4-UWM, which can influence the effectiveness of acoustic communication. As part of our two-month test deployment, we assessed the performance of four different floatation collars:

- (1) Kintama float
- (2) Open Seas Instrumentation SUBS float
- (3) ROMOR C-ROM float, and
- (4) ROMOR prototype elliptical float (Figure 1).



Figure 3. VR2W mooring with copper sleeve

Each VR4-UWM was equipped with a Star-Oddi DST tilt logger to record tilt every two minutes.

The tilt data clearly show a tidal influence on the moorings, even at a 280m depth (Figure 2). The extreme tilt values suggest that the bottom currents can be very strong. The Kintama and C-ROM floats were most affected by bottom currents with maximum tilts >60 degrees. The SUBS and elliptical floats had much lower maximum tilts and performed the best at maintaining a more vertical orientation.

The influence of receiver tilt on communication and data offloading can be significant. During one communications test, the C-ROM was tilted at 57 degrees and technicians could not establish sufficient communication for data offload. During the same test, the SUBS float was tilted at eight degrees and we were able to connect and offload data from the VR4-UWM.

In addition to communication tests, technicians conducted drift tests with Vemco range-test tags (V9, V13, V16) over the moored receivers. All tags were detected through the permanent pycnocline. Fixed sentinel range tags were also deployed as part of the two-month test. Results from these two cruises demonstrate that the VR4-UWM can be used effectively in the Strait of Gibraltar. The full deployment of this line is planned for later this year.

### Biofouling

OTN was onsite with the South African Institute of Aquatic Biodiversity (SAIAB) during the June recovery/refurbishment of the Algoa and Mossel Bay VR2W stations. One of the greatest challenges faced in South Africa is the heavy biofouling that accumulates on the shallower deployments. This fouling can affect receiver performance as well as

impact release times for the Sub Sea Sonics acoustic releases being used by our partners in South Africa. The issue is also faced by other partners in the network and will no doubt be a topic discussed further by its members, especially as many organizations and countries move to restrict the use of some types of copper-based antifouling “hull” paints. Paul Cowley (SAIAB) and Duncan Bates collaborated on new and innovative solutions, such as a copper sleeve for the VR2W receiver (Figure 3). These were range tested alongside control (unfouled) and heavily fouled receivers. Field tests show that there is no fouling on these copper sleeves. Tag detection tests with the sleeve, control, and fouled receivers suggest that detection efficiency was not significantly impacted by the copper sleeve. This is a promising development and has provided further directions for assessment.



VR2W mooring with extensive biofouling recovered in Algoa Bay, South Africa

## Data discourse

Since December 2011, OTN's data warehouse has grown from 5 to ~10 million records. Species composition graphics by ocean region, collaboration group and individual deployment can be viewed [here](#).

OTN's GoogleEarth Flyover labels were improved to show acronyms and short names (e.g. PRT: Perth Line) with summary metadata pop-ups linked to the OTN members' site, also [viewable via Smart Phone](#).



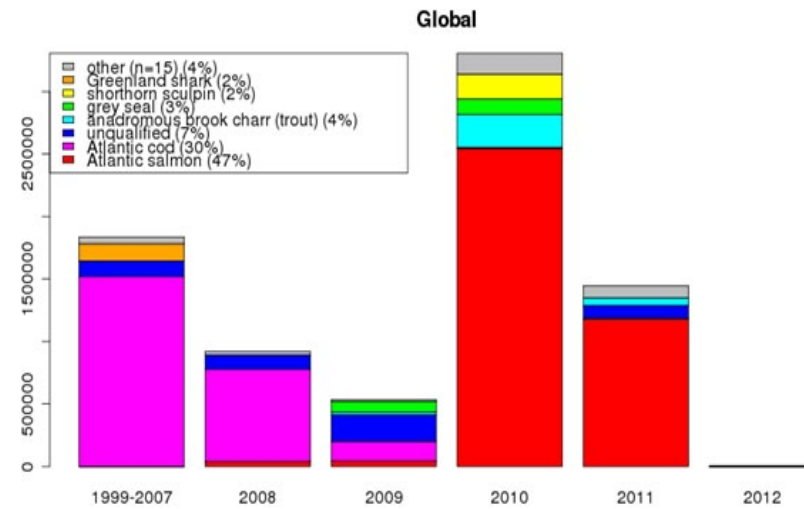
OTN resources in East Indian Ocean as viewed on a Smart Phone.

