MEOPAR

ANNUAL NETWORK MEETING 2022

Supporting research excellence for ocean protection and coastal community resilience in Canada

VIRTUAL EVENT

NOVEMBER 22-30, 2022

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Meeting Agenda

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1:45 – 2:00 PM	BREAK	
2:00 – 3:00 PM	Zoom Meeting	Canada's Climate Science 2050 Plan *with Environment and Climate Change Canada (ECCC) and Fisheries and Oceans Canada (DFO)*
3:00 – 3:30 PM	BREAK	
3:30 – 5:00 PM	Zoom Meeting	Beyond Barriers 4 Inclusion: Breaking Binary Bias *an Equity, Diversity, Inclusion, and Accessibility Workshop by Simply Good Form Inc.*

DAY 2 – THURSDAY NOVEMBER 24, 2022

Time (Atlantic Time)	Event Platform	Session Topic
1:00 – 2:30 PM	Zoom Meeting	Modular Ocean Research Infrastructures Initiation Design and Demonstration (MORI IDD) Project: Recent Achievements, Results from Scientific Cruises and Looking Forward
2:30 – 3:00 PM	BREAK	
3:00 – 4:30 PM	Gather Town	Turning Results into Applied Solutions: A Knowledge Mobilization Session *Networking Opportunity & Science-Art Showcase Viewing*

DAY 3 – MONDAY NOVEMBER 28, 2022

Time (Atlantic Time)	Event Platform	Session Topic
1:00 – 2:30 PM	Zoom Meeting	State of Ocean Deoxygenation in Canada Workshop *Presentation & Working Session*
2:30 – 3:00 PM	BREAK	
3:00 – 4:30 PM	Zoom Meeting	Bursting the Bubble: Science Communication Best Practices Workshop

DAY 4 – WEDNESDAY NOVEMBER 30, 2022

Time (Atlantic Time)	Event Platform	Session Topic
1:00 – 2:00 PM	Zoom Meeting	Moving into Mid-Career *Early Career Faculty Session*
2:00 – 2:30 PM	BREAK	
2:30 – 5:00 PM	Gather Town	Discussion/Q&A session for Project Pre-recorded Presentations, Poster Session, Science-Art Showcase *Networking Opportunity*
5:00 – 5:15 PM	Gather Town	Closing Remarks

About the Virtual Conference Space

MEOPAR's Annual Network Meeting (ANM) 2022, themed "Supporting research excellence for ocean protection and coastal community resilience in Canada," will be hosted virtually over four half days using Zoom and Gather Town.

Gather Town is a virtual platform designed to make virtual interactions more human. Gather Town allows conference goers to move around our virtual conference space, viewing posters and art pieces in the Science-Art Showcase while interacting with other ANM attendees. When you log in, you'll create a personalized avatar and from there, you can explore and connect.

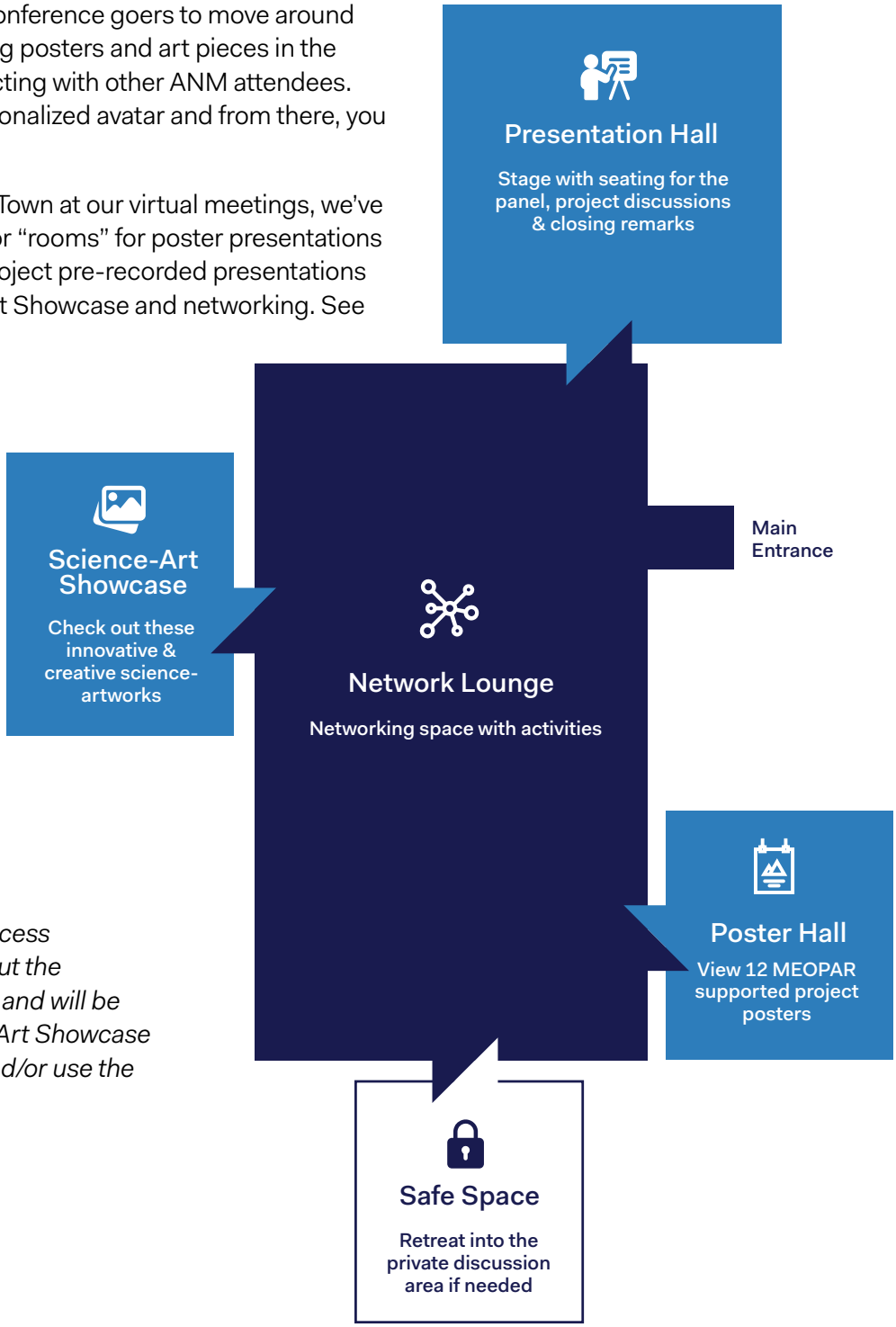
After previous success with Gather Town at our virtual meetings, we've expanded to have dedicated areas or "rooms" for poster presentations (Poster Hall), discussion/Q&A for project pre-recorded presentations (Presentations Hall), the Science-Art Showcase and networking. See the map at right to orient yourself.

Curious to see what Gather Town is all about?

- Watch this short video where the creators walk you through one of their own virtual spaces.
- Here is a walk-through tutorial on how to use Gather Town.
- Read our Tips & Tricks Document

**Note that all attendees will have access to the Gather Town space throughout the Annual Networking Meeting period and will be encouraged to go see the Science-Art Showcase and posters at their convenience and/or use the space for networking!*

MEOPAR's 2022 Virtual Annual Network Meeting Space in Gather Town



Day 1 – Tuesday November 22, 2022

Opening Remarks & Plenary Session: A Vision for the Future of MEOPAR under the Strategic Science Fund

Tuesday, November 22 from 1-1:45PM AST | Zoom

Kick off the conference with MEOPAR's Scientific Director, Doug Wallace, followed by a presentation by MEOPAR Scientific Associate Co-Directors about MEOPAR's vision for its future under the Strategic Science Fund (SSF). The SSF is a new approach to improve the effectiveness of federal investments in supporting third-party science and research organizations (TPOs). The SSF is jointly administered by Innovation, Science and Economic Development Canada and Health Canada. MEOPAR has submitted a full proposal to the SSF.

HOST:

- **Rodrigo Menafra,** MEOPAR Managing Director

SPEAKERS:

- **Douglas Wallace,** MEOPAR Scientific Director (Dalhousie University)
- **Brent Else,** MEOPAR Associate Scientific Co-Director (University of Calgary)
- **Fanny Noisette,** MEOPAR Associate Scientific Co-Director (Université du Québec à Rimouski)

Canada's Climate Science 2050 Plan

Tuesday, November 22 from 2-3PM AST | Zoom

This joint session from Environment Climate Change Canada (ECCC) and Fisheries and Oceans Canada (DFO) will provide an opportunity to learn more about the upcoming Climate Science 2050: Canada's Climate Change Science & Knowledge Plan (CS2050). Building on the Climate Science 2050: Advancing Science and Knowledge on Climate Change synthesis report published in 2020, the CS2050 Plan identifies priority science activities for investment across the climate change science and knowledge ecosystem in Canada over the next five years. These near-term priorities focus on climate change science to inform equitable and transformational climate actions to support achieving a resilient and net zero Canada.

HOST:

- **Karen Dodds,** Chair, MEOPAR Board of Directors

SPEAKERS:

- **Marjorie Shepherd,** Director and Senior Climate Change Science Advisor, Environment and Climate Change Canada (Science & Technology Strategies Directorate)
- **Keith Lennon,** Director, Fisheries and Oceans Canada (Ocean Science Branch)

Beyond Barriers 4 Inclusion: Breaking Binary Biases

An EDI Workshop by Simply Good Form Inc.

Tuesday, November 22 from 3-4:30PM AST | Zoom

Everyone has bias. It is part of our internal survival mechanisms, shaped in early childhood development and evolves throughout our lives. The workshop is all about going "Beyond Barriers 4 Inclusion."

Through this workshop, we explore how "binary biases" have contributed to systemic barriers to equitable workplace cultures and systems of oppression for trans and non-binary people; what bias is harmful; and how and why it creates barriers for individuals and those with whom they interact.

Simply Good Form Inc. (SFG) helps organizations, big or small, succeed at being intentional about equity, diversity and inclusion (EDI). SFG offers dynamic beyond binary content creation, facilitation, and learning tools produced by professionals with lived experiences.

TOPICS COVERED

- Going beyond binary and the intersections of identity
- Examining identity through an intersectional lens
- Microaggressions
- Tools to examine internal biases and check harmful behaviors to inspire equitable opportunities for all to thrive

KEY LEARNING OUTCOMES

By the end of this workshop, participants will be able to:

- Identify the difference between gender identity and sexual orientation, including variations in gender expression, and be able to apply knowledge and language competencies within their professional roles.
- Recognize the role of subconscious bias and impacts of language in perpetuating stigma and barriers for marginalized communities.
- Apply thought-leadership skills to practice inclusive verbal and non-verbal tools with an enhanced understanding of intersectional identities.
- Develop language confidence and demonstrate inclusive communications best practices in countering cisnormative and heteronormative workplace practices.
- Use strategies to navigate challenging situations with increased confidence and competency.
- Critical knowledge of why beyond binary ethics skills are essential for service providers and professionals in every industry, with actionable tools and goal setting.

