MEOPAR

MARINE ENVIRONMENTAL OBSERVATION
PREDICTION & RESPONSE NETWORK

2014/15 ANNUAL REPORT

DALHOUSIE
UNIVERSITY

Government of Canada   Gouvernement du Canada
Networks of Centres   **Réseaux de centres**
of Excellence   **d'excellence**

Building Canada's capacity to
anticipate and respond to marine risk

*Richard Davis (Dalhousie University) recovers an autonomous
surface vehicle as part of a project to reduce ship-whale collisions.*

(L to R): Dr. Robert Walker, Mr. Neil Gall, Dr. Douglas Wallace and Dr. Ron Pelot

Message from Board Chair and Directors

It is my pleasure to present the 2014-15 NCE Annual Report for the Marine Environmental Observation Prediction and Response (MEOPAR) network on behalf of the Board of Directors.

Building on our success from last year, MEOPAR has matured into a national force in oceans research. This year we expanded our research portfolio and welcomed new researchers, new trainees, new universities and new partners to our network. We hosted workshops and seminars across the country including our Expert Forum on Ocean Acidification, the first event of its kind in Canada. We are now playing a leadership role in addressing key issues requiring national coordination, such as ocean acidification and ocean data management, as well as assisting Canadian researchers and interests to be represented in major international research projects, such as those initiated under Europe's Horizon 2020 program. Using our strong relationships with government departments and external partners, we are linking academic research to both public policy and the private sector.

Dr. Robert Walker,
Chair, Board of Directors

On behalf of the Management and Staff of MEOPAR, we would like to thank all our researchers, "MEOPeer" trainees, and partners for their enthusiasm and achievement in developing new knowledge, technologies and partnerships. Our expanded Research Management Committee has worked hard to guide the development of the research program and ensure that we maintain quality as the Network grows. We continue to benefit from the guidance and support of our Board of Directors, our International Science Advisory Committee and NCE program representatives and committees.

We look forward to another exciting and impactful year for MEOPAR.

Dr. Douglas Wallace,
Scientific Director

Dr. Ronald Pelot,
Associate Scientific Director

Mr. Neil Gall,
Executive Director

About MEOPAR

Strategic Vision: The MEOPAR network delivers knowledge, technology, and people to enable Canada's communities and industry to enhance resilience and economic opportunity through an informed relationship with the changing marine environment.

The Network was established in 2012 through the federal Networks of Centres of Excellence Program (NCE), which provided MEOPAR with $25 million for its first five years of operations. MEOPAR will apply for renewal funding from the NCE that if successful, will see MEOPAR move through a total of three, five-year operational cycles:

Phase 1: Build Capacity (2012 – 2017)

Phase 2: Open Pathways (2017 – 2022)

Phase 3: Sustain Momentum (2022 – 2027)

7 STRATEGIC OBJECTIVES
MEOPAR's strategic objectives for Phase 1 (2012 – 2017) are:

New Ocean Science

1 Establish the first nodes of a new pan-Canadian network of integrated observing and prediction systems for strategically important locations.

2 Develop new tools and technologies for rapid environmental assessment and forecasting during marine environmental emergencies.

3 Link projection of future changes in storms, coastal flooding, waves on local scales with consideration of economic impacts, safety, planning, and policy.

4 Assess the impact of long term, oceanic change on Canadian coastal communities, ecosystems and economic interests, including implications for resource management, regulation and policy.

New Approaches to Ocean Science

5 Introduce new approaches for training of highly qualified personnel with skills in the natural and social sciences and their use in solving problems related to marine risk.

6 Implement new approaches for sharing natural and social science expertise, data and infrastructure in order to respond more effectively to marine emergencies.

7 Establish an "Expert Forum" involving Canadian and international experts, policymakers and stakeholders for the illumination, evaluation and communication of emerging and new risks in the marine environment.

APPROACH

MEOPAR integrates research, cross-sector engagement and capacity building activities to address the complex and highly interdisciplinary field of marine risk.

RESEARCH

We fund interdisciplinary research at universities across Canada to generate new knowledge and technology, and to create new opportunities for students and researchers to develop expertise in issues related to marine risk.

PARTNER ENGAGEMENT

All MEOPAR research projects involve stakeholders from outside academia. Their regular collaboration through these projects, and on initiatives via MEOPAR programs and the corporate centre, ensures multiple sectors are engaged in marine risk activities across Canada.

RESEARCH
Observation
Prediction
Response

HQP
Training

Partner
Engagement

Knowledge
Sharing

RECEPTOR
IMPACT
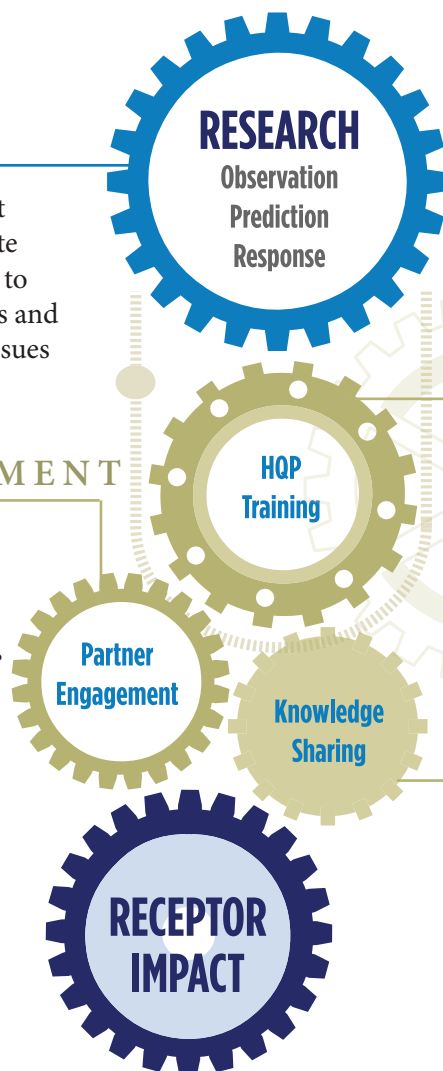
HQP TRAINING

MEOPAR offers its Highly Qualified Personnel a variety of training opportunities beyond their work experience on their specific project. This includes training workshops, monthly online research exchanges, travel to conferences, funding for professional development training, and other activities.

KNOWLEDGE SHARING

MEOPAR ensures that new knowledge produced by the network is shared with receptor communities through a variety of channels. Stakeholder collaboration and other activities ensure expertise outside the academic community is integrated into our research work.

RECEPTOR IMPACT

Our work impacts a wide variety of receptor groups including stakeholders and end-users from the private, public, academic, and government sectors.

The MEOPAR Network

70 Principal Investigators

162 Highly Qualified Personnel

20 Universities

147 Industry, Government and Other Partners

The MEOPAR Network includes:

2 Canada Excellence Research Chairs

19 Canada Research Chairs

PARTNER ENGAGEMENT

MEOPAR creates pathways for prospective partners and academic researchers to connect with one another. We also spur collaboration within the scientific community, and foster dialogue between our researchers and external partners such as end-users, government agencies, and non-governmental organizations. By engaging multiple sectors in our work, we are strengthening Canada's collective capacity to anticipate and respond to marine risk.

"MEOPAR is making great strides to connect academia and bright, motivated young people with a whole-of-society effort to increase resilience to marine risk."

