Laurentian
SETAC

LAURENTIAN SETAC 28th
CONFERENCE & AGM

David Braley Health Sciences Centre
Hamilton, ON | June 13-14th, 2024

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PROGRAM AT A GLANCE
THURSDAY, JUNE 13

INTRO TO ENVIRONMENTAL CHEMISTRY | 09:00 - 12:00 | DBHSC 1005A

All environmental research includes some chemistry; however, many self-identified non-chemists perceive the subject to be an insurmountable obstacle. In this course I will present an environmental chemistry primer aimed at non-experts from biology and engineering that will provide participants with an appreciation for the role of chemistry in their environmental research.

Instructor:
Dr. Jessica D'eon | Department of Chemistry | University of Toronto

INTRO TO CSMs AND PROBLEM FORMULATION | 13:00 - 17:00 | DBHSC 1005A

This short course will introduce the Problem Formulation, the first step of a Human Health and Ecological Risk Assessment. The Problem Formulation provides the objectives, framework and approach for the risk assessment. This short course is ideal for students, new graduates, and early career professionals.

Instructors:
Andrea Amendola | Ecometrix Inc.
Lara Alves-Beese | Dillon Consulting Ltd.

LAURENTIAN SETAC PUB NIGHT | ANCHOR BAR | 18:00 TO LATE

Join us for a talk by Dr. Emily Choy (McMaster University) on the effects of climate change and pollutants on Arctic seabirds, followed by Q&A, and a meet and greet with fellow Laurentian SETAC members to start off the 2024 conference!

PROGRAM AT A GLANCE

FRIDAY, JUNE 14

7:30-8:30 AM	**Registration & Poster Set-Up**	Atrium (DBHSC 2nd Floor)
8:30-8:45 AM	**Opening Remarks**	DBHSC 2032
8:45 - 9:00 AM	**SETAC North America & NASAC Update**	DBHSC 2032
9:00-9:55 AM	**Plenary:** Dr. Darren Thomas, Wilfrid Laurier University	DBHSC 2032
10:00 - 10:15 AM	**Coffee Break**	Atrium (DBHSC 2nd Floor)
10:15 AM - 12:00 PM	**AM Concurrent Sessions**	DBHSC 2032 / DBHSC 1005A
12:00-1:00 PM	**Lunch**	DBHSC 2032
1:00 - 3:15 PM	**PM Concurrent Sessions**	DBHSC 2032 / DBHSC 1005A
3:15 - 4:30 PM	**Poster Session (Judging)**	Atrium (DBHSC 2nd Floor)
4:30 - 4:45 PM	**AGM Closing Remarks & Updates**	DBHSC 2032
5:00 - 6:00 PM	**Student Event**	Anchor Bar
6:00- 8:00 PM	**Awards Social**	Anchor Bar

OMICS RESEARCH

DBHSC 1005A | 10:15 - 12:00

10:15 - 10:30

G. GAO: Assessment of the metabolic perturbations with exposure to N-(1,3-dimethylbutyl)-N′-phenyl-p-phenylenediamine (6PPD) in *Eisenia fetida* earthworms

10:30 - 10:45

S. HAJIR: Metabolomics identified early molecular responses after exposure to phenanthrene and its oxygen and nitrogen-containing analogs on *Daphnia magna*

10:45 - 11:00

C. HENRIQUES: Proteomic analysis of short-chain perfluorinated alkyl substance (PFAS) exposure in Fathead Minnows (*Pimephales Promelas*)

11:00 - 11:15

R. HUBLEY: The Effects of Hypoxia on Fathead Minnow Behaviour and ‘Omics

OMICS RESEARCH

DBHSC 1005A | 10:15 - 12:00

11:15 - 11:30

E. HUNG: Investigating the impacts of pyrene and tire wear particle leachate on the *Daphnia magna* transcriptome

11:30 - 11:45

A. POINT: Using omics approaches to identify sublethal, chronic effects of artificial sweeteners on rainbow trout

11:45 - 12:00

S. ST-HILAIRE: Multigenerational toxicity of lead from fishing gear to the freshwater snail, *Planorbella pilsbryi*

FIELD TOXICOLOGY & ENVIRONMENTAL MONITORING

DBHSC 2032 | 10:15 - 12:00

10:15 - 10:30

C. BROWN: Can young-of-the-year Smallmouth Bass be useful for post-development monitoring?

10:30 - 10:45

E. DIESBOURG: Microbiomes of freshwater insects and riparian spiders downstream of municipal wastewater discharges in the Bow River, AB

10:45 - 11:00

M. IJZERMAN: New insights into pesticide occurrence and multicompartmental monitoring strategies in stream ecosystems using periphyton and suspended sediment

11:00 - 11:15

C. LAJOIE: Variable effects of forestry on mercury biomagnification pre-and post- harvest in Boreal headwater stream food webs

FIELD TOXICOLOGY & ENVIRONMENTAL MONITORING

DBHSC 2032 | 10:15 - 12:00

11:15 - 11:30

K. McCUTCHEON: Characterization of microbiomes from Tree Swallow (*Tachicyneta bicolor*) nestling fecal samples collected from colonies near a wastewater treatment plant

11:30 - 11:45

H. SCHMALZ: Assessing the dynamics of dissolved organic matter in stormwater: implications for greenhouse gas emissions

11:45 - 12:00

K. SIMPSON: Assessment of environmental microplastic sources across an urban environment

FIELD TOXICOLOGY & ENVIRONMENTAL MONITORING

DBHSC 1005A | 13:00 - 14:15

13:00 - 13:15

K. STEVENS: Assessing stormwater management pond water quality, function, and potential biotic effects to receiving waters

