Understanding Species Movements, Interactions, and Environmental Variability across Canada's Three Oceans

Annual Reports Year 5 (2014)
(DRAFT)

NSERC Research Network Grant: NETGP 375118 – 08

Sara J. Iverson et al.

Table of Contents

Project Reports

Ocean Tracking Network (OTN) Canada Network Overview

1. Network Overview

1.1 OTN Canada Phase II framework

In 2014, OTN Canada entered its second funding phase (years 5-7; 2014-2016). Phase II builds on the work of Phase I. To achieve the evolved aims of OTN Canada, a conceptual framework of scientific questions was established to more strategically align the related research activities within that framework and to inform ocean governance. In Phase II, the research questions being addressed across OTN Canada (and international partners) are broadly structured around three major integrated "framework questions" (FQs), under which projects are organized (Table 1). Many activities will relate to more than one FQ. Additional scientific activities are structured under four major "cross-cutting activities" (CCAs; Table 1). CCAs are activities that cut across two or more FQs and/or projects and subprojects, which include methodologies and approaches that can inform the three FQs. This overall organization ensures a conceptual understanding of how projects are interrelated, illustrates how these can be most effectively integrated across the Network to best address OTN Canada's mission, and allows rapid dissemination to interested parties of all individual research projects and programs. This approach also fosters a breadth of training opportunities and exposure for HQP.

Table 1. Framework Questions and Cross-Cutting Activities matrix used in Phase II.

Cross-Cutting Activity (CCA)	FRAMEWORK 1: How do oceanographic & environmental features (both physical & biological) affect animal habitat use, movement & migrations?	FRAMEWORK 2: How do aquatic species interactions & areas of ecological significance relate to habitat use, movement patterns, & biotic/abiotic features?	FRAMEWORK 3: How do anthropogenic activities & development influence aquatic animal behaviour & ecology?
1: Assimilating animal tracking data with coastal & offshore oceanographic models	→		
2: Visualization & modeling of complex aquatic & marine observations	→		
3: Advancing animal tracking technology & tagging techniques	→		
4: Policy, stake holders & mechanisms for feeding into outreach & management; cooperation of natural & social scientists	→		

1.2 OTN Canada Phase II framework objectives

- FQ1: Understand valued or keystone species in marine ecosystems, and species at risk, and how their movements change in relation to oceanographic features and variability.
- FQ2: Expand knowledge of predator and prey distributions in time and space in relation to ocean characteristics and to test hypotheses concerning predator and other impacts on prey populations, including economically important commercial fish stocks.
- FQ3: Understand the direct and indirect effects of anthropogenic activities and infrastructure on animal populations and their movements, migrations and habitat use and survival, in the face of changing ocean environments.

2. Progress and Network Integration

Researchers have accumulated an outstanding track record of first-rate science and have developed an integrated Canada-wide research network with increasing international reach now in Phase II of Network activities. A key focus of the NSERC Network is the training of students and postdoctoral fellows, as well as technicians and research assistants. During this report year, OTN Canada was supporting, in whole or in part, the programs of over 80 of these trainees. Details of all the projects and Network integration are described in each of the individual reports. Integration of the Network within and across FQs and CCAs continues to increase and evolve through directed workshops and meetings, data exchange and joint publications and presentations, exchange of HQP, and integrated field exercises.

2.1 HQP exchange highlights

Dr Mélanie Béguer continues her research at Dalhousie University (having relocated from Laval in fall 2013) to strengthen ties between the American Eel project (Project 4.5) and physical oceanography studies (Project 4.1).

Montana McLean began PhD work on white sturgeon migration (Project 4.14) in the Pacific Arena under Dalhousie PI Glenn Crossin. McLean completed her Masters with OTN during Phase I at Acadia on Atlantic sturgeon (Project 4.6).

Numerous HQP have been able to participate in outreach, exchange and conference activities as described in 4.16.

2.2 Network integration and collaboration

OTN has made steady and significant progress towards greater Network integration during Phase II. There is unprecedented sharing of research results, techniques, models, and data between HQP and PIs of different projects (described further in the individual reports). The figure below (created by HQP Marianne Marcoux) illustrates collaborations initially described between PIs in the Phase I proposal and those described in the Phase II proposal. This diagram will be updated as the Network progresses to demonstrate growth and integration during Phase II.