Dr. Ron Pelot (Associate Scientific Director, MEOPAR, Dalhousie University)

Knowledge Sharing Activities
(e.g., workshops, expert fora, conferences)

Research & Scientific Collaboration
(e.g., project collaboration, technology transfer)

Corporate Sponsorship
(e.g., event sponsorship, corporate support)

Partner Pathways

HQP Development
(e.g., internships, training opportunities)

Research Funding
(e.g., direct or in-kind contributions, matching funds program)

Environment Canada

Research Collaboration

Seasonal Climate Predictions: Marine Applications and Improved Resolution

Dr. Bill Merryfield (University of Victoria / Environment Canada) is investigating how Environment Canada's seasonal climate forecasts can be applied to marine environmental prediction. This includes development of new methods to "downscale" seasonal predictions of wind and storminess from global models to scales of 25-50 km along Canada's east and west coasts.

This MEOPAR project, which is conducted in close collaboration with Environment Canada, is of high relevance for coastal stakeholders, who would benefit significantly from more precise and informative seasonal forecasts of weather conditions along Canada's coasts.
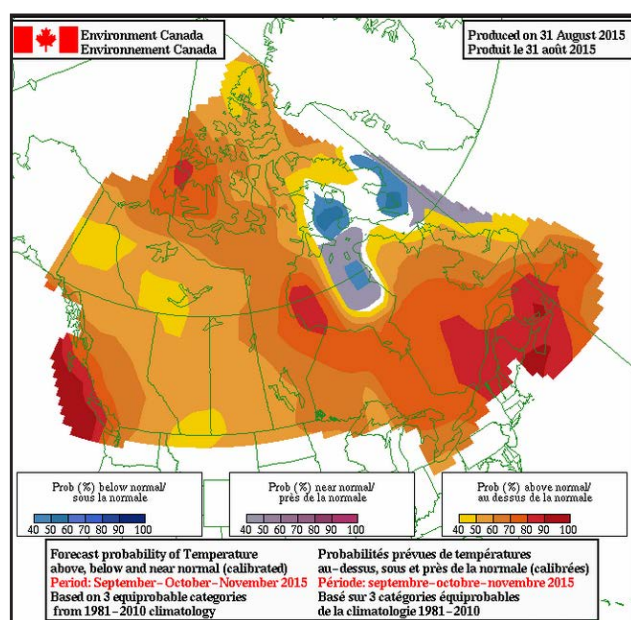
A seasonal climate model from Environment Canada.

ExxonMobil

Research Funding

The Role of Marine Bacteria in Remediating Oil Spills

Marine bacteria represent the first line of defense against oil spills in the ocean environment – but very little is known about how naturally occurring bacteria in Canada's northern waters would react to a spill. Dr. Casey Hubert (University of Calgary) has partnered with ExxonMobil to explore the physiology and diversity of marine bacteria in Canada's Arctic to better assess vulnerability and potential response mechanisms in these waters.

Through the MEOPAR partnership program, ExxonMobil's $50,000 cash investment in Dr. Hubert's research was matched with a $50,000 contribution from MEOPAR, in addition to another $40,000 from MEOPAR to match contributions from Dr. Hubert's other co-funding partners.

Dr. Casey Hubert (University of Calgary) partnered with ExxonMobil to study marine bacteria response to oil spills.

exactEarth Ltd.

Corporate Sponsorship & HQP Development

Tracking Ship Movements by Satellite

exactEarth Ltd. uses satellite AIS data (Automatic Identification System) to track ship movements in the world's oceans. These data are critical for MEOPAR researchers investigating marine traffic issues such as air quality, ship safety, surface spills, ship-mammal interactions, noise exposure, and transportation disruption.

exactEarth Ltd. partnered with MEOPAR to provide their AIS data and software to the entire MEOPAR network of researchers at an 80% discount (an approximately $800,000 CAD value). They also donated $20,000 to the MEOPAR Corporate Centre to support our knowledge sharing activities, and are making internship positions available to MEOPAR's highly qualified personnel interested in further developing their AIS data knowledge and skills.
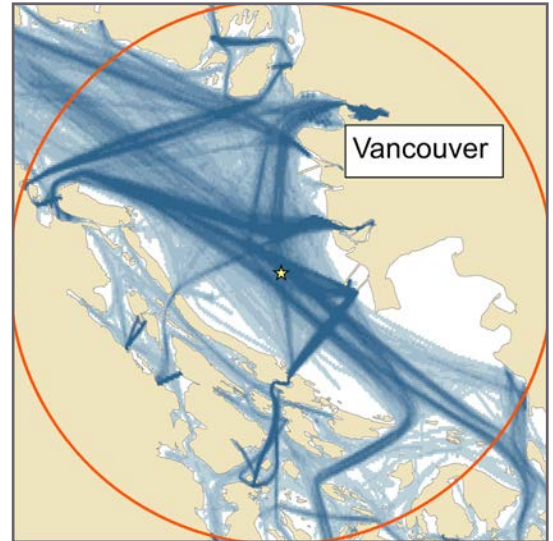
Dr. Rosaline Canessa (University of Victoria) uses AIS data from exactEarth to study vessel traffic noise impacts near Vancouver, B.C.

"exactEarth is very keen on building stronger ties to the maritime academic and research community across Canada and we believe there is no better partner to achieving this goal than MEOPAR"

- Peter Dorcas (Senior Director Business Development, exactEarth Ltd.)

Knowledge Sharing

Partnership Workshop Program

MEOPAR provides its researchers and project partners with funding to host project-specific stakeholder workshops.

The Evolving Arctic, Challenges and Opportunities
Partners: Master Mariners of Canada and Dalhousie University

Municipal Climate Change Action Plan Focus Groups
Partners: Department of Municipal Affairs (NS) and Western University

Fishermen's Forum 2014: Collaboration on Climate Change Research
Partners: Gulf Aquarium & Marine Station Cooperative and Dalhousie University

Ocean Citizen Science and Ocean Literacy Across Biological and Technical Gradients Workshop
Partner: Memorial University

International Workshop on Modeling the Ocean
Partners: Lloyd's Register and Dalhousie University

Optimizing Real Time Locations for Ballast Water Exchange
Partners: Maritime Way Scientific & University of Victoria

MEOPAR Research

MEOPAR's research is broad in scope; it brings together natural, social and health scientists to address critical Canadian issues stemming from the full range of marine hazards, including those associated with weather and climate change, chemical and biological change, geophysical events, and direct human impacts. In addition to providing scientific knowledge, our research facilitates cooperation and communication among experts and stakeholders across the country, while also creating jobs and training opportunities for the next generation of Canadian problem solvers.

Research Projects

Our research projects fall into two thematic categories based on the time scale of the topic under investigation. Projects integrate partners from the government, private and public sectors.

Theme 1- Hours to seasons: prediction and rapid response to immediate marine issues (e.g., oil spills, hurricanes, weather)

Theme 2 – Seasons to decades: prediction, response and planning associated with longer term issues (e.g., ocean acidification, sea level rise, changing patterns in extreme weather)

Research Cores

The MEOPAR research cores develop and/or provide shared instruments, technology and resources in support of MEOPAR research projects, while also facilitating knowledge transfer and communication between projects. The Observation and Prediction Cores are well established, and the Response Core is under development (expected in 2015).