Vemco's Instrument Specification Authorization form now has space for multiple trackers. Sending the completed [form](#) to Vemco allows OTN to provide trackers with prefilled tag release spreadsheets reducing transcription errors and associated "mystery tags."

In March 2012, John Payne, POST's data manager and Marta Mihoff, OTN's senior database developer, began to load POST data and metadata directly into the OTN data warehouse. They expect to be done in September 2012, at which point the OTN data centre will start accepting POST data collection forms as well as providing confidentiality arrangements like at POST.

OTN's iconic Dalhousie black and gold website was recently given a makeover to create a consistent and unique look and feel among all OTN webpages. The new sites run on Plone, an open source content management system.

[OTN's member site](#) was recently moved and will soon have the same look and feel as the Global and Canada sites. The OTN Secretariat and Data Centre staff now provide support for all three OTN websites.



OTN detections world wide by species common name as of May 16, 2012.

## Five-step path to integrating biological and social sciences into harvest management actions

Experience in telemetry studies spanning two decades on migrations of adult Pacific salmon, coupled with recent collaborations with social scientists and fisheries extension specialists, has led Pacific Arena investigators to a better understanding of how harvest management actions are influenced by telemetry science.



Greenland shark -- Steven Kessel

In the opening plenary lecture of the Second Annual OTN Canada Symposium hosted at Dalhousie University, Dr. Scott Hinch illustrated how science can inform management using a five-step process. Hypotheses on either pure science or perceived knowledge gaps by managers initiate this process, constituting "Step 1." The biological phenomenon in question is then described in peer-reviewed papers, theses, etc. This is "Step 2," where the biological science interest normally peaks and when telemetry practitioners often move on to study new hypotheses. However, Dr. Hinch explicitly expressed that scientists must persist beyond "Step 2" to inform management meaningfully. The tipping point where science meets management is "Step 3," obliging researchers to further articulate findings through publications of descriptive models made available to, and informed by, fisheries managers and stakeholders. At this stage, it is beneficial for social scientists to quantify how stakeholders perceive the initial biological phenomenon and to understand how various management prescriptions would be perceived or embraced and could be implemented. Predictive models, "Step 4," can then be developed by fisheries scientists with input from fisheries management with the aim to provide a harvest management "prescription" that is



Atlantic Sturgeon -- Andrew Taylor

consistent with the logistic and regulatory constraints of the fishery. "Step 5" is to have a management prescription adopted and routinely re-examined and assessed for potential improvements.

## OTN Social Sciences Workshop



Pacific Salmon -- Kendra Robinson

The purpose of this workshop was to present and finalize the list of case studies to be published as a special issue of the Journal of International Wildlife Law and Policy. The volume will be entitled, "Tracking and Protecting Marine Species at Risk: Scientific Advances, Sea of Governance Challenges."

The workshop started with a short review of the project and case study methodologies by Drs. David VanderZwaag and Richard Apostle, followed by editorial guidelines for case study authors by Dr. Susan Rolston. Natural, social, and legal scientists discussed nine research case studies. Each presentation covered four items: a working title for the paper, a draft outline, a synopsis of scientific developments with policy implications, and a summary of species-based governance issues.

These presentations were followed by a general discussion of the next steps towards the final publication of the special journal issue. The interdisciplinary research teams will continue to work closely together towards integrated social, legal, and scientific manuscripts, which will be submitted by mid-December 2012.

The workshop represented a valuable integrative step for OTN Canada by bringing together natural and social scientists to discuss governance implications of Canadian tracking efforts in all three Arenas and with transboundary and international reach. Resulting case studies are expected to make substantial law and policy recommendations for further strengthening the management of marine species at risk of importance to Canada.

