Proceedings of the 2025 Canadian Freshwater Mollusc Research Meeting: November 4-6, 2025, Burlington, Ontario

Editors: Todd J. Morris, Jason Barnucz, Scott M. Reid
and Kelly A. McNichols-O'Rourke

Fisheries and Oceans Canada
Great Lakes Laboratory for Fisheries and Aquatic Sciences
867 Lakeshore Rd.,
Burlington, ON
L7S 1A1

2026

Canadian Technical Report of Fisheries and Aquatic Sciences 3747

Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

Canadian Technical Report of Fisheries and Aquatic Sciences

Technical reports contain scientific and technical information that contributes to existing knowledge but which is not normally appropriate for primary literature. Technical reports are directed primarily toward a worldwide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of Fisheries and Oceans Canada, namely, fisheries and aquatic sciences.

Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in the data base *Aquatic Sciences and Fisheries Abstracts*.

Technical reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page.

Numbers 1-456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457-714 were issued as Department of the Environment, Fisheries and Marine Service, Research and Development Directorate Technical Reports. Numbers 715-924 were issued as Department of Fisheries and Environment, Fisheries and Marine Service Technical Reports. The current series name was changed with report number 925.

Rapport technique canadien des sciences halieutiques et aquatiques

Les rapports techniques contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui ne sont pas normalement appropriés pour la publication dans un journal scientifique. Les rapports techniques sont destinés essentiellement à un public international et ils sont distribués à cet échelon. II n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques de Pêches et Océans Canada, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports techniques peuvent être cités comme des publications à part entière. Le titre exact figure au-dessus du résumé de chaque rapport. Les rapports techniques sont résumés dans la base de données *Résumés des sciences aquatiques et halieutiques.*

Les rapports techniques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre.

Les numéros 1 à 456 de cette série ont été publiés à titre de Rapports techniques de l'Office des recherches sur les pêcheries du Canada. Les numéros 457 à 714 sont parus à titre de Rapports techniques de la Direction générale de la recherche et du développement, Service des pêches et de la mer, ministère de l'Environnement. Les numéros 715 à 924 ont été publiés à titre de Rapports techniques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 925.

Canadian Technical Report of
Fisheries and Aquatic Sciences 3747

2026

Proceedings of the 2025 Canadian Freshwater Mollusc Research Meeting: November 4-6, 2025, Burlington, Ontario

Editors:

Todd J. Morris[1], Jason Barnucz[1], Scott M. Reid[2]
and Kelly A. McNichols-O'Rourke[1]

[1]Fisheries and Oceans Canada
Great Lakes Laboratory for Fisheries and Aquatic Sciences
867 Lakeshore Rd.
Burlington, ON
L7S 1A1
Email: Todd.Morris@dfo-mpo.gc.ca, Jason.Barnucz@dfo-mpo.gc.ca,
Kelly.McNichols-ORourke@dfo-mpo.gc.ca

[2]Aquatic Research and Monitoring Section
Ministry of Natural Resources
Trent University – DNA Building, 2140 East Bank Drive
Peterborough, ON
K9J 7B8
Email: Reid.Scott@ontario.ca

Cat. No. Fs 97-6/3747E-PDF ISBN 978-0-660-97804-8 ISSN 1488-5379
https://doi.org/10.60825/karh-w930

Correct citation for this publication:

Morris, T.J., Barnucz, J., Reid, S.M. and McNichols-O'Rourke, K.A. (Editors). 2026. Proceedings of the 2025 Canadian Freshwater Mollusc Research Meeting: November 4-6, 2025, Burlington, Ontario. Can. Tech. Rep. Fish. Aquat. Sci. 3747: ix + 56 p. https://doi.org/10.60825/karh-w930

TABLE OF CONTENTS

ABSTRACT

Morris, T.J., Barnucz, J., Reid, S.M. and McNichols-O'Rourke, K.A. (Editors). 2026. Proceedings of the 2025 Canadian Freshwater Mollusc Research Meeting: November 4–6, 2025, Burlington, Ontario. Can. Tech. Rep. Fish. Aquat. Sci. 3747: ix + 56 p. https://doi.org/10.60825/karh-w930

The sixth biennial Canadian Freshwater Mollusc Research Meeting was held at the Canada Centre for Inland Waters in Burlington, Ontario on November 4–6, 2025. The meeting was jointly hosted by Fisheries and Oceans Canada and the Ontario Ministry of Natural Resources. Sponsors for the event included the St. Clair Region Conservation Authority and the Healthy Headwaters Lab at the University of Windsor. The meeting program included 40 platform presentations and 3 posters. For this year's hybrid meeting there were 80 in-person attendees and another 104 online for the largest group to date.

The objective of the meeting was to bring together malacologists to share past, current, and ongoing research on freshwater molluscs. Topics of discussion included distribution and sampling, toxicology and threats, mitigation and recovery actions, and life history. Attendees were from eight Canadian provinces (BC, AB, SK, MB, ON, QC, NB, NS) and three American states (MI, NY, GA). In addition to interested members of the public, participants were from federal departments, provincial/state agencies, First Nations, academic institutions, environmental consulting firms, non-governmental organizations, naturalist groups, zoos, and museums. The goals of the meeting were to build relationships and promote future collaborations and research opportunities.

RÉSUMÉ

Morris, T.J., Barnucz, J., Reid, S.M. and McNichols-O'Rourke, K.A. (Editors). 2026. Proceedings of the 2025 Canadian Freshwater Mollusc Research Meeting: November 4–6, 2025, Burlington, Ontario. Can. Tech. Rep. Fish. Aquat. Sci. 3747: ix + 56 p. https://doi.org/10.60825/karh-w930

La sixième réunion biennale de recherche sur les mollusques d'eau douce du Canada a eu lieu les 4 au 6 novembre 2025 au Centre canadien des eaux intérieures à Burlington, Ontario. Elle était organisée conjointement par Pêches et Océans Canada et le ministère des Richesses naturelles de l'Ontario. Les commanditaires de l'événement comprenaient l'Office de protection de la nature de la région de St. Clair et le laboratoire Healthy Headwaters de l'Université de Windsor. On y comptait 40 conférences orales et 3 affiches exposées. Le taux de participation à cet événement hybride était à son plus élevé; en effet, il y avait 80 participants en personne et 104 participations en ligne.

L'objectif de cette réunion était de rassembler les malacologistes afin qu'ils puissent échanger sur la recherche passée, actuelle et en cours portant sur les mollusques d'eau douce. Les sujets de discussion abordés comprenaient : la répartition et l'échantillonnage, la toxicologie et les menaces, les mesures d'atténuation et de rétablissement ainsi que, le cycle biologique. Les participants, provenant de huit provinces canadiennes (Colombie-Britannique, Alberta, Saskatchewan, Manitoba, Ontario, Québec, Nouveau-Brunswick, Nouvelle-Écosse) et de trois états américains (Michigan, New York, Géorgie). Outre les membres intéressés du public, les participants représentaient des ministères fédéraux, des organismes provinciaux et d'État, des Premières Nations, des établissements universitaires, des consultants en environnement, des organisations non gouvernementales, des groupes de naturalistes, des zoos, des musées. L'objectif de la réunion était axé sur le réseautage et la promotion de futures collaborations et possibilités de recherche.

EDITORS' COMMENTS

These proceedings contain all of the abstracts that were presented at the research meeting. The abstracts were reviewed in a limited capacity and formatted by the editors. Questions or comments relating to their content should be directed to the authors of each abstract and not to the editors. The views and statements contained in these proceedings are those of the presenters and are neither condoned nor rejected by the editors. Any use of trade names or products does not constitute endorsement or recommendation for use.

REMARQUES DES ÉDITEURS

Le présent compte rendu contient tous les résumés ayant été présentés lors de la réunion de recherche. Les résumés ont été révisés en partie et formatés par les éditeurs. Les questions ou les commentaires liés à leur contenu devraient être envoyés aux auteurs de chaque résumé et non aux éditeurs. Les points de vue et les affirmations exprimés dans ces comptes rendus sont ceux des conférenciers et n'ont été ni approuvés, ni infirmés par les éditeurs. L'utilisation d'une marque de commerce ou d'un produit ne constitue nullement une forme d'approbation ou de recommandation de son utilisation.

DR. GERALD “GERRY” L. MACKIE MEMORIAM

(July 20, 1942 – November 4, 2025)

On November 4, 2025, during Day 1 of the Canadian Freshwater Mollusc Research Meeting, we were deeply saddened to learn of the passing of Dr. Gerald L. Mackie.

Gerry began his life in small town northern Ontario and then headed to Sudbury where he received his B.Sc. at Laurentian University. This was followed by a move south where he attended the University of Ottawa, and added M.Sc. and Ph.D. behind his name. In 1974, Gerry moved further south and settled at the University of Guelph where he became a Professor in the Department of Zoology (now Integrative Biology). There, he dedicated his life to education and science specializing in freshwater invertebrates. Throughout his career he inspired countless students with his knowledge, passion, and inclusivity.

Gerry worked on freshwater invertebrates, with an emphasis on molluscs, for over 40 years. To many, he was “the” Canadian expert. Always eager to teach and share his knowledge, he supervised at least 29 post graduate students (M.Sc. or Ph.D.) and was on the supervisory committee for over 50 more—many of whom remain active in the malacological community today. He authored over 150 peer-reviewed journal articles, and authored or co-authored five books, 15 book chapters, and 25 peer-reviewed conference proceedings as well as many technical and government publications. Those working across Canada will be familiar with “the Mackie protocol” for relocating freshwater mussels. In 1990, while continuing to work as a professor at the University of Guelph, he formed Mackie & Associates Water Systems Analysts Inc. (later becoming Water Systems Analysts). This consulting company first focused on various research studies to determine if and how the invasive Zebra Mussel could be controlled, and later expanded to risk assessments for invasive molluscs as well as relocating and monitoring freshwater mussel species at risk. From 1995 to 2006 and again from 2011 to 2014, Gerry was co-chair of the COSEWIC Mollusc Species Specialist Subcommittee (SSC). In 2009, he was awarded the life-time achievement award from the international

Freshwater Mollusk Conservation Society which is given to an individual who has "…advanced the conservation and science of freshwater mollusks at a national or international level".

While his accomplishments are many and he was world renowned for his knowledge and expertise on freshwater invertebrates, he was, first and foremost, a man known for his love of family, kindness, humour, and easy-going nature. He was a teacher, a mentor, and most of all a friend. The "Mackie Lab" legacy runs deeps through today's Canadian malacological community.

Gerry—you will be missed, but we will carry on your legacy with the love and passion you shared with all of us.

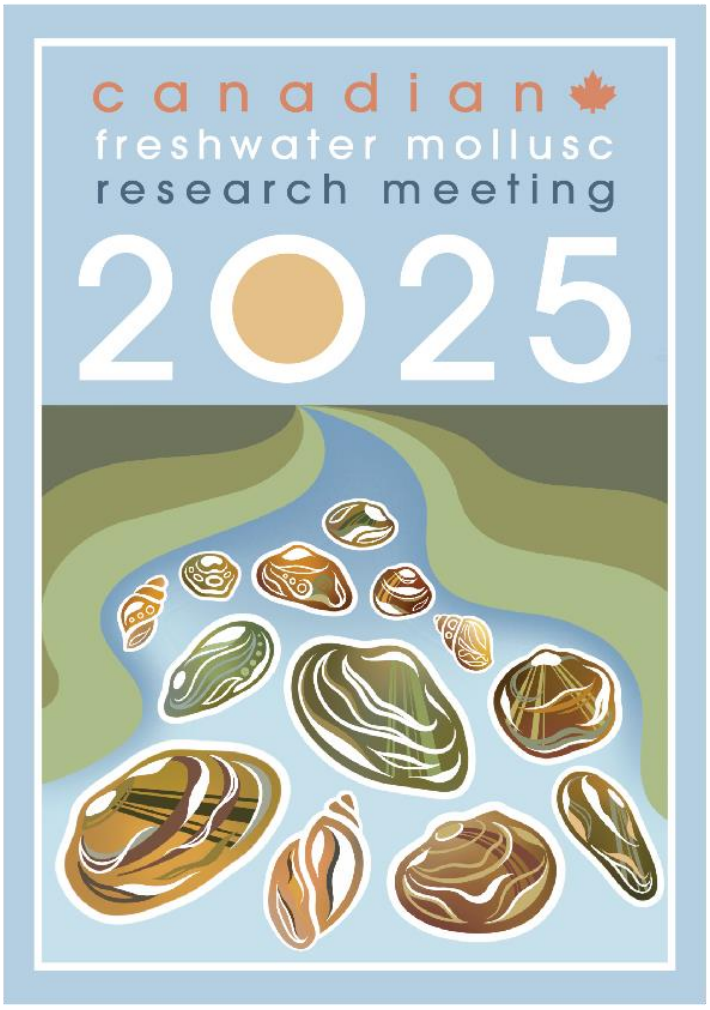
ACKNOWLEDGEMENTS

The organizers would like thank all presenters and attendees for making this research meeting successful. A special thanks goes to our supporting partners—Healthy Headwaters Laboratory at the University of Windsor and the St. Clair Region Conservation Authority. We thank the Green Café for providing hospitality services over the two-day meeting. Thanks go to Jessica Epp-Martindale, Julia Colm, and Stephen Fisches for technical support and to all those who helped with clean up at the end of the meeting. Thanks to Joanne Dziuba from the graphics department at Environment and Climate Change Canada for printing support and Julia Colm and David Andrews for reviewing this technical report.