HOST:

- **Alexa Goodman** (they/she), MEOPAR Training Program Manager

SPEAKERS:

- **Simply Good Form Inc., Cynthia Sweeney** (she/her), CEO/Founder, and/or **Connor McKiggan** (they/he), Inclusion Educator

Day 2 – Thursday November 24, 2022

Modular Ocean Research Infrastructures Initiation Design and Demonstration (MORI IDD) Project: Recent Achievements, Results from Scientific Cruises, and Looking Forward

Thursday, November 24 from 1-2:30PM AST | Zoom

Since its inception in the spring of 2021, the MORI IDD project has acquired a broad suite of modular ocean research equipment, mobilized the components in various configurations onboard the Atlantic Condor (Atlantic Towing Ltd.) and supported a total of five unique ocean research cruises. This session will provide an overview of the MORI IDD project from a logistics perspective, as well as insights from Chief Scientists about the work accomplished during their scientific missions. Come listen to the scientific work done so far and what is coming next as part of this exciting initiative!

HOSTS:

- **Daniel Gibson,** MEOPAR Project Manager MORI IDD
- **Douglas Wallace,** MEOPAR Scientific Director (Dalhousie University)

SPEAKERS:

- **Dariia Atamanchuk,** Research Associate, Canada Excellence Research Chair (CERC) Ocean Laboratory (Dalhousie University)
- **Ed Creegan,** Chief Scientist, PSV/RV Atlantic Condor-Fog and Turbulence in the Marine Atmosphere (FATIMA), Development Command Army Research Lab
- **Jackie Zorz**, Postdoctoral Fellow (University of Calgary)
- **Owen Sherwood,** Assistant Professor (Dalhousie University)

PANEL DISCUSSION:

Moderator: **Douglas Wallace,** MEOPAR Scientific Director (Dalhousie University)

- **Barbara Neves,** Research Scientist, Fisheries and Oceans Canada
- **Dariia Atamanchuk,** Research Associate, CERC Ocean Laboratory (Dalhousie University)
- **Feiyue Wang,** Professor (University of Manitoba)
- **Rachel Chang,** Associate Professor (Dalhousie University)

Turning Results into Applied Solutions: How did they do it? A Knowledge Mobilization Workshop and Networking Opportunity

Thursday, November 24 from 3-4:30PM AST | Gather Town

This session will feature MEOPAR researchers who have used knowledge mobilization (KM) techniques to turn their research results and outcomes into applied solutions and end-user-driven products. During this session, we will hear the stories behind how they turned research into action and how you can too! This session will include a 45-minute panel discussion in the Gather Town plenary room before free time to network with peers while viewing the Poster Hall and Science-Art Showcase.

HOST:

- **Evelyn Hornbeck,** MEOPAR Communication Manager

SPEAKERS:

- **Ryan P. Reynolds,** Lead Researcher and Developer, Canadian Hazards Emergency Response & Preparedness Initiative (CHERP)
- **Jean Holloway,** Postdoctoral Fellow (University of Ottawa)

Science-Art Showcase

Thursday, November 24 from 3-4:30PM AST | Gather Town

Wednesday, November 30 from 2-5:30PM AST | Gather Town

The Ocean Decade Community of Practice has been exploring the practice of science-art with the intention of inspiring future creations, by Network members and beyond. Developed by interdisciplinary scientist Samantha Jones, this program aimed to engage diverse participation across the network and center the science-art practices of diverse folks.

Applying knowledge gained from the first two Science-Art Symbiosis activities, this “science as art” showcase has been integrated into the Annual Meeting Gather Town venue, in its own museum-like room. This showcase includes traditional and non-traditional mediums, such as creative writing pieces, videos, sculpture, "3D art" with standing quilting and beadwork, photography, paintings, and more. More information

We will have a keynote feature from Geneviève Dupéré, who will present her work-in-progress “From River to Stage,” featuring écH2osystème, a documentary-type performing arts project.

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

This Program is an officially endorsed Ocean Decade Activity by the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (IOC-UNESCO) as it aligns with the United Nations (UN) Decade of Ocean Science for Sustainable Development Challenge 10: Change humanity's relationship with the ocean and Outcome 7: An inspiring and engaging ocean. Ocean literacy and communicating the value of the oceans is important for knowledge mobilization and to inspire people to get involved. Disclaimer

HOST:

- **Samantha Jones,** PhD Candidate, University of Calgary

ARTISTS:

- **Keynote: Geneviève Dupéré** (she/her) — Maritime performing arts and acrobatic project/ Recherche-création maritime — "écH2osystème"
- **Ana Carolina Esteves Dias** (she/her) — Watercolour paintings — "Small-scale fisheries in Colours"
- **Cailin Correia** (she/they) — Video — "An Artful Conversation"
- **Carley Mullally** (she/they) — Marine Debris Quilt — "Beach Towel"
- **Cécile Tang** (she/her) — Acrylic Painting — "REGENERATION"
- **Danielle Nowosad** (she/her) — Beadwork — "*Mysis relicta*, with DNA barcode border"
- **Dave Riddell** (he/they) — Music — "Last Days Of The Pacific"
- **Jane Affleck** (she/they) — Storyboards — "Fiona Photo-graphs"
- **Navya Vikraman Nair** (she/her) — Drawings — "Save it to cherish or Leave it to Perish" & "Born to Fish, Forced to Shift"

For Science-Art Showcase Abstracts, see p. 32

Day 3 – Monday November 28, 2022

State of the Ocean Deoxygenation in Canada Workshop

Monday, November 28 from 1-2:30PM AST | Zoom

Oxygen in the ocean supports the largest ecosystems on the planet. It is alarming that the world's ocean is losing oxygen, primarily due to global warming by greenhouse gas emissions and pollution by nutrients and organic wastes, particularly in coastal waters. Canadian oceans are facing deoxygenation too. In an effort to connect with the Canadian ocean deoxygenation community and to discuss challenges and top priorities in relation to deoxygenation research in Canada, a one-day virtual workshop "The state of ocean deoxygenation research in Canada" was held on June 20th, 2022.

The goals of today's session are to i) inform and raise the MEOPAR community's awareness about the state of ocean deoxygenation in Canada and the magnitude of the problem and ii) discuss the priorities identified at the June 2022 workshop.

Following a short overview of the situation in Canada, from the west to the east coast, the co-president of The Global Ocean Oxygen Network (GO2NE) will present the objectives and actions of the UNESCO-endorsed program. We will then invite the MEOPAR community to participate to the discussion in breakout rooms to help shaping and developing the ocean deoxygenation scientific community in Canada.

HOST:

- **Gwénaëlle Chaillou,** Professor (Université du Québec à Rimouski)

SPEAKERS:

- **Hayley Dosser,** Ocean Glider Scientist (Fisheries and Oceans Canada)
- **Mathilde Jutras,** PhD student (McGill University)
- **Marilaure Grégoire,** Co-President, Global Ocean Oxygen Network (GO2NE) program, Professor (Université de Liège)

Bursting the Bubble: Science Communication Best Practices

Monday, November 28 from 3-4:30PM AST | Zoom

This session will walk practitioners through how to get your science and research results noticed by focusing on building clear messaging. Join experienced researchers and practitioners who have excelled at using the best science communications techniques to move beyond the norm of sharing results via research papers. During this session, you'll learn how to craft your message and how to use some of today's best science communication tools. You'll put them into practice in this interactive workshop focused on Challenge Area 6 of the Ocean Decade: Increasing community resilience to ocean hazards.

Learn more about the Ocean Decade here, or watch this video.

HOSTS AND SPEAKERS:

- **Alexa Goodman,** MEOPAR Training Program Manager
- **Jonathan Kellogg,** Science Communications Coordinator, CIOOS Pacific and Hakai Institute

BREAKOUT GROUP FACILITATORS:

- **Lucija Prelovec,** Communications Coordinator, DeepSense and ShiftKey Labs
- **Evelyn Hornbeck,** MEOPAR Communications Manager
- **Austin Pugh,** Coordinator, Ocean Acidification Community of Practice

Day 4 – Wednesday November 30, 2022

Moving into Mid-Career (Early Career Faculty session)

Wednesday, November 30 from 1-2PM AST | Zoom

This is a session specifically for MEOPAR Early Career Faculty (ECF). This session will offer ECF the opportunity to connect with academic researchers who are further along in their professional careers and discuss their experiences and some lessons learned.

HOSTS:

- **Barret Kurylyk,** Associate Professor (Dalhousie University)
- **Kyle Elliott,** Associate Professor (McGill University)

SPEAKERS:

- **Paul G. Myers,** Professor (University of Alberta)
- **Natalie Ban,** Professor (University of Victoria)
- **Dany Dumont,** Director (Réseau Québec Maritime), Professor (Université du Québec à Rimouski)

Discussion/Q&A Session for Pre-Recorded Project Presentations; Poster Session; Science-Art Showcase; Networking opportunity

Wednesday, November 30 from 2:30-5PM AST | Gather Town

Join us in MEOPAR's Annual Network Meeting Gather Town space to participate in live Q&A discussions about the projects' pre-recorded presentations in the Presentation Hall and see the posters in the Poster Hall. Plan for some extra time, so you can visit the Science-Art Showcase, or just catch up with meeting attendees in innovative and fun Networking Spaces!