THEME 1: Hours to Seasons

Observation Core — Prediction Core

Response Core

THEME 2: Seasons to Decades

MEOPAR research portfolio

19 research and core projects 2013-2014

49 research and core projects 2014-2015

Early-Career Faculty Development Program

In late 2014, MEOPAR introduced funding designed specifically to involve early-career academic researchers in the Network. A call for proposals was targeted at full time faculty who had received their appointment at a Canadian University over the last five years. A total of $1.2 million was awarded to 12 of Canada's most promising young researchers. Through this program, MEOPAR has integrated a broad array of new talent into its Network and the funding recipients have the opportunity to accelerate development of their research ideas at a critical stage in their careers.
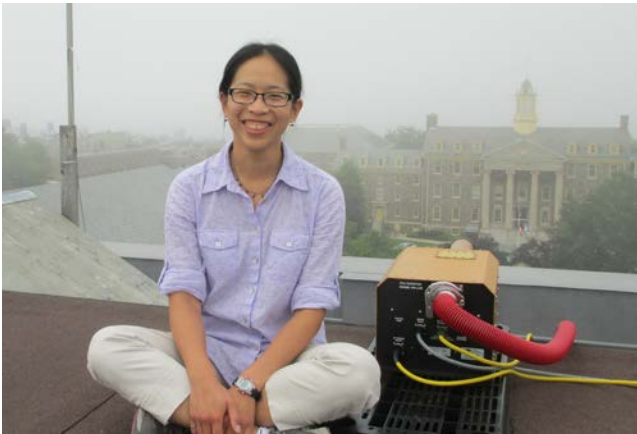
Early-career researcher Dr. Rachel Chang (Dalhousie University), pictured here with her fog droplet monitor, is evaluating coastal fog formation.

Early-career researcher Dr. Philip Loring (University of Saskatchewan) is working with residents of Haida Gwaii, B.C., to understand how the marine environment influences their health and well-being and to identify concerns regarding sustainability.

Early-career researcher Dr. Rocky Taylor (Memorial University) is investigating risks posed by pressurized ice events in Newfoundland & Labrador.

RESEARCH PROJECTS

In 2014/2015, MEOPAR funded 34 research projects covering a broad range of topics related to marine risk. The projects are led by principal investigators at Canadian universities who manage teams of students, technicians and research assistants working on the project. Every project involves non-academic partners and applies an interdisciplinary approach to their investigation.

MARINE FORECASTING
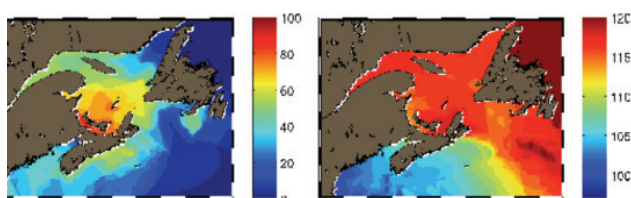
Coastal communities and maritime users depend on forecasts of marine weather and currents to protect their communities and reduce their risk at sea. MEOPAR scientists are developing new and/ or improved technology and models that strengthen Canada's capacity to provide accurate, timely marine forecasts.

Developing a re-locatable coupled atmospheric-ocean forecast system for use in marine emergencies (1.1)
Dr. Harold Ritchie, Dalhousie University & Environment Canada

Building a network of fixed coastal observing and forecasting systems (Halifax Harbour and Straight of Georgia) (1.2)
Dr. Jinyu Sheng, Dalhousie University
Dr. Susan Allen, University of British Columbia

Evaluation, improvement and communication of short-term hazardous weather forecasts over coastal British Columbia (1.14)
Dr. Daniel Kirshbaum, McGill University

Marine applications & downscaling of seasonal climate predictions (2.1.1)
Dr. Bill Merryfield, University of Victoria & Environment Canada

Measuring marine boundary layers in an urban shipping environment: monitoring trace gases relevant to air quality and climate change (2.8)
Dr. Aldona Wiacek, Saint Mary's University

EXTREME EVENTS

Extreme events such as intense storms and large waves can have catastrophic consequences on coastal communities and marine operations. Understanding these unique events, and how we might better forecast and prepare for them, is a critical area of MEOPAR research.

Climate change and extreme events in the marine environment: predicting the likelihood and intensity of extreme events, and identifying issues related to the fishing industry and coastal communities (2.1.0)
Dr. Bill Merryfield & Dr. Greg Flato, University of Victoria & Environment Canada

Coastal storm activity: understanding model biases in predicting frequency and intensity of weather bombs (2.1.2)
Dr. Francis Zwiers, University of Victoria

Estimation of extreme wave statistics off the East Coast of Canada and their future change: improving extreme wave prediction by downscaling model resolution (2.1.3)
Dr. Jinyu Sheng, Dalhousie University

Developing a Re-locatable Forecast System for Rapid Response to Marine Emergencies

Principal Investigator: Dr. Harold Ritchie, Dalhousie University / Environment Canada
Partners: Environment Canada, Fisheries and Oceans Canada (CONCEPTS), Ocean Networks Canada, Ocean Tracking Network

Dr. Harold Ritchie (Dalhousie University/ Environment Canada) is spearheading a project to develop a fine scale re-locatable forecasting model that can be used within hours of marine emergencies, such as oil spills or search and rescue operations. The system will have an ocean resolution of 500m – a substantial improvement over current models, which have a resolution of 10-25km. This new model will produce high resolution, short-term forecasts of variables like wind, fog, sea level, waves and currents. It will also be capable of tracking plumes of hazardous materials from marine wrecks or oil spills, and providing rapid appraisal of socio-economic risks to the environment and coastal communities.

The level of detail provided by this model will enable better decisions and emergency response plans across Canada. Ultimately, this system will be transferred to Environment Canada for operational use.
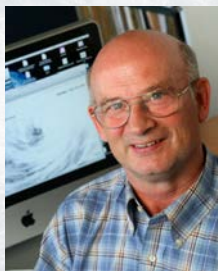
Dr. Harold Ritchie, Dalhousie University / Environment Canada

The system will improve ocean-forecasting resolution from 25 kilometres down to just 500 metres

ICE

Changes in global climate are causing substantial change in the development, breakup, and movement of ice in Canadian waters. MEOPAR researchers are investigating ice forecasting and risk mitigation techniques in an effort to improve Canadian understanding of the changing frozen environment.

Improving sea ice prediction by incorporating visual infrared sensors and synthetic aperture radar data sources into an operation sea ice forecasting system (1.6)
Dr. Andrea Scott, University of Waterloo

Improving marine drift and dispersion forecasts (1.3)
Dr. Dany Dumont, Université du Québec à Rimouski

Pressured ice: environmental monitoring, modeling and mitigation of risk for marine operations (1.17)
Dr. Rocky Taylor, Memorial University

A meteorological observatory in the NW Passage: understanding sea ice changes and Inuit use of scientific information (2.6)
Dr. Brent Else, University of Calgary

User-driven monitoring of adverse marine weather states in the Eastern Beaufort Sea (2.3)
Dr. David Atkinson, University of Victoria

OIL SPILLS AND CONTAMINANTS

The increasing amount of extraction and transportation of oil and other contaminants in Canadian waters reinforces the need for research into contaminant tracking, remediation and response. Our researchers are working to improve contaminant monitoring and modeling, and are exploring if/when specific remediation techniques may be effective in response scenarios.