CANADIAN FRESHWATER MOLLUSC RESEARCH MEETING

November 4–6, 2025

Canada Centre for Inland Waters



CANADIAN FRESHWATER MOLLUSC RESEARCH MEETING ORGANIZING COMMITTEE

Dr. Todd J. Morris	Fisheries and Oceans Canada
Jason Barnucz	Fisheries and Oceans Canada
Kelly McNichols-O'Rourke	Fisheries and Oceans Canada
Dr. Scott M. Reid	Ontario Ministry of Natural Resources

SUPPORTING PARTNERS

Healthy Headwaters Laboratory, Great Lakes Institute for Environmental Research, University of Windsor, Canada

THE HEALTHY HEADWATERS LAB
Great Lakes Institute for Environmental Research
University of Windsor, Canada

St. Clair Region Conservation Authority, Strathroy, Ontario, Canada

St. Clair Conservation

PROGRAM SCHEDULE: TUESDAY, NOVEMBER 4, 2025

All times are in Eastern Standard Time (EST)

8:15 – 9:00	**Registration and poster set-up**	
9:00 – 9:20	**Introductions and welcoming address**	
9:20 – 10:20	Plenary	From coast to coast to coast, 25 years of genomic studies document species-dependent patterns of variation and geographic structure for native freshwater mussels in Canada **David T. Zanatta,** Central Michigan University
10:20 – 10:40	BREAK	
Session 1: Distribution and Sampling		
10:40 – 11:00	Platform 1 (Virtual)	Using environmental DNA (eDNA) techniques to map the distribution of Mapleleaf Mussel in Manitoba **Margaret Docker,** Jessie Ogden, Brennan Richards, Lauren Teller, Isabelle Yakmission, and Erin Wieler
11:00 – 11:20	Platform 2 (Virtual)	Refining the distribution of Eastern Pondmussel (*Sagittunio nasutus*) in Upper St. Lawrence River tributaries using environmental DNA (eDNA) **Kate Schwartz,** Matthew J. S. Windle**,** Emma Ehrenfeld, Ashley McCrimon, and Bella Gyanyama
11:20 – 11:40	Platform 3	Historical comparisons of freshwater mussel assemblages in the Grand River from 1970–2021 **Laura M. Dutheil,** Mandy, P. Gibson, Kelly A. McNichols-O'Rourke, and Todd J. Morris
11:40 – 12:00	Platform 4	The effectiveness and potential uses of muskrat midden searches as a qualitative survey method in the Lower Grand River, Ontario Samuel E. S. Turner, Mitchell B. Shorgan, **Emma M. Maclennan-Nobrega,** Lenka B. Trivett, and Hossam K. Ehab
12:00 – 13:00	LUNCH	

Session 1: Distribution and Sampling (continued)		
13:00 –13:20	Platform 5	Community-based inspections within flood plains: evaluation of a freshwater mussel graveyard as a surrogate for river surveys **Dean Fitzgerald,** Jessica Zadori, Fraser Gibson, and Edward Kott
13:20 – 13:40	Platform 6	Community-based monitoring of unionids at Bkejwanong Territory (Walpole Island First Nation) **Thiranya Weerakoon, Jeffrey Lallean, Lauren Damphousse,** Montana Riley, and Catherine Febria
13:40 – 14:00	Platform 7	Capturing citizen science unionid observations through the Canaiad Project hosted by iNaturalist **Samual Turner,** Philippe Blais, Paul D. Smith, William D. Van Hemessen, and Dwayne Sabine
14:00 – 14:20	Platform 8	You found mussels where?! Essex County, that's where **Alexia Macri**, Katie Stammler, Alyssa Frazao, Melanie Thomas, and Catherine Febria
14:20 – 14:40	Platform 9 (Virtual)	The hunt for Rocky Mountain Ridged Mussel (*Gonidea angulata*) in British Columbia **Jennifer Heron**
14:40 – 15:00	Platform 10 (Virtual)	Update on the biology and distribution of Rocky Mountain Ridged Mussel (*Gonidea angulata*) in Canada **Joy Wade,** Barb Campbell, Margaret Docker, Scott Gilmore, Jessie Ogden, Craig Stephen, and Paul Grant
15:00 – 15:20	Platform 11 (Virtual)	The lower Columbia River, BC, the site of the only Canadian populations of the COSEWIC Endangered Shortface Lanx (*Fisherola nuttallii*) and currently being assessed Ashy Pebblesnail (*Fluminicola fuscus*) **Dwayne Lepitzki**
15:20 – 15:40	BREAK	
Session 2: Toxicology and Threats		

15:40 – 16:00	Platform 12	Toxicity of technology-critical elements in the freshwater snail *Planorbella pilsbryi* **Ève Gilroy,** Kallie Shires, David McNabney, Jiae (Maddy) Kim, Matthew Balter, Patrice Turcotte, Christian Gagnon, and Erin Leonard
16:00 – 16:20	Platform 13	Unintended consequences: the impact of Bayluscide® application on different life stages of freshwater mussels **Olivia Coffield,** Yaryna Kudla, Joseph Langlois, and Ryan Prosser
16:20 – 16:40	Platform 14 (Virtual)	Oxygen consumption as a non-lethal proxy for determining the sensitivity of non-target species to TFM Laura Melina Gobel, Aiden Moore, Robert Lennox, and **Hugo Flávio**
17:30	SOCIAL EVENT – Port House @ The Waterfront Hotel	

PROGRAM SCHEDULE: WEDNESDAY, NOVEMBER 5, 2025

All times are in Eastern Standard Time (EST)

Session 2: Toxicology and Threats (continued)		
9:00 – 9:20	Platform 15	The toxicity of sulfate to *Lampsilis siliquoidea* glochidia and relevance to the Grand River Watershed **Sabrina Cagampan**, Lisa Hoard, Erika A. Burton, C. James Bennett, and Patricia L. Gillis
9:20 – 9:40	Platform 16	Exploring the relationships between waterborne contaminants and glochidia toxicity in surface waters collected adjacent to varied land uses **Lisa Hoard,** Erika A. Burton, C. James Bennett, Jenna Anderson, and Patricia L. Gillis
9:40 – 10:00	Platform 17	Effects and fate of microplastics in multiple life stages of freshwater mussels **Yaryna Kudla,** Patricia L. Gillis, Karen A. Kidd, and Ryan S. Prosser
10:00 – 10:20	Platform 18	Identifying pathways of exposure to Bisphenol A in the freshwater gastropod *Planorbella pilsbryi* **David W. G. McNabney,** Karyn B. Robichaud, Maria Villella, Kara Chan, and Ève A. M. Gilroy
10:20 – 10:40	BREAK	
10:40 – 11:00	Platform 19	Weathered bitumen alters the memory consolidation process in *Lymnaea stagnalis* Jack Zhang, Ken Lukowiak, and **Iain D. Phillips**
11:00 – 11:20	Platform 20	Investigating how complex contaminant mixtures affect freshwater mussels in the lab and in the field C. James Bennett, Erika A. Burton, Lisa Hoard, Jenna Anderson, Ben Nussbaum, Adrienne Bartlett, Gerald Tetreault, Shirley Anne Smyth, L. Mark Hewitt, and **Patricia L. Gillis**
11:20 – 11:40	Platform 21	Examining the sensitivity of freshwater mussels to contaminants and the challenges of protecting species at risk **Patricia L. Gillis**
Session 3: Mitigation and Recovery Actions		

11:40 – 12:00	Platform 22	The life cycle of an infrastructure project, protecting mussels in Ontario **Victoria Tousaw** and **Livia Collinson**
12:00 – 13:00	LUNCH	
13:00 – 13:20	Platform 23	Are we mussel-ready? Assessing water and sediment quality for the potential reintroduction of freshwater mussels in the Niagara River **Isabel Porto-Hannes,** Jonah A. Fronk, Max S. Striedl, and Corey A. Krabbenhoft
13:20 – 13:40	Platform 24	Making good after bad beginnings: exploring the effects of improved environmental conditions on stunted juvenile Fatmucket (*Lampsilis siliquoidea*) **Jonah Fronk,** Max S. Striedl, Corey A. Krabbenhoft, and Isabel Porto-Hannes
13:40 – 14:00	Platform 25 (Virtual)	Monitoring freshwater mussel populations in the Ausable River, Ontario: tracking changes in populations at index stations over time to evaluate recovery efforts **Kari Jean** and Mari Veliz
14:00 – 14:20	Platform 26	Making moves in the deep end: relocating freshwater mussels in non-wadeable habitats **Kelly A. McNichols-O'Rourke** and Todd. J. Morris
14:20 – 14:40	Platform 27	Mitigation as conservation: evaluating freshwater mussel translocations in Canada **Lauren Damphousse,** Todd J. Morris, and Catherine Febria
14:40 – 15:00	Platform 28	In situ assessment of priority stressors on freshwater mussels: implications for conservation and management **Hans-Frédéric Ellefsen,** Benjamin de Mongolfier, Laurie Savard, Simon Jacques, Romy Léger-Daigle, Guillaume Durier, and Réjean Tremblay
15:00 – 15:20	Break	
Session 3: Mitigation and Recovery Actions (continued)		
15:20 – 15:40	Platform 29	Assessing stream habitats that support unionid species at risk: insights for land-based stewardship **Thiranya Weerakoon** and Catherine M. Febria

15:40 – 16:00	Platform 30	Enhancing our understanding of freshwater mussels in TRCA's jurisdiction: integrating shell collections and iNaturalist observations **Jessica Fang** and **David Lawrie**
16:00 – 16:20	Platform 31	Conservation translocation: a case study of Kidneyshell (*Ptychobranchus fasciolaris*) in Medway Creek **Todd J. Morris,** Jason Barnucz, Chris C. Wilson, Christopher G. Wilson, Lauren Damphousse, Mandy P. Gibson, and Kelly McNichols-O'Rourke
16:20 – 17:20	POSTER SESSION	

PROGRAM SCHEDULE: THURSDAY, NOVEMBER 6, 2025

All times are in Eastern Standard Time (EST)

Session 4: Life History		
9:00 – 9:20	Platform 32 (Virtual)	Macroinvertebrate assemblages using live unionid shells as habitat in the Chippewa River, Lake Huron drainage, Michigan, USA Madison M. Dunlap and **Daelyn Woolnough**
9:20 – 9:40	Platform 33 (Virtual)	Habitat parameters of unionid assemblages in lower reaches of Lake Michigan tributaries **Masaki Hara,** David T. Zanatta, and Daelyn A. Woolnough
9:40 – 10:00	Platform 34 (Virtual)	Host associations of Canada's 55 freshwater mussel species **Ben Aubrey,** Sarah E. Steele, André L. Martel, Steven J. Cooke, and Katriina L. Ilves
10:00 – 10:20	Platform 35 (Virtual)	When mussels meet trout: immunological responses in Brook Trout (*Salvelinus fontinalis*) infected with glochidia from two freshwater mussel species **Riley McInnis,** Noah Rogozynski, Brian Dixon, Heather Penney, and Tammy Rodela
10:20 – 10:40	BREAK	
Session 4: Life History (continued)		
10:40 – 11:00	Platform 36 (Virtual)	Identifying host species of Brook Floater (*Alasmidonta varicosa*) in Maritime rivers using non-destructive visual and molecular methods **Joshua B. Roland,** Kellie White, Nathan Trimm, Robert J. Lennox, and Timothy A. Rawlings
11:00 – 11:20	Platform 37	A tradeoff between glochidia/juvenile size and dispersion in rivers Christopher R. Farrow, Loong-Tak Lim, Todd J. Morris, and **Josef D. Ackerman**
11:20 – 11:40	Platform 38	Local adaptation and forecasting response in the endangered Scottish freshwater mussel, *Margaritifera margaritifera* Victoria Gillman, Lesley Lancaster, Stuart Piertney, Victoria Pritchard, and **Kara Layton**

11:40 – 12:00	Platform 39	With me or with you? An investigation into the self-fertilization of planorbid snails **Matthew Balter,** Branavi Kumarasamy, Kallie Shires, David W. G. McNabney, and Ève A. M. Gilroy
12:00 – 12:20	Platform 40 (Virtual)	Floating vernal snails: summer studies of species & mortality in seasonal waterbodies **Frederick W. Schueler**
END		

POSTER SESSION: WEDNESDAY, NOVEMBER 4, 2025

All times are in Eastern Standard Time (EST)

16:40 – 17:40

Poster 1	Using metabarcoding to identify mussel glochidia from naturally infested fishes in the Lower Qu'Appelle River, SK **Gregory Frie,** Tim Jardine, Iain Phillips, André Martel, and Markus Brinkmann
Poster 2	Toxicity, bioconcentration and maternal transfer of short-chain perfluoroalkyl sulfonic acids (PFSAs) and perfluoroalkyl carboxylic acids (PFCAs) in the freshwater snail *Planorbella pilsbryi* **Ève A. M. Gilroy,** David W. G. McNabney, Shelby A. Ravary, Kallie Shires, Maria Villella, Kara Chan, Almira Khan, Amila O. De Silva, Cassandra Brinovcar, Amy Sett, Adrienne J. Bartlett, and Stacey A. Robinson
Poster 3	Targeted surveys of *Toxolasma parvum* (Lilliput) in Canada Mandy P. Gibson, **Kelly A. McNichols-O'Rourke**, and Todd J. Morris

PLENARY PRESENTATION

From coast to coast to coast, 25 years of genomic studies document species-dependent patterns of variation and geographic structure for native freshwater mussels in Canada.