13:15 - 13:30

C. WARDLAW: Uptake and transfer of microplastics in riparian food webs

13:30 - 13:45

E. ZVEREVA: Estimating the mass of PFAS in exterior surfaces of Toronto buildings

13:45 - 14:00

A. OGUNLAJA: Harmful algal blooms in the Nigerian-Canadian context; measurement and remediation of cyanobacteria and cyanotoxins

14:00 - 14:15

A. RESIDE: Evaluating the presence and tissue distribution of the neurotoxin β-methylamino-L-alanine (BMAA) and its isomers in Lake Erie fishes

CHEMISTRY & METHOD DEVELOPMENT

DBHSC 1005A | 14:15 - 15:15

14:15 - 14:30

T. DOW: Advancing harm reduction strategies in Ontario: Analysis of opioid consumption through wastewater-based epidemiology in the Durham Region

14:30 - 14:45

N. ZABEL: Effects of ethanol preservation on total mercury concentrations, and C:N and stable isotope ratios in dorsal muscle tissues of two salmonid species

RISK ASSESSMENT

14:45 - 15:00

L. FURTADO: Completing a human health and ecological risk assessment for on-land disposal of dredged tributyltins

15:00 - 15:15

S. WOLK: Phthalate exposure from graphic designs in children's clothing

LABORATORY TOXICOLOGY

DBHSC 2032 | 13:00 - 15:15

13:00 - 13:15

Q. ALLAMBY: Assessing microplastics toxicity and accumulation in freshwater macroinvertebrates

13:15 - 13:30

C. DO: Individual and mixture accumulation of rare earth elements (REEs), Nd, Pr, and Y on *Daphnia magna*

13:30 - 13:45

Z. HAMOODI: Selenium in focus: Exploring the effect of supra-physiological selenium on trophoblast function

13:45 - 14:00

M. HENDERSHOT: The effects of neurochemical manipulation on the behaviour of *Capitella teleta*

14:00 - 14:15

Y. KUDLA: Lethal effects of granular Bayluscide® on the early life stages of a freshwater mussel (*Lampsilis siliquoidea*)

LABORATORY TOXICOLOGY

DBHSC 2032 | 13:00 - 15:15

14:15 - 14:30

O. KUNTYJ: Use of a mummichog (*Fundulus heteroclitus*) laboratory bioassay to assess the effects of 17α-Ethinylestradiol (EE2) and increased temperature on growth and the GH-IGF1 pathway

14:30 - 14:45

N. NYKAMP: Assessing the variation in ventilation rate and activity of fathead minnows exposed to Pb and Ni

14:45 - 15:00

A. FAIRWEATHER: How much is too much? A novel approach for assessing imidacloprid's impact on soil insects, utilizing the common agricultural ant *Lasius neoniger*

14:45 - 15:00

C. RUAN: Glyphosate-based herbicide (Roundup©) alters prostaglandin biosynthesis and angiogenesis pathways in human trophoblasts.

POSTER PRESENTATIONS

DBHSC ATRIUM

CHEMISTRY & METHOD DEVELOPMENT

J. FAST: Detection of pharmaceuticals in biofilm exposed to municipal effluents using UPLC-MS/MS

Y.J. XU: Microplastic extraction methods in complex water samples- effects on aged and pristine microplastics

FIELD TOXICOLOGY & ENVIRONMENTAL MONITORING

B. HOLOWCZAK: In-situ assay development for testing soil and waterborne contaminant effects on wetland vegetation

A. NANCE: Accumulation of microplastics in the littoral-shoreline: Analysis of rock rings, shoreline surface water and macrophytes

N. MINDA: Identifying sources of atmospheric anthropogenic particles and evaluating their transport to urban watersheds

POSTER PRESENTATIONS

DBHSC ATRIUM

LABORATORY TOXICOLOGY

F. AMARAL SPAHIU: The ecotoxicity of a n-heterocyclic carbene species on *Dugesia dorotocephala*

P. COCHRANE: Testing effluent samples from Canadian pulp and paper mills and metal mines with *Ceramium tenuicorne* at a Canadian commercial laboratory

O. COFFIELD: Acute sensitivity of adult washboard mussels (*Megalonaias nervosa*) to granular Bayluscide®

C. ENNIS: Sodium selenite exposure in placental trophoblasts alters markers of cellular senescence

S. GAEINI: Investigating the effect of venlafaxine on the behaviour of washboard mussels (*Megalonaias nervosa*)

M. ZAJDLIK: Sensitivity of brown flatworms (*Dugesia dorotocephala*) to the lampricide TFM

J. GAWRONSKI: An improved method to assess growth rates of the freshwater diatom *Navicula Pelliculosa* and applicability for mayfly toxicity testing

A. KHAN: The effects of heat stress on fathead minnow behaviour

POSTER PRESENTATIONS

DBHSC ATRIUM

LABORATORY TOXICOLOGY

S. HANG: The toxicity of firefighting water additives on the embryos of the freshwater pulmonated snail *Planorbella pilsbyri*

N. LETWIN: Usage of x-ray microtomography to assess microplastic movement within earthworm tissues

V. LOOR: Using a passive dosing system to assess the aquatic toxicity of five individual aromatic compounds to different life stages of Manila clam (*Ruditapes philippinarum*)

A. STRBAC: Assessing the impacts of individual aromatic compounds on Pacific purple sea urchin behaviour

J. SALOLE: Replacing fish use in effluent toxicity testing with the RTgill-W1 cell line

K. ROBICHAUD: Venlafaxine exposure alters mitochondrial respiration and mitomiR abundance in zebrafish brains

E. MONNIEZ: Screening for potential stress-disrupting compounds using the SR4G transgenic zebrafish line.

POSTER PRESENTATIONS

DBHSC ATRIUM

OMICS

M. EASWARAMOORTHY: The chemical defensome in the gut and gill of zebrafish

A. PASHA: The effects of heat stress on fathead minnow metabolomics

RISK ASSESSMENT

R. DUTT: Developing a standardized water-based brewing protocol for Labrador tea

G. IZMA: From rain to drain: Understanding urban pond pollution

EXHIBITORS

DBHSC ATRIUM

Be sure to visit our exhibitors during the breaks and lunch!