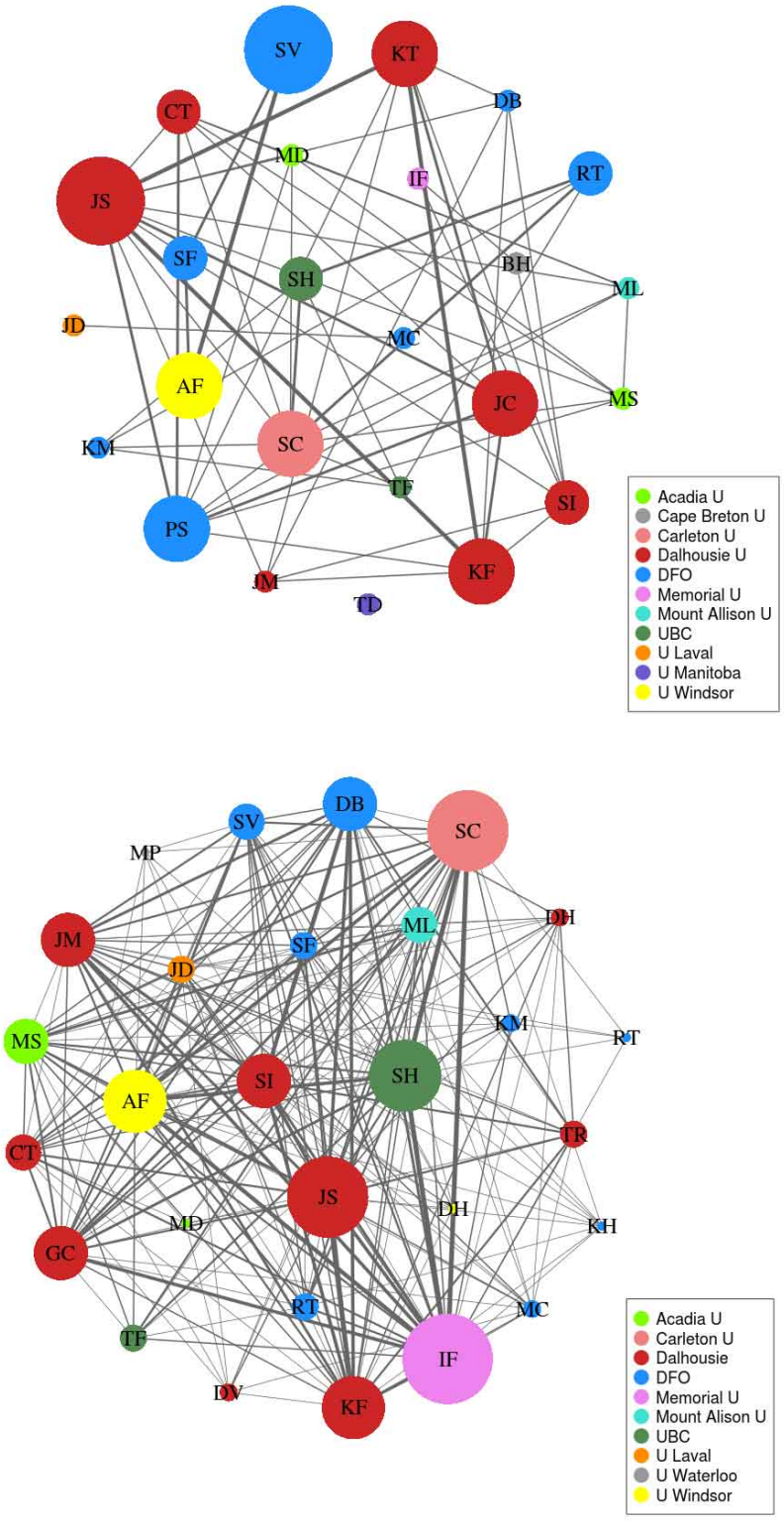

Figure 1. Comparison of OTN Canada integration as described in Phase I (top) and as described at the initiation of Phase II (bottom). Developed and presented by HQP Marianne Marcoux at the 2014 OTN Canada Symposium.