**Please note that attendees will be given access to the pre-recorded project presentations 48 hours before the live Q&A discussion sessions take place. Watch the presentations ahead of time and have questions ready for the speakers.*

For a map of the Gather Town layout and more information about using Gather Town, please see p. 4

For Project Presentation Abstracts, see p. 15

For Poster Abstracts, see p. 25

For Science-Art Showcase Abstracts, see p. 32

SCHEDULE

Time (Atlantic Time)	Gather Town Area	Session Topic
2:30-3:00 PM	Poster Hall Sci.-Art Showcase Hall	**Poster Session** *(poster presenters by their posters)* **Science-Art Showcase** **Networking**
3:00-3:15 PM	Presentation Hall	**Project Presentation Discussion/Q&A: Theme 1 – Ocean Observation and Modelling: Processes and Productivity**
3:15-3:25 PM	**BREAK** *(attendees are encouraged to view posters and Science-Art Showcase during the break)*	
3:25-3:40 PM	Presentation Hall	**Project Presentation Discussion/Q&A: Theme 2 – Coastal Resilience and Coastal Ecosystems**
3:40-3:50 PM	**BREAK** *(attendees are encouraged to view posters and Science-Art Showcase during the break)*	
3:50-4:05 PM	Presentation Hall	**Project Presentation Discussion/Q&A: Theme 3 – Maritime Operation/Transportation and Coastal Resilience Knowledge Mobilization**
4:05-4:15 PM	**BREAK** *(attendees are encouraged to view posters and Science-Art Showcase during the break)*	
4:15-4:30 PM	Zoom Meeting	**Project Presentation Discussion/Q&A: Theme 4 – Ocean Observation and Prediction: Canadian Platforms and Communities of Practice (CoPs)**
4:30-5:00 PM	Poster Hall Sci.-Art Showcase Hall	**Poster Session** *(poster presenters by their posters)* **Science-Art Showcase** **Networking**
5:00-5:15 PM	Presentation Hall	**Closing Remarks**

Project Presentations

Theme 1 – Ocean Observation and Modelling: Processes and Productivity

HOST:

- **Graigory Sutherland,** Research Scientist, Environment and Climate Change Canada

PRESENTERS:

- **Ludovic Pascal** (Université du Québec à Rimouski)
- **Audrey Limoges** (University of New Brunswick)
- **Hannah Sharpe** (University of New Brunswick)
- **Jean Clary** (Université du Québec à Rimouski)
- **Abïgaëlle Dussol** (Université du Québec à Rimouski)
- **Chris Whidden** (Dalhousie University)

Theme 2 – Coastal Resilience and Coastal Ecosystems

HOST:

- **Elliot Dreujou,** Postdoctoral Fellow (Université du Québec à Rimouski)

PRESENTERS:

- **Marie-Pomme Presne-Poissant** (Université du Québec à Rimouski)
- **Andrea Bryndum-Buchholz** (Dalhousie University)
- **Acacia Markov** (University of Ottawa)
- **Christian Marchese** (University of Victoria)

Theme 3 – Maritime Operation/Transportation and Coastal Resilience Knowledge Mobilization

HOST:

- **Rodrigo Menafra,** MEOPAR Managing Director

PRESENTERS:

- **Jean Holloway** (University of Ottawa)
- **Mauricio Carvallo Aceves** (University of British Columbia)
- **Karen Kun** (Waterlution) and **Robert Newell** (Royal Roads University, University of the Fraser Valley)
- **Dana Lepofsky** (Simon Fraser University)
- **Lilia Yumagulova** (Simon Fraser University/University of Saskatchewan)

Theme 4 – Ocean Observation and Prediction: Canadian Platforms and Communities of Practice (CoPs)

HOST:

- **Isabelle Tremblay,** MEOPAR Research Program Manager

PRESENTERS:

- **Jonathan Kellogg** (Hakai Institute)
- **Brad deYoung** (CIOOS Pacific)
- **Clark Pennelly** (University of Alberta)
- **Austin Pugh** (University of Calgary)
- **Sylvie Daniel** (Université Laval)

Closing Remarks

Wednesday, November 30 from 5-5:15PM AST | Gather Town

Conference closing remarks with MEOPAR Associate Scientific Co-Directors Fanny Noisette and Brent Else.

HOSTS:

- **Brent Else,** MEOPAR Associate Scientific Co-Director (University of Calgary)
- **Fanny Noisette,** MEOPAR Associate Scientific Co-Director (Université du Québec à Rimouski)

Abstracts

Abstracts are listed in alphabetical order

Project Presentation Abstracts

Estimation of the Stokes drift based on the wind field retrieved by a single high frequency radar

Abïgaëlle Dussol[1], Cédric Chavanne[1] and Dany Dumont[1]

[1]Institut des Sciences de la Mer de Rimouski, Université du Québec à Rimouski, Rimouski, Québec, Canada

It has been recently established that High-Frequency (HF) radars measure half of the surface Stokes drift in addition to near-surface Eulerian currents. For some applications such as assimilating HF radar measurements into purely Eulerian ocean numerical models, it is necessary to remove this wave-induced contribution from these measurements. Due to the horizontal variability of the wave field in coastal environments, a single instrument measuring the wave spectrum is not sufficient to estimate the surface Stokes drift over the entire area covered by an HF radar. Thus, a method to estimate the Stokes drift is proposed using a theoretical Toba wave spectrum determined from the wind field (directions and speeds) retrieved by a single HF radar. Based on the relative strength of the positive and negative Bragg-resonant, which correspond to wind-driven waves approaching and receding from the radar, respectively, a new wind direction estimation algorithm is proposed. Radar measurements of the wind filed are compared with in-situ data in the Lower St. Lawrence Estuary (Québec, Canada) during the summer 2013. The correlation coefficient between the radar-estimated and the in-situ wind directions is 0.93 for the Wellen Radars (WERA) and 0.88 for the Coastal Ocean Dynamics Applications Radars (CODAR). The relationship between wind speed and the wind-driven currents measured by the radar is established by an artificial neural network. The correlation coefficient between the radar-estimated and the in-situ wind speed is 0.93 for the WERAs and 0.88 for the CODARs. Finally, the estimated Stokes drift is compared with the Stokes drift computed from in-situ observations of the wave spectra by a bottom-mounted Acoustic Wave and Current Profiler, yielding correlation coefficients of 0.87 for the WERAs and 0.86 for the CODARs.

Methods for Downscaling Coastal Marshes in Experimental Investigations of Wave-Vegetation Interactions

Acacia Markov[1], Margo Muller[2], Ioan Nistor[1], Scott Baker[3], Enda Murphy[3], Jacob Stolle[4], Andrew Cornett[1]

[1]University of Ottawa, Ottawa, Canada, [2]Université Bretagne-Sud, Lorient, France, [3]National Research Council, Ottawa, Canada, [4]Institut National de la Recherche Scientifique, Québec City, Canada

To date, physical modelling studies of wave-vegetation interactions have predominantly used surrogate vegetation due to the logistical challenges associated with live plant experiments. Most studies have also been performed at or near full-scale to avoid uncertainties associated with downscaling vegetation. In

this study, wave attenuation by a scaled living dyke model was investigated by researchers of uOttawa and INRS, in collaboration with the NRC Ocean, Coastal and River Engineering Centre (Ottawa, Canada), as part of a MEOPAR-funded study of saltmarsh systems in the Baie St-Paul region, Québec. The dyke (1V:20H) contained a simulated *Spartina alterniflora* meadow, downscaled using a solid volume fraction approach and modelled by both rigid and flexible cylinders. The study aims to address existing knowledge gaps related to physical modelling of wave-vegetation interactions at small-scale, including: 1) testing the sensitivities of the solid volume fraction approach for downscaling marsh meadows in laboratory settings, and 2) comparing the performance of various surrogate proxies for *S. alterniflora*, to inform guidelines for surrogate selection. Various arrays of surrogate elements modelling the living dyke structure were subjected to irregular wave conditions between 0.075 m <Hm0< 0.23 m, with wave periods between 2.0 s <Tp< 3.25 s, and at two water depths d=0.60 m and 0.75 m, and wave attenuation associated with the simulated meadow was measured for each test. Overall, the results of this study indicate that wave attenuation is sensitive to stem diameter selection in the percent volume fraction approach to downscaling vegetation meadows, but not to surrogate element flexibility.

Future-proofing marine conservation planning in the Northwest Atlantic Ocean

Andrea Bryndum-Buchholz[1,2], Julia L. Blanchard[3,4], Marta Coll[5,6], Hubert Du Pontavice[7], Jason D. Everett[8, 9, 10], Jerome Guiet[11], Ryan F. Heneghan[12], Camilla Novaglio[3,4], Juliano Palacios-Abrantes[13], Colleen M. Petrik[14], Derek P. Tittensor[1,15], Heike K. Lotze[1]

[1]Dalhousie University, Halifax, Canada, [2]Fisheries and Marine Institute, Memorial University of Newfoundland, St. John's, Canada, [3]Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, Australia, [4]Centre for Marine Socioecology, University of Tasmania, Hobart, Australia, [5]Institute of Marine Science (ICM-CSIC), Barcelona, Spain, [6]Ecopath International Initiative Research Association, Barcelona, Spain, [7]Atmospheric and Oceanic Sciences Program, Princeton University, Princeton, USA, [8]School of Mathematics and Physics, The University of Queensland, St Lucia, Australia, [9]Commonwealth Scientific and Industrial Research Organization (CSIRO) Oceans and Atmosphere, Queensland Biosciences Precinct (QBP), St Lucia, Australia, [10]Centre for Marine Science and Innovation, The University of New South Wales, Sydney, Australia, [11]Department of Atmospheric and Oceanic Sciences, University of California Los Angeles, Los Angeles, USA, [12]School of Mathematical Sciences, Queensland University of Technology, Brisbane, Australia, [13]Institute for the Oceans and Fisheries, The University of British Columbia, Vancouver, Canada, [14]Scripps Institution of Oceanography, University of California San Diego, USA, [15]United Nations Environment Program World Conservation Monitoring Centre, Cambridge, UK

Climate change is altering marine ecosystems on local to global scales and is projected to do so for centuries to come. Marine conservation agencies can use short- and long-term projections of species-specific or ecosystem-level climate responses to inform marine conservation planning, yet, integration of climate change adaptation, mitigation and resilience into marine conservation planning is limited. Here, we analyzed future trajectories of climate change impacts on marine animal biomass and six key physical and biogeochemical drivers across the Northwest Atlantic Ocean to evaluate the consequences for Marine Protected Areas (MPAs) and Other Effective area-based Conservation Measures (OECMs) in Atlantic Canada. We also identified climate change hotspots and refugia where the environmental drivers will most change or remain close to their current state by mid- and end-century. To do so, we used standardized outputs from the Fisheries and Marine Ecosystem Model Intercomparison Project and the

6th Coupled Model Intercomparison Project. Our analysis revealed that no existing marine conservation areas in Atlantic Canada overlap with identified climate refugia. Most established MPAs and almost half of the established OECMs lie within climate hotspots. Our results provide important long-term context for climate change adaptation and future proofing spatial marine conservation planning and decision-making in Canada and the Northwest Atlantic region.