David T. Zanatta

Department of Biology and Institute for Great Lakes Research, Central Michigan University, Mount Pleasant, Michigan, USA, 48859. Email: zanat1d@cmich.edu

Dr. David Zanatta is a Professor in the Biology Department and Institute for Great Lakes Research at Central Michigan University (CMU). Dr. Zanatta has over 25 years of experience researching freshwater mussels and gastropods. He has a B.Sc. in Biology from Laurentian University (Sudbury, ON); an M.Sc. in Zoology from the University of Guelph; a Ph.D. from the University of Toronto where he researched the evolution and population genetics of lampsiline mussels; and held an NSERC post-doctoral fellowship at Trent University prior to starting a professorship at CMU. In his 17 years at CMU, Dr. Zanatta has co-authored numerous peer-reviewed papers on freshwater mollusk biology, ecology, evolution, and conservation. He maintains close ties with Canadian collaborators and research programs in the Great Lakes region, including a recently completed collaborative project to determine the status and distribution of native and invasive molluscs in the Detroit and St. Clair river systems and to model areas for the recovery of native mussels in that system.

Abstract

The vast majority of Canada was completely glaciated during the last ice age, meaning that most of Canada's freshwater biodiversity colonized from unglaciated regions in the last 15,000–20,000 years. Advancing genetic and genomic studies have shed light on the complex evolutionary patterns of many of Canada's 55 species of native freshwater mussels (order Unionida, unionids). Malacologists, including my students and I, have spent the last two decades uncovering these patterns using an advancing genomic toolset. I will review the state of and advances in our knowledge. Increasingly powerful genomic tools and techniques have been developed and become available, advancing from mtDNA sequencing, to microsatellite genotyping, to genome-wide SNPs and complete genomes. I will highlight the varied and often complex patterns of genetic variation we have documented in published and ongoing studies from unionid species across Canada. Most published studies have focused on the species-rich Great Lakes region, but examples from the Pacific coast, Atlantic coast, and Arctic watersheds will also be highlighted. I will discuss priority regions and species in Canada still in need of (more) genomic studies, namely species listed by SARA and/or COSEWIC, candidate species, or species with interesting or unique distributions. These patterns have interesting implications for both basic science questions in ecology and evolution and

applied conservation-oriented implications because of critical ecological roles unionids play in freshwater systems. I will conclude by highlighting how genomic studies are informing taxonomy and systematics, and informing conservation and recovery actions like supplementing declining populations via relocations and hatchery propagated mussels.

PLATFORM PRESENTATION ABSTRACTS

Platform 1: Using environmental DNA (eDNA) techniques to map the distribution of Mapleleaf Mussel in Manitoba (Virtual)

Margaret Docker[1], Jessie Ogden[1], Brennan Richards[2], Lauren Teller[1], Isabelle Yakmission[1], and Erin Wieler[2]

[1]Department of Biological Sciences, University of Manitoba, Winnipeg, MB, Canada
[2]Manitoba Métis Federation, Winnipeg, MB, Canada. Email: *Margaret.Docker@umanitoba.ca*

The Saskatchewan–Nelson Rivers population of Mapleleaf Mussel (*Quadrula quadrula*) was assessed as Threatened by COSEWIC in 2016, after having been assessed previously as Endangered (COSEWIC 2006). Its range is small, it is known from relatively few locations, and it occurs in habitat projected to continue to decline in quality. Present and ongoing threats include agricultural, urban, and industrial pollution, as well as the arrival and establishment of invasive Zebra Mussels in 2013. Nevertheless, its improved status between 2006 and 2016 was due to new surveys that revealed previously unknown locations, and some new records since 2016 (e.g., in the Winnipeg River system and some tributaries to Lake Winnipeg) suggest that it might be even more widely distributed in the Saskatchewan–Nelson watershed. Thus, with funding from DFO's Species at Risk Program and the Aboriginal Fund for Species at Risk, we are using a published probed-based environmental DNA (eDNA) assay targeting a 99-bp fragment of the COI gene developed and tested on the species in the Ontario portion its range (Currier et al. 2018, Aquat Conserv Mar Freshw Ecosyst 28: 545–558) to map its distribution in Manitoba. We have sampled 55 sites to date in 2025, including positive control sites where the species is known to occur (e.g., the Red, Assiniboine, Rat, and Brokenhead rivers) and targeting a number of potential range extension sites (e.g., the Shell, Qu'Appelle, Souris, Little Saskatchewan, and Whitemud rivers). This distributional information will help inform COSEWIC decisions when the species is next scheduled for reassessment.

Platform 2: Refining the distribution of Eastern Pondmussel (*Sagittunio nasutus*) in Upper St. Lawrence River tributaries using environmental DNA (eDNA) (Virtual)

Kate Schwartz, Matthew J. S. Windle, Emma Ehrenfeld, Ashley MacCrimmon, Bella Gwanyama, and Cassey O'Connor

River Institute, Cornwall, ON K6H 4Z1, Canada. Email: kschwartz@riverinstitute.ca

In 2023, the River Institute initiated a project with the objective of exploring the historical and critical habitat of the Eastern Pondmussel (*Sagittunio nasutus*) in the Upper St. Lawrence River (USLR) and its tributaries, to determine the health and distribution of remnant populations in the region. The project also aimed to provide insight into the health of non-SAR unionid mussel populations and the spread of invasive dreissenid mussels within tributaries of the St. Lawrence River. Critical habitat sites were sampled using a combination of visual/tactile timed searches and environmental DNA (eDNA). Following limited positive detections in Lyn Creek, additional eDNA sampling was conducted in 2024 and 2025 to better characterize the distribution of Eastern Pondmussel along the length of the creek, to quantify eDNA detections using a qPCR standard curve, and to investigate seasonal differences and water quality changes on eDNA detection rates. Here we present the results of these three years of research efforts, with preliminary eDNA results from 2025 sampling in Lyn Creek.

Platform 3: Historical comparisons of freshwater mussel assemblages in the Grand River from 1970–2021

Laura M. Dutheil, Mandy P. Gibson, Kelly A. McNichols-O'Rourke, and Todd J. Morris

Great Lakes Laboratory for Fisheries and Aquatic Sciences, Fisheries and Oceans Canada, Burlington, ON L7S 1A1, Canada. Email: laura.dutheil@hotmail.ca

Southern Ontario's Grand River is home to 27 species of freshwater mussel (Unionidae), many of which are found only in Ontario. Comprehensive sampling of this watershed only began a few decades ago, but recent re-sampling of historical sites reveals how these mussel assemblages have changed over the past 50 years. In 2019 and 2021, Fisheries and Oceans Canada (DFO) revisited and surveyed 52 historical sample sites in the Grand River to compare mussel abundances and species diversity with results from surveys conducted in the 1970s and 1990s. All sites were surveyed using a timed-search method, although historical surveys varied in search effort from the standard 4.5 person-hours. Across the watershed, mussel assemblages show a stable and slightly increasing trend across four metrics: abundance, species richness, and species at risk (SAR) abundance. Additionally, the average number of mussels found per site increased from 8 in the 1970s to 73 in 2019 and 2021. SAR abundance also showed a significant increase between the 1990 and 2000 sampling events, supporting a positive trend in this metric. The findings of this research summarize how mussel populations in the Grand River have changed over the past five decades and highlight the importance of continued monitoring by revisiting historically sampled sites.

Platform 4: The effectiveness and potential uses of muskrat midden searches as a qualitative survey method in the Lower Grand River, Ontario

Samuel E. S. Turner, Mitchell B. Shorgan, **Emma M. Maclennan-Nobrega**, Lenka B. Trivett, and Hossam K. Ehab

Email: e.maclennan.nobrega@gmail.com

Species richness and community composition are key metrics used to evaluate Ontario's freshwater mussel populations. Timed searches are typically used to detect species presence, but are known to be biased towards conspicuous and large mussels as a visual-based survey method, resulting in an underrepresentation of small and cryptic species. Consequently, relative abundance estimates based on timed searches provide an incomplete understanding of actual assemblage composition. Muskrat middens (i.e., discarded piles of predated shells) have been suggested as an alternative qualitative survey method, although no study in Ontario has previously evaluated their effectiveness. We collected 1,540 shells from 12 middens in the Lower Grand River and compared our findings to a timed search and an intensive mussel relocation within the same reach. We found that middens contained mussels between 30 and 80 mm in length, whereas the timed search was dominated by mussels between 100 and 140 mm. Middens yielded a greater species richness than did timed searches, and we found that neither method was suitable for estimating relative abundances when compared to the assemblage observed in the relocation. Combining both methods produced a more representative estimate of species abundances. Our findings suggest that midden surveys may be used in combination with timed-search surveys when the goal is comprehensive assessments of unionid assemblage structures.

Platform 5: Community-based inspections within flood plains: evaluation of a freshwater mussel graveyard as a surrogate for river surveys

Dean Fitzgerald[1], Jessica Zadori[2], Fraser Gibson[3], and Edward Kott[4]

[1]*Integrated Ecosystem Solutions, Cambridge, ON, Canada. Email: deanfishy@hotmail.com*
[2]*Fieldstone Environmental Consulting, Cambridge, ON, Canada*
[3]*Waterloo Region Nature, Waterloo, ON, Canada*
[4]*Department of Biology, Wilfrid Laurier University, Waterloo, ON, Canada (Retired)*

Episodic events can represent a unique opportunity for learning about processes evident in ecosystems. Flooding of rivers represents an episodic event with opportunities to learn about how turbulent flows influence physical and biological features within floodplains. A key consideration with quantifying influences of flooding is the analysis may represent an unreplicated study. However, if flood responses are studied over multiple seasons, the repeated inventories of physical and biological features can be quantified and help identify patterns within these habitats and possibly mimic a replicated study. Inspections along the unimpounded Nith River, part of the middle Grand River in Ontario, were completed during different months of the year from 2020 to 2024 within areas along the shoreline, extending over about 2,000 m^2. When these areas were inspected, it usually involved citizen scientists from Waterloo Region Nature and other volunteers, with the goal to find and then identify freshwater mussel shells on land, as a surrogate to back-cast presence of freshwater mussels in the river. When comparing the identity of 2,000+ mussel shells deposited in this flood plain to available past published in-water studies, it was found that the biodiversity of freshwater mussel species on land is likely comparable to that within the Nith River itself. Other analyses in the flood plain identified that an inverse significant relationship exists between the length of the mussel shell and displacement from the edge of the river during spring floods. This relationship then allowed for the identification of an optimum distance along the river shoreline, within the flood plain, to focus search efforts for finding displaced mussel shells. These results suggest that surveys of flood plains represent a viable initial assessment tool for freshwater mussels prior to surveys within rivers. These results also demonstrate how citizen-based community involvement can enhance environmental management.

Platform 6: Community-based monitoring of unionids at Bkejwanong Territory (Walpole Island First Nation)

Thiranya Weerakoon[1], Jeffrey Lallean[1,2], Lauren Damphousse[1], Montana Riley[2], and Catherine Febria[1]

[1]Healthy Headwaters Lab, Department of Integrative Biology, University of Windsor, Windsor, ON, Canada. Email: catherine.febria@uwindsor.ca
[2]Walpole Island First Nations, Heritage Centre

Unionid freshwater mussels are found across the freshwater habitats of Bkejwanong Territory, or Walpole Island First Nation. Over the past five years, partnerships between the Walpole Island Heritage Centre (NinDaWaabJig), Walpole Island Land Trust and the Healthy Headwaters Lab at the University of Windsor have been building in support of Indigenous youth education and community engagement efforts. Since 2019 various projects have enabled community engagement efforts around aquatic species at risk alongside experiential learning opportunities with Bkejwanong Eco-Keepers, a youth-focused education and summer work training experience, and Bkejwanong Guardians for adult land-based learners. Annual unionid freshwater mussel training days exposed participants to local rivers in the Sydenham River watershed and the coastal waters of Bkejwanong Territory. Here we present the stories of collaboration and knowledge sharing through community-led unionid freshwater mussel surveys in 2023 and 2025. We share how local knowledge helped to identify sites and local community members participated in freshwater mussel sampling. We will share species found through these two surveys, reflections from all partners on the value of working together in a good way, and insights into how collaborations are helping pave the way for more community-driven aquatic species at risk monitoring across Bkejwanong Territory.

Platform 7: Capturing citizen science unionid observations through the Canaiad Project hosted by iNaturalist

Samuel E. S. Turner, Philippe Blais, Paul D. Smith, William D. Van Hemessen, and Dwayne Sabine

All authors are curators of the iNaturalist-based Canaiad Project, an inventory of Canada's freshwater mussels: https://www.inaturalist.org/projects/canaiad. Email: sam10turner@icloud.com

The Canaiad Project was launched in 2017 on the citizen science platform iNaturalist. The goal of the project is twofold, to capture iNaturalist records of freshwater mussels (Unionida) across Canada under a centralized, curated project, and to attract a community of iNaturalist users sharing an interest in freshwater mussels. Since the project's inception, over 18,000 freshwater mussel records have been reviewed by a team of volunteer curators and added to the Canaiad Project. Freshwater mussels have been recorded from every province and territory but Nunavut, and the project includes observations of all extant Canadian freshwater mussel species. The project membership has grown to over 100 participants, and observations from over 2,600 iNaturalist users have been captured by the project. This presentation will highlight key findings from the Canaiad Project such as range expansions of species at risk including Rocky Mountain Ridged Mussel (*Gonidea angulata*) from the Fraser River drainage in British Columbia, Lilliput (*Toxolasma parvum*) from two Lake Huron drainages in Ontario, and Mapleleaf (*Quadrula quadrula*) from a Georgian Bay drainage in Ontario. The potential value of the Canaiad Project to researchers, government agencies, and environmental consultants will be discussed with guidance provided on navigating the iNaturalist platform and requesting project data. Finally, case studies will be presented showcasing community outreach achieved through the project, as well as challenges faced working with citizen science information.