3. Training of Highly Qualified Personnel (HQP)

The integration of research activities among projects within and across Arenas from University, and Government Agencies has proven to be invaluable in terms of allowing HQP access to varied expertise across multiple fields of ocean sciences. Descriptions of HQP involvement are contained in the individual project reports. The following table summarizes the HQP who have been supported by the Network during 2014.

Table 2. Summary of the number of Highly Qualified Personnel (HQP) trained within the scientific program of OTN Canada by Project. Brackets represent the number of HQP receiving 100% support from OTN Canada.

HQP Total (Receiving 100% support from OTNC)	BSc students	MSc students	PhD students	Post Doctoral Fellows	Research Associates	**Total (100% support from OTNC)**
4.1	-	-	4 (1)	-	2 (2)	**4 (3)**
4.2	-	2 (0)	1 (1)	-	8 (0)	**11 (1)**
4.3	5 (0)	-	1 (0)	-	-	**6 (0)**
4.4	1 (0)	1 (0)	-	-	-	**2 (0)**
4.5	-	-	-	-	1 (1)	**1 (1)**
4.6	6 (3)	3 (0)	-	-	-	**9 (3)**
4.7	-	1 (1)	-	-	2 (0)	**3 (1)**
4.8	-	2 (0)	1 (1)	1 (1)	1 (1)	**5 (3)**
4.9	-	-	2 (1)	-	1 (1)	**3 (2)**
4.10	-	2 (2)	2 (1)	-	1 (1)	**5 (4)**
4.11	-	1 (1)	1 (1)	1 (0)	-	**3 (1)**
4.12-4.15	6 (0)	4 (0)	10 (2)	6 (0)	1 (0)	**27 (2)**
Total (receiving 100% support from OTNC)	**18 (3)**	**16 (4)**	**22 (8)**	**8 (1)**	**17 (6)**	

4. Participation of Key Partners

4.1 Government

The involvement of the Canadian Department of Fisheries and Oceans (DFO) occurs at all levels of research and coordination, including the transfer of research results within the Network and to the general scientific community. DFO has two voting members (A. Vezina, DFO representative, and S. Vagle, Arctic Arena representative) on the NSERC Scientific Advisory Committee (SAC) and ten of the 27 Network PIs are university adjunct professors from DFO. Since many of the DFO scientists that are either co-PIs or collaborators are also adjunct faculty, they have a significant involvement in both student

and postdoctoral training. The details on involvement of partners in individual projects are described in section 11 of each individual report.

4.2 Canada Foundation for Innovation (CFI)

None of the research programs of the OTN Canada Network could take place without the significant contribution of infrastructure support from CFI. The OTN Global Network, through the CFI funding, has worked extensively with OTN Canada through deployment of fixed receiver arrays throughout areas of the Atlantic, Arctic, and Pacific Arenas and according to the needs of the OTN Canada PIs, through the purchase of acoustic tags and use of gliders, through the servicing and uploading of data that must be obtained from receiver lines, and finally through access to the data management support that is part of the infrastructure. The OTN International Scientific Advisory Committee (ISAC) works with the NSERC SAC to inform research decisions as they overlap. Since its establishment, ISAC meetings have been held in conjunction with the OTN Canada Symposia to better keep key international partners abreast of Canadian Network news and research, to offer global perspectives on Canadian research issues, challenges and successes, and to forge new paths for international collaboration and integration.

4.3 Industry

OTN Canada continues to have a number of industry collaborators, both national and international. These industry collaborators, such as VEMCO, Satlantic, Romor, Lotek, the Sea Mammal Research Unit, and others, have been integral in helping solve problems, develop new technology, construct needed equipment, and brainstorm about better ways to use it. A number of new industry partners were established during the reporting year and two spinoff companies from OTN (Baker Blue Ocean and Maritime bioLoggers) continue operations and expansion. Examples beyond a supplier-buyer relationship are included in individual project reports.

4.4 Universities and other research institutions

The many universities and research institutions with whom the OTN Canada PIs and collaborators are associated provide further infrastructure and support, including personnel support, to conduct the Network's research, sponsor HQP, and host various other activities. These are apparent throughout, and detailed in, individual project reports. Eight universities listed in *Times Higher Education* World University (top 200) Rankings are primary collaborating institutions under the OTN umbrella. University of British Columbia and University of Victoria are ranked 32nd and 173rd respectively.