## Integrating physical oceanography and animal tracking

Dr. Svein Vagle, from the Institute of Ocean Sciences in Victoria, presented the plenary lecture on the integration of ocean modelling and animal tracking. By asking what environmental conditions dictate animal movement and how animals respond to changing climate conditions, Dr. Vagle's lecture captured OTN's integrative themes of ocean physics, marine resources, species interactions, and the impact of climate variability to ultimately influence ocean policy. Dr. Vagle's lecture focused on the cold pool on the Bering Sea continental shelf, salinity-temperature conditions associated with Arctic cod distribution, and the east-west differences in ocean stratigraphy of the Bellot Strait.

These projects are helping scientists answer questions of global importance in the study of oceans. For example, how will ice melt and fresh water affect the Arctic current system? In the Bering Sea, what is known as a "cold pool" exists where ice melt creates a layer of less salty water on top of an ocean layer of salty water. Cold pools are areas of high biotic productivity, however, they are extremely sensitive to changes in the sea ice. The effects of climate change may first be seen in such areas. This makes the Bering Sea ice, currents, and ecosystem very important to understanding how global climate change may affect a specific region.

Dr. Vagle's research on ocean currents makes clear the idea that ocean research cannot be limited to specific areas or regions; connected oceans mean connected species and "must be studied accordingly."

## Summary of HQP presentations

HQP researchers presented twenty-five talks and nine posters at the Second Annual OTN Canada Symposium. HQP being trained under the guidance of OTN Canada's Principal Investigators (PIs) range in experience from qualified technical staff to postdoctoral fellows (PDFs), research assistants (RAs), and students in PhD, MSc, and BSc programs.

HQP presentations at the Symposium spanned three conceptual frameworks that address factors affecting marine animal movement and migrations:

- (a) Oceanographic and environmental features and their variability;
- (b) Species interactions: predator-prey, conspecifics, etc.;
- (c) Anthropogenic interactions: catch and release practices, tidal power, etc.

The OTN salmon projects are exemplars of HQP research that address the above questions. HQP presented research on Pacific salmon migration and associations with their physical environment and ecological genomics. One project related smolt migration to disease pathogenesis. Outside the Pacific, they will address movements of

anadromous salmonids at Atlantic-Arctic transition zones.

The Bay of Fundy Atlantic sturgeon HQP put forth aims to provide key information to management strategies and protection of this species. Exciting results were presented by the American eel team in which eel migration patterns are being elucidated using ocean current modelling, acoustic telemetry, and otolith microchemistry. HQP presentations on Arctic species encompassed a multitude of research objectives for Arctic cod and Greenland shark, and their relationship with changing ice conditions. Knowledge of these species is key to their preservation at our unique and fragile "edge of the earth."

Much of the HQP research presented at the Symposium fell under more than one of the newly identified conceptual frameworks for OTN Canada. Some projects are considered cross-cutting activities, namely:

- (a) Coupled physical-biological ocean modelling and assimilation;
- (b) Data visualization from complex marine observations;
- (c) Technological advances;
- (d) Policy, end users, and management (the social science implications of our research).

Touching on each and all of the HQP presentations is beyond the scope of this newsletter, however, we hope to convey the integration, impact, and international relevance of their top-quality research.

## Data Visualization Workshop

Among the Symposium events was a successful plenary lecture and workshop that demonstrated the importance of data visualization and statistical modelling to OTN research and animal tracking data.

The lecture by Dr. Joanna Mills-Flemming, entitled "OTN: A Statistician's Perspective on Complex Marine Observations," briefly reviewed OTN Canada's mandate, technologies, and infrastructure with a view to moving forward via cross-cutting activities like data visualization and statistical modelling.

The OTN grey seal bioprobe platform was used to illustrate how valuable insight can be gained from visualization tools that reveal key features of complex data sets. These tools are vital for developing statistical models for inference and prediction of important biological phenomena.