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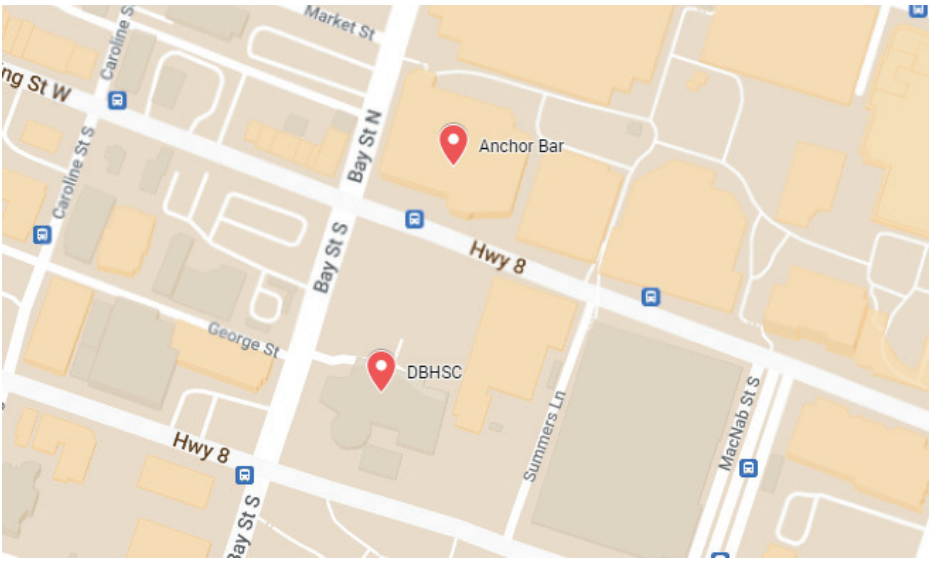
CONFERENCE LOCATIONS

The Conference and AGM will be hosted at the David Braley Health Sciences Centre (DBHSC) located in central Hamilton. The pub night and awards social will be hosted at Anchor Bar Hamilton, just a short walk from the DBHSC.



David Braley Health Sciences Centre
100 Main Street West
Hamilton, Ontario
L8P 1H6

Anchor Bar Hamilton
120 King Street West
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BRIGHTER FUTURE

L-SETAC AGM 2024

TOWARDS THE HEALTH & WELL-BEING OF ALL

Laurentian SETAC

Laurentian Chapter of the Society of Environmental Toxicology and Chemistry

McMaster University

AM Sessions:
Field Toxicology & Environmental Monitoring
DBHSC 2032 | 10:15 – 12:00

Can young-of-the-year Smallmouth Bass be useful for post-development monitoring?

Carolyn Brown [1,2], Allen Curry [2,3], Karen Kidd [2,4], Kelly Munkittrick [2,5]

[1] Department of Biology, Wilfrid Laurier University, Waterloo, ON
[2] Canadian Rivers Institute, University of New Brunswick, Fredericton, NB
[3] Department of Biology and Faculty of Forestry and Environmental Management, University of New Brunswick, Fredericton, NB
[4] School of Earth, Environment, and Society and Department of Biology, McMaster University, Hamilton, ON
[5] Department of Biological Sciences, University of Calgary, Calgary, AB

Presenter E-mail: carolyn.brown06@gmail.com

Keywords: Monitoring, Effects-Based Approach, Young-of-the-Year, Stable Isotopes

A major challenge in Environmental Impact Assessment is selecting the right indicators to detect impacts during monitoring programs. Monitoring young-of-the-year (YOY) fish metrics in freshwater systems may be good effects-based indicators because they respond quicker than the larger bodied adults to changes in the environment, they are typically less mobile than adults, and they are often easier to sample. We sampled YOY Smallmouth Bass (*Micropterus dolomieu*) monthly in an area upstream of a reservoir (reference) and downstream of the hydroelectric dam (nearfield) in 2021 and annually from 2015-2022 in the nearfield. We found evidence of multiple cohorts, higher concentrations of mercury, higher levels of δ15N, and lower levels of δ13C in fall 2021 YOY fish. The nearfield displayed similar trends when compared to the reference area. Ontogenetic diet shifts are well documented in YOY Smallmouth Bass and are likely the reason for the differences in chemistry between fish of different ages. Fish lengths from long-term monitoring in the nearfield area varied significantly from 2015-2022. It is probable that sampling time was the main contributor to the year-to-year differences. This presentation will highlight the importance of consistency in sampling time and location when using YOY fish for an effects-based monitoring program. Given the quick response to changes in the environment and the potential for non-lethal sampling, YOY Smallmouth Bass promise to be informative for detecting aquatic impacts.