Investigating the connectivity between sedimentary, hydrodynamic and biological processes in the Pointe-des-Monts submarine canyon system (Québec)

Audrey Limoges[1], J.-C. Montero-Serrano[2], A. Normandeau[3], D. Didier[4], K. Baccara[2], C. Bernier[4], P. Bernatchez[4], D. Bourgault, C. Deslauriers[4], M. Gosselin[2], F. Jacques[2], P. Lajeunesse[5], C. Lalande[6], T. Laphengphratheng[4], K. Lemmens[4], U. Neumeier[2], A. Rochon[2], H. Sharpe[1], O. Sherwood[7], G. St-Onge[2]

[1]University of New Brunswick, Fredericton, Canada, [2]Institut des sciences de la mer de Rimouski, Rimouski, Canada, [3]Geological Survey of Canada (Atlantic), Dartmouth, Canada, [4]Université du Québec à Rimouski, Rimouski, Canada, [5]Université Laval, Québec, Canada, [6]Amundsen Science, Québec, Canada, [7]Dalhousie University, Halifax, Canada

The Lower St. Lawrence Estuary (LSLE, Québec) hosts several submarine canyon and channel systems. While these canyons have the potential to provide ecosystem services, their ecological role has been poorly investigated. This project aims at understanding the interplay between coastal dynamics, sedimentary and hydrodynamic processes, and pelagic productivity in the Pointe-des-Monts canyon system. Coastal sediment budgets around Pointe-des-Monts were monitored and current profilers were deployed along with sediment traps inside and outside the Pointe-des-Monts canyon system. Coastal and nearshore imagery shows that sediments are stored on the shelf, in small ponded basins. During intense storms, increased wave heights can lead to shelf-sediment resuspension and trigger turbidity currents. Other hydrodynamic processes including internal tides and internal waves also remobilize near-bed sediment and cause vertical mixing. Chlorophyll *a* data from the sediment traps suggests that these processes impact biological productivity, as phenological patterns of pelagic primary production recorded in the canyon differ from those under background LSLE conditions. This research has also animated literary creations that have been combined into the literary and scientific notebook "Mailler les eaux"—to be published in Fall 2022 by Éditions de l'écume—and the exhibition "Fathom the depths of the St. Lawrence Estuary: Art and Science" that will first be hosted at the Art Center of the University of New Brunswick (Fredericton) in January 2023, before travelling to other provinces.

Canada's Ocean Acidification Community of Practice

Austin Pugh[1], Brent Else[1], Helen Gurney-Smith[2]

[1]University of Calgary, Calgary, Canada, [2]St. Andrews Biological Station, St. Andrews, Canada

The need for science-informed decision-making in the face of climate change is ever-increasing, with knowledge users ranging from scientists, governance, stakeholders, rightsholders, and the general public. To increase knowledge sharing and mobilization on ocean acidification (OA) in Canada, the MEOPAR (Ma-

rine Environmental Observation, Prediction and Response) Network of Centres of Excellence formed an OA Community of Practice (CoP) in 2018, which is open for any interested parties to join (www.oceanacidification.ca). OA CoP objectives include the development of knowledge transfer and community engagement via accessible content; resources, and databases; best practices for data collection, and; interdisciplinary knowledge sharing. We will present some of our key activities to date, our new online resources and blog series aimed at increasing OA awareness, membership diversification, and engagement, research projects such as low-cost OA sensor package to aid aquaculture operations and larger monitoring efforts in coastal zones, our role in the facilitation of OA climate adaptation plans, linkages to other national and international OA initiatives, how we built this community, and the future of the CoP.

Development of an Information Service for CIOOS Pacific

Brad deYoung[1], Ray Brunsting and Jorin Wetherston[2], Richard Dewey[3]

[1]CIOOS Pacific, Victoria, Canada, [2]Hakai Institute, Victoria, Canada, [3]Ocean Networks Canada, Victoria, Canada

The Canadian Integrated Ocean Observing System (CIOOS) has been expanding its data access and developing tools such as the Data Explorer to make ocean data more available. There has been real progress and both the depth and accessibility of ocean data in CIOOS has greatly expanded. Such development, while necessary, is however not sufficient to meet the goals of a sustainable ocean observation program. A review of the developments of CIOOS Pacific will highlight the progress made in coordinating ocean data and consider what is missing. We will review the societal needs of an ocean information service considering both what and how users require access. CIOOS Pacific has considered the needs, the strategy, and an approach to developing an ocean information service. We will present a design for a service that builds upon the existing strengths of the CIOOS catalog and is directed towards users in the Pacific region.

Prediction of contaminant dispersion in the Gulf of St. Lawrence via Deep Learning

Rishita Kotiyal[1], Aditya Jain[1], Uriel Zajaczkovski[2], Graigory Sutherland[3], **Chris Whidden[1]**

[1]Dalhouse University, Halifax, Canada, [2]Willis Towers Watson, [3]Environment and Climate Change Canada, Dorval, Canada

We developed and trained machine learning models for predicting tracer and contaminant dispersion in the Gulf of St. Lawrence, leveraging data collected by the RQM/MEOPAR Tracer Release Experiment (TReX). There have been few attempts using machine learning to study ocean dispersion and none in the Gulf of St. Lawrence. A successful machine learning model for this task would have the potential to provide rapid estimates that could be used in combination with numerical models and field observations to further assess contingency plans. We first tested four standard machine learning models: Linear Regression, Support Vector Machines (SVM), Random Forest (RF) and XGBoost. Initial results using positional data were poor, so we augmented the data set with additional features including velocity and a moving average. Surprisingly, simple linear regression performed the best with a mean absolute error of 0.11km at predicting drifter positions one hour in advance but with reduced accuracy at longer term prediction.

We then tested neural network models, particularly Long Short-Term Memory (LSTM) models which often work well on time series data. We observed good prediction accuracy when trained with the first 80% of data from each drifter but poor performance when trained on a subset of 80% of the drifters and tested on the other 20% (i.e., novel drifter prediction). This work highlights the difficulty of applying machine learning for dispersion prediction with multiple objects and suggests several avenues for further research.

Bioregionalization of the coastal and open oceans of British Columbia and Southeast Alaska based on Sentinel-3A satellite-derived phytoplankton seasonality

Christian Marchese[1,2,3], Brian Hunt[2,3], Fernanda Giannini[4], Matthew Ehrler[1], Maycira Costa[1]

[1]University of Victoria, Canada, [2]University of British Columbia, Vancouver, Canada, [3]Hakai Institute, Heriot Bay, Canada, [4]Federal University of Rio Grande, Rio Grande do Sul, Brazil

Despite their highly dynamic nature, physical complexity, and rich biological activity, it is widely accepted that oceans can be partitioned into regions with distinct properties to help in identifying pelagic habitats and a baseline for assessing ocean variability and future changes. British Columbia (BC) and Southeast Alaska (SEA) coastal oceans host essential habitats for several critical species. Across this heterogeneous marine domain, phytoplankton are subject to ocean circulation patterns and atmosphere-ocean-land interactions, and their variability, in turn, influences marine food web structure and function. We developed a two-step classification procedure (i.e., using a Self-Organizing Maps analysis followed by the affinity propagation clustering method) to define bioregions based on the seasonal climatology of high-resolution (300 m) Sentinel-3A surface chlorophyll *a* data for the coastal and open oceans of British Columbia (BC) and Southeast Alaska (SEA). The technique allowed high precision in delineating ten bioregions, broadly divided between off-shelf bioregions and those in neritic waters. Consistent with the high-nutrient, low-chlorophyll regime, relatively low values of phytoplankton biomass (< 1 mg/m3) distinguished off-shelf bioregions, which also displayed, on average, more prominent autumn biomass peaks. In sharp contrast, neritic bioregions were highly productive (>> 1 mg/m3) and characterized by different phytoplankton dynamics. The spring phytoplankton bloom onset varied spatially and inter-annually, with substantial differences among bioregions. This presentation resumes the primary outcomes and will highlight how the proposed regionalization may constitute a reference step for practical and more extensive implementation.

Canadian NEMO Modelling Forum

Clark Pennelly[1], Paul Myers[1]

[1]University of Alberta, Edmonton, Canada

The ocean modelling group at the University of Alberta has been developing a website with the goal to become a central hub showcasing NEMO modelling expertise among the various Canadian institutions. Built via github, the forum provides a space for Canadian researchers to share information regarding their NEMO development, configurations, media, research goals, source code, publications and more with the rest of us. Having all this information on a single platform allows for greater clarity on what each group

is working on, the ability to showcase some new results and media, eventually improving collaboration across Canadian NEMO users. Other planned features to increase collaboration include a Slack channel, a shared calendar of NEMO-related events, discussion board, a mailing list and more. Our site is still in its infancy and requires other institutions to sign up and contribute by either producing their own site alongside our master domain or to link to their existing site.

Empowering a Nation: The Laxgalts'ap website project, Gitga'at territory, northern coastal British Columbia

Dana Lepofsky[1], Spencer Greening[1,2,3], Bryn Letham[1,3], Mark Wunsch[4]

[1]Department of Archaeology, Simon Fraser University, Burnaby, Canada, [2]Gitga'at Nation [3]Coast Mountain College, Terrace, Canada, [4]Greencoast Media, Quathiaski Cove, Canada

Gitga'at First Nation, in Northern British Columbia, has a deep physical, emotional, and spiritual connection to its ancestral lands. Ensuring the continuity of this connection is fundamental to Gitga'at cultural survival and ensuring their on-going stewardship of their lands and seas. For the past eight years, Gitga'at Nation has partnered with archaeologists, ethnoecologists, and videographers to document the rich and ancient history of one important Gitga'at place: Laxgalts'ap ("Old Town") in the Quaal River watershed. By weaving together memories, oral traditions, and local ecological knowledge, with archaeological, geomorphological, and ethnoecological data, we have documented how the Gitga'at have lived with within this 26km long watershed for at least 10,000 years. Thanks to MEOPAR, we are creating an interactive web site, configured for computers, touch screens, and handheld devices, to chronicle this history. In doing so, we not only strengthen and support Gitga'at connections to the marine and terrestrial landscapes of Laxgalts'ap, but also educate settler communities about these connections. In this presentation, we highlight some of the knowledge gained and provide sneak previews on the final product.