Platform 8: You found mussels where?! Essex County, that's where

Alexia Macri[1], Katie Stammler[2], Alyssa Frazao[1], Melanie Thomas[3], and Catherine Febria[1]

[1]Healthy Headwaters Lab, Department of Integrative Biology, University of Windsor, Windsor, ON, Canada. Email: healthy.headwaters@uwindsor.ca
[2]Essex Region Conservation Authority, Essex, ON, Canada.
[3]Caldwell First Nation, Leamington, ON, Canada.

Watersheds in Essex County, ON consist of land areas that drain to Lake St. Clair, the Detroit River and Lake Erie. The area predominantly consists of a relatively flat clay plain with the exception of some sandy areas in the south. Given the ideal soil and climate for plant growth, the land use is dominated by agriculture, with 18–19% urban land use and 8.5% natural cover. Essex County is a highly disturbed environment that has seen continuous changes to land use from its natural landscape and is now shifting from row crop agriculture in some areas to either rural development or greenhouse activity. In Essex County, the Ruscom River and Belle River are identified as having critical habitat for freshwater mussels. While historical records show that these rivers along with the Canard River have supported documented SAR freshwater mussel populations (Lilliput and/or Mapleleaf), there have not been ongoing monitoring efforts. In 2024, the Essex Region Conservation Authority (ERCA) in partnership with the University of Windsor and two local First Nations (Caldwell First Nation and Walpole First Nation) executed freshwater mussel surveys throughout the three sub-watersheds. In 2024 and 2025, 10 sites and 6 sites were sampled respectively for a total of 16 distinct sampling locations. Freshwater mussels were found at 5 sites in 2024 and at 3 sites in 2025. SAR were found at 2 sites in both 2024 and 2025. This presentation will highlight the importance of partnership and will offer a preliminary review of our findings. This work has been funded through the Canada Nature Fund for Aquatic Species at Risk.

Platform 9: The hunt for Rocky Mountain Ridged Mussel (*Gonidea angulata*) in British Columbia (Virtual)

Jennifer Heron

British Columbia, Ministry of Water, Land, and Resource Stewardship, PO Box 9338 STN PROV GOVT, Victoria, BC V8W 9M1, Canada. Email: Jennifer.Heron@gov.bc.ca

Rocky Mountain Ridged Mussel (*Gonidea angulata* (Lea 1838)) is a freshwater bivalve with a global range that extends from British Columbia, Canada south to central California and east through Nevada and Idaho in the United States. In Canada, the species is known to occur in southern British Columbia in the Okanagan watershed, with historical yet vague records in the Kootenay River and Vancouver Island. The mussel is assessed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and listed as Special Concern under the federal *Species at Risk Act* (SARA). A photograph of a Rocky Mountain Ridged Mussel shell from the confluence of the Pitt and Fraser rivers in the lower Fraser Valley of British Columbia was posted to the online forum iNaturalist.ca. The Fraser River watershed has no present-day aquatic linkages with the Okanagan watershed. The potential range extension for this mussel within a new watershed prompted targeted field surveys within the Pitt River and surrounding waterways to confirm the presence of live mussels. We completed surveys and confirmed a population of live mussels within the Pitt River in 2023, 2024 and 2025. The confirmed presence of a Rocky Mountain Ridged Mussel in the Fraser River watershed could indicate a distinct designatable unit from the population in the Okanagan watershed and enables exciting future research, monitoring and stewardship opportunities. This talk is an overview of the results of these surveys to date.

Platform 10: Update on the biology and distribution of Rocky Mountain Ridged Mussel (*Gonidea angulata*) in Canada (Virtual)

Joy Wade[1], Barb Campbell[2], Margaret Docker[3], Scott Gilmore[2], Jessie Ogden[3], Craig Stephen[4], and Paul Grant[5]

[1]Fundy Aqua Services Inc., 1859 Delanice Way, Nanoose Bay, BC V9P 9B3, Canada. Email: Joywadefundyaqua@gmail.com
[2]Fisheries and Oceans Canada, Pacific Biological Station, 3190 Hammond Bay Road, Nanaimo, BC V9T 6N7, Canada
[3]University of Manitoba, Department of Biological Sciences, Winnipeg, MB R3T 2N2, Canada
[4]Pacific Epidemiology Services, 1859 Delanice Way, Nanoose Bay, BC V9P 9B3, Canada
[5]Fisheries and Oceans Canada, Institute of Ocean Sciences, Sidney, BC V8L 5T5, Canada

For the past several years, Fisheries and Oceans Canada, the McEachran Institute and the University of Manitoba have supported research to fund key aspects of the conservation management of Rocky Mountain Ridged Mussels in Canada. These collaborative efforts have resulted in important insights into length at age and habitat influences on growth. This work has also resulted in the detection of the species, through eDNA, in areas outside their known distribution. A brief update on these efforts and their significance to the conservation of the species is presented.

Platform 11: The lower Columbia River, BC, the site of the only Canadian populations of the COSEWIC Endangered Shortface Lanx (*Fisherola nuttallii*) and currently being assessed Ashy Pebblesnail (*Fluminicola fuscus*) (Virtual)

Dwayne Lepitzki

Wildlife Systems Research, P.O. Box 1311, Banff, AB T1L 1B3, Canada; co-chair Molluscs SSC of COSEWIC. Email: lepitzki@telusplanet.net

The Columbia River originates in British Columbia before flowing into the Pacific Ocean at the Washington/Oregon border. Numerous dams in both the US and Canada have changed much of the high-energy, fast-flowing main-stem river and many of its tributaries into reservoirs for hydroelectric power generation and flood control. Two freshwater snails are globally endemic to the Columbia River Basin. Shortface Lanx (*Fisherola nuttallii*) was assessed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2016 because of its small occupied area and continuing threats. This species is yet to be federally listed under the Canadian *Species at Risk Act* (SARA), which could lead to protection and hopefully, recovery and possible down-listing. Ashy Pebblesnail (*Fluminicola fuscus*) is currently being assessed by COSEWIC; its lecto- and paralectotypes are from Canada because the original type material collected in 1834 from the lower Snake–Columbia River, Oregon has been lost. Until the status assessment of Shortface Lanx, Ashy Pebblesnail was known in Canada only from two tributaries of the Columbia River (Wigwam and Kootenay rivers) collected by J.K. Lord, the naturalist on the western end of the British North American Boundary Commission; the objective was to mark the boundary line from the west coast to the eastern slopes of the Rocky Mountains and occurred around 1860 or 1861. Interestingly, the lanx, under a different name, also had been found in one of these Canadian rivers (the Kootenay) during the same Canada–US boundary survey; syntypes of both species collected during the boundary survey are in the British Museum of Natural History. During searches for the lanx in the Columbia River in 2014 before it crosses the international border, the pebblesnail also was found, approximately 215 km west of its previously known albeit historical occurrences in Canada. Because of this more modern discovery, the pebblesnail then became a COSEWIC candidate for assessment. Searches of the two historically occupied rivers in 2023 and 2024 failed to find the pebblesnail, suggesting it too is confined in Canada to the lower Columbia River. Both snails are trigger species for the proposed Canadian Columbia River–Keenleyside Reach Key Biodiversity Area (KBA) along with the Upper Columbia River population of White Sturgeon (*Acipenser transmontanus*; COSEWIC Endangered 2012) and Umatilla Dace (*Rhinichthys umatilla*; COSEWIC Threatened 2010), attesting to the global and national importance of the lower Columbia River. Note that these fishes have also not been listed under SARA. Since the 2014 field surveys, no formal searches for either snail species has occurred in the lower Columbia River in Canada. Results of the scheduled 6–10 October 2025 searches for both snails will be shared.

Platform 12: Toxicity of technology-critical elements in the freshwater snail *Planorbella pilsbryi*

Ève Gilroy[1], Kallie Shires[1], David McNabney[1], Jiae (Maddy) Kim[1], Branavi Kumarasamy[1], Matthew Balter[1], Patrice Turcotte[2], Christian Gagnon[2], and Erin Leonard[3]

[1]Aquatic Contaminants Research Division, Environment and Climate Change Canada, Burlington, ON, Canada
[2]Aquatic Contaminants Research Division, Environment and Climate Change Canada, Montréal, QC, Canada
[3]Department of Biology, Wilfrid Laurier University, Waterloo, ON, Canada

Over the last decades, the extraction and use of new minerals in emerging industries have increased dramatically, and as their use in commerce further develops, the risks associated with their use, disposal, and presence in the environment need to be properly assessed. Thus, several metals, metalloids, and rare earth elements (technology-critical elements) have been targeted as priority contaminants for assessment under the Chemicals Management Plan.

The objective of the present study was to assess the effect of lithium, tellurium, platinum, and palladium in developing freshwater snail embryos (*Planorbella pilsbryi*) to fill knowledge gaps surrounding the chronic toxicity of these technology-critical elements. We conducted 21-d tests on developing snail embryos. Fresh (< 16 h) egg masses were transferred into each well of 24-well culture plates containing solutions of the element of interest (0.10–10 mg/L nominal). Each egg mass was photographed on Days 0 and 3, and daily on Days 7 to 21. Endpoints included egg development (Day 7), hatching (Day 14, Day 21), and time to hatch.

Preliminary results suggest that tellurium is not toxic to freshwater snails at nominal concentrations up to 10 mg/L, and that lithium impairs embryonic development (MATC 3.2 mg/L nominal). Platinum had adverse effects on snail embryo development and hatching (MATC = 0.57 mg/L nominal) and caused significant deformities. Palladium did not appear to affect snail development, but impaired hatching (MATC 3.2 mg/L nominal). These results will be discussed in the context of future studies.

Platform 13: Unintended consequences: the impact of Bayluscide® application on different life stages of freshwater mussels

Olivia Coffield, Yaryna Kudla, Joseph Langlois, and Ryan Prosser

School of Environmental Sciences, University of Guelph, Guelph, ON, Canada. Email: ocoffiel@uoguelph.ca

Invasive sea lampreys (*Petromyzon marinus*) have caused economic and ecological damage to the Laurentian Great Lakes since their arrival almost a century ago. In response to the threat, the Great Lakes Fishery Commission implemented several control measures to reduce their abundance, including the use of the lampricide, Bayluscide®. Although highly effective, there is growing concern about the risk the chemical may pose to non-target organisms, such as unionid mussels, that reside in the application path. Few studies have examined the toxicity of granular Bayluscide® on freshwater mussels, making it difficult to characterize its potential ecological risk. To determine their susceptibility to this chemical, two freshwater mussel species of different life stages were subjected to granular Bayluscide® for 7 days to generate an LC_{50} value. Newly metamorphosed Fatmucket (*Lampsilis siliquoidea*) were exposed to concentrations equivalent to 1–100% of the application rate while adult Washboard (*Megalonaias nervosa*) were exposed to 6–200% of the rate. Adult mussels remained viable in the lowest treatments but experienced mass mortality in the higher treatments. In comparison, all treatments resulted in complete mortality in the newly metamorphosed mussels. Shorter follow-up experiments with the newly metamorphosed mussels showed similar results when exposed to a single Bayluscide® pellet for 24 hours. Our results suggest that both life stages, but specifically early-metamorphosed, are sensitive to granular Bayluscide® and their presence should be taken into consideration when applying this chemical to prevent population disruption.

Platform 14: Oxygen consumption as a non-lethal proxy for determining the sensitivity of nontarget species to TFM (Virtual)

Laura Melina Gobel, Aiden Moore, Robert Lennox, and **Hugo Flávio**

[1]Department of Biology, Dalhousie University, Halifax, NS B3H 4R2, Canada. Email: hflavio@dal.ca

The lampricide 3-trifluoromethyl-4-nitrophenol (TFM) is widely used in the tributaries of the Laurentian Great Lakes to suppress invasive populations of sea lamprey (*Petromyzon marinus*). While particularly effective at killing larval sea lamprey, the TFM's mode of action impacts all organisms that rely on mitochondria for aerobic metabolism. As such, some native species may have difficulty handling the concentrations that must be used to ensure successful control of sea lamprey. Earlier work has shown that exposure to TFM leads to stepwise increases in oxygen consumption in larval sea lamprey, and may have the potential to predict lethal concentrations without requiring traditional toxicity testing. Here, we aim to prove that this stepwise relationship between TFM concentration and oxygen consumption also holds true for non-target species, including the bivalve Giant Floater (*Pyganodon grandis*). Using intermittent-flow respirometry, we'll characterise the standard and maximum metabolic rates of this species, and study how those are impacted by exposure to TFM. Ultimately, this work will 1) expand our knowledge of the physiology of Giant Floater, 2) open interesting possibilities for the study of other native molluscs, and 3) pave the way for better monitoring of TFM applications in the field.

Platform 15: The toxicity of sulfate to *Lampsilis siliquoidea* glochidia and relevance to the Grand River Watershed

Sabrina Cagampan, Lisa Hoard, Erika A. Burton, C. James Bennett, and Patricia L. Gillis

Aquatic Contaminants Research Division, Environment and Climate Change Canada, Burlington, ON, Canada. Email: scagampan@uwaterloo.ca

A third of all freshwater mussel species in Ontario are classified as “species-at-risk”, making it imperative to understand which chemicals could pose a risk to mussel populations and threaten their recovery. Sulfate (SO_4), which can originate from both natural and anthropogenic sources including oil sands and gypsum mining, could be one such chemical. Previous studies with other biota have shown that sulfate toxicity increases as water hardness decreases. However, studies with freshwater mussels tend to focus on the toxicity of sulfate at low water hardness. Given the elevated water hardness of many important mussel habitats in southern Ontario, including the Grand River watershed, it is important to learn how early life stage freshwater mussels would respond to elevated sulfate in waters with relevant water chemistry. In response to this knowledge gap, this study examined the acute toxicity of sulfate in water with elevated hardness (~150 mg $CaCO_3$/L). Standard methods were employed to determine the concentration of sulfate that would be lethal to *Lampsilis siliquoidea* (Fatmucket) glochidia. Results indicated that after 48 h of exposure, 1,525 mg SO_4/L would be toxic (i.e., loss of ability to close valves) to 50% of the exposed glochidia. These results will be compared to measured sulfate levels in mussel habitats and used to inform future toxicity assays both with sulfate alone and in combination with other chemicals of concern that co-occur in mussel habitats.