Microbiomes of freshwater insects and riparian spiders downstream of municipal wastewater discharges in the Bow River, AB

Emilie Diesbourg [1], Brittany G. Perrotta [2], Karen A. Kidd [1,3]

[1] McMaster University, Department of Biology, Hamilton, ON
[2] United States Geological Survey, Columbia, MO
[3] McMaster University, School of Earth, Environment and Society, Hamilton, ON

Presenter E-mail: diesboue@mcmaster.ca

Keywords: Microbiome, Dysbiosis, Municipal Wastewater Effluents

The host microbiome is essential for host immune function, metabolism, and digestion. Alterations in these microbes, known as dysbiosis, generally results in adverse effects to the host, including diseases. Dysbiosis can be induced from exposures to various anthropogenic contaminants including constituents of municipal wastewater treatment effluents (MWWEs). Despite MWWEs being one of the largest dischargers to aquatic ecosystems, impacts of these contaminants on exposed aquatic insect microbiomes is unclear. Some aquatic contaminants may transfer to riparian habitats through predation on emergent insects that were exposed to contaminants as larvae, and subsequently alter microbiomes of terrestrial predators. Our study evaluated whether MWWEs altered microbiomes of freshwater larval and adult insects and their riparian spider predators using effluent-associated bacteria and stable nitrogen isotopes (δ15N) to confirm effluent exposure. We analyzed microbiome compositions through sequencing of the V3-V4 hypervariable region of the 16S rRNA gene. We found that insects and spiders were enriched in δ15N at one site downstream of wastewater outfalls, indicating exposure to effluents and transfer of nutrients to terrestrial ecosystems. Microbiomes of most larval and adult insects were altered downstream of wastewater outfalls and had lower relative abundances of endosymbiont bacteria, shifts in bacterial diversities, and increases in abundances of effluent-associated bacteria than those collected at upstream sites. However, spider microbiomes had little evidence of dysbiosis, and were distinct from those of adult insects, despite a close association in their isotopic signatures. Overall, this study provides evidence of biological impacts from MWWEs to exposed insects and suggests that changes in microbial communities of invertebrates may be used as an effective indicator of effluent exposure as part of monitoring frameworks.

New insights into pesticide occurrence and multicompartmental monitoring strategies in stream ecosystems using periphyton and suspended sediment

Moira M. Ijzerman [1], Melanie Raby [2], Nicholas V. Letwin [1], Yaryna M. Kudla [1], Jenna D. Anderson [1], Brian J. Atkinson [3], Rebecca C. Rooney [4], Paul K. Sibley [1], Ryan S. Prosser [1]

[1] University of Guelph, School of Environmental Sciences, Guelph, ON
[2] Ontario Ministry of the Environment, Conservation and Parks, Toronto, ON
[3] University of Waterloo, Department of Biology, Waterloo, ON
[4] Laboratory Services Division, University of Guelph, Guelph, ON

Presenter E-mail: mijzerma@uoguelph.ca

Keywords: Biofilm, Bioconcentration, Insecticides, Herbicides

Streams are susceptible to pesticide pollutants which are transported outside of the intended area of application from surrounding agricultural fields. It is essential to monitor the occurrence and levels of pesticides in aquatic ecosystems to comprehend their effects on the aquatic environment. The common sampling strategy used for monitoring pesticides in stream ecosystems is through the collection and analysis of grab water samples. However, grab water sampling may not effectively monitor pesticides due to its limited ability to capture temporal and spatial variability, potentially missing fluctuations and uneven distribution of pesticides in aquatic environments. Monitoring using periphyton and sediment sampling may offer a more comprehensive approach by accounting for accumulative processes and temporal variations.

The objective of this study was to assess pesticides detected through periphyton, suspended sediment, and grab water sampling methods and identify the matrix that offers a more comprehensive characterization of a stream's pesticide exposure profile. Ten streams across Southern Ontario were sampled in 2021 and 2022. At each stream site, water, sediment and periphyton, colonizing both artificial and natural substrates, were collected and analyzed for the presence of ~500 pesticides. Each of the three matrices detected distinctive pesticide exposure profiles. The frequency of detection in periphyton, sediment and water matrices were related to pesticide's log Kow and log Koc ($P < 0.05$). In addition, periphyton bioconcentrated 22 pesticides above levels observed in the ambient water. The bioconcentration factors of pesticides in periphyton can be predicted from their log Kow. The results demonstrate that sediment and periphyton accumulate pesticides in stream environments. This highlights the importance of monitoring pesticide exposure using these matrices to ensure a complete and comprehensive characterization of exposure in stream ecosystems.

Variable effects of forestry on mercury biomagnification pre-and post- harvest in Boreal headwater stream food webs

Celine Lajoie [1], Karen Kidd [2], Carl Mitchell [3], Erik Emilson [4], Rob Mackereth [5]

[1] McMaster University, Hamilton, ON
[2] McMaster University, Hamilton, ON
[3] University of Toronto Scarborough, Scarborough, ON
[4] Great Lakes Forestry Centre, Natural Resources Canada, Sault Ste. Marie, ON
[5] Centre For Northern Forest Ecosystem Research, Ontario Ministry of Natural Resources and Forestry, Thunder Bay, ON

Presenter E-mail: lajoic1@mcmaster.ca

Keywords: Mercury, Food Webs, Streams, Forestry

Land-use disturbances such as forestry can affect mercury (Hg) dynamics in boreal stream food webs by influencing the availability and methylation of Hg and by altering dietary exposure to Hg through changes in basal resources. This study aimed to quantify differences in consumer Hg concentrations ([Hg]) and Hg biomagnification rates 1) pre- (2019), during- (2020), and post-harvest (2021) within Boreal streams, 2) and across harvested and non-harvested landscapes. Streams were sampled for basal food sources (aquatic and terrestrial), invertebrate primary and secondary consumers, and top predators (fish). To determine differences in consumer [Hg] and Hg biomagnification rates across years and landscapes, samples were analyzed for [Hg], and carbon and nitrogen stable isotopes. Overall, we detected variable effects of forestry on consumer [Hg] and biomagnification rates pre-and post-harvest, likely due to differences in best management practices across sites. Further, when comparisons were made across harvested and non-harvested landscapes, we detected significantly higher consumer [Hg] in harvested landscapes, but no difference in biomagnification rates. On-going analyses comparing the diversity of basal resources within stream food webs pre- and post- harvest will help elucidate effects of forest harvesting on Hg uptake. Ultimately, this work will advance our understanding about Hg cycling in impacted boreal streams and may assist in the development of forestry guidelines that will minimize Hg risk to aquatic systems.