Seasonal variations in vertical export of primary production tracers in the subarctic St. Lawrence Estuary

Hannah Sharpe[1], Audrey Limoges[1], Michel Gosselin[2], Catherine Lalande[3], Alexandre Normandeau[4], Jean-Carlos Montero-Serrano[2], Owen Sherwood[5]

[1]University of New Brunswick, Fredericton, Canada, [2]Institut des sciences de la Mer de Rimouski, Université du Québec à Rimouski, Rimouski, Canada, [3]Amundsen Science, Québec, Canada, [4]Geological Survey of Canada (Atlantic), Dartmouth, Canada, [5]Dalhousie University, Halifax, Canada

The northern shore of the subarctic Lower St. Lawrence Estuary (LSLE) is characterized by active submarine canyons. Despite the presence of regional biological hotspots, we lack an understanding of the relationship between canyon processes, sea-surface conditions, and surface primary production. This study documents variations in the vertical export of primary production tracers obtained with three sediment traps deployed near Baie-Comeau (BC) and at the base of the Pointe-des-Monts (PDM) canyon system from October 2020 to September 2021, covering an anomalously nearly ice-free winter in the LSLE. Daily fluxes of chloropigments, particulate organic carbon (POC), and particulate nitrogen (PN) were low during autumn and winter and relatively high during spring and summer near BC. By contrast, higher fluxes of

POC and PN were recorded during autumn and winter near PDM, likely due to sediment resuspension. The composition of diatom and dinoflagellate assemblages was strikingly similar at the two locations, with a dominance of the centric diatoms *Chaetoceros, Rhizosolenia, Skeletonema, Thalassiosira*, and the pennate diatom *Pseudo-nitzschia*. A bloom of the domoic-acid producing diatom *Pseudo-nitzschia seriata* was captured in September 2021 at the BC site. Peaks in diatom and dinoflagellate fluxes occurred concurrently in April near BC, whereas near PDM, diatom fluxes peaked in April and dinoflagellate fluxes peaked in June. Relatively high diatom fluxes were sustained for eight months, exhibiting an unusually long production season for the region. In the context of climate warming, this study provides valuable insight into future trends of primary production in the LSLE and other subarctic settings.

Surface dispersion of dyed freshwater and drifting buoys in the lower St. Lawrence estuary

Jean Clary[1], Cédric Chavanne[1], Dany Dumont[1], Rich Pawlowicz[2]

[1]Université du Québec à Rimouski, Québec, Canada, [2]Department of Earth, Ocean and Atmospheric Sciences, Vancouver, British Columbia, Canada

Surface dispersion in the lower St. Lawrence estuary was studied using releases of dyed freshwater and drifting buoys in September 2020 and 2021 as part of the Tracer Release eXperiment (TReX). On September 10, 2020, 162 drifting buoys (81 drogued between 10-60cm depth and 81 undrogued) were released with initial separation distances ranging from 10m to 30km across the estuary offshore of Rimouski. On September 11, 2020, 680L of rhodamine-WT at 2% concentration in a freshwater solution were released about 13km offshore of Le Bic. Each day from September 5 to 9, 2021, 300L of rhodamine-WT at 1% concentration were released between 1 and 8km offshore of Rimouski. For each dye release, photographs of the rhodamine patch were taken from an aerial drone until the patch was no more visible, and vertical profiles of rhodamine concentration were obtained with a Turner Cyclops fluorometer. The rhodamine always remained in the surface mixed-layer, which was less than 10m deep. The intensity of the red channel in the aerial photographs was best correlated with the rhodamine concentration averaged over the top 4m. The analysis of Sundermeyer et al. (2001) was performed on the surface dye spreading to estimate both the turbulent horizontal diffusivity and the large-scale horizontal strain. Horizontal diffusivity values range from 0.7 to 1.3m^2/s. In comparison, horizontal diffusivity estimated from the relative dispersion of drifting buoys initially separated by less than 150m is always lower than 2m^2/s.

Improving weather, water, ice, and climate information for better ship navigation through the Canadian Arctic

Jean Holloway[1], Jackie Dawson[1], Annika Stensland[1], Jelmer Jeuring[2], Machiel Lamers[3], Brent Else[4]

[1]University of Ottawa, Ottawa, Canada, [2]Norwegian Meteorological Institute, Bergen, Norway, [3]Wageningen University, Wageningen, The Netherlands, [4]Arctic Institute of North America, University of Calgary, Calgary, Canada

Substantial advances in environmental prediction capabilities for the Arctic are needed, specifically improvements in weather, water, ice, and climate (WWIC) information to ensure safe and sustainable ship

navigation. Currently, there is a significant gap in reliable information that ship operators can utilize when travelling in the Arctic. To better understand operator needs, a mixed-methods survey was developed, targeting mariners with experience travelling in the Canadian Arctic on board a range of vessel types and sizes (e.g., cargo ships, pleasure craft), from a variety of sectors (e.g., tourism, resource extraction). Results show that 61% of survey participants felt their needs were met "frequently" by current WWIC services, but 63% said their operations would benefit from additional information. Sea ice concentration was identified as the most important information need, and that more frequent updating of ice charts was essential, ideally in real-time. However, different vessel types have different information needs. For example, the Northwest Passage was identified by pleasure craft operators as an area where WWIC information is most inaccurate and where improvement is needed, while the extent of information deficiencies reported for other vessel types was much more geographically diverse. Pleasure craft operators also indicated that access to information was impeded by the unavailability of technology onboard. These differences between vessel types emphasizes the necessity to develop WWIC services for specific user needs. Ultimately, these results will be shared with service providers to help stimulate the co-production of meaningful WWIC products that support safer navigation through the Canadian Arctic.

Explore what's new with CIOOS

Jonathan Kellogg[1], Alexi Baccardax Wescott[2], Andréane Bastien[3], Naomi Boon[4], Brad de Young[5], Shayla Fitzsimmons[6], Evelyn Hornbeck[7], Shen Malloy[2], Samuel Richard-Dubé[3]

[1]Hakai Institute, Vancouver, Canada, [2]COINAtlantic, Halifax, Canada, [3]St Lawrence Global Observatory, Rimouski, Canada, [4]CIOOS, Victoria, Canada, [5]CIOOS Pacific, Victoria, Canada, [6]CIOOS Atlantic, Halifax, Canada, [7]MEOPAR, Halifax, Canada

More data and new tools are making the Canadian Integrated Ocean Observing System (CIOOS) better and easier to use. See what's new with CIOOS as we work from coast to coast to coast to improve Canada's nucleus for integrated ocean observing activities. With major new datasets and decades of observations in key basins, CIOOS should be your first stop when proposing science in a new-to-you location or searching for historical records. Find data faster with our improved tools. The CIOOS Asset Map has refined capabilities and the new Data Explorer allows users to search across datasets by area of interest and filter to get just the data you want. Check out the improvements and get the ocean data you need to prepare for our ocean future.

World Water Journey

Karen Kun[1], Robert Newell[2,3]

[1]Waterlution, Toronto, Canada, [2]Royal Rhodes, Victoria, Canada, [2]Canada Research Chair in Climate Change, Biodiversity and Sustainability, Royal Roads University, British Columbia, Canada,[3]Research Associate, Food and Agriculture Institute, University of the Fraser Valley, British Columbia, Canada

World Water Journey (WWJ) is a new platform (launched October 18, 2022) connecting researchers, communities, water and climate innovators, Indigenous knowledge keepers and young professionals on water and climate knowledge from across Canada and around the world. WWJ offers an immersive space

bringing together the challenges, solutions, change makers, researchers to elevate dialogue and collaboration opportunities for the global water community. A space where users can learn, listen, watch, all with the goal to increase much needed solution making and collaboration. World Water Journey enables global and regional connections between emerging young professionals, water leaders, transforming researchers, communities, market leaders and innovators.

Canoe as Teacher

Lilia Yumagulova[1]

[1]Pacific Regional Coordinator, Canadian Ocean Literary Coalition, Simon Fraser University; Banting Postdoctoral Fellow, Indigenous Studies, University of Saskatchewan

This presentation is about a Knowledge Mobilization project created in collaboration with the Squamish Ocean Canoe Family and International Sustainability Education Foundation. It is based on stories shared by key family members such as the President of the Squamish Ocean Canoe Family, Larry (Shucks) Nahanee, the Skwxwú7mesh Chiaxten ("Protocol Keeper"), Wes Nahanee, and Alroy "Bucky" Baker K'etximtn. Narrated by Aaron Williams, animated by Carime Quezada, and produced by Jonathon Reynolds, the short, animated video tells the story of the Skwxwú7mesh ocean-going canoe and traditions. A more detailed story can be found in an academic article titled Canoe as Teacher. Through the stories, reflections, and teachings shared by Wes and Shucks, this article looks at the "canoe as a teacher" and how Indigenous Pedagogies are attained through Canoe Journeys, particularly in the urban Indigenous context where this canoe resurgence means cultural continuity and healing. In this presentation, you will learn about collaboration and reciprocity for community-engaged research in First Nation context.

Persistent hypoxia in the Estuary and Gulf of Saint Lawrence: influence on sediment biogeochemistry and bioturbation activity

Ludovic Pascal[1], Joannie Cool[1], Philippe Archambault[2], Piero Calosi[1], Gwenaëlle Chaillou[1]

[1]Université du Québec à Rimouski, Québec, Canada; [2]Université Laval, Québec, Canada

Dissolved oxygen is a key environmental factor influencing sediment chemistry as well as organisms' behavior, ecology and distribution. Over the course of the last decades, persistent hypoxic waters (O2 concentration < 62.5 µmol/L) have increased in number, duration and intensity, a trend that is predicted to continue with climate change. The Estuary and Gulf of St. Lawrence (EGSL) is impacted by persistent hypoxia since the 1980s. Indeed, during the past 90 years, oxygen concentration in the bottom waters of the EGSL has been decreasing at a rate of 1 µmol/y. The oxygen concentration measured in September 2020, with hypoxic waters observed down to the Gulf and oxygen concentration as low as 43 µmol/L, highlight the need to better understand the response of the benthic compartment to hypoxia to improve our prediction on the consequences of bottom water deoxygenation on sediment biogeochemistry. For instance, although bioturbation is an important process influencing sediment biogeochemistry, the nature of its relationship with oxygen concentration remains unknown. In this context, the aim of this study is to elucidate the response of sediment biogeochemistry and macroinfauna communities to decreasing bottom water concentration in the EGSL.

Functional traits and ecosystem functioning in a fragmented boreal eelgrass meadow

Marie-Pomme Presne-Poissant[1], Elliot Dreujou[1], Fanny Noisette[1]

[1]Université du Québec à Rimouski, Rimouski, Canada

Eelgrass sustains large meadows in coastal environments. These ecosystems provide a number of benefits to marine fauna and human communities living by (carbon sequestration, shore stabilization). On a global scale, meadows decline is often associated with increase of fragmentation that influences ecosystem functioning. The intertidal meadow of Rimouski (Québec, Canada) is a highly fragmented ecosystem where barren and vegetated habitats, formed by ice scouring and wave action, coexist in the same ecosystem. This project aimed to correlate community characteristics and community functioning in this boreal fragmented eelgrass meadow. In 2021 summer, 9 cores were randomly sampled in both vegetated and barren areas. Cores were kept in an outdoor mesocosm from June 15 to August 1. Biochemical fluxes (oxygen, carbon and nutrients) were measured at immersion and emersion to assess community functioning. Community traits (macrophytes biomass, microphytobenthos concentration and macrofauna abundances) were quantified. After 45 days in the mesocosm, primary producers and macrofauna biomass were higher in vegetated than barren cores. Community respiration (CR) was higher in vegetated cores, driven by high macrofauna and macrophytes biomasses. However net community production (NCP) was greater in vegetated than in barren cores only during immersion and significantly related to primary producers. Surprisingly, at emersion, NCP was related to macrofauna biomass. This project highlights the major role of eelgrass on community productivity. However, this fragmented ecosystem is highly dynamic. For instance, increase in green algae and microphytobenthos presence on barren areas can increase the productivity to match the functioning level of vegetated areas.