Platform 16: Exploring the relationships between waterborne contaminants and glochidia toxicity in surface waters collected adjacent to varied land uses

Lisa Hoard, Erika A. Burton, C. James Bennett, Jenna Anderson, and Patricia L. Gillis

Aquatic Contaminants Research Division, Environment and Climate Change Canada, Burlington, ON, Canada. Email: Lisa.Hoard@ec.gc.ca

Negative effects have been observed in freshwater mussels that live in habitats with poor water quality. However, it remains a challenge to determine which contaminants are responsible for the observed effects. To determine which chemicals and/or water quality parameters are associated with reduced glochidia survival, surface waters from areas with different land uses were sampled. Beginning near the Grand River headwaters, and ending near its mouth at Lake Erie, 11 sites that span the main stem and various tributaries were sampled on two occasions. The studied sites receive one or more of the following anthropogenic inputs: municipal wastewater, industrial effluent, road runoff, and agricultural runoff. The acute (48 h) response of *Lampsilis fasciola* glochidia to the field-collected waters was assessed using standard laboratory methods. Comprehensive chemical analyses of the waters included quantification of metals, major ions, pesticides, pharmaceuticals, nutrients, suspended solids, dissolved carbon, polycyclic aromatic hydrocarbons (PAHs), and other parameters. Regression analysis revealed which water quality parameters and chemicals had significant relationships with reduced glochidia survival. To confirm whether the identified parameters are toxic, ongoing experiments will assess their toxicity, both individually and in combination (binary and tertiary mixtures) with other identified relevant parameters. This study will provide information on which anthropogenic inputs are most harmful to larval mussels.

Platform 17: Effects and fate of microplastics in multiple life stages of freshwater mussels

Yaryna M. Kudla[1], Patricia L. Gillis[2], Karen A. Kidd[3], and Ryan S. Prosser[1]

[1]School of Environmental Sciences, University of Guelph, Guelph, ON, Canada. Email: ykudla@uoguelph.ca
[2]Aquatic Contaminants Research Division, Environment and Climate Change Canada, Burlington, ON, Canada
[3]Department of Biology & School of Earth, Environment & Society, McMaster University, Hamilton, ON, Canada

Although detection of microplastics (MPs) has been confirmed globally in freshwater systems, there is a need to assess how their presence may impact important species at risk through environmentally relevant and longer-term exposures. MPs have been consistently found in wild unionid mussels, but the toll of MP exposure is under-represented in freshwater bivalve research. Both acute and chronic studies were run in multiple life stages of unionid species to determine the risk that MPs may have for this imperiled group. Glochidia of *Lampsilis siliquoidea* and *Lampsilis fasciola* were individually exposed to a suite of MPs of varying size, shape, and polymer to determine effects on acute mortality. Sub-adult *L. fasciola* were exposed to multiple MPs for 28 days to examine ingestion, burial and survival in sub-chronic exposure, as well as the sub-adult's ability to depurate the particles they ingested. Adult *Megalonaias nervosa* were exposed to MPs for 7 days to evaluate the fate of an MP once ingested, and how size and shape may affect ingestion. Waste production (pseudofeces and feces) was measured for 7 days to determine whether MP exposure increases waste production and impacts energy reserves. *M. nervosa* were then exposed to MPs for 3 months to measure effects on clearance rate, respiration, lipid peroxidation and concentration in hemolymph. Finally, to link the potential transfer of MPs from a sediment-dwelling bivalve to an invertebrate that may travel between the littoral and benthic zones, MP-rich waste packaged by *M. nervosa* was exposed to the freshwater snail *Planorbella pilsbryi*. In most effect endpoints tested, there were no persistent effects from any MP exposure. When measuring ingestion, adult mussels were found to ingest more particles that resembled their algal food and depurated irregularly shaped particles much more efficiently. Finally, increased ingestion in *P. pilsbryi* was observed when snails were exposed to some MPs coated in mussel waste, with effects on reproduction and survival, although these did not persist for the entire exposure. The exposures conducted in each distinct unionid life stage in this study suggest a negligible effect of MPs on mussels during the time frames tested, and the mussel's ability to efficiently depurate MPs if ingested.

Platform 18: Identifying pathways of exposure to Bisphenol A in the freshwater gastropod *Planorbella pilsbryi*

David W. G. McNabney, Karyn B. Robichaud, Maria Villella, Kara Chan, and Ève A. M. Gilroy

Aquatic Contaminants Research Division, Water Science and Technology Directorate, Environment and Climate Change Canada, Burlington, ON, Canada. Email: David.McNabney@ec.gc.ca

Bisphenol A (BPA) is a widely known chemical used in the production of plastics and resins. This chemical has been identified as an endocrine disruptor in humans and has been well studied in vertebrates, however its effect on invertebrates is less understood. This study employed metabolomics as a technique to examine the biological effects of BPA in the freshwater pulmonate snail, *Planorbella pilsbryi*, after a 28-d exposure at three concentrations (0.1, 10, and 1,000 µg/L, nominal). Using non-targeted liquid chromatography tandem mass spectrometry (LC-MS), we characterized the metabolomic profile of exposure to BPA in *P. pilsbryi* and identified the impact BPA has on its biological pathways. The results of this investigation revealed that BPA exposure caused a notable increase in the abundance of lipids at all three concentrations. As has been observed in other organisms, BPA appears to have decreased the abundance of methylated nucleobases, suggesting changes to DNA that may affect disease susceptibility. Additionally, the results of this study reveal that numerous biological pathways were dysregulated because of BPA exposure, including pathways related to energy metabolism and digestion. These effects were observed at concentrations above those usually reported in the environment, though metabolic dysregulation was observed even in the lowest exposure treatment. Overall, the present study reveals insights into the ways in which BPA affects freshwater pulmonate snails and serves as a framework for the use of metabolomics as a tool to investigate non-lethal endpoints of effect. Additional work is needed to elucidate the effects of alternatives to BPA.

Platform 19: Weathered bitumen alters the memory consolidation process in *Lymnaea stagnalis*

Jack Zhang[1], Ken Lukowiak[1], and **Iain D. Phillips**[2]

[1]*Hotchkiss Brain Institute, Cumming School of Medicine, University of Calgary, 3330 Hospital Dr. NW., Calgary, AB T2N 4N1, Canada. Emails: jzzhang@ualberta.ca and lukowiak@ucalgary.ca*
[2]*Department of Biology, University of Saskatchewan, 112 Science Place, Saskatoon, SK S7N 5E2, Canada. Email: iain.phillips@wsask.ca*

Oil spills into aquatic environments have well publicized lethal impacts that can reduce populations, alter assemblages, and affect whole ecosystems in some cases; however, few studies have used the oil from actual oil spills to investigate sub-lethal effects on the learning and memory of organisms exposed. An accidental discharge of bitumen into the North Saskatchewan River in 2016 provided an opportunity to experimentally test whether this real-world example of oil exposure may affect a freshwater snail that is frequently used as a model organism for the impacts of environmental stressors on learning, memory, and cognition. Here we experimentally exposed freshly collected outbred wild and inbred laboratory *Lymnaea stagnalis* snails to bitumen collected from this spill and demonstrate the negative effects of these hydrocarbons on the ability of the snails to form long-term memory (LTM). In both populations the snails exposed to hydrocarbons during the consolidation period of learning had blocked LTM formation. However, experiencing the same exposure during training or before training had no significant effect on LTM formation. This work serves as a baseline for outlining potential impacts hydrocarbons may have on important homeostatic behaviours and cognitive processes through an established aquatic model organism.

Platform 20: Investigating how complex contaminant mixtures affect freshwater mussels in the lab and in the field

C. James Bennett, Erika A. Burton, Lisa Hoard, Jenna Anderson, Ben Nussbaum, Adrienne Bartlett, Gerald Tetreault, Shirley Anne Smyth, L. Mark Hewitt, and **Patricia L. Gillis**

Aquatic Contaminants Research Division, Environment and Climate Change Canada, Burlington, ON, Canada. Email: Jim.Bennett@ec.gc.ca

Compared to other biota, freshwater mussels have a heightened sensitivity to waterborne contaminants. Field studies can identify habitats where mussel populations are affected by poor water quality, and laboratory studies can identify which species and life stages are the most sensitive to contaminants. In this project we combine lab and field-based endpoints spanning multiple levels of biological organization to investigate how complex contaminant mixtures affect freshwater mussels. A series of sites in the lower Grand River watershed that bracket either the Brantford (ON) wastewater treatment plant or an industrial discharge (gypsum plant) were sampled in 2024 and 2025. At each site the freshwater mussel population (richness, abundance, population size structure) and the benthic community (CABIN protocol) were characterized to investigate population level effects of the exposure. The targeted effluents and site waters were analyzed for chemicals associated with each mixture (i.e., treated wastewater: pharmaceuticals, metals, nutrients; gypsum industry: metals, major ions). Tissues from wild mussels and other benthos were collected to quantify accumulated metals and assess sub-organismal effect endpoints (e.g., oxidative stress, lipids, metabolomics). Acute toxicity tests with *Lampsilis fasciola* glochidia were conducted with undiluted surface waters and serial-diluted wastewater effluent using standard methods. Results from the glochidia exposures and the mussel population assessments will be presented. This investigation is part of a broader study, the Integrated Chemicals Mixtures Project where other aquatic biota, including fish, snails, and amphipods will be exposed to or collected from the same surface waters and thus the same chemical mixture.

Platform 21: Examining the sensitivity of freshwater mussels to contaminants and the challenges of protecting species at risk

Patricia L. Gillis

Aquatic Contaminants Research Division, Environment and Climate Change Canada, Burlington, ON, Canada. Email: patty.gillis@ec.gc.ca

Nearly 70% of North American freshwater mussel species are threatened, endangered, or in decline. Environmental contaminants are believed to be a key contributing factor to mussel declines worldwide. Nineteen species of freshwater mussels are listed as species at risk (SAR) under Canada's *Species at Risk Act*. Federal recovery documents for mussel SAR indicate the need to understand the risk poor water quality and waterborne contaminants pose to recovery. Freshwater mussels, particularly the early-life stages, have a heightened sensitivity to inorganic contaminants including some metals and major ions, as well as ammonia. Freshwater mussels were the three most sensitive species (including two SAR) in the toxicity dataset used to derive Canada's Chloride Water Quality Guideline. Similarly, for the dataset used to derive the US Ammonium Water Quality Criteria, freshwater mussels were the seven most sensitive species. This demonstrates the need for mussel toxicity data to ensure that water quality regulations protect all sensitive species. However, there are challenges to protecting mussels from poor water quality. Firstly, not all parameters that matter to mussels are managed with water quality regulations. For example, mussels are particularly sensitivity to potassium and sulfate, neither of which have Canadian Water Quality Guidelines. There are also uncertainties associated with using toxicity metrics derived from standard, single-chemical toxicity tests to predict holistic impacts on mussel populations and habitats. Examples include the influence of water composition on the toxicity of inorganic contaminants and a paucity of data on the effects of chemical mixtures. This presentation will summarize the relative sensitivity of mussels, including SAR, to some ubiquitous contaminants and examine the challenges and information gaps needed to inform Recovery Strategies.

Platform 22: The life cycle of an infrastructure project, protecting mussels in Ontario

Victoria Tousaw and **Livia Collinson**

LEA Consulting Ltd., Markham, ON N5A 0B5, Canada. Email: vtousaw@lea.ca

LEA Consulting Ltd. (LEA) is a consulting firm that provides Environmental Assessment (EA) services for transportation infrastructure and development projects across Ontario. A component of this work is mussel assessments. Mussel assessments focus on identifying the mussel community and habitat features present to inform the planning and design process of the project and ensuring compliance with provincial and federal legislation that protects mussels and their habitat.

Background research and field investigations are used to identify the mussel species and habitat features present within the infrastructure project limits. Using project designs, impact assessments are then conducted to evaluate the potential risk posed to mussels and their habitat from the proposed works. In consultation with the design team and federal and provincial agencies, mitigation and offsetting measures are incorporated into the project to minimize impacts to mussels and their habitat. During construction, inspections are conducted to ensure contractor compliance with the prescribed mitigation measures.

This presentation will provide an overview of infrastructure development projects from initial planning and design through to construction, with an emphasis on how mussels are considered and protected throughout.