Characterization of microbiomes from Tree Swallow (*Tachicyneta bicolor*) nestling fecal samples collected from colonies near a wastewater treatment plant

Katrina McCutcheon [1], Miranda MacCormack [2], Kim Fernie [3], Rebecca T. Doyle [4], Emily S. Choy [5]

[1] Department of Biology, McMaster University, Hamilton, ON
[2] Department of Biology, McMaster University, Hamilton, ON
[3] Environment and Climate Change Canada
[4] Department of Biology, McMaster University, Hamilton, ON
[5] Department of Biology, McMaster University, Hamilton, ON

Presenter E-mail: kmemccutcheon@gmail.com

Keywords: Tree Swallows, Fecal Sampling, Gut Microbiome, Contaminants

Environmental contaminants threaten wildlife and human health. Despite the suitability of wild birds for monitoring ecosystem changes resulting from pollution and their microbiomes being good indicators of stressors in the environment and of host health, research on their microbiomes is limited. This study focuses on tree swallows (*Tachicyneta bicolor*) as a model species to investigate the impact of contaminants on the gut microbiome. Objectives include 1) Developing an optimized protocol for extracting DNA from tree swallow fecal samples; 2) Comparing the composition of fecal microbiomes collected from a polluted site versus a less polluted site; and 3) Characterizing the fecal microbiome as an indicator of host health. Gut microbiomes were characterized by 16S rRNA sequencing of fecal samples collected from nestlings at a historically contaminated site near a Wastewater Treatment Plant outfall in Hamilton, ON and at another site further from the outfall. It was expected that the gut microbiome composition would change in response to pollution and that fecal samples containing a lower microbial diversity would correlate with a less healthy host. In this study, we provide an optimized DNA extraction protocol using the HiPure Soil DNA Kit with a modified temperature of 50°C, which performed best when considering both dsDNA concentration and purity. While no significant differences were found in alpha or beta diversity, or in pathogenic or commensal microbial abundance between sites, there were correlations between alpha diversity and several chick morphometrics, suggesting connections between host health and microbiome diversity. The use of fecal sampling, a novel and non-invasive microbiome sampling technique, allows repeated sampling of individuals, which is especially important for monitoring endangered wild species. Understanding the impact of contaminants on microbiomes may aid in conservation efforts to mitigate contamination to protect vulnerable species.

Assessing the dynamics of dissolved organic matter in stormwater: implications for greenhouse gas emissions

Harper Schmalz [1], Scott Smith [1], Kevin Stevens [1]

[1] Faculty of Science, Wilfrid Laurier University, Waterloo, ON

Presenter E-mail: schm8880@mylaurier.ca

Keywords: Stormwater, Dissolved Organic Matter, Carbon, Greenhouse Gas

Stormwater management ponds (SWMPs) are important aspects of land-use planning initiatives designed to manage urban runoff; however, it remains a debate whether SWMPs contribute to positive climate benefits. In particular, it is unclear if SWMPs are a net source or sink for greenhouse gases (GHG) and how SWMP monitoring and operation might be optimized to produce positive climate benefits without compromising stormwater impact mitigation. To clarify if SWMPs exacerbate or mitigate climate forcing, their net effects must be evaluated and consider the surrounding and internal plant biomass as contributors to dissolved organic matter (DOM) concentrations. This study will explore the quality of DOM (a reduced form of carbon) in SWMPs and how dissolved organic carbon (DOC) concentrations vary in SWMPs with respect to time, space, and hydrology. The objectives of this study are to evaluate the spatial and temporal variation in the concentrations of DOC in urban stormwater systems and quantify the degradation rates of different SWMP vegetation (terrestrial, emergent, and submerged aquatic) and the corresponding change in carbon. The research findings will assist in developing overall GHG models for stormwater infrastructure. This information will provide decision makers with sufficient information to make scientifically-sound GHG management decisions in terms of SWMP design and operation.

Assessment of environmental microplastic sources across an urban environment

Kayla Simpson [1], Miriam Diamond [2], Paul Helm [3], Roxana Sühring [4], Eric Fries [5], Huy Nguyen [6]

[1] PhD Student, University of Toronto, Toronto, ON
[2] Faculty of Science, University of Toronto, Toronto, ON
[3] Senior Research Scientist, Ontario Ministry of the Environment, Toronto, ON
[4] Faculty of Science, Toronto Metropolitan University, Toronto, ON
[5] PhD Student, Toronto Metropolitan University, Toronto, ON
[6] PhD Candidate, Toronto Metropolitan University, Toronto, ON

Presenter E-mail: kayla.simpson@mail.utoronto.ca

Keywords: Microplastics, Analytical Chemistry

Ineffective plastic waste management and irresponsible discharge of plastic products have caused a surge in plastic pollution, thus leading to the accumulation of smaller plastic particles in the environment called microplastics. Microplastic particles are of concern as they have become ubiquitous in the environment and pose potential threats to the organisms exposed. Furthermore, the chemicals added to plastic products during production can leach into the environment and persist for long periods. As such, it is crucial to understand the sources of microplastic pollution in the environment to prevent their environmental release. However, current methods to identify sources of microplastic pollution are underdeveloped and lack a harmonized approach, making it challenging to compare data over time and across studies. As a result, there is a lack of accountability for plastic polluters, and it remains difficult to implement appropriate policies and regulations due to a lack of source information. Therefore, this study aims to establish harmonized and reproducible methods for accurate source identification of microplastics in the environment to inform policymakers and stakeholders and inspire microplastic management strategies. As such, the present study will visually characterize environmental microplastics under a stereomicroscope, and micro-Fourier transform infrared spectroscopy will be used to confirm polymer compositions. Finally, using high-performance liquid chromatography coupled with high-resolution mass spectrometry, microplastics from potential sources will be characterized for their chemical additive fingerprints. Environmental microplastic fingerprints will then be characterized and matched to the library of potential source plastics. Ultimately, this study's results are expected to link environmental microplastics to possible sources, thus providing information transferrable to policy implementation.