5. Dissemination and Other Contributions

5.1 Publications and presentations

OTN Canada research is making impacts locally, regionally, nationally and abroad. Network members regularly present to and exchange information among government scientists, other research networks, ENGOs and private industry. Formal presentations at workshops and seminars are helping forge and solidify relationships with collaborators and stakeholders and augment visibility in the broader science community. Additionally, consultations with local community members help inform tracking study design and are an important part of planning and implementation as well as serve to build important relationships with communities on which research has direct implications. Network members continue to share research insights and results with stakeholders including grade-school groups, local communities, academic and industry partners, and government officials through such communications channels as workshops and lectures (outside the Network); public presentations; newspaper, television and radio interviews; and through affiliated organizations' newsletters and other media.

Table 3. Summary of accepted or published refereed journal articles and conference presentations (invited and contributed) by HQP and PIs by project.

Project	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10	4.11	4.12-4.15	**Total**
Accepted/published refereed journal articles	6	0	1	0	4	6	3	3	0	1	7	39	**97**
Conference presentations (invited and contributed)	17	3	6	0	8	13	4	3	1	6	4	50	**196**

Table 4. Summary of dissemination (partner meetings, public outreach of other deliverables) by HQP and PIs by project.

Project	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10	4.11	4.12-4.15	**Total**
Formal meetings as part of collaborations with non-OTN members	3	8	5	6	4	4	7	2	2	3	1	12	**57**
Public dissemination (e.g., interview, community or school presentation, book)	0	6	2	1	0	6	3	0	6	8	3	22	**57**
Other (e.g. facility tour, meeting with government official)	0	6	0	0	0	0	0	0	0	0	0	2	**8**

5.2 Newsletter and Website

The OTN newsletters share news and events from Canadian and Global perspectives. It reflects the work and success of both national and international Network efforts and their increasing integration, and serves to keep OTN members, collaborators, granting councils, government and industry sponsors, and relevant members of the Dalhousie community abreast of OTN news. The newsletter has evolved to feature regular segments including global deployment, data, and technology updates as well as conference dates and calls for proposals and now stands at 12 pages, almost double the content from the first issue; however, the newsletter now competes with the annual report in terms of reporting breadth and scope. As such, the Network is in a better position to produce ~monthly reports thus keeping the Network more visible by publishing more frequent, timelier and shorter newsletters beginning in the new-year. Analytics will be tracked and compared to semi-annual publications to enhance the quality of newsletter content and drive better engagement with OTN digital media per the communications strategy.

All newsletters are hosted on the OTN website with a link sent via email to over 800 national and international partners. This recipient list continues to grow as industry, science, and media contacts are made. Hardcopies are distributed during promotional events and to visiting delegations.

The OTN website (oceantrackingnetwork.org) underwent a significant redesign (again) in 2014. Dalhousie Computer Science student Timothy Arrott was hired as a full-time summer co-op student (50% salary from N.S. Government, 50% from CFI) dedicated to migrating the OTN website from Plone to the more user-friendly WordPress (Figure 2). The 2013 redesign used Plone. Redesign was facilitated in consultation with the Scientific Director and Communications Officer. All targets were met and analytics describe better overall engagement compared to the previous year including greater overall usership and longer session duration,