Platform 23: Are we mussel-ready? Assessing water and sediment quality for the potential reintroduction of freshwater mussels in the Niagara River

Isabel Porto-Hannes[1], Jonah A. Fronk[2], Max S. Striedl[2], and Corey A. Krabbenhoft[2]

[1]Department of Environment and Sustainability, University at Buffalo, Buffalo, NY 14260, USA. Email: isabelha@buffalo.edu
[2]Department of Biological Sciences, University at Buffalo, Buffalo, NY 14260, USA

Over the past century, the Niagara River basin has undergone significant habitat loss and water quality degradation due to industrial development, shoreline and channel modifications for navigation and hydropower, and the introduction of invasive species. Freshwater mussels (family Unionidae), once abundant in the basin, have experienced severe declines—recent surveys report only 13 of the 32 historically documented species remain. Despite years of restoration efforts, mussel diversity and abundance remain low. Because mussels recover slowly, large-scale propagation offers a promising strategy to accelerate restoration. However, uncertainty persists regarding whether current habitat conditions can support reintroduction. This project addresses that gap. To evaluate water and sediment suitability, in 2024 and 2025 we placed 3-month-old Fatmucket (*Lampsilis siliquoidea*) in silos and sediment cages within the Niagara River and in tributaries known to sustain healthy mussel populations. Over three months, we monitored growth and survival. In 2025, we also placed 1-year-old mussels in cages for assessment of differential survivorship at different stages of ontogeny. Our findings show that 3-month-old juvenile mussels in the Niagara River had higher mortality and slower growth than those in tributaries. In particular, silt and sand substrates in the river resulted in high mortality rates in sediment cages, whereas gravel and cobble in tributaries supported both survival and growth. There was no mortality of 1-year-old juveniles across sites. Water quality in the Niagara River was sufficient to sustain juveniles in silos, yet growth lagged behind tributary sites. This may stem from limited food availability, possibly due to dreissenid mussel competition, flow conditions, temperature, or a combination of factors. These results highlight sediment composition and food availability as key drivers of juvenile mussel survival and growth, providing critical guidance for future restoration planning.

Platform 24: Making good after bad beginnings: exploring the effects of improved environmental conditions on stunted juvenile Fatmucket (*Lampsilis siliquoidea*)

Jonah A. Fronk[1], Max S. Striedl[1], Corey A. Krabbenhoft[1], and Isabel Porto-Hannes[2]

[1]*Department of Biological Sciences, University at Buffalo, Buffalo, NY 14260, USA. Email: jonahfro@buffalo.edu*
[2]*Department of Environment and Sustainability, University at Buffalo, Buffalo, NY 14260, USA*

Freshwater mussels (Unionida) are most vulnerable to poor environmental conditions during their early juvenile stages. In low-quality environments, juveniles have been shown to experience higher mortality and decreased growth rates. We tested whether transplanting mussels reared in low-quality habitat to high-quality habitat would improve growth and survival, or they would experience permanent stunting and developmental delays. In 2024, we placed juvenile Fatmucket (*Lampsilis siliquoidea*) in silos and sediment cages in the Niagara River and its tributaries. We noted high mortality and low growth rates at sites in the Niagara River, whereas juvenile mussels placed in tributaries experienced much higher growth rates and very low mortality. We reasoned that the restricted growth in the Niagara River was due to low flow, silty substrate, and possibly limited food availability. In 2025 we translocated a subset of Niagara River juveniles to a tributary site, and a subset of tributary juveniles to the Niagara River. We noted continued high growth rates in mussels placed at the tributary, even among juveniles that had previously poor growth. We also observed that all juveniles in the Niagara River experienced low growth regardless of their origin. This experiment illustrates that individual mussel health can improve if remedial actions take place, even after prolonged residence in deficient habitat during a critical developmental period.

Platform 25: Monitoring freshwater mussel populations in the Ausable River, Ontario: tracking changes in populations at index stations over time to evaluate recovery efforts (Virtual)

Kari Jean and Mari Veliz

Ausable Bayfield Conservation Authority, Exeter, ON N0M 1S5, Canada. Email: kjean@abca.ca

The Ausable River, located on the northern edge of the Carolinian Zone in southwestern Ontario, supports one of the most diverse and unique assemblages of aquatic fauna in Canada. At least 26 species of freshwater mussels have been confirmed. Seven of these species (Kidneyshell, Northern Riffleshell, Snuffbox, Mapleleaf, Rainbow, Purple Wartyback and Wavyrayed Lampmussel) have been assessed by the Committee on the Status of Endangered Wildlife in Canada as at risk. In 2006, a long-term mussel monitoring program for the Ausable River was initiated with the objective to track responses of the mussel community to on-going recovery efforts aimed at reducing threats such as sediment and nutrient inputs and river flow variability. Seven monitoring stations were surveyed with a systematic quadrat method in 2006, 2011, 2018–2019 and 2024–2025. A total of 75 one-square-metre quadrats were excavated and searched at each site in each sampling year. In 2025 a new site was added to the monitoring program as a previously unknown population of Eastern Pondmussel was discovered. The results of this work inform recovery strategies and action or management plans, and begin to provide a long-term approach to evaluating efforts on the landscape to reduce sediment, nutrients and changes to flow.

Platform 26: Making moves in the deep end: relocating freshwater mussels in non-wadeable habitats

Kelly McNichols-O'Rourke and Todd J. Morris

Great Lakes Laboratory for Fisheries and Aquatic Science, Fisheries and Oceans Canada, Burlington, ON L7S 1A1, Canada. Email: kelly.mcnichols-orourke@dfo-mpo.gc.ca

Freshwater mussels of the Family Unionidae play important ecological and bioengineering roles in many aquatic ecosystems. Unfortunately, their sedentary adult nature explains why they are one of the most globally imperilled taxa—they are largely unable to escape when their habitats are disrupted, disturbed or degraded. As such, these species and their habitat are protected under the Canadian *Fisheries Act* and the *Species at Risk Act* and their presence must be addressed during the project planning phase when in-water works may occur. In 2008, DFO developed a protocol that details how to determine the presence of mussels and how to relocate them in wadeable and non-wadeable (> 1 m) systems in Ontario. The protocol has been used for over 65 mussel relocations in DFO's Ontario and Prairie Region. Approximately half of these relocations have involved the use of SCUBA divers to relocate mussels from deeper water. Relocating mussels in deep water environments is challenging given flow, depth, lack of visibility and cost, and DFO Science was asked to develop a standard protocol for relocating these animals in such environments. The resulting protocol outlined here builds off of the 2008 DFO protocol and existing mussel relocation protocols in place in US jurisdictions using SCUBA. The recommended and most cost effective survey method in non-wadeable environments is a moving transect (1 m^2 width) with repeat passes conducted systematically to ensure complete coverage of the impacted area. Search effort is to be determined by site-specific density estimates and/or the presence of species at risk. Given the extensive amount of work and expertise required to relocate mussels in deep, turbid environments, relocations should only be employed as a mitigation technique when all other alternatives to avoid or reduce the impact have been determined to be unfeasible.

Platform 27: Mitigation as conservation: evaluating freshwater mussel translocations in Canada

Lauren Damphousse[1], Todd J. Morris[2], and Catherine Febria[1,3]

[1]Healthy Headwaters Lab, Department of Integrative Biology, University of Windsor, Windsor, ON, Canada. Email: damphoul@uwindsor.ca
[2]Great Lakes Laboratory for Fisheries and Aquatic Sciences, Fisheries and Oceans Canada, Burlington, ON L7S 1A1, Canada
[3]Great Lakes Institute for Environmental Research, University of Windsor, Windsor, ON, Canada

Freshwater mussels (Unionidae) are among the most imperiled animal groups globally, providing critical ecosystem functions such as water filtration, nutrient cycling, and habitat stabilization. Across Canada, many species are listed under the *Species at Risk Act* (SARA), and populations continue to decline due to habitat loss, pollution, altered flow regimes, and invasive species. In response, mitigation translocations—relocating mussels ahead of in-water construction activities—are increasingly used to prevent immediate mortality, particularly where species at risk (SAR) are present. Yet, their long-term effectiveness for sustaining populations and community structure remains poorly understood. We synthesized data from 12 mitigation translocation projects across southern Ontario rivers, representing over a decade of relocation activity. Each project included displaced mussels (PSA), resident populations at relocation sites (RS), and undisturbed control sites (CS), with monitoring at 1-month, 1-year, and 2-year intervals. Observed mortality was low across all groups (<5%), with PSA populations exhibiting slightly higher losses than RS and CS, but rates remained within a few percent even after two years. The relative proportion of SAR species remained stable through time, with no evidence of disproportionate declines. However, multivariate analyses revealed significant shifts in community composition at PSA sites, while RS and CS assemblages remained stable. These findings demonstrate that mitigation translocations can effectively reduce acute construction impacts but may not fully preserve ecological community structure. Strengthened long-term monitoring (e.g., PIT tagging), standardized reporting, habitat suitability assessments, and meaningful Indigenous community involvement are critical to improving conservation outcomes.

Platform 28: In situ assessment of priority stressors on freshwater mussels: implications for conservation and management

Hans-Frédéric Ellefsen[1], Benjamin de Mongolfier[2,3], Laurie Savard[1], Simon Jacques[1], Romy Léger-Daigle[1], Guillaume Durier[3], and Réjean Tremblay[3]

[1]*Fisheries and Oceans Canada, Mont-Joli, QC G5H 3Z4, Canada. Email: hans-frederic.ellefsen@dfo-mpo.gc.ca*
[2]*Bio-Laurentia, St-Anaclet, QC G0K 1H0, Canada*
[3]*Université du Québec à Rimouski – Institut des sciences de la mer, Rimouski, QC G5L 3A1, Canada*

Freshwater mussels are among the most vulnerable animal taxa worldwide. While the stressors affecting these taxa are broadly understood, their impacts remain difficult to quantify, particularly under natural field conditions. The Maurice Lamontagne Institute hosts one of Canada's largest aquatic research facilities, spanning over 2,000 m^2 and equipped with a range of tank sizes and advanced technological instrumentation. In 2024–2025, an experiment was successfully conducted to assess behavioural and physiological stress responses in Eastern Lampmussel (*Lampsilis radiata*) using valvometry and hemolymph sampling. Mussels were exposed to simulated relocation at two temperatures (12°C and 16°C), allowing for systematic evaluation of thermal stress effects. Building on promising results obtained in the controlled tank environment, the study will be expanded to field conditions over the following two years to validate findings in natural environments. Mussel stress levels will be measured in situ throughout spring, summer, and autumn, under multiple experimental treatments. The first field site is Lake Témiscouata, which hosts Eastern Elliptio (*Elliptio complanata*) and Zebra Mussel (*Dreissena polymorpha*) populations. This location offers suitable environmental conditions—including accessibility, shallow-water (< 5m), favorable currents, and good visibility—for high-quality monitoring. The stressors investigated at this site include (1) mussel relocation, (2) simulated sedimentation via dredged material deposition, and (3) Zebra Mussel infestation. Stress responses will be assessed using valvometry, hemolymph sampling, and behavioural observations. The second site, located in the St. Lawrence River near Portneuf, will focus on translocated Hickorynut (*Obovaria olivaria*) in summer 2025 and will be monitored using telemetry. The knowledge gained will support efforts to oversee projects involving the translocation of freshwater mussels, the release of sediments into open water, or activities likely to generate high sediment loads in habitats where freshwater mussels occur.

Platform 29: Assessing stream habitats that support unionid species at risk: insights for land-based stewardship

Thiranya Weerakoon and Catherine M. Febria

Department of Integrative Biology, University of Windsor, Windsor, ON N9B 3P4, Canada. Email: weerakot@uwindsor.ca and Catherine.Febria@uwindsor.ca

Habitat stewardship plays a pivotal role in protecting Canada's threatened freshwater aquatic species from extinction. However, the effectiveness of such actions in safeguarding habitats is not well understood. North American freshwater mussels (Bivalvia, Unionidae) represent one of the most at-risk benthic macroinvertebrate taxa, and their sessile, filter-feeding nature makes them reliable indicators of ecosystem health. The Sydenham River watershed, comprised of two branches (North and East), is home to Canada's highest diversity of freshwater mussels, including multiple species at risk. This study evaluated how stream habitat characteristics shape unionid assemblages and how these findings inform existing and future stewardship measures. Stream habitats at ten previous unionid survey sites were quantified and characterized using a range of in situ sediment characterization measures. We quantified habitat variables in terms of in-stream substrate (proportion of gravel, coarse sand, fine sand, and silt + clay), riparian vegetation composition (proportion of graminoid, forb, shrub, vine, tree, sedge, and fern), and water quality parameters. Multivariate analyses were then applied to explore relationships between these habitat features and unionid community composition. Results revealed that coarse sand is the dominant substrate type in this watershed, with the North branch containing more coarse sand than the East branch. Gravel was more limited but strongly associated with unionid SAR, while non-SAR species occurred across a broader range of substrate types. Not one specific vegetation type dominated the watershed, showing a variability in vegetation types across the branches, though graminoids were positively linked with SAR presence. These findings highlight the importance of in-stream substrate conditions, particularly gravel availability, in supporting unionid species at risk. Land-based stewardship may wish to focus on the outcomes of measures to restore in-stream conditions aligned with SAR habitat preferences, especially gravel substrate, while also accounting for riparian vegetation structure and water quality. Such targeted measures can improve the effectiveness of stewardship to match habitat preferences for unionid SAR in this watershed.

Platform 30: Enhancing our understanding of freshwater mussels in TRCA's jurisdiction: integrating shell collections and iNaturalist observations

Jessica Fang and **David Lawrie**

Toronto and Region Conservation Authority, Toronto, ON M3N 1S4, Canada. Email: jessica.fang@trca.ca and david.lawrie@trca.ca

The Toronto and Region Conservation Authority's (TRCA's) jurisdiction spans nine watersheds across Canada's most urbanized region. While TRCA's Regional Watershed Monitoring Program (RWMP) has long included monitoring of fishes and benthic macroinvertebrates, information on freshwater mussels has historically been limited.