AM Sessions: ‘Omics
DBHSC 1005A I 10:15 – 11:45

Assessment of the metabolic perturbations with exposure to N-(1,3-dimethylbutyl)-N′-phenyl-p-phenylenediamine (6PPD) in *Eisenia fetida* earthworms

Gloria H.Y. Gao [1][2], Suzie M. Reichman [2], Myrna J. Simpson [1]

[1] Department of Physical and Environmental Sciences, University of Toronto Scarborough, Toronto, ON
[2] School of Biosciences, The University of Melbourne, Victoria, Australia

Presenter E-mail: gloriahy.gao@mail.utoronto.ca

Keywords: Environmental Metabolomics, Tire Wear Particles, Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS), Ecotoxicology

Tire wear particles are a pervasive form of microplastics in the environment, produced from the abrasion between vehicle tires and road surfaces. Leachates from tire wear particles can introduce pollutants into the environment. One compound that has been detected in multiple environmental matrices is N-(1,3-dimethylbutyl)-N′-phenyl-p-phenylenediamine (6PPD), an additive that is ubiquitously used in tire production to increase product lifetime. Since most tire wear particle emissions are deposited in soil, 6PPD may leach out and pose a potential risk to soil organisms. We studied the acute toxicity of 6PPD on earthworms (*Eisenia fetida*) by investigating both traditional toxicity and molecular-level endpoints. The acute median lethal concentration (LC50) was 693 µg/g, following a 14-day exposure period. Targeted mass spectrometry-based metabolomics was employed to measure the metabolic responses of earthworms exposed for 48h to five 6PPD concentrations (0.12, 1.2, 12, 120, and 1,200 µg/g). At the highest concentration, multivariate analysis showed that changes to the metabolic profile of earthworms were statistically significant ($p = 0.006$) compared to the unexposed group. Furthermore, normalized concentrations of alanine, which has been reported as universal bioindicator of oxidative stress, were significantly upregulated with high concentrations of 6PPD exposure. Biochemical pathway analyses revealed disruptions to protein synthesis, amino acid metabolism, and energy metabolism. No metabolites were significantly perturbed after exposure to 6PPD concentrations 0.12-120 µg/g, compared to the control ($p > 0.05$), suggesting that sorption may have reduced the bioavailability and impact of 6PPD on earthworms based on its octanol-water partition coefficient (log KOW = 4.47). This study demonstrates that metabolomic profiling yields consistent results with LC50 values, and is valuable to elucidate molecular-level perturbations in soil organisms.

Metabolomics identified early molecular responses after exposure to phenanthrene and its oxygen and nitrogen-containing analogs on *Daphnia magna*

Salwa Hajir [1], Sonya Kleywegt [2], Karl Jobst [3], André Simpson [1], Myrna Simpson [1]

[1] Environmental NMR Centre and Department of Physical and Environmental Sciences, University of Toronto Scarborough, Toronto, ON
[2] Technical Assessment and Standards Development Branch, Ontario Ministry of the Environment, Conservation and Parks, Toronto, ON
[3] Department of Chemistry, Memorial University of Newfoundland, St. John's, NL

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Keywords: Metabolic Profile, Daphnia Magna, Phenanthrene, 9,10-Phenanthrenequinone, Phenanthridine

The prevalence of polycyclic aromatic hydrocarbons and their oxygenated and nitrogen-containing analogs in freshwater ecosystems are of concern due to their reported toxicity to several aquatic species including *Daphnia magna*. The aim of this study was to explore the mode of action of phenanthrene (PHEN), 9,10-phenanthrene quinone (PHQ), and phenanthridine (PN) as little is known about the molecular-level impairments, especially at low levels. For this purpose, *D. magna* was exposed to three sub-lethal levels of pollutants for 24 h. To assess biochemical responses, 52 polar metabolites were extracted from individual adult daphnids, and analyzed using a mass spectrometry-based targeted metabolomics approach. Changes in the normalized metabolite concentrations revealed up and down-regulation relative to the control group for all pollutants. PN exposure resulted in the most statistically significant changes to metabolite concentrations across all applied sub-lethal levels. Moreover, PN exposure responses were non-monotonic across exposure concentrations, whereas monotonic responses were observed for PHEN and PHQ. Biochemical pathway analysis for PN showed that all exposure concentrations had the same perturbed metabolic pathways. However, the number of perturbed pathways increased with increasing exposure concentrations for PHEN and PHQ. The results suggest that PN, and PHQ are more disruptive due to the presence of reactive functional groups when compared to PHEN. The findings of this study indicate that the sub-lethal mode of action of PN was equally disruptive across all applied levels; however, for PHEN and PHQ, the mode of action was concentration-dependent. Although the reported median effective concentration for PN is higher than PHEN and PHQ, our data shows that metabolomics captures molecular-level changes that may not be detected by traditional toxicity metrics.