Improving oil spill models to support environmental emergency response and chemical dispersant use policy development (1.16)
Dr. Haibo Niu, Dalhousie University

Predicting the microbial bioremediation response to marine oil spills in Canada (1.20)
Dr. Casey Hubert, University of Calgary

International Fukushima Ocean Radionuclide Monitoring Network: monitoring the presence/absence of Fukushima radiation in Canada's Pacific and Arctic oceans (2.4)
Dr. Jay Cullen, University of Victoria

Monitoring Canada's coasts for Fukushima Radiation

Principal Investigator: Dr. Jay Cullen, University of Victoria
Partners: Health Canada – Radiation Protection Bureau; Woods Hole Oceanographic Institution; Fisheries and Oceans Canada, Raincoast Education Society; Surfrider Foundation; Georgia Strait Alliance; David Suzuki Foundation; Clayoquot Biosphere Trust; Living Oceans

Following the tragic Tohoku earthquake and ensuing tsunami in March, 2011, the Fukushima Daiichi nuclear power plant experienced meltdowns in three of its reactors, releasing significant quantities of radionuclides into the Pacific Ocean. Models predict this contamination will spread to Canada's Western and Arctic coasts, raising public concern about potential threats to human and environmental health.

The International Fukushima Ocean Radionuclide Monitoring (InFORM) Network, led by University of Victoria Professor Jay Cullen, was established to monitor Canada's Western and Arctic coasts for the presence of Fukushima radionuclides. An organization of citizen, academic and government scientists, InFORM aims to communicate scientifically sound results to the public in the most timely manner possible. Early results indicate that ocean borne contamination arrived on the B.C. coast in February 2015, but at levels that are far below those that are known to pose a risk to environmental or human health.

Dr. Jay Cullen,
University of Victoria

MARINE TRANSPORTATION

Canada's coasts, and especially its primary ports, are active centres of marine transportation. Understanding how communities rely on marine transportation, and how transportation may impact the environment, are critical to marine planning, regulation and policy.

Maritime transportation disruption: an integrated assessment for coastal community resilience (1.9)
Dr. Stephanie Chang, University of British Columbia

Modeling ship movements: application for noise exposure to the marine environment (1.7)
Dr. Rosaline Canessa, University of Victoria

Integrating the model of sound propagation into the Marine Mammal and Maritime Traffic Simulator (1.12)
Dr. Jérôme Dupras, Université du Québec en Outaouais

Whale Habitat and Listening Experiment (WHaLE): using new technology to locate whales and alert ships (1.8)
Dr. Chris Taggart, Dalhousie University
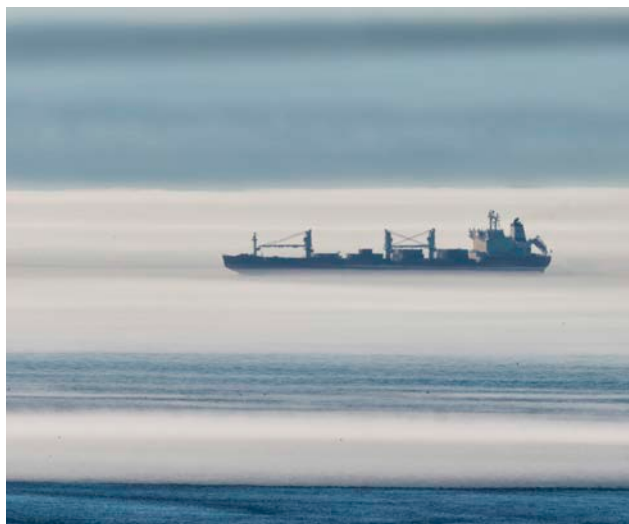
FISHERIES AND ECOSYSTEMS

The fishing industry is a major player in Canada's economy and a key piece of our national identity. MEOPAR researchers are investigating how extreme events may put fishers at risk, how fishing activities impact marine ecosystems, and how disease and invasive species may pose threats to fisheries.

Assessing and reducing risk of injury and fatality associated with extreme events in Newfoundland and Labrador fishing (2.1.4)
Dr. Barbara Neis, Memorial University

Enhancing ecosystem resilience: integrating social and natural sciences to evaluate how fishing has altered ecosystems (2.5)
Dr. Natalie Ban, University of Victoria

Modelling and predicting disease outbreak and spread in coastal seas (1.15)
Dr. Martin Krkosek, University of Toronto

Using underwater video to optimize capture efficiency of invasive green crab to reduce their impact on fisheries (1.13)
Dr. Brett Favaro, Memorial University

FOG

Fog is still a poorly understood phenomenon, making it difficult to predict. This, in turn, creates safety and economic challenges for maritime operations. We are studying factors influencing fog formation at micro-scales, and working at larger scales to refine fog forecasting models to reduce the negative impacts of fog on offshore and coastal activities.

Forecasting Grand Banks fog: assessment, improvement and application (1.19)
Dr. Joel Finnis, Memorial University

Understanding the factors that affect the properties of coastal and polar fog (1.11)
Dr. Rachel Chang, Dalhousie University

Evaluating Vulnerability to Maritime Transportation Disruption

Principal Investigator: Dr. Stephanie Chang, University of British Columbia
Partners: BC Ferries; BC Government – Emergency Management BC; Nanaimo Port Authority; Port Metro Vancouver; Seaspan Ferries

Coastal communities in Canada rely heavily on maritime transportation for the delivery of critical supplies such as food and fuel. These supplies are often transported via "just-in-time" delivery systems, which although economically efficient, can leave communities vulnerable during emergency situations if transportation is disrupted. Vancouver Island, for example, is home to over 750,000 Canadians, yet it only has two to four days worth of food reserves and approximately five days of fuel reserves on the island.

Dr. Stephanie Chang (University of British Columbia) and her colleagues are developing knowledge and tools to enhance the resilience of coastal communities to maritime transportation disruption. Ultimately, this research is expected to enhance the capacity of the stakeholders to understand the risk, prepare in advance, and respond effectively in marine emergencies, thereby reducing disaster losses to coastal communities.

Dr. Stephanie Chang,
University of British Columbia

Vancouver Island has only 2-4 days of food reserves, making it vulnerable to transportation disruption

CLIMATE CHANGE ADAPTATION

Coastal communities in Canada are especially at risk to climate change. MEOPAR supports several projects that assess the socio-economic risks communities are likely to face in a warmer future, with the aim of helping those communities adapt and/or mitigate the risks.

Adapting to climate change risks: planning and policy in Nova Scotia municipalities (2.1.5)
Dr. Gordon McBean, Western University

Linking ocean and human health: coastal security and sustainability in Haida Gwaii (2.7)
Dr. Philip Loring, University of Saskatchewan

Insuring coastal communities in the era of wild weather (1.18)
Dr. Jason Thistlethwaite, University of Waterloo

OCEAN ACIDIFICATION

As atmospheric carbon dioxide levels increase, so do the dissolved carbon dioxide levels in the ocean. This causes the pH of the ocean to decrease, making it more acidic. MEOPAR funds several projects that evaluate how increasing acidity will affect marine ecosystems.

Biogeochemical projections under a changing climate (2.2)
Dr. Katja Fennel, Dalhousie University

Ocean acidification in Canadian coastal communities: an integrated coastal acidification program (2.9)
Dr. Karen Kohfeld, Simon Fraser University

Canadian ocean acidification research program (2.10)
Dr. Helmuth Thomas, Dalhousie University

"The rate of sea level rise since the mid-19th century has been larger than the mean rate during the previous two millennia."