Resilient Coasts Canada online platform: Update and knowledge mobilization

Mauricio Carvallo Aceves[1], Ryan Reynolds[1], Stephanie Chang[1]

[1]University of British Columbia, Vancouver, Canada

The Resilient Coasts Canada (Resilient-C) platform is a free online tool for coastal community resilience, developed with multi-year MEOPAR support. The platform helps coastal communities to identify other communities across the country that share similar hazard exposure and vulnerability profiles, discover the actions their peers have taken to address coastal hazard risks, and promote resilience-building networks (https://resilient-c.ubc.ca). The recently completed Version 4.0 of Resilient-C includes information on 180+ coastal communities in 7 provinces and over 2,100 risk reduction actions that they are undertaking. Recent enhancements to the platform include expanded geographic scope (e.g., Québec communities), software refinements based on a usability study, a series of supplementary reports, and translations of key elements for francophone users. This presentation provides a guided tour through Resilient-C 4.0 and highlights associated knowledge mobilization efforts.

Overview of the Canadian ocean mapping research & education network (COMREN) CoP

Sylvie Daniel[1], Ian Church[2], Anders Knudby[3]

[1]Université Laval, Québec, Canada, [2]University of New-Brunswick, Fredericton, Canada, [3]University of Ottawa, Ottawa, Canada

COMREN CoP aims to develop research activities, achieve technology transfer to industry and develop and run educational programs. It looks to operate in liaison with government agencies and international organizations, to increase Canada's ocean and coastal mapping research, education capacity and presence, both domestically and internationally. Central to this is providing opportunities to train Highly Qualified Personnel (HQP) who can help advance ocean technologies and solve problems, both applied and theoretical, with hydrospatial science and the ideas of neighboring disciplines. The presentation will provide an overview of the COMREN CoP, which has just successfully completed its first year. It will cover its current members and its scope. Illustrative examples of some collaborative projects as well as information about its International Hydrography and Hydrospatial School will be shared. The presentation will also focus on upcoming initiatives to grow its community, for example, the recruitment of new members, the broadening of its focus to a greater diversity of technology and mapping activities, especially coastal, the development of open educational materials and resources.

Posters Abstracts

Sources of predictability for the St-Lawrence Seaway freeze-up date and application of Machine Learning as a downscaling approach

Amélie Bouchat[1], Pascale Bourbonnais[2], Philippe Lamontagne[3], Jean-François Lemieux[4], Bruno Tremblay[1]

[1]McGill University, Montreal, Canada, [2]Fednav Limited, Montreal, Canada, [3]National Research Council of Canada, Ottawa, Canada, [4]Environnement et Changement Climatique Canada, Dorval, Canada

While the presence of river ice can critically affect navigation safety, forecasts of ice conditions are almost non-existent for the St. Lawrence Seaway, a major shipping channel in Canada. To address this, we investigate sources of predictability for the Seaway freeze-up date (FUD) near Montreal. We identify that predictability originates mostly from atmospheric variables, with a maximum lead time of ~2 months. Based on this analysis, we develop statistical models to forecast the FUD at sub-seasonal time scales using a Multiple Linear Regression (MLR) approach. The mean absolute error (MAE) for MLR forecasts starting as early as November 1 is 6 days, improving on the climatological baseline by ~3.5 days. We also produce a categorical FUD forecast using the same tercile categories (i.e., below, near, and above normal) as that of CanSIPS deterministic seasonal predictions of air temperature and show that its accuracy is not better than that of a random forecast (< 33%). To improve on this, we investigate the possibility to use Machine Learning (ML) models as a tool to process and correct seasonal atmospheric forecasts to extract FUD forecasts. Due to limited ice observations for the St. Lawrence Seaway, we train the ML model to forecast daily water temperature, from which freeze-up is detected in post-processing. Specifically,

we build an Encoder-Decoder LSTM system that takes in prior weather time series as well as daily atmospheric forecasts for the next 60 days as inputs, and outputs a forecast of daily water temperature time for the next 60 days. We first investigate the limitations of this model using idealized experiments in which reality is considered as perfect atmospheric forecasts and we also present preliminary results using daily atmospheric forecasts from the SEAS5 forecasting system.

A likely mechanism for a "first-time" ice-free Arctic

Alice Le Guern-Lepage[1], **Bruno Tremblay[1]** (presenter)

[1]McGill University, Department of Atmospheric and Oceanic Sciences, Montreal, QC, Canada

In recent decades, the Arctic minimum sea ice extent has transitioned from a predominantly thick multiyear ice cover to a thinner seasonal ice cover. In this contribution, we quantify the summer thermodynamic (lateral and basal melt) and dynamic (advection, compaction and export) sea ice area loss in the Arctic Ocean during the satellite era from 1979 to 2021 using passive microwave sea ice concentration and a Lagrangian sea ice tracking model driven by satellite-derived sea ice velocities. Results show that the thermodynamic signal dominates the total summer ice area loss and the dynamic signal remains small (~15%), even in years when the export is largest. Sea ice loss by compaction dominates the dynamic area loss except in the 1980s and early 1990s when the pack is thick and less mobile and in the 2010s when ridging and export become more important. Results from a simple (Ekman) free-drift sea ice model, supported by results from the Lagrangian model, suggest that non-linear effects between dynamic and thermodynamic area loss are key for all-time record minimum sea ice extent years. A detailed analysis of two all-time record minimum years (2007 and 2012) — one with a semi-permanent high in the southern Beaufort Sea and the other with a short-lived but extreme storm in the Pacific sector of the Arctic — shows that compaction by Ekman convergence amplified by the ice-albedo feedback dominated the sea ice loss signal in 2007 while Ekman divergence (together with an early melt onset) amplified by sea-ice albedo feedback was a major cause of 2012 minimum. We argue that Ekman divergence from more numerous and earlier intense summer storms when the sun is high above the horizon is a likely mechanism for a "first time" ice-free Arctic.

Observations-based seasonal predictability of sea ice in the Arctic Ocean: new tools to investigate dynamic mechanisms

Charles Brunette[1], Bruno Tremblay[1], Robert Newton[2]

[1]McGill University, Montréal, Canada, [2]Lamont-Doherty Earth Observatory, Columbia University, Palisades, New York, USA

Sea ice plays a fundamental role in the regulation of the Arctic environmental system. It is a highly dynamic medium: under forcing from the winds and currents, sea ice drifts up to several kilometers per day. This circulation contributes to sea ice predictability, an active area of research where both observational and modelling efforts are required for improving Arctic forecasting capabilities. The objective of this project is to improve observations-based sea ice motion datasets, and investigate the regional and seasonal predictability of sea ice in the Arctic Ocean based on dynamic mechanisms. We

develop a method for quantifying winter ice circulation in the Laptev Sea, showing that late winter coastal divergence explains up to 40% of the interannual variability of the minimum sea ice extent. During winter, sea ice motion away from the coastlines leads to the opening of coastal polynyas, where new ice is formed but does not grow to a sufficient thickness to survive the summer melt. Sea ice circulation in the winter therefore preconditions the pack ice by reconfiguring the ice thickness distribution, and thickness anomalies then propagate through the summer. Aiming to improve sea ice drift datasets, we revisit the optimal interpolation scheme for merged sea ice motion vectors. The analysis of sea ice trajectories relies on spatially and temporally complete drift information, which we obtain by combining drifting-buoy data, satellite-derived ice motion, and free-drift estimates. We develop a new interpolation method that includes a parameterization for error-based weights, a calibration of satellite-derived data, a new parameterization for free-drift estimates, and an optimization of the weighted average scheme. The new interpolation method reduces the error on drift speed and orientation, and improves the seasonal cycle. These optimally interpolated sea ice motion vectors will support future studies of sea ice predictability based on sea ice tracking.

Studies of coastal fish movement in critical habitat areas as a vector for understanding species' flexibility to Borealization

Harri Pettitt-Wade[1,2,3], Jack Hollins[1], Nigel Hussey[1], Nick Jeffery[3], Stanley Ryan[3], Lisa Loseto[2]

[1]Integrative Biology, University of Windsor, Ontario, [2]Fisheries and Oceans Canada – Arctic, Ontario and Prairie, Freshwater Institute, Winnipeg, [3]Fisheries and Oceans Canada – Maritimes, Bedford Institute of Oceanography, Dartmouth

Coastal marine ecosystems are data deficient and facing increasing stressors brought on by climate change, including the ongoing northern range expansion of temperate and Boreal fauna and contraction of the distribution of Arctic fauna. In order to understand these processes, effort must be made to understand the primary drivers of variation in coastal fish movement in both boreal and Arctic ecosystems. For the Ulukhaktok Fish Tagging Project, acoustic telemetry was used to investigate habitat-associated fine-scale movement dynamics of Greenland cod, and coastal residency and migration patterns of anadromous Arctic char near Ulukhaktok, NT. The acoustic telemetry array consisted of 50 receivers including a grid of 27 moorings within a semi-enclosed coastal marine channel (Vemco Positioning System), several gates at channel entrances, and a discontinuous array along >300km of coast for tracking long distance coastal migrations. Several lakes were monitored using fixed receivers and a portable receiver (VR100). During summers of 2018 and 2019, Greenland cod and Arctic char were tagged with transmitters (V13, V16) and released on the marine coast near Ulukhaktok. Temperature, current strength, and conductivity were measured using loggers fixed to moorings. After two years, the study was reduced to focus on tracking the movements of Arctic char at major river mouths and in overwintering lakes, and the last moorings were recovered in winter 2021-2022. During summer 2022, interviews and workshops were held with local Inuit in Ulukhaktok to co-interpret the research findings with local and traditional knowledge in mind.

Our findings revealed that Arctic char from different overwintering lakes exhibited divergent use of the marine coast during summer, with periods of residency indicating the importance of partially enclosed bays and estuaries for summer foraging. Greenland cod exhibited high year-round residency in the

partially enclosed bay where they were captured and released. High intraspecific variation in space use at fine spatial and temporal scales indicated capacity for flexibility to ecosystem change for this Arctic gadid population. The questions and techniques used in this project are currently being applied to develop multi-species acoustic telemetry arrays and array networks in Canadian Marine Protected Areas, including a proposed Anguniaqvia niqiqyuam MPA array (Northwest Territories) and St. Anns Bank MPA and proposed Maritime's array network (Nova Scotia), with the broad aim of understanding connectivity within and among critical habitat areas, species interaction, and response to climate change effects including distribution shifts.