Visualization of horizontal (light lines) and vertical (depth profile) movements of a grey seal

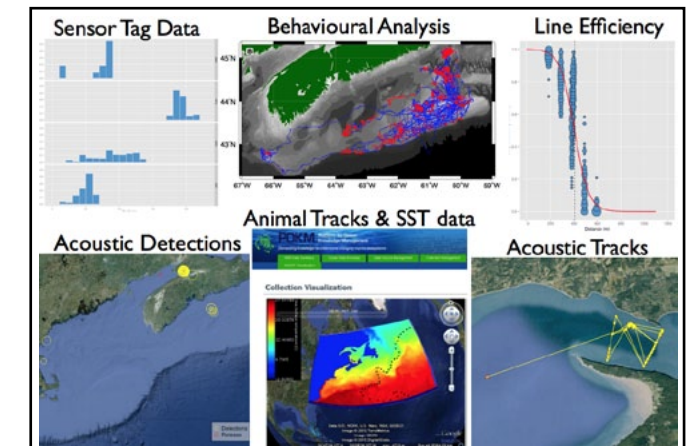
In the workshop, Drs. Ian Jonsen and Svein Vagle highlighted the need to understand performance characteristics of OTN acoustic technology and demonstrated that much can be learned through the application of statistical models that are informed by underlying physical properties of marine acoustics. In a similar vein, Dr. Jonsen demonstrated how statistical models are helping us to understand how detection range and efficiency of OTN bioprobes varies with environmental and behavioural factors.

## Platform for Ocean Knowledge Management (POKM)

POKM is the result of a multidisciplinary collaboration between OTN and computer scientists, led by Dr. Raza Abidi from Dalhousie's Faculty of Computer Science.

Originally funded by CANARIE, Canada's Advanced Research and Innovation Network, POKM is a web-based environment that provides tools for:

- (a) Access, visualization, and analysis of OTN tracking data;
- (b) Merging tracking data with environmental data products (when available);
- (c) Sharing data, analysis tools, and products with colleagues throughout OTN and the broader scientific community.



Example data visualization and analysis outputs that will become available via POKM

POKM is a proof of concept and can presently serve a limited number of users simultaneously. Additional development is required to become fully operational for OTN. The POKM team is seeking new funding opportunities to support this required development.

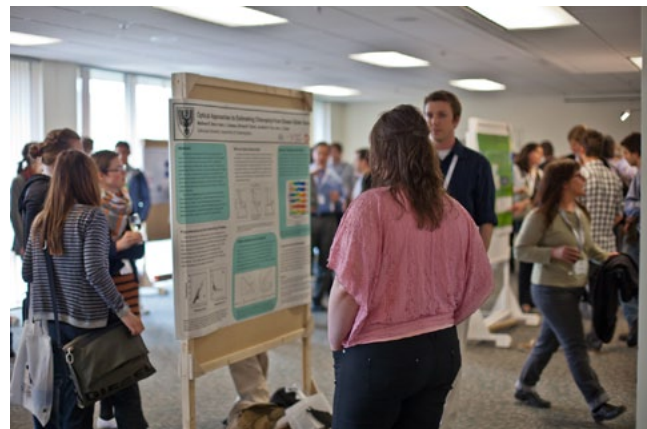
Over the coming months, our goals are to:

- (a) Enhance POKM's capacity for simultaneous users;
- (b) Build secure links from POKM to OTN tracking data collections and to available environmental data;
- (c) Populate POKM with a more comprehensive library of data visualization and standard analysis tools.

If you have other ideas for useful visualizations or general analysis tools geared toward acoustic tracking data, or ideas for the kinds of environmental data that POKM should be linking to, feel free to send an email to Ian Jonsen (ijonsen@dal.ca) with POKM in the subject line.

## HQP commentary on OTN Canada

OTN HQP are afforded the unique opportunity of being part of a national collaborative research network. The Symposium provided a venue for discussing how to best capitalize on OTN resources to promote learning, training, and collaboration among HQP. In light of strong interest in a more integrated communications platform, the OTN Canada website is undergoing minor restructuring. A private discussion forum is in production that will bring attention to potential research collaborations, professional development and travel opportunities, social events, and available grants.



HQP mingling at the poster session during the OTN Canada Annual Symposium

Additionally, HQP will have a private template attached to their public profile outlining their area of research, research itinerary, and opportunities for collaboration. Both the private profile and the discussion forum require login access. All HQP can expect an email with further details and registration instructions in the coming weeks and are encouraged to explore the changes and update their profiles at their earliest convenience.