–2014 Synthesis Report, Intergovernmental Panel on Climate Change

Insuring Canadian Coastal Communities in the Era of Wild Weather

Principal Investigator: Dr. Jason Thistlethwaite, University of Waterloo
Partners: Institute for Catastrophic Loss Reduction; Partnership for Canada-Caribbean Climate Change Adaptation; C-Change: Managing Adaptation to Environmental Change in Coastal Communities: Canada and Caribbean

Coastal communities in Canada are experiencing increasingly severe, and costly, extreme weather events. As a result, insurers are forced to adapt their rates and coverage to meet the changing risk patterns in these communities. Early-career researcher Dr. Jason Thistlethwaite (University of Waterloo) is investigating how insurance coverage in coastal communities is likely to change in the future, and what the resulting socio-economic impacts of those changes will be for coastal communities.

This study is conducting the first of its kind case study on insurability in the coastal communities of the District of Shelburne, Nova Scotia, and Charlottetown, Prince Edward Island (PEI). Dr. Thistlethwaite and his team will identify the existing and future socio-economic impacts of changes in coverage to inform strategies that local communities and insurers can use to sustain coverage in an era of wild weather.

Dr. Jason Thistlethwaite,
University of Waterloo

Insurance coverage in coastal communities is changing in response to increasingly severe weather.

CORE PROJECTS AND RESOURCES

The research cores provide the MEOPAR network with access to people, expertise, technology, and other resources that are needed for their work and to facilitate knowledge mobilization and technology transfer across Canada.

The Observation Core develops data collection instruments and systems, and improves the exchange of data, expertise, and technological developments related to ocean observing in Canada.

The Prediction Core improves models to make them more precise, region-specific, and interpretive of socio-economic impacts.

The Response Core (under development) will strengthen connections among MEOPAR's social scientists, increase the Network's focus on policy and impacts, and promote social science perspectives and approaches.

OBSERVINGINSTRUMENTS: RESEARCH&DEVELOPMENT
Observation Core

DORADO autonomous vehicle development (3.1)
Dr. Douglas Wallace & Dr. Mae Seto, Dalhousie University

Tethered float development (3.2)
Dr. Brad deYoung & Dr. Ralf Bachmayer, Memorial University

ENHANCINGOBSERVINGSYSTEMS
Observation Core

Strait of Georgia observations (VENUS Network) (3.4)
Dr. Ken Denman & Dr. Richard Dewey, University of Victoria, Ocean Networks Canada

Coastal Ocean Dynamics Application Radar (CODAR) installation, Halifax (3.3)
Dr. Brad deYoung, Memorial University & Dr. Douglas Wallace, Dalhousie University

Atlantic Shelf observations (3.6)
Dr. Douglas Wallace, Dalhousie University

RESEARCHANDSUPPORTFOR PREDICTIVE MODEL DEVELOPMENT,INTEGRATION, AND DOWNSCALING
Prediction Core

Downscaling from large to small spatial scales
Dr. René Laprise, Université du Québec à Montréal

Support for the NEMO model
Dr. Youyu Lu, Dalhousie University / Fisheries and Oceans Canada

Climate change: assessing & and visualizing marine risk
Dr. Ronald Pelot, Dalhousie University

Bio-geochemical model development
Dr. Jim Christian, University of Victoria / Environment Canada

Socio-economic indicators
Dr. Stephanie Chang, University of British Columbia

OBSERVINGRESOURCESAND SUPPORT SERVICES
Observation Core

Remote sensing support and observations from the Takuvik Research Station (3.5)
Dr. Marcel Babin, Université Laval

Ocean acidification measurement and instrument sharing (3.10)
Dr. Douglas Wallace, Dalhousie University and Dr. Ken Denman, University of Victoria

Natural sciences data management: expertise, research and support (3.7)
Dr. Mike Smit, Dalhousie University

Social sciences data management: expertise, research and support (3.8)
Dr. Tony Charles, Saint Mary's University

Technical workshops (3.9)
Dr. Brad deYoung, Memorial University

Modifying Autonomous Surface Vehicles

Ph.D. student Chris L'Esperance (Dalhousie University) and Dr. Mae Seto (Defence Research and Development Canada / Dalhousie University) are working together with Dr. Douglas Wallace (Canada Excellence Research Chairholder and MEOPAR Scientific Director, Dalhousie University) to modify the Canadian autonomous surface vehicle, DORADO. The vehicle, presently used for mine countermeasures, will become a platform for conducting rapid surveys of the marine environment. DORADO will have the ability to assist, unattended, with new ocean experiments like rapid environmental assessments, oil dispersion experiments, and as a model for search and rescue. The project supports MEOPAR's re-locatable coupled atmosphere-ocean prediction system research project.

At right: MEOPeer Chris L'Esperance (Dalhousie University) & Dr. Mae Seto (Defence Research and Development Canada / Dalhousie University)
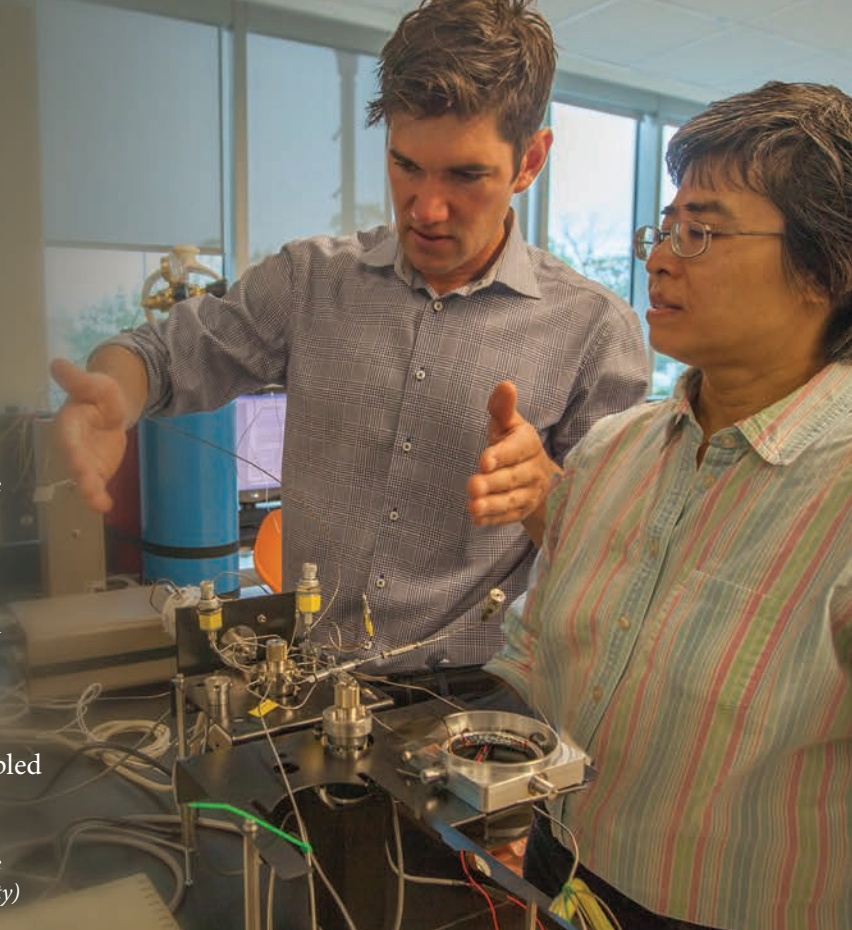
The Takuvik Joint International Laboratory

The Takuvik Joint International Laboratory is the research home to the Canada Excellence Research Chair (CERC) in Remote Sensing of Canada's New Arctic Frontier. CERC Chairholder Dr. Marcel Babin (Université Laval) and his team provide the MEOPAR network with expertise in remote sensing of the ocean, especially in ocean colour, as well as access to observational data. This data improves the efficacy of multiple MEOPAR models currently under development, and fosters collaboration among ocean observing scientists working on all three of Canada's oceans.