Motivated by insights from the 2023 Canadian Freshwater Mussel Research Meeting, as well as previous shell collection efforts, TRCA launched a formal mussel shell inventory in 2024. This initiative was designed as an opportunistic extension of RWMP fieldwork to begin addressing the knowledge gap on freshwater mussels.

We compared TRCA shell records (2024–2025) with iNaturalist research-grade observations (2017–2025), standardizing taxonomy, spatial precision, and temporal coverage. iNaturalist yielded slightly higher species richness than the RWMP shell inventory, with strong overlap and unique detections in both datasets. Notably, the shell inventory produced the first and only record of the Eastern Pondmussel (*Sagittunio nasutus*) in Duffins Creek, a federally listed species of Special Concern. This finding highlights the conservation value of opportunistic shell surveys and their ability to detect rare and at-risk mussels in urban watersheds.

Several sites showed co-located detections, confirming mussel presence. However, species composition often differed, highlighting the complementary nature of the two datasets. Species observed only through iNaturalist were generally found outside RWMP station coverage, suggesting that absences in the shell inventory reflect geographic gaps rather than failed detection.

The shell collection process expanded mussel record coverage and species distribution knowledge in TRCA watersheds. We recommend ongoing curation, strategic monitoring expansion, and integration of community-science data to enhance TRCA's biomonitoring. These actions will improve spatial representation and conservation relevance of freshwater mussel data across TRCA's jurisdiction.

Platform 31: Conservation translocation: a case study of Kidneyshell (*Ptychobranchus fasciolaris*) in Medway Creek

Todd J. Morris[1], Jason Barnucz[1], Chris C. Wilson[2], Christopher G. Wilson[3], Lauren Damphousse[4], Mandy P. Gibson[1], and Kelly McNichols-O'Rourke[1]

[1]*Great Lakes Laboratory for Fisheries and Aquatic Science, Fisheries and Oceans Canada, Burlington, ON L7S 1A1, Canada. Email: todd.morris@dfo-mpo.gc.ca*
[2]*Aquatic Research and Monitoring Section, Ontario Ministry of Natural Resources, Trent University, Peterborough, ON K9L 0G2, Canada*
[3]*Fish Culture Section, Fish & Wildlife Services Branch, Ontario Ministry of Natural Resources, Peterborough, ON K9J 8M5, Canada*
[4]*Healthy Headwaters Lab, Department of Integrative Biology, University of Windsor, Windsor, ON, Canada*

Ptychobranchus fasciolaris (Kidneyshell) was assessed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2003, having experienced a 70% decline from its historical range due to the dreissenid invasion, habitat loss, and pollution. The species was then listed under Canada's *Species at Risk Act* in 2005, where a Recovery Strategy was developed with a long-term goal of maintaining current subpopulations and re-establishing others in historically occupied habitats. Currently, this species is extant and reproducing in only two Canadian waterbodies (the East Sydenham River and the Ausable River) whereas it is now considered extirpated from lakes Erie and St Clair as well as the Grand, Thames, Welland and St Clair rivers. The 2013 federal Recovery Strategy for Kidneyshell identified a long term goal of re-establishing populations in historically occupied habitats while, in 2023, Fisheries and Oceans Canada (DFO) developed a decision support framework for assessing the feasibility of conservation translocations that can be used to support this recovery goal. We investigate the application of this framework to a case study of Kidneyshell in Medway Creek (Thames River) using hatchery reared stock currently maintained at Ontario's Ministry of Natural Resources (MNR) White Lake Fish Culture Station. Through targeted surveys, new and previously available survey and habitat data, eDNA sampling and in situ cage trials, we explore the possibility of restoring this extirpated population through conservation translocation.

Platform 32: Macroinvertebrate assemblages using live unionid shells as habitat in the Chippewa River, Lake Huron drainage, Michigan, USA (Virtual)

Madison M. Dunlap[1,2] and **Daelyn A. Woolnough[1]**

[1]Central Michigan University Biology Department and Institute for Great Lakes Research, Mount Pleasant, MI 48859, USA. Email: wooln1d@cmich.edu
[2]Center for Watershed Sciences, University of California, Davis, 425 LaRue Road, Davis, CA 95695, USA

Unionids have been hypothesized to form a single functional group, however species of unionids may not be ecologically redundant. This research considers how the assemblage of macroinvertebrates that live on live unionids (i.e., epizoites) differs from macroinvertebrates sampled via D-net. We also considered whether unionid traits, including species, can predict epizoic assemblages. Sampling of epizoites, collected from live unionids, and macroinvertebrates, collected by traditional D-net, was conducted in the Chippewa River, Michigan, USA across 12 sites. Target species chosen for epizoite sampling were *Ortmanniana ligamentina*, *Amblema plicata*, *Eurynia dilatata*, *Lampsilis cardium* (male and female as *L. cardium* is sexually dimorphic), and *Lasmigona costata*. We sampled epizoites from 428 individual unionids; 19,361 epizoites from 20 taxa were identified with an average of 46.7 ± 64.9 living on each unionid (min zero, 5 unionids; max 798 on a *L. costata)*. We found that epizoites were more abundant than previously documented in the literature. There was overlap in the taxa found as epizoites and those macroinvertebrates found in D-nets though assemblages were different (NMDS; PERMANOVA $p < 0.001$). The epizoic assemblage produced the same % EPT (Mann-Whitney U $p > 0.05$) as D-net samples but not diversity or evenness measurements. Unionid species had different assemblages of epizoites (NMDS; PERMANOVA $p < 0.001$). In our model selection exposure level above the sediment was the only unionid trait in the best model(s) that predicted epizoite species richness and density. Density of epizoites was highest on *A. plicata* and *L. costata* compared to all other unionid species while epizoites were more taxa rich on *A. plicata* compared to other unionid species. These data suggest that unionids provide direct habitat to a far greater number of organisms than previously measured and that the assemblage is structured differently than the surrounding benthic assemblage and in response to unionid species identity. These findings indicate that unionid net ecosystem function may be greater than previously thought and that unionid species are not ecologically redundant.

Platform 33: Habitat parameters of unionid assemblages in lower reaches of Lake Michigan tributaries (Virtual)

Masaki Hara, David T. Zanatta, and Daelyn A. Woolnough

Department of Biology and Institute for Great Lakes Research, Central Michigan University, Mount Pleasant, MI 48859, USA. Email: hara1m@cmich.edu

Although freshwater mussels (Unionidae) are considered ecologically crucial in the Great Lakes watersheds and many of the 43 species in Michigan are considered imperiled, no comprehensive or standardized surveys of the lower reaches of Lake Michigan tributaries have been conducted. Among many known threats to unionids, non-native bivalves (dreissenids and *Corbicula*) have invaded the region. This study examines the relationships among environmental factors and unionid and invasive bivalve distributions and diversity. The lower reaches of Lake Michigan tributaries that are transitional zones between Lake Michigan and inland waterbodies and may provide habitats for both unionids and invasive bivalves were surveyed in 2024 and 2025 (two years of a larger three-year study). Watersheds surveyed were randomly selected based on the proportion of the watershed area represented in the entire Lake Michigan drainage. We conducted standardized timed-search unionid surveys (SCUBA and snorkeling) to detect the presence of unionids and used PONAR methods to sample invasive bivalves. Habitat parameters were recorded during each survey. The surveys, stratified based on watershed size (e.g., larger watersheds had more survey sites), visited 151 sites in 68 watersheds of Lake Michigan. Of these, live unionids were detected in 27 watersheds (40% of all surveyed watersheds), consisting of 3,040 live unionids representing 23 species, including ten species considered imperiled (i.e., Endangered, Threatened, and Special Concern) in Michigan. Zebra Mussels (*Dreissena polymorpha*), Quagga Mussels (*Dreissena rostriformis bugensis*) and Asian Basket Clam (*Corbicula fluminea*) were detected in 48%, 31%, and 9% of all sites surveyed, respectively. Principal Component Analysis (PCA) was used to determine how habitat parameters were related to unionid presence, relative density, and diversity. Unionid density differences were compared between latitude and longitude to identify species distribution trends. This study attempts to clarify the relationship among the distribution patterns of unionids, habitat parameters, and threats to unionids and habitats in these transitional zones. Understanding distribution patterns and potential drivers of the patterns will support constructing habitat models for species assemblages in these under-surveyed lower reaches of Great Lakes tributaries. Our findings on unionid and invasive mollusks highlight the need for habitat management and will support conservation decisions in these areas.

Platform 34: Host associations of Canada's 55 freshwater mussel species (Virtual)

Benjamin R. Aubrey[1,2], Sarah E. Steele[1], André L. Martel[1], Steven J. Cooke[2], and Katriina L. Ilves[1,2]

[1]Canadian Museum of Nature, Research and Collections (Zoology), Ottawa, ON, Canada. Email: Benjamin.r.aubrey@gmail.com
[2]Carleton University, Department of Biology, Ottawa, ON, Canada

Freshwater mussels of the order Unionida are one of the world's most imperiled groups of animals. The two families that occur in Canada (Margaritiferidae, Unionidae) produce parasitic larvae called glochidia that generally rely on attachment to a suitable host fish to facilitate metamorphosis into the juvenile phase. We synthesized the current knowledge on the hosts of all 55 species of freshwater mussels that occur in Canada, compiled from 265 citations, 71 of which were newly identified by this review. As of October 2023, evidence for 850 mussel-host associations has been documented, though a relatively small proportion of the data was collected in Canada. Evidence types were assigned to each relationship following previously established guidelines. The Winged Floater and the Lake Floater currently have no known hosts, with 14 other species having only a single associated evidence type. This review provides an updated library of current knowledge on hosts of Canadian unionoids, discusses notable trends, and outlines outstanding knowledge gaps to be addressed in future studies. Considering many of the host associations were not studied in Canadian waters, knowledge gaps remain regarding relevant ecological and climatic contexts in Canada.

Platform 35: When mussels meet trout: immunological responses in brook trout (*Salvelinus fontinalis*) infected with glochidia from two freshwater mussel species (Virtual)

Riley McInnis[1], Noah Rogozynski[2], Brian Dixon[2], Heather Penney[3], and Tammy Rodela[1]

[1]Department of Biology, St. Francis Xavier University, Antigonish, NS, Canada. Email: rmcinnis@stfx.ca
[2]Department of Biology, University of Waterloo, Waterloo, ON, Canada
[3]Aquatic Resources Program, St. Francis Xavier University, Antigonish, NS, Canada

Freshwater unionid mussels rely on an obligate parasitic larval stage that must encyst on a suitable fish host to complete development. Despite the ecological importance of these interactions, host responses to glochidia infection remain poorly understood, particularly in systems where multiple mussel species exploit the same host. We are investigating the immune and physiological stress responses of Brook Trout (*Salvelinus fontinalis*) to glochidia infections from two native Nova Scotian mussel species: the Eastern Elliptio (*Elliptio complanata*) and the Freshwater Pearlshell (*Margaritifera margaritifera*). Brook Trout were assigned to three experimental treatments: (1) *E. complanata* glochidia infection, (2) *M. margaritifera* glochidia infection, or (3) sequential infection to *E. complanata* glochidia (early July) followed by *M. margaritifera* (re-infected in mid-August). Two time-matched control groups mirrored the infection schedules of treatments 1 and 2, receiving sham exposures, while an additional sequential control group paralleled treatment 3, undergoing two sequential sham exposures. Fish were kept in recirculating stream-simulation tanks and lethally sampled at 0 h, 6 h, 24 h, 7 d, and 21 d post-infection/sham treatment. Liver, spleen, gill, and plasma samples were collected from each fish to evaluate biochemical markers (e.g., cortisol, glucose, lactate), gene expression of key cytokines (IL-1β, TNF-α, IFN-γ, MHCs), antibody levels (IgM, IgT), and infection intensity (glochidia load). It is predicted that long-term brooding and encysting species, like Freshwater Pearlshell, will have a bigger impact on fish hosts, resulting in stronger physiological and immunological responses. Additionally, prior exposure to short-term brooding and encysting species, such as the Eastern Elliptio, may prime Brook Trout by activating innate defenses and facilitating adaptive immune memory, thereby enabling them to better tolerate subsequent infections by long-term encysting species like the Freshwater Pearlshell. This research advances understanding of fish host–glochidia interactions with potential application to conservation of imperiled freshwater mussel species and using immunological responses to identify suitable hosts for at-risk species.

Platform 36: Identifying host species of Brook Floater (*Alasmidonta varicosa*) in Maritime rivers using non-destructive visual and molecular methods (Virtual)

Joshua, B. Roland[1], Kellie White[2], Nathan Trimm[2], Robert J. Lennox[1], and Timothy A. Rawlings[2]

[1]*Department of Biology, Dalhousie University, Oxford St, Halifax, NS, Canada. Email: Josh.Roland@dal.ca*
[2]*Department of Biology, Cape Breton University, Grand Lake Road, Sydney, NS, Canada*

Freshwater mussels (Unionidae) have experienced some of the highest rates of decline among North American taxa, and the Brook Floater (*Alasmidonta varicosa*) is among the most imperiled members of this group. Brook Floater has been extirpated from half of its historical United States range, with remaining populations reduced by 50–95%, and in Canada it is designated as Special Concern under the federal *Species at Risk Act* and the New Brunswick *Species at Risk Act*, and as Threatened in Nova Scotia. Several fish species have been identified as potential hosts in tank exposure experiments, but these remain unverified in the wild, where behaviour, habitat, and range overlap influence which fish serve as hosts. Our research aimed to identify Brook Floater host species through non-destructive gill sampling of fish in the Wallace and St. Mary's rivers in Nova Scotia. Electrofishing was used to capture potential host fish, followed by gill swabs to test for the presence of glochidia. Swabs were examined using light microscopy and any glochidia found were retained for morphological and molecular analyses. All swabs were then tested for Brook Floater DNA using a customized PCR. Of the seven fish species sampled in the St. Mary's River, glochidia identified as Brook Floater morphologically were detected only on Lake Chub (*Couesius plumbeus*), with five of the 17 (29.4%) Lake Chub positive for Brook Floater glochidia. Molecular analyses are currently underway to confirm the species identity of these larvae. In addition, a gill swab from one Lake Chub was positive for Brook Floater DNA. No Brook Floater were found on the gills of the two fish species sampled from the Wallace River. The next steps will focus on amplifying glochidia DNA to confirm the presence of Brook Floater glochidia. This study improves understanding of suitable fish hosts and Brook Floater recruitment ecology, demonstrates a non-destructive method for host identification, and provides information essential for the development of effective Brook Floater conservation strategies.