Proteomic analysis of short-chain perfluorinated alkyl substance (PFAS) exposure in Fathead Minnows (*Pimephales promelas*)

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Keywords: Perfluoroalkyl Substances, Proteomics, Fathead Minnow

Perfluoroalkyl substances are widely used anthropogenic compounds with many structures and applications. Over the years, there has been a great concern regarding their usage as exposure can result in liver toxicity, endocrine disruption and bioaccumulation. Due to these concerns PFOS and PFOA have been banned, thus making short-chained PFAS more prevalent within the market. Due to this, the presence of short-chain PFAS within commercial products and within the environment has risen. Current research focuses on legacy long-chained PFAS, with very little information available for the health and environmental risks of short-chain PFAS. Therefore, more information on short-chained PFAS toxicity is required as their prevalence increases. To determine the toxicity of short-chain PFAS in comparison to its' long-chained counterparts, fathead minnow (*Promelas pimephales*) were exposed to PFOS (5ug/L), PFHxS (5ug/L), PFBS(5ug/L) as well as an environmentally relevant mixture (PFOS: 110ng/L, PFHxS:10ng/L, PFBS: 20ng/L) for 28 days. Post exposure, mucus, blood and brain were collected and stored at -80oC for future proteomic analysis. Muscle was also collected to determine bioaccumulation. Proteins from samples were digested with heat and formic acid, and analyzed with a LC-QTOF (Agilent 1260 LC and 6545 QTOF) using data-dependent acquisition (DDA) to create a spectral peptide library, and then MS1 filtering was performed using Skyline software and their DDA workflow. In this presentation, proteomic data will be presented, with emphasis on impacts to cellular function, and potential disease outcomes.

Investigating the impacts of pyrene and tire wear particle leachate on the *Daphnia magna* transcriptome

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Keywords: Road Runoff, Multi-Stressor, Daphnia, Transcriptomics

Anthropogenic contaminants such as polycyclic aromatic hydrocarbons (PAHs), tire wear particles, salts, and heavy metals enter aquatic ecosystems as runoff during rainfall or snowmelt events. These contaminants can interfere with physiological processes of organisms, including gene expression, to impact higher levels of biological organization (i.e., ecosystems). Although a significant amount of research has investigated the ecotoxicological effects of individual contaminants, the impacts of combinations of contaminants remains unresolved, especially at a transcriptomic level. This project aims to investigate the effects of a combination of road-related contaminants on the survival and gene expression of *Daphnia magna*. The gene expression analysis examines Daphnia's transcriptomic patterns in response to pyrene, tire wear particle leachate, and their combination at five environmentally relevant concentrations. We exposed Daphnia to these treatments in a two-day, acute toxicity test, performed RNA-sequencing, and employed Weighted Gene Correlation Network Analysis (WGCNA). We identified and clustered over 20,000 genes into 21 eigengene modules. Preliminary analysis does not show any obvious correlation patterns of gene expression to contaminant or concentration level. Gene Ontology (GO) terms associated with each contaminant show that many GO terms were shared amongst all the treatments, such as DNA and metabolic processes, but tire wear particle leachate was also correlated additional unique biological processes such as biological regulation, response to stimulus, and various processes related to signaling and cell communication. Overall, this project aids in understanding the sublethal impacts of multiple stressors on aquatic organisms, integrates environmental relevance into toxicity tests, and ultimately helps to inform protection and monitoring of aquatic systems.

The effects of hypoxia on Fathead Minnow behaviour and 'omics

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Keywords: Fathead Minnow, Behaviour, Multi-omics

Behaviour is a beneficial parameter for observing the health of an array of species in the context of environmental changes. Behavioural monitoring is non-invasive and could be utilized as a refinement for fish studies. Traditional 'omics methods can be utilized to determine changes in fish protein, metabolite, and lipid abundance due to toxic exposures. Dissolved oxygen (DO) fluctuations in water bodies have become more prevalent due to climate change and these fluctuations can lead to increased frequency and intensity of hypoxic conditions. We aimed to combine non-invasive methods with traditional methods to determine the effect of hypoxia on Fathead minnow (*Pimephales promelas*) behaviour and 'omics. We exposed 90 Fathead minnows to hypoxic (2.10-2.80 mg/mL DO) and normoxic (5.80-7.50 mg/mL DO) conditions over a 7-day period. Fish were video recorded on days 1, 3, 5, and 7. Three blind observers analyzed the videos for fish tank location activity, foraging behaviour, and novel object behaviour. On day 8, we anaesthetized fish with 100 mg/L MS-222 and collected mucus, plasma, gill, and brain samples. In this presentation, we will share the integrated results of fish behaviour, brain, mucus, and plasma 'omics. We found that hypoxia-exposed fish had altered activity levels over the course of the 7-day treatment. Additionally, the fish exhibited behavioural plasticity. Our proteomic analyses exhibited that hypoxic fish brain, mucus, and plasma protein abundances were significantly altered when compared to normoxic fish. Furthermore, the metabolomic data showed that asparagine was elevated in hypoxic fish brains (p-value<0.05), which may indicate apoptosis suppression and support tumor formation.