Dr. Marcel Babin (Université Laval)

Highly Qualified Personnel

A focal priority of the MEOPAR Network is to develop the next generation of scientists and problem solvers capable of addressing issues related to marine risk in Canada. To foster this goal, we developed a training program for the HQP in our Network, known as **MEOPeers**, that provides them with diverse training and learning experiences that compliment existing training activities at their home university. MEOPAR Training Coordinator Tanya Crawford works with the MEOPeer Training Council (made up of volunteer MEOPeers) to plan and implement training activities.

21 technicians & research associates

15 undergraduate students

31 Post-doctoral fellows

162
MEOPeers

52 masters students

43 Ph.D. students
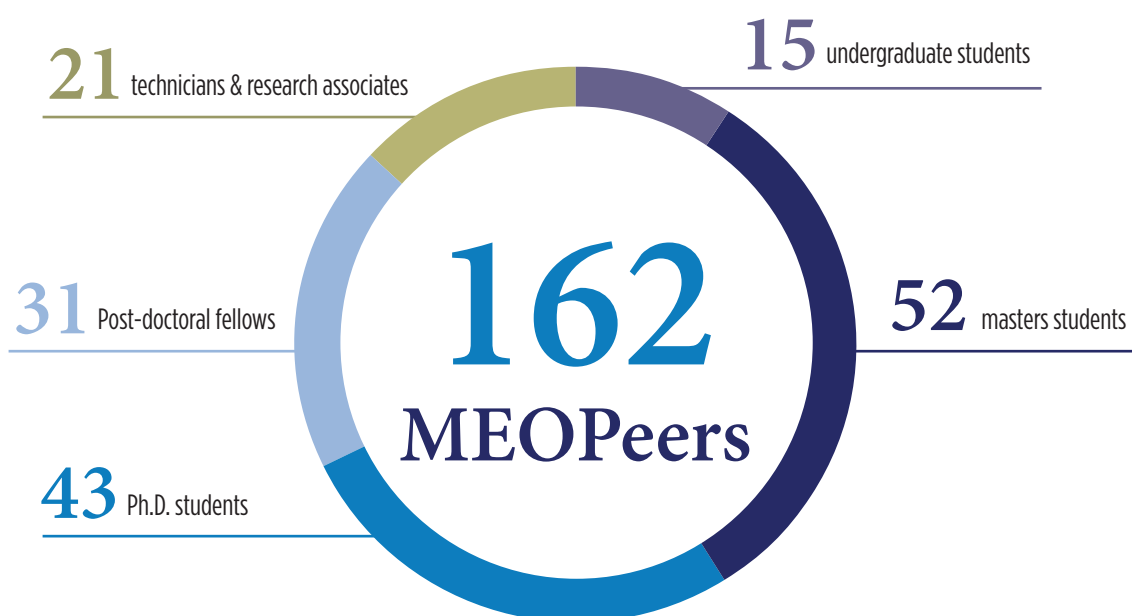
MEOPAR Engagement

We encourage MEOPeers to participate in as many of our Network-wide conferences and workshops as possible. This includes general participation, as well as supporting the organization of events including planning, introducing speakers, and/or presenting their research findings. Two MEOPeers sit on our Research Management Committee (RMC), and we regularly invite MEOPeers to present their research to our Board of Directors, RMC, and network partners throughout the year.

MEOPeer and Ph.D. student Angela Kuhn (Dalhousie University) shares her research with fellow MEOPeers.

National Training Session

(Quebec City, February 2015): This three day training meeting included MEOPeer research presentations and workshops on communities of practice, scientific poster design, social media, open access, financial management and leadership.

MEOPeers Dr. Hilario Calderon (Dalhousie University) and Jonathan Reikes (Western University) at the National Training Session.

Women and Marine Science Initiative

(Across Canada, March 2015): This weeklong initiative promoted women's involvement and progression in marine science through a series of in-person and online activities.

West Coast Regional Training Event

(Vancouver, January 2015): This regional event brought West coast MEOPeers together to present their research to one another, and participate in workshops about data analysis, career development, and grant proposal writing.

MEOPeer and Ph.D. student Jackie Yip (University of British Columbia) facilitates a grant proposal writing workshop at the West Coast Regional Training event.

Monthly Research Exchanges

MEOPeers participated in monthly online research exchanges, where they presented their research to fellow MEOPeers and external researchers for discussion and feedback.

Researcher Development Fund

In 2014 MEOPAR created a Researcher Development Fund to encourage MEOPeers to continue their own professional development. The fund provides MEOPeers with up to $5,000 towards the cost of unique professional development experiences outside of the MEOPeer training program.

MEOPeer and post-doctoral fellow Dr. Clément Chion (Université du Québec en Outaouais) received $2,400 to attend a week long companion modeling training course (Institut National de la Recherche Agronomique in Châteauneuf-de-Gadagne, France).

Ocean Maritime Monitoring Visualization Data Workshop

(Vancouver, August 2014): MEOPAR co-hosted this 1-day workshop that connected data-rich ocean projects with the latest in visualization tools and techniques.

Annual Scientific Meeting Training Event

(Halifax, June 2014): This training workshop was held in conjunction with MEOPAR's first Annual Scientific Meeting (ASM). MEOPeers learned about the world café process and participated in a world café about engaging with stakeholders, represented by seven industry representatives.

Knowledge Sharing

The exchange of knowledge is the fundamental driver in the progression of science. MEOPAR's knowledge sharing activities involve disseminating research findings / technology, and promoting dialogue among key stakeholders.