Platform 37: A tradeoff between glochidia/juvenile size and dispersion in rivers

Christopher R. Farrow[1], Loong-Tak Lim[2], Todd J. Morris[3], and Josef D. Ackerman[1]

[1]*Integrative Biology, University of Guelph, ON, Canada. Email: ackerman@uoguelph.ca*
[2]*Food Science, University of Guelph, ON, Canada.*
[3]*Great Lakes Laboratory for Fisheries and Aquatic Science, Fisheries and Oceans Canada, Burlington, ON L7S 1A1, Canada.*

We examined the effects of particle size on downstream dispersal by releasing biodegradable microbeads (density ~1,200 kg m^{-3}) of three size classes (~150, 250, 350 µm) at the Speed River, Guelph, ON. Hitting distance estimates and longitudinal dispersion coefficients declined with particle size and were significantly different between 150 and 350 µm microbeads. The magnitude of these differences was relatively small (~5 m) because of the slow velocity (9.5 ± 0.01 cm s^{-1}) and low turbulence (shear velocity = 1.9 ± 0.13 cm s^{-1}) in the river. We examined the dispersion of larval and juvenile unionid mussels (size range = 56–415 µm, 247.54 ± 60.38 [mean ± SD] µm, N = 174) across a broader range of flow conditions by applying laminar and turbulent flow models in three river reaches of increasing velocity and turbulence. Model results indicated that the dispersal of smaller larvae increased disproportionately with increasing water column turbulence. Given that the peak in the size frequency distribution of larvae and juveniles corresponded to Rouse numbers (ratio of gravitational settling to water column turbulence) $P < 1$, we suggest a trade-off in propagule size in the taxa, whereby the increased dispersal of smaller juveniles may come at the cost of reduced settlement success in turbulent environments.

Platform 38: Local adaptation and forecasting response in the endangered Scottish Freshwater Mussel, *Margaritifera margaritifera*

Victoria Gillman[1], Lesley Lancaster[1], Stuart Piertney[1], Victoria Pritchard[2], and **Kara Layton[3]**

[1]School of Biological Sciences, University of Aberdeen, Aberdeen, UK
[2]Rivers and Lochs Institute, Inverness College, University of the Highlands and Islands, UK
[3]Department of Ecology and Evolutionary Biology, University of Toronto, ON, Canada.
Email: kara.layton@utoronto.ca

Given the rapid pace of climate change, there is an urgent need to understand how endangered species will respond to changes in their environment. Species distribution modelling is a popular tool used to forecast a species range based on the relationship between surveyed occurrence data and explanatory (habitat) factors. However, it does not account for local adaptation and intraspecific response to change. Genomic offset offers an evolutionary dimension for forecasting species response to change and is defined as the mismatch between current adaptive composition and future optimal composition under a changed environment. The Freshwater Pearl Mussel, *Margaritifera margaritifera*, has a widespread Holarctic distribution but many constituent populations are endangered or threatened. Scottish populations have a complex pattern of genomic population structure, partially explained by local climate. Here, we compare predictions from an ensemble species distribution model (SDM) of 462 presence points of *M. margaritifera* with genomic offset estimates derived from 417 putatively adaptive SNPs from 18 populations in Scotland. Both the SDM and genomic offset forecast a loss of *M. margaritifera* from the eastern Scottish Highlands, with loss of suitable habitat and maladaptation of local populations. However, while the SDM indicates a future loss of suitable habitat on the Ardnamurchan Peninsula, these populations have a lower value of genomic offset suggesting these populations are more resilient to climate change through existing adaptation. As such, these findings indicate that although general trends are congruent among methods, there are fine scale differences that may go undetected without considering genomic composition. This study examines the use of both species distribution models and genomic offset and demonstrates the utility of an evolutionary perspective alongside species distribution models for forecasting species response to a changing climate.

Platform 39: With me or with you? An investigation into the self-fertilization of planorbid snails

Matthew Balter, Branavi Kumarasamy, Kallie Shires, David W. G. McNabney, and Ève A. M. Gilroy

Aquatic Contaminants Research Division, Water Science and Technology Directorate, Environment and Climate Change Canada, Burlington, ON, Canada. Email: matthewbalter11@gmail.com

Several species of freshwater snails are simultaneous hermaphrodites (possess male and female organs) and reproduce through the exchange of sperm collected in the *bursa copulatrix*, designed to that effect. However, the literature often states that some species have the ability to self-fertilize, yet few studies to date appear to have verified this. Since 2018, our laboratory has been conducting scientific research with several hermaphrodite species of freshwater gastropods, and in the absence of literature confirming or denying it, the present study aimed to determine whether two freshwater snail species from the Planorbidae family were able to self-fertilize, and to what extent.

In a first study, juvenile *Helisoma trivolvis* (3.0 ± 0.31 mm, n = 8) were transferred to individual exposure jars for nine weeks. When they had reached a size at which they were expected to reproduce (12.4 ± 0.54 mm, n = 8), none of the snails had. Four snails were then randomly paired (n = 2*)*, while four snails remained, alone, in their original exposure jar. Paired snails started reproducing, while the unpaired snails did not.

A second study was initiated with juvenile *Planorbella pilsbryi* following similar experimental procedures, except that the snails were isolated on the day they hatched to avoid contact with other individuals. In contrast with *H. trivolvis*, most isolated *P. pilsbryi* started producing egg masses around 11 weeks. Eight of the snails were then randomly paired (*n = 4*), four were left in their jar of origin (n = 4), and four snails from the culture tank seeded at the beginning of the study were isolated at week 16 for comparison (n = 4). The snail pairs and the snails from the culture tank produced significantly more egg masses than the isolated snails. The results of the present study suggest that although *P. pilsbryi* is capable of self-fertilization to ensure the re-establishment of a population, it is at the cost of considerable depression of fitness, and unlikely to be a viable long-term alternative. Yet, the ability to self-fertilize could be relevant to the maintenance of *P pilsbryi* populations, should an event occur causing isolation of individuals.

Platform 40: Floating vernal snails: summer studies of species and mortality in seasonal waterbodies (Virtual)

Frederick W. Schueler

Fragile Inheritance Natural History, 6 St-Lawrence Street Bishops Mills, RR#2 Oxford Station, ON K0G 1T0, Canada. Email: bckcdb@istar.ca

Triggered by an interest in the distribution of *Aplexa* in eastern Ontario vernal wetlands, I have begun taking dry 20 litre samples of vernal pool bottoms, mixing them with water, and floating snail shells out of them. Preliminary results are that *Aplexa* is more widespread than expected, that no live snails revived to attach to the bins the soil was soaked in, and that the huge numbers of juvenile shells suggest that the snails reproduce until the water is gone, and then survive if adult and die if juvenile.

POSTER PRESENTATION ABSTRACTS

Poster 1: Using metabarcoding to identify mussel glochidia from naturally infested fishes in the Lower Qu'Appelle River, SK

Gregory Frie[1], Tim Jardine[1], Iain Phillips[2], André Martel[3], and Markus Brinkmann[1]

[1]School of Environment and Sustainability, 117 Science Place, Saskatoon, SK S7N 5B3, Canada. Email: gdf233@usask.ca
[2]Water Security Agency, Ecological and Habitat Assessment Services, 10-3904 Millar Avenue, Saskatoon, SK S7P 0B1, Canada
[3]Canadian Museum of Nature, Zoology Department, ON, Canada

The river mussels (Unionidae) of Saskatchewan are a community that persists in heavily drawn-upon river systems, that provide Saskatchewan with water for drinking, irrigation, industry, and recreation. Heavy water usage by humans, along with impacts from pollution, damming, and invasive species, makes the prairie community of river mussels vulnerable to decline or extirpation. River mussels likely play important ecosystem roles in this region, but remain largely understudied, with uncertainties surrounding their presence and specific reproductive behaviour. The Qu'Appelle River, located in southeastern Saskatchewan, is a major tributary of the Assiniboine River, and within it, eight of the 13 river mussel species known to the Assiniboine drainage have been recently documented in Saskatchewan. However, Manitoban records for several of the remaining species in the drainage come exceedingly close to Saskatchewan waters—including the threatened Mapleleaf (*Quadrula quadrula*). We are using a molecular approach to identify glochidia collected on wild, large-bodied fishes from the Lower Qu'Appelle River. We developed Unionidae-specific metabarcoding primers, which we are testing against naturally infested fish gill tissue samples. This research can uncover important details about Saskatchewan's river mussel populations, by A) identifying glochidia of rare mussel species that may not have been recorded through adult mussel surveys, B) confirming existing or identifying novel host-parasite relationships that mussels share with fishes in the region, and C) by specifically targeting the known-host Channel Catfish (*Ictalurus punctatus*), further assessing if threatened Mapleleaf are present in Saskatchewan waters. By identifying glochidia using molecular tools, we can more thoroughly document the mussel community in the Lower Qu'Appelle River to better conserve mussel assemblages in this river, and provide an identification method that can reliably identify glochidia for use in Saskatchewan and other parts of Canada.

Poster 2: Toxicity, bioconcentration and maternal transfer of short-chain perfluoroalkyl sulfonic acids (PFSAs) and perfluoroalkyl carboxylic acids (PFCAs) in the freshwater snail *Planorbella pilsbryi*

Ève A. M. Gilroy[1], David W. G. McNabney[1], Shelby A. Ravary[1], Kallie Shires[1], Maria Villella[1], Kara Chan[1], Almira Khan[1], Amila O. De Silva[1], Cassandra Brinovcar[1], Amy Sett[1], Adrienne J. Bartlett[1], and Stacey A. Robinson[2]

[1]Aquatic Contaminants Research Division, Water Science and Technology Directorate, Environment and Climate Change Canada, Burlington, ON, Canada
[2]Ecotoxicology and Wildlife Health Division, Environment and Climate Change Canada, Ottawa, ON, Canada

Toxicity, bioconcentration, and maternal transfer of short chain perfluoroalkyl sulfonic (PFSA) and carboxylic (PFCA) acids were investigated in the freshwater snail *Planorbella pilsbryi*. Toxicity of PFSAs and PFCAs was assessed in three life stages (embryo, juvenile, and adult) through a combination of tests of various duration. Toxicity was influenced by the length of the fluorinated carbon chain and by the functional group [e.g, 21-d EC50s for snail embryonic development varied from 31.3 mg/L (PFOS) to 4,445.9 mg/L (PFBA)]. Bioconcentration factors for C4, C6, and C8 perfluoroalkyl sulfonates and carboxylates were relatively low, varying from 0.02 to 13.1 L/kg ww (whole body) in adult snail tissues, similar to bioaccumulation reported in other species of freshwater pulmonate snails. Concentrations measured in egg masses were similar to those measured in snail tissues and given the elevated frequency of egg laying in our laboratory specimens, maternal offloading could partly explain whole-body concentrations lower than reported in other freshwater invertebrates.

Poster 3: Targeted surveys of *Toxolasma parvum* (Lilliput) in Canada

Mandy P. Gibson, **Kelly A. McNichols-O'Rourke**, and Todd J. Morris

Great Lakes Laboratory for Fisheries and Aquatic Science, Fisheries and Oceans Canada, Burlington, ON L7S 1A1, Canada. Email: Kelly.mcnichols-orourke@dfo-mpo.gc.ca

Toxolasma parvum (Lilliput) is currently listed as Endangered in Canada under the federal *Species at Risk Act* (SARA). At the time of its first assessment by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2013, only 47 live individuals had ever been found in Canada. *Toxolasma parvum* are due for reassessment in 2024 and recent evidence suggests the previous low detection may be due to a lack of targeted sampling in their preferred habitat. During the 2022 field season, Fisheries and Oceans Canada (DFO) conducted targeted surveys to sample *T. parvum* preferred habitat at 28 sites in the Lake St. Clair watershed, 5 sites in the Lake Erie watershed, and 2 sites in the Lake Ontario watershed. A semi-quantitative timed-search survey was conducted using 4.5 person-hours of search effort at each site. In the Lake St. Clair watershed, 55 live *T. parvum* were found, with presence at 50% of sites and occurrence in 83% of waterbodies. Mean site CPUE (± standard error) for *T. parvum* in this watershed was 0.44 mussels/hour ± 0.19. *Toxolasma parvum* was not detected at any sites in the Lake Erie watershed or Lake Ontario watershed in these targeted surveys; however, there have previously been numerous collections of live *T. parvum* in Cootes Paradise Marsh located in the western portion of the Lake Ontario watershed. Since the last COSEWIC assessment, 480 individuals have been found in an additional 15 different waterbodies; the discovery of *T. parvum* in seven of these waterbodies was a direct result of targeted surveys. Information gathered through targeted surveys of the species and assessment of life history characteristics will aid in the upcoming species reassessment and the ongoing management of the species.