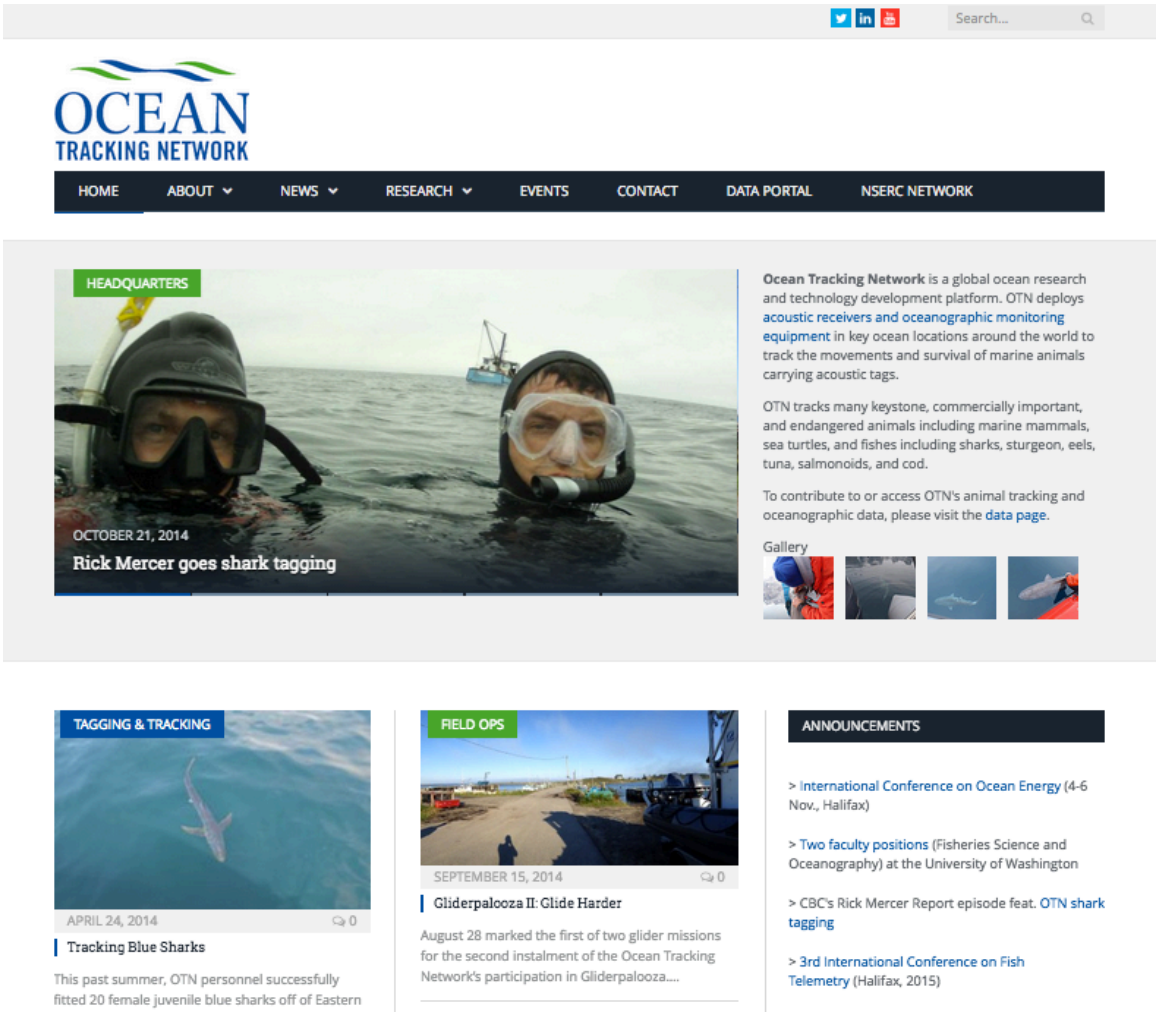

Figure 2: OTN website landing page (launched July 2014).

5.3 Data management/sharing

The OTN Data Centre made significant strides in management of OTN research data in 2014. While not a formal project of OTN Canada, the work of the data team is integral to the success of OTN Canada research and is leading to a deeper understanding of animal movement by OTN Canada researchers. As such it warrants mention here. Several data tools were developed and disseminated to the Network in the form of a Data Workshop and follow-up online tutorials.

6. Changes, Reprofiling, and Delays

6.1 Deviation from the original overall research objectives

There have been no significant deviations to the Phase II objectives of the Network. Within the specific projects, adjustments have been made where required to maximize the productivity toward stated goals (in response to new personnel expertise and changes in logistical support).

6.2 Reprofiling and Budget Implications

The Reprofiling Sub-committee deals with ongoing changes to programs and funding, projects facing problems, and makes recommendations on these to the SAC. "Reprofiling" is meant to encompass issues, such as investigators proposing a deviation of >20% of their approved budget, investigators who have proposed to conduct certain work but are not performing this work, PIs raising concerns about the progress of specific projects and suggesting possible solutions or new directions, for special-purpose projects or activities outside the scope of the original proposal. Details of reprofiling requests are documented in the individual projects (see also 4.16)