A multi-modal logistics model to assist preparedness planning for coastal communities: The case of a megathrust earthquake on Canada's West Coast

Luana Souza Almeida[1], Floris Goerlandt[1], Ronald Pelot[1]

[1]Dalhousie University, Halifax, Nova Scotia, Canada

In the aftermath of a natural disaster, the road network can be covered with debris. Such road blockages can disrupt emergency activities, such as the distribution of food, water, and medicine. Therefore, it is critical to use alternative transportation modes, such as ferries, barges, and helicopters, to reach vulnerable communities, while unblocking the road network. Canada's West Coast is located near the Cascadia Subduction Zone, where evidence indicates that past earthquakes with magnitudes over 8.0 on the moment scale have occurred. This presentation outlines a mathematical problem that synchronizes multi-modal logistic transportation with road clearing activities, useful for scenario analysis and preparedness planning. A hybrid metaheuristic solution approach is proposed, which consists of an initial step using the Greedy Randomized Adaptive Search Procedure followed by a Genetic Algorithm. The approach is applied to a magnitude 9.0 earthquake scenario in the region of Vancouver Island.

Disentangle Nitrogen budget in the Estuary and Gulf of St. Lawrence using the N2/Ar ratio: Preliminary results

Ludovic Pascal[1], Olivier Hérard[1], Felix Cloutier-Artiwat[1], Gwenaëlle Chaillou[1]

[1]Institut des Sciences de la Mer de Rimouski, Université du Québec à Rimouski, Québec, Canada

Denitrification (defined here as the canonical denitrification and anaerobic ammonium oxidation) and nitrogen (N) fixation are essential processes controlling the bioavailability of N in the N cycle. The former converts nitrate (and eventually ammonium) into N2 (a low bioavailable gas) while, the other way around, N fixation converts N to bioavailable forms of N. The imbalance of these two processes is a major factor influencing N limitation in marine systems. The rates of these processes are controlled by complex interactions between various factors such as organic carbon supply, nitrate water concentration and water oxygenation. Over the past century, the Lower Estuary and the Gulf of St. Lawrence (LEGSL) has undergone a variety of ecological changes. These changes include an increase of bottom water temperature, an increase in the sedimentation rate as well as a change in the origin of organic matter resulting in a decrease of bottom water oxygen concentration and a persistent hypoxia since 1980s. These changes are not

homogeneous along the LEGSL, and environmental gradients exist. Therefore, we hypothesize that the rates of denitrification and N fixation changed along these gradients. Here, we present results of monitoring dissolved gas in the water column of the LEGSL using N2/Ar ratio as geochemical tracers of the N cycle. Ultimately, these results will help to improve our understanding of N cycle in the LEGSL and better predict the consequences of the current water deoxygenation on N processes.

Analytical results of a road clearing and relief supplies distribution model for Vancouver Island

Pranitha Vattoni[1], Ronald Pelot[1], Floris Goerlandt[1]

[1]Dalhousie University, Halifax, Canada

The Strategic Planning for Coastal Community Resilience to Marine Transportation Disruption (SIREN) project was started to develop strategies to improve the preparedness of communities in southwestern British Columbia in the event of a major earthquake. One of the culminating models developed as part of this project is a Road Clearing and Relief Supplies Distribution (RCRSD) model which uses damage data obtained from other models made for SIREN. The RCRSD model uses data, such as damaged and available roads, ports, shipping routes, etc., and builds road clearing as well as emergency supplies delivery routes using a mixed integer linear programming (MILP) optimization model. Due to the extensive number of inputs, a Greedy Randomised Adaptive Search Procedure (GRASP) metaheuristic is employed to come up with the solutions. Performing extensive sensitivity analysis on this model is expected to display some similarities in the results of the model, thus, enabling the stakeholders to narrow down the scope of the inputs. The results are also analyzed to anticipate certain 'critical' roads and regions on the island, where road clearing and relief activities seem to be more prominent. The inputs chosen for the analyses are fairly random in the beginning but become more structured as the study develops. The results of the analyses are presented with respect to Vancouver Island overall as well as regional divisions of the island.

The water-following performance of various Lagrangian surface drifters measured in a dye release experiment

Rich Pawlowicz[1], Cedric Chavanne[2], Dany Dumont[2]

[1]University of British Columbia, Vancouver, Canada, [2]Institut des sciences de la mer de Rimouski, Université du Québec à Rimouski, Québec, Canada

Recently, many different ocean surface drifter designs have been developed to track near-surface currents, but the degree to which these drifters slip through the water due to mechanisms associated with the wind is poorly known. In the 2020 Tracer Release Experiment (TReX), 19 drifters of 8 different designs, both commercially available and home-built, were simultaneously released with a patch of rhodamine dye. Although winds were light, drifters moved downwind from the dye patch at speeds of 3-17cm/s (0.8 to 4.5% of wind speed) depending on the design type. A simple boundary layer model was developed and used to find horizontal velocities at all heights between those of measured water column speeds and measured winds. Then, a steady-state drag model was used with this profile to successfully predict

drifter slip. Drogued drifters were found to be affected by Eulerian shear in the upper half-meter of the water column, as well as the Stokes drift, but undrogued drifters were in addition greatly affected by direct wind drag, and possibly by resonant effects. The dye was largely unaffected by all three factors, thus, even "perfect" surface drifters do not move with the mixed layer.

The CMSRF Inventory of Marine Shipping Risk projects and players in Canada

Ronald Pelot[1], Meghan Mathieson[2], Dave Chuck[1], Jessica Cucinelli[1], Louise Spiteri[1], Julia Bullard[3]

[1]Dalhousie University, Halifax, Canada, [2]Clear Seas Centre for Responsible Marine Shipping, Vancouver, Canada, [3]University of British Columbia, Vancouver, Canada

The Canadian Marine Shipping Risk Forum has gradually built its membership to hundreds of individuals from all sectors. While the CMSRF is proving its worth as a venue for networking, sharing new developments, and fostering collaborations, it became clear that there was no simple way to discover all of the projects, groups, companies or individuals in Canada who conduct R&D related to marine shipping risk. Through the CMSRF's Steering Committee it was decided that developing a living online inventory of such stakeholders and their studies would be a useful tool for any interested party, especially those undertaking topics new to them, whether students or employees. The concept took shape through consultation with CoP leaders, literature review, database experts, and librarians. Developing a set of fields that was broad enough to encompass all relevant topics, but aggregated enough to render searches practically useful, formed the basis for the online tool development. The idea was implemented with the aid of a MEOPAR-supported Computer Science Co-op student, and a prototype populated with a sample of entries has been completed. The next steps are to test the prototype with a few volunteers (and fix it as needed), then broadly advertise the inventory tool to have as many relevant stakeholders as possible submit their info to expand the database, and to also solicit ideas for future enhancements of the tool.

TReX deep mission — initial results from a tracer release experiment in the Gulf of St. Lawrence

Samuel W. Stevens[1], Douglas Wallace[2], Rich Pawlowicz[1]

[1]University of British Columbia, Vancouver, Canada, [2]Dalhousie University, Halifax, Canada

The Gulf of St. Lawrence tracer experiment (TReX) is a study that aims to model and observe dispersion and exchange pathways in the local marine environment. For the deepwater component of this project, an inert chemical tracer (SF5CF3) was released at the σ=27.26 kg m-3 isopycnal in Cabot Strait (~275 m) during November 2021 and a subsequent sampling mission was conducted in June 2022, where 113 stations were sampled to assess to what extent the tracer had spread through the gulf. Here, I will present the results of this cruise that show a westward (i.e., inland) movement and general horizontal spreading of the tracer patch, in addition to a vertical spreading of the tracer that is variable in different regions of the gulf. Additionally, I will present the results from a number of neutrally buoyant floats that were deployed during the experiment.

Predictability of the Minimum Sea Ice Extent from Late Winter Fram Strait Ice Export: Model vs Observations

Sandrine Trotechaud[1], Bruno Tremblay[1,2], James Williams[3], Joy Romanski[3], Anastasia Romanou[3], Mitch Bushuk[4], William Merryfield[5], Rym Msadek[6]

[1]Department of Atmospheric and Oceanic Sciences, McGill University, Montréal, Québec, Canada, [2]Lamont-Doherty Earth Observatory, Columbia University, Palisades, New York, [3]NASA Goddard Institute of Space Studies, Columbia University, New York City, New York, [4]NOAA/Geophysical Fluid Dynamics Laboratory, Princeton, New Jersey, [5]Canadian Centre for Climate Modelling and Analysis, Environment and Climate Change Canada, Victoria, Canada, [6]Université de Toulouse, CNRS, CERFACS, Toulouse, France

Late winter coastal divergence along the Eurasian coastline (referred to as the ice factory) – or the Fram Strait ice export, a proxy for coastal divergence in the ice factory – is a skillful predictor of the minimum sea ice extent (Williams et al., 2016; Brunette et al., 2019; Kim et al., 2021; Nikolaeva and Sesterikov, 1970). Coastal divergence leads to the formation of coastal polynya where new ice grows but to a thickness that is not large enough to survive the following summer melt. This signal is then amplified by the ice albedo feedback and leads to more open water at the end of the summer melt season. In this thesis project, we will identify if this source of predictive skill in the seasonal forecast of the minimum sea ice extent is present in General Circulation Models, more precisely in the CESM2-LE, GISS-E2.1-G, GFDL FLOR-LE, CNRM-CM6-1 and the CanESM5. Since even small biases in the large-scale atmospheric circulation simulated by a model can short-circuit this coupling between dominant modes of atmospheric variability (NAO and AO), coastal divergence along the Eurasian coastline, Fram Strait ice export and therefore seasonal forecasting skill of the model, failure to reproduce this coupling observed in the real Arctic will be used to identify biases in GCM. Results show that subtle changes in the large-scale atmospheric circulation leads to opposite statistical relationship between Fram Strait ice area export and the minimum sea ice extent the following September. Differences are linked with difference in the sea ice thickness regimes, more particularly with the partitioning between recirculation within the Beaufort Gyre, ice exported through Fram Strait, ridging north of the Canadian Arctic Archipelago and the persistence of sea ice through the melting season.