A communications platform captures both what HQP hope to gain out of being part of the Network and how OTN can grow from the experiences of its personnel. Upon publication, the Secretariat welcomes changes and suggestions to facilitate communication and collaboration among HQP from different Arenas and Themes.

## Notes from the OTN Secretariat

*We would like to take this opportunity to say fond farewell to outgoing people and to welcome new folks to the OTN team. Farewell and huge thank-yous to Glenn Crossin, acting Network Manager for OTN Canada, who is starting a new faculty position in the Dalhousie Biology Department, but will immediately become an OTN researcher, and to Shauna Baillie, OTN Canada Administrative Assistant, who is starting a postdoctoral fellowship at the University of Winnipeg. A warm welcome to Kes Morton, OTN's new Senior Project Manager; Kyle McKenzie, OTN Canada's new Network Manager; and to Nikki Beauchamp, OTN's new Communications Officer. We look forward to a great team as we move forward in our evolution.*

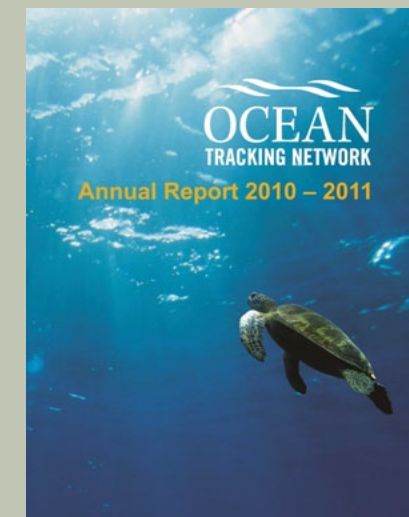
Sara Iverson,  
OTN Scientific Director

A picture is worth a thousand words! Compelling visuals help raise the profile of OTN. Please send photos you don't mind sharing to Nikki (n.beauchamp@dal.ca). Please include a photo description as well as your name and institution so we can give you credit for your images.

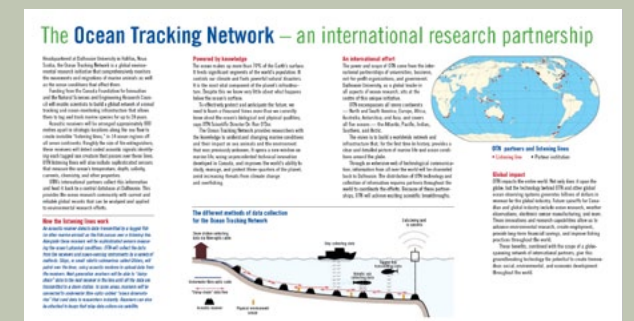
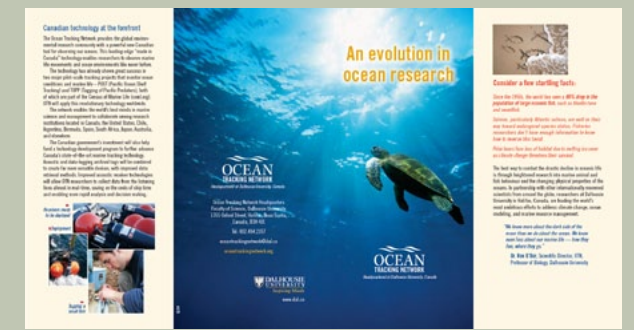
To ensure that all OTN members receive the various OTN publications and notifications, it's important that new members' contact information be sent to the Secretariat as soon as possible. We hope that the publications are useful and interesting to members and promote connectedness across the Network.

Finally, if you have suggestions for how to improve the newsletter, please contact Nikki.

OTN publishes a quarterly bulletin, semi-annual newsletter, and annual report. If you would like to receive any of these publications, either electronically or in hardcopy, please email OTN communications and public relations officer, Nikki Beauchamp at n.beauchamp@dal.ca.



OTN brochures are also available for download on both the OTN Canada and OTN Global websites.





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