68
Knowledge & technology exchange activities

34
Refereed scientific publications

MEOPAR
2013-2014

174
Knowledge & technology exchange activities

74
Refereed scientific publications
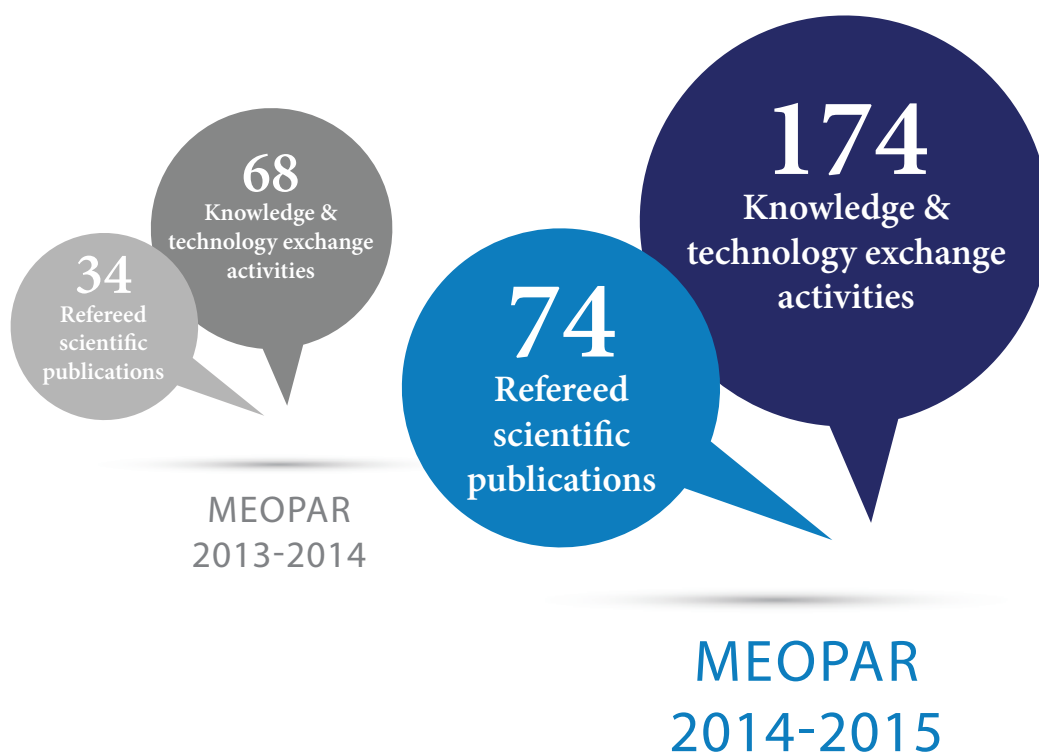
MEOPAR
2014-2015

Annual Scientific Meeting

(HALIFAX, JUNE, 2014):
MEOPAR's first Annual Scientific Meeting was a two-day gathering of the entire MEOPAR network including trainees, researchers and partners. At the meeting, network members shared their research progress, discussed critical issues and participated in learning workshops.

The Annual Scientific Meeting included a harbour cruise to visit an observational buoy, which also fostered professional networking among attendees.

MEOPeer and Ph.D. student Jean-Pierre Auclair (Dalhousie University) served as a session chair during the conference.

Dr. Gordon McBean (MEOPAR researcher; Western University; President - International Council for Science)

Mobilizing Science Knowledge and Research Symposium

Scientific knowledge is increasingly in demand from all aspects of modern society, yet few scientists are trained to mobilize their knowledge outside of academia. In response, MEOPAR hosted a Mobilizing Science Knowledge and Research Symposium to provide a forum for staff, researchers and highly qualified personnel from Networks of Centres of Excellence (NCE) across Canada to learn the latest knowledge mobilization best practices. Non-NCE interested participants, practitioners of science knowledge mobilization, transfer, exchange and brokerage also attended this sold out event, which was the first symposium about knowledge mobilization planned for and led by an NCE for other NCEs.

Dr. Anneliese Poetz (Knowledge Translation Manager, NeuroDevNet)

MEOPeer and Ph.D. student Tugce Conger (University of British Columbia)

Dr. Rob Greenwood (Executive Director, Public Engagement, Memorial University)

> "Since the beginning of the industrial era, oceanic uptake of CO_2 has resulted in a 26% increase in acidity in the world's oceans."
>
> *- 2014 Synthesis Report, Intergovernmental Panel on Climate Change*

Expert Forum guest speaker Dr. Jean-Pierre Gattuso, Research Professor at the Centre National de la Recherche Scientifique (France)

Ocean Acidification Expert Forum

Dubbed "the other CO_2 problem," ocean acidification (OA) has not shared the same public attention as the broader topic of climate change. However, OA is quickly emerging as a critical issue to Canadian oceans and especially to the shellfish industry, which is particularly vulnerable to ocean acidification.

In early 2015, MEOPAR hosted an Ocean Acidification Expert Forum in Victoria, B.C. that brought experts from across Canada and the international community together to discuss ocean acidification and its implications in Canada. The result was the largest gathering on the topic to date in Canada. The forum was both multi-disciplinary and multi-sectoral, and addressed not only the academic challenges of ocean acidification, but also the approaching issues that will impact government, industry and other stakeholders.

Forum attendees heard from a wide range of national and international experts.

> **The best conference I have ever attended...**
>
> *Bruce Johnson, Pro-Oceanus Systems Inc.*

*Dr. Kumiko Azetzku-Scott
(Fisheries and Oceans Canada)*

Dr. Ken Denman (University of Victoria), Chair of the MEOPAR Ocean Acidification Coordinating Committee

Dr. Karen Kohfeld (Simon Fraser University, MEOPAR Researcher)

Dr. Simone Alin (NOAA Pacific Marine Environmental Laboratory) and Dr. Pierre Pepin (Fisheries and Oceans Canada)

MEOPAR AND OCEAN ACIDIFICATION (OA)

Prior to MEOPAR's efforts in this area, Canada did not have a national coordinated program to address OA and the community. In partnership with Fisheries and Oceans Canada, private industry, international partners and national experts, we now have national projects, a national coordinating committee, and the foundations of a national response to one of the greatest challenges facing the world's oceans.

MEOPAR works with a variety of organizations, such as the SmartAtlantic Alliance, to improve ocean observing infrastructure in Canada.

International Leadership in Atlantic Ocean Observing

MEOPAR is playing a lead role in improving the capacity and integration of ocean observing systems in Canada and internationally. The year was especially busy on the Atlantic observation front, where in addition to supporting our ongoing observation research and development, we published a white paper on Atlantic Ocean Observation that laid the foundation for multi-sectoral Atlantic observation activities in Canada and internationally.

In addition, MEOPAR's work on the Canadian Marine Working Group, an initiative of Fisheries and Oceans Canada, led to our role as one of only two Canadian organizations partnered on the international AtlantOS consortium. The AtlantOS project is a massive Atlantic Ocean observing initiative involving 62 partners from 18 countries that is backed by 21 million euros in funding from the European Union's Horizon 2020 framework. The project will address critical research gaps in observing the Atlantic Ocean, and will improve system integration within and between countries.

Dr. Douglas Wallace (MEOPAR Scientific Director and Canada Excellence Research Chair in Ocean Science and Technology) leads MEOPAR's work on the international AtlantOS project.

Attendees from the 2014 international Smart Ocean / Smart Industries workshop in Montreal, QC, which MEOPAR organized in partnership with the World Ocean Council to advance industry-science collaboration, and ocean industry data collection in Canada.

Financial Statements

MEOPAR Incorporated

March 31, 2015

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Grant Thornton

Independent auditor's report

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To the Board of Directors of MEOPAR Incorporated

We have audited the accompanying financial statements of **MEOPAR Incorporated**, which comprise the statement of financial position as at March 31, 2015, and the statements of operations and changes in net assets and cash flows for the year then ended, and a summary of significant accounting policies and other explanatory information.

Management's responsibility for the financial statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with accounting standards for not-for-profit organizations, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with Canadian generally accepted auditing standards. Those standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

GrantThornton

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements present fairly, in all material respects, the financial position of MEOPAR Incorporated as at March 31, 2015, and the results of its operations for the year then ended in accordance with accounting standards for not-for-profit organizations.