An interactive visual website to communicate changes in the marine food web in Qikiqtarjuaq, Nunavut

Sara Pedro[1], Mélanie Lemire[1], Blanche Saint-Béat[2], Muhammad Yamin Janjua[3], Jennifer Herbig[4], Maxime Geoffroy[4], Gustavo Yunda-Guarin[1], Marie Ange Moisan[5], Justin Boissinot[1], Jean-Éric Tremblay[1], Tiff-Annie Kenny[1], Carie Hoover[6], Marianne Falardeau[1], Matthieu Little[7], Laurie Chan[8], Marcel Babin[1], Frédéric Maps[1]

[1]Université Laval, Québec, Canada, [2]IFREMER, France, [3]Department of Fisheries and Oceans, Manitoba, Canada, [4]Memorial University, Newfoundland and Labrador, Canada, [5]INRS, Quebec, Canada, [6]Dalhousie University, Nova Scotia, Canada, [7]University of Victoria, British Columbia, Canada, [8]University of Ottawa, Ontario, Canada

Climate change threatens Inuit food systems at the ecosystem level through changes that affect access to culturally important species, such as narwhal, Arctic char, and seal. To better understand these changes at a broad scale, we are co-developing an ecosystem model of western Baffin Bay (representing food web

interactions from algae to marine mammals) to project future scenarios and predict changes in species availability and accessibility, in collaboration with Inuit partners in Qikiqtarjuaq NU, Canada. Yet, we anticipate that the complexity of ecosystem responses to these scenarios may present a challenge to the effective communication of project results to community members. With this in mind, we are building an interactive website that will emphasize the visual representation of the results. Such a tool is better adapted to Inuit ways that prioritize knowledge exchange through observation and storytelling. The website will include the modeled marine food web and interactive infographics showing the different co-developed scenarios. In English and Inuktitut, these visuals will be coupled with plain text descriptions of the project. During the workshops with local partners, that are already in place for the core project, we will work together to co-construct the website and validate its efficacy at conveying information before launching to a broader audience. We will also engage local artists, youth, and teachers in website development, bringing together art, science, and education. The website will expand the knowledge mobilization of the core project in a clear, visual way, providing a tool to support informed decision-making.

Science-Art Showcase Abstracts

Watercolour Paintings — "Small-scale fisheries in Colours"

Ana Carolina Esteves Dias (she/her)[1]

[1]Postdoctoral Fellow, V2V Global Partnership, University of Waterloo

These paintings were inspired by meetings with countries in Asia and Africa to portray a visual memory of key learnings on small-scale fisheries in these countries. Ana Carolina used watercolours as a learning process to get to know more about the countries while expressing in colours her experience. The paintings were inspired by the Photo of the week initiative and photos presented by countries in V2V events and meetings. These paintings were made during her postdoctoral fellowship with the V2V Global Partnership, supporting small-scale fishers in their transition from vulnerability to viability.

Video — "An Artful Conversation"

Cailin Correia (she/they)[1]

[1]Ocean Literacy Events Administrator, Ocean Networks Canada

Cailin created video that captures the raw pieces of their experience with the ocean in recent years. This video zooms into different elements of the marine world - the sea, the birds, the whales, the plants, and the moon. These short clips are often brief, slow, blurry or fast, reflecting the dynamic nature of the ocean and the constant movement or energy that exists despite what we might perceive as stillness. They want to share the beauty and fascination that comes with focusing on the details and the smaller, more subtle components. Throughout the video, there are several shots that include hands, attached to the ocean in some way. This demonstrates the connectedness of our actions, that they are always involved in the greater picture. Overlaid on the video is a conversation they recorded by the sea, chatting with two friends after having asked the questions, "How does the ocean make you feel?" and "What do you see?" Art is perspective.

Marine Debris Quilt — "Beach Towel"

Carley Mullally (she/they)[1]

[1]Instructor, Nova Scotia College of Art and Design University, Halifax, Nova Scotia, Canada

This "towel" was created with hundreds of discarded rubber lobster bands that were collected on shorelines across Nova Scotia. In Atlantic Canada, we are often attached to the image of the lobster, but this artwork draws attention to the need to view this industry with a critical eye towards its environmental impacts. There are solutions out there, but there needs to be an ongoing discussion with the fishing industry, designers and engineers alike in order to enact change. Having a visual representation of the amount of lobster bands may be the first step in showcasing the actual impact of these bands. There is great potential for new band designs, shore clean-up initiatives and further research which can solve the ongoing issue of marine pollution.

Acrylic Painting — "REGENERATION"

Cécile Tang (she/her) — (Chinese name 希西, pronounced "C-C")[1]

[1]Youth Engagement Independent Consultant

This painting (acrylic on canvas) entitled "REGENERATION" sheds light on the inter-connectedness of living beings thanks to water and the marine world, to our collective resilience and adaptability, and ultimately continued hope for marine conservation. This is portrayed through the painting of a jellyfish and the accompanying text: REGENERATION, acrylic on canvas Jellyfish. I'm 90% water, my structure and survival depend on water like the planet itself. Aren't we all the same? Fluttering and pulsating, our countless trailing tentacles are all part of an intrinsic system. Aren't you part of it as well? Our free-moving nature allows us to interpret the world around us, so we constantly respond and adapt to environmental changes. Are we there yet? My tentacles. Pulsating endlessly, forever propelling me forward. This is progress, let's keep moving. My brothers and sisters are found all over the world, from surface waters to deep seas. Re-birth and regeneration, that we know. I'm a symbol of resilience and renewal – there is hope.

Beadwork — "*Mysis relicta*, with DNA barcode border"

Danielle Nowosad (she/her)[1]

[1]Postdoctoral Student, University of Guelph, Guelph, Ontario, Canada

This small shrimp is a wonderful example of the resiliency of invertebrate life in marine and freshwater systems. Danielle's study region is on Inuinnait Nuna/Inuit Nunangat, or Inuit Homelands, in Iqaluktuttiaq, Kitlineq, Nunavut (Cambridge Bay, Victoria Island, Nunavut). Early on in her research, she came across a paper published in 1962, where the author found *Mysis* in a glacial lake near town (plus a handful of other aquatic invertebrates) that survived the transition from the ocean to its current freshwater home. The Laurentide ice sheet retreated about 7,000 years ago from the island. With the weight of the ice sheet gone, the land started lifting up out of the ocean through a process called isostatic rebound. Over

the millennia, the lake where the Mysids live transitioned from a marine environment to fresh water. They somehow survived! After lots of planning and searching, she found some Mysids in the same lake and submitted them for DNA barcoding. Dani chose to depict *Mysis relicta* as a piece of beadwork because she enjoys combining this cultural artistic practice with her scientific work.

Music — "Last Days Of The Pacific"

Dave Riddell (he/they)[1]

[1]Post-Secondary Education Coordinator, Ocean Networks Canada

This layered musical piece has a simple underlying structure. The shimmering electronic tones in the background represent the slow but persistent changes to the abiotic environment of the Pacific Ocean: warming waters, increasing acidity, hypoxia, methane release, altered current structure and dynamics. The multiple tracks of electric guitar feedback in the foreground represent biotic activity such as stress responses of aquatic life to the changing environment but also human activity, including actions impacting the marine environment as well as vocal calls for better stewardship. The layered tracks of feedback blend into and become indistinguishable from one another. Overall, the theme, and the title of the piece, are of loss—a loss driven by greater instability and uncertainty in a broad global sense. However, there are moments when the foreground dissonance resolves, suggesting hope—an audacious hope that compels us to act lest the warning of the piece become inevitable.

Maritime performing arts and acrobatic project/Recherche-création maritime — "écH2osystème"

Geneviève Dupéré (she/her/elle)[1]

[1]Doctoral candidate, Université du Québec à Montréal, Montréal, Québec; Artistic-Researcher, Center for Circus Arts Research, Innovation and Knowledge Transfer; professor, National Theatre School of Canada

Science-Art Symbiosis is pleased to present this interview with Geneviève Dupéré about écH2osystème, a maritime performing arts and acrobatic project that documents and explores the St. Lawrence ecosystem. MEOPAR Science-Art Symbiosis practitioner Samantha Jones asks Geneviève about the evolution of the project, the collaborations involved, and the insights and outcomes generated through the work. Please enjoy the conversation, film, and images included in this keynote discussion. Learn more about écH2osystème: Web | Facebook

Partners:

- Natural Sciences and Engineering Research Council of Canada/Conseil de recherches en sciences naturelles et en génie du Canada (NSERC)
- Canada Council for the Arts/Conseil des arts du Canada (CAC)
- Réseau Québec Maritime
- Center for Circus Arts Research, Innovation and Knowledge Transfer/École nationale de cirque (CRITAC)

- Ocean Group/Groupe Océan
- DOORspec
- Multi-Électronique (MTE)

Storyboard — "Fiona Photo-graphs"

Jane Affleck (she/they)[1]

[1]Policy Analyst, Native Council of Prince Edward Island; independent researcher, artist, and writer

The series of three "Fiona Photo-graphs" is comprised of strips of digital photographic prints formatted as graphs; the paper on which the photos are mounted was washed with watercolour paint handmade by the artist from locally sourced hematite clay. The "photo-graphs" are presented with various descriptors: basic information about the material content of the photo is along the y axis, a severity scale is along the x axis (with neologisms alluding to the content in subjective terms), and a caption that begin with objective information and moves into more subjective descriptions of the observed/experienced environment. The photos document some of the damage caused by Hurricane Fiona in fall 2022 to the intertidal zone of Prince Edward Island/Epekwitk, part of the larger region of Mi'kma'ki, unceded Mi'kmaq territory. The juxtaposition of objective and subjective descriptions is intended to demonstrate the impossibility of separating the self from environment, as well as the impossibility of remaining fully objective (i.e., scientists have a subjective response to objective data). Also, the subjective descriptions attempt to convey the difficulty of grappling with feelings of "solastalgia," a term coined by philosopher Glenn Albrecht to account for a sense of grief and loss caused by changes in the environment. Perhaps these descriptions can help viewers who do not live in coastal regions to better understand the impacts of climate change in these areas, yet the combination of objective and subjective information may be more effective than either alone in provoking viewers to empathize with the sense of loss, and to consider how to take action about climate change.

Drawing & Photography — "Save it to cherish or Leave it to Perish" & "Born to Fish, Forced to Shift"

Navya Vikraman Nair (she/her)[1]

[1]School of Environment, Enterprise and Development (SEED), University of Waterloo, Waterloo, Ontario, Canada

Navya's sketch conveys the effects of anthropogenic drivers on water quality and their impact on fisheries. In this advancing era, many innovations are really helping poor fishing communities. They are experiencing livelihood vulnerability due to fish decline, income loss, and poor nutrition. The image Navya captured on a field trip to Chilika Lagoon (Asia's largest brackish water lagoon in India) after cyclone Fani where small-scale fisheries are vulnerable to various social-ecological threats. This picture speaks a lot about the hopeless livelihood concerns of the fishing community when Navya visited the villages and had chats with fisher folks. They wanted to convey observations of the stress of casting the net, the hope of making a capture, and the apprehension of troubling the well-being of the fishing community.