Grant Thornton LLP

Halifax, Canada
September 15, 2015

Chartered Accountants

MEOPAR Incorporated
Statements of operations and net assets

Year ended March 31	2015	2014
Revenue		
Government assistance – Natural Sciences and Engineering Research Council of Canada (NSERC)	$ 6,641,053	$ 3,732,610
Partnership	57,600	-
Other	10,061	-
	6,708,714	3,732,610
Grants		
Research	4,397,580	3,098,600
Early career	583,308	-
Partnership	352,421	-
	5,333,309	3,098,600
Excess revenue over grants	1,375,405	634,010
Expenses		
Board insurance	13,851	12,293
Contract personnel	6,403	20,462
Depreciation	15,360	14,630
Marketing and communications	93,494	60,365
Meetings and receptions	13,427	8,402
Miscellaneous	4,959	13,342
Office supplies and administration	31,121	3,965
Outreach and events	33,372	35,248
Printing and publications	9,537	4,241
Professional fees	28,157	18,248
Research management	62,560	47,769
Salaries and benefits	585,799	259,555
Training and knowledge mobilization	337,440	72,765
Travel	110,032	62,725
	1,345,512	634,010
Excess of revenue over expenses	$ 29,893	$ -
Net assets, beginning of year	$ -	$ -
Excess of revenue over expenses	29,893	-
Net assets, end of year	$ 29,893	$ -

See accompanying notes to the financial statements.

MEOPAR Incorporated
Statement of financial position

March 31		**2015**		2014
Assets				
Current				
Cash and cash equivalents	$	**44,603**	$	-
Receivable from Dalhousie University (Note 6)		**4,394,175**		6,175,959
HST receivable		**40,579**		14,708
		4,479,357		6,190,667
Capital assets (Note 3)		**3,079**		12,281
	$	**4,482,436**	$	6,202,948
Liabilities				
Current				
Accounts payable and accruals	$	**129,637**	$	26,989
Deferred revenue (Note 4)		**4,322,906**		6,175,959
		4,452,543		6,202,948
Net assets				
Unrestricted net assets		**29,893**		-
	$	**4,482,436**	$	6,202,948

Commitments (Note 5)

On behalf of the Board

_____ Director

See accompanying notes to the financial statements.

MEOPAR Incorporated
Statement of cash flows

March 31		**2015**		2014
Increase (decrease) in cash and cash equivalents				
Operating				
Excess of revenue over expenses	$	**29,893**	$	-
Amortization of capital assets		**15,360**		14,630
		45,253		14,630
Change in non-cash operating working capital				
Receivable from Dalhousie University		**1,781,784**		(1,708,696)
HST receivable		**(25,871)**		(10,290)
Payables and accruals		**102,648**		4,528
Deferred revenue		**(1,853,053)**		1,724,390
		50,761		24,562
Investing				
Purchase of capital assets		**(6,158)**		(24,562)
Net increase in cash and cash equivalents		**44,603**		-
Cash and cash equivalents				
Beginning of year		**-**		-
End of year	$	**44,603**	$	-

See accompanying notes to the financial statements.

MEOPAR Incorporated
Notes to the financial statements
March 31, 2015

1.   Authority and purpose

The Organization was incorporated on February 17, 2012 under the Canada Corporations Act – Part II – as an income tax exempt not-for-profit Organization. The Organization provides funding to develop knowledge, tools, technology and highly qualified people through collaborative research.

2.   Summary of significant accounting policies

These financial statements are prepared in accordance with Canadian Accounting Standards for Not-For-Profit Organizations ("ASNPO").

Cash and cash equivalents
Cash and cash equivalents include cash on hand and balances with banks and other institutions and term deposits with maturities of three months or less.

Based on the funding agreement between the Natural Sciences and Engineering Research Council ("NSERC"), the Social Sciences and Humanities Research Council ("SSHRC") and MEOPAR Incorporated, grant funds are considered restricted and are to be held in trust and administered by Dalhousie University, the Network's host institution. Other funds are administered by the Network and are considered unrestricted cash. Unrestricted cash is held in a separate bank account.

Revenue recognition
The Organization follows the deferral method of accounting for contributions, which include government grants.

Contributions which have external restrictions governing the types of activities they can be used to fund are deferred until related spending on these activities is incurred.

Restricted contributions for the purchase of capital assets that will be amortized are deferred and recognized as revenue at the same rate of amortization as the related acquired capital assets.

Unrestricted contributions are recorded as revenue when received or receivable, provided the amount to be received can be reasonably estimated and collection is reasonably assured.

Contributed materials and services
Contributed materials and services are recognized at their fair value in the financial statements when the amount can be reasonably estimated and when the materials and services used in the normal course of the Organization's operations and would otherwise have been purchased.

MEOPAR Incorporated
Notes to the financial statements
March 31, 2015

2. Summary of significant accounting policies (continued)

Capital assets

Capital assets are recorded at cost. Depreciation is provided on the straight-line basis over their estimated useful lives as follows:

Computer hardware   2 years

When a capital asset no longer has any long-term service potential to the Organization, the excess of its net carrying amount over any residual value is recognized as an expense in the statement of revenues, expenses, and net assets. Any write-downs recognized are not reversed.

Use of estimates

Management reviews the carrying amounts of items in the financial statements at each balance sheet date to assess the need for revision or any possibility of impairment. Many items in the preparation of these financial statements require management's best estimate. Management determines these estimates based on assumptions that reflect the most probable set of economic conditions and planned courses of action.

These estimates are reviewed periodically and adjustments are made to net income as appropriate in the year they become known.

Financial Instruments

Initial measurement

The Organization's financial instruments are measured at fair value when issued or acquired. For financial instruments subsequently measured at cost or amortized cost, fair value is adjusted by the amount of the related financing fees and transaction costs. Transaction costs and financing fees relating to financial instruments that are measured subsequently at fair value are recognized in operations in the year in which they are incurred.

Subsequent measurement

At each reporting date, the Organization measures its financial assets and liabilities at cost or amortized cost (less impairment in the case of financial assets). The financial instruments measured at amortized cost are cash and cash equivalents, receivable from Dalhousie University, HST receivable and accounts payable and accruals.

For financial assets measured at cost or amortized cost, the Organization regularly assesses whether there are any indications of impairment. If there is an indication of impairment, and the Organization determines that there is a significant adverse change in the expected timing or amount of future cash flows from the financial asset; it recognizes an impairment loss in the statement of operations. Any reversals of previously recognized impairment losses are recognized in operations in the year the reversal occurs.

3. Capital assets

	Cost	Accumulated Depreciation	2015 Net Book Value	2014 Net Book Value
Computer hardware	$ 35,417	$ 32,338	$ 3,079	$ 12,281

MEOPAR Incorporated
Notes to the financial statements
March 31, 2015

4. Deferred revenue	2015		2014
Balance – beginning of year	$	**6,175,959** $	4,451,569
Contributions received from NSERC		**4,788,000**	5,457,000
Less: amounts recognized as revenue in year		**(6,641,053)**	(3,732,610)
Balance – end of year	$	**4,322,906** $	6,175,959

5.   Commitments

The Organization has committed to provide funding to participating institutions to be paid in the following years as follows:

2016	$ 4,344,560
2017	2,656,640

Under the terms of the NSERC agreement, funding at the current level will be completed by March 2017.

6.   Related party transactions

The Organization is related to Dalhousie University by virtue of the fact that the University is its host institution under the Networks of Centres of Excellence program.

Under an agreement between the Organization and the host institution, the University provides accounting and administrative support services as well as office space without charge to the Organization. The value of the in-kind contributions received by means of services, equipment and facilities in fiscal 2015 is estimated by Dalhousie to be $55,000 (2014 – $66,000). These contributions have not been recognized in the financial statements.

Receivable from Dalhousie University represents government contributions received, which are subject to NSERC eligibility requirements. The cash is held in trust by Dalhousie University in accordance with the Host Agreement.