Using omics approaches to identify sublethal, chronic effects of artificial sweeteners on rainbow trout

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Keywords: Biomarkers, Emerging Contaminants, Aquatic Toxicology, Fish

Artificial sweeteners are sugar substitutes added to foods, beverages, and various pharmaceutical and personal hygiene products. Sucralose and saccharin – two highly used artificial sweeteners – are not metabolized by humans and are poorly removed during wastewater treatment, resulting in their widespread release to environmental waterbodies. Constant discharge, increasing usage, and environmental persistence of artificial sweeteners yield worsening chronic exposure conditions for aquatic organisms. Artificial sweeteners are not acutely toxic; however, they represent a potentially significant threat to aquatic life because of their ubiquity and understudied chronic effects. Stressors, including contaminant exposure, often cause rapid perturbations in metabolite abundance. Thus, metabolomics – the comprehensive study of an organism's metabolites at a specific time – is a sensitive approach to detect sublethal health effects. We exposed adult rainbow trout (*Oncorhynchus mykiss*) to either 20 or 200 μg/L aqueous sucralose or saccharin for 28 days. Sample analysis is currently ongoing to identify biomarkers (e.g., proteins and polar metabolites) in trout blood plasma and tissues using liquid chromatography and tandem mass spectrometry. We will then apply bioinformatics tools to map identified biomarkers to their biological pathways and present our resulting preliminary findings on the environmental health threat of artificial sweeteners.

Multigenerational toxicity of lead from fishing gear to the freshwater snail, *Planorbella pilsbryi*

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Keywords: Lead, Multigenerational, Molluscs, Ecotoxicology

Lead is a highly toxic element with no known biological function. It is estimated that over 460 tonnes of lead fishing gear are lost in Canada's waterways annually, posing a health risk to aquatic organisms. There is an ongoing debate in the fishing community on the impact of lost lead fishing gear to the aquatic environment. Although the toxicity of lead is well known, the toxicity of lead from fishing gear remains unknown. Lower trophic-level organisms, such as invertebrates, are an important food source within aquatic food-webs and are highly sensitive to metals in the ecosystem. Despite their importance and abundance in aquatic environments, freshwater snails (Planorbella pilsbryi) lack representation in environmental risk assessments. In order to address these research gaps, this project has two main objectives: (i) to determine the toxicity of lead from fishing gear to *P. pilsbryi* through a multigenerational exposure; (ii) use metabolomics to investigate the mechanisms of lead toxicity to *P. pilsbryi*. Chronic 28-d exposures were conducted with adult snails, and embryo exposures were conducted on eggs from unexposed (F0) and exposed (F1) adults. The lead from fishing gear did not affect the reproduction or growth of adult snails, however there was an decrease in growth seen when lead sinkers were added to the jars, and in the positive control, 10 mg/L (nominal) Pb(NO3)2. We observed decreased hatching in the F0 embryo generation at the highest concentrations of lead from fishing gear. Similar results were observed in the F1 embryo generation. Future metabolomic analysis will provide insight into the mechanistic toxicity of lead and the physiological pathways disrupted. This work will provide fundamental knowledge for metabolomics in freshwater snails, contributing relevant data to risk assessors on the risk of lead fishing gear and provide baseline data for future efforts restricting the use of lead fishing gear in Canada.

PM Sessions:
Field Toxicology & Environmental Monitoring
DBHSC 1005A | 13:00 – 14:15

Assessing stormwater management pond water quality, function, and potential biotic effects to receiving waters

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Keywords: Stormwater Management Ponds, Water Quality, Contaminant Removal

Stormwater management (SWM) ponds are common approaches employed to replace natural stormwater retention and cycling process that are no present in urban areas with significant areas of impervious surfaces. While initially designed to reduce flooding in downstream receiving waters, SWM ponds are increasingly being relied upon to treat urban runoff removing contaminants that are acquired as precipitation and meltwaters flow across urban surfaces including roads, parking areas, lawns, and parks. Understanding how effective SWM ponds are at reducing contaminants is complicated due to potential daily and seasonal differences in influent quality, seasonal activity of biota involved in contaminant cycling and the frequency and timing of required monitoring. To better understand SWM function we monitored daily influent/effluent flow in two SWM ponds in Waterloo, ON over one-year period, assessed year-round removal efficiency using established guidelines, and evaluated potential ecological impacts of effluent water quality. In the two ponds, effluent concentrations of total phosphorus were above eutrophic concentrations (0.03 mg/l) 10.7 – 40.2% of the time. Chloride concentrations were above chronic exposure values (120 mg/l) between 88- 99.46% of the year and acute concentrations (640 mg/l) 21.59 – 55.1% of year. Chronic elevations of TSS, >5 mg/l above background levels occurred between 65-70% of the time and acute elevations, > 25 mg/l above background levels occurred between 15-25% of the year. DO was below recommended concentrations (5.5 mg/l) between 9-29% of the year. Water quality in and exiting the SWM ponds has the potential to impact aquatic biota and the ecosystem services they provide.

Uptake and transfer of microplastics in riparian food webs

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Keywords: Microplastic, Emergent Insects, Food Web, Wastewater Treatment

Microplastics (plastic particles ≤ 5mm) are recognized as widespread environmental contaminants, and wastewater treatment plant outfalls are a source of them to aquatic ecosystems. Once present in water bodies, microplastics may be retained in basal resources such as sediment or biofilms, making them potentially available to be ingested by aquatic organisms, including insects. Emergent insects, having both aquatic and terrestrial life stages, may ingest and transport microplastics out of aquatic ecosystems, and into near-shore food webs. Our study examined microplastics sourced from eight wastewater treatment facilities in the Grand River watershed, ON, using a multi-trophic approach by assessing microplastics in wastewater effluent, sediment, biofilm, larval aquatic insects, emerged adult insects and riparian spiders. Microplastics were extracted from sediment with CaCl2 density separations, and from biofilm, insects and spiders using H2O2. Microplastics counts varied between sites, with some downstream locations having elevated levels when compared to upstream of the wastewater treatment facility ($p<0.05$). Fibres were the most common microplastic found across all sample types, and microplastic abundance varied based on month sampled in all sample types except in larval insects and spiders. Overall, spiders were found to contain low amounts of microplastics, suggesting potential transfer of microplastics from aquatic to riparian ecosystems. The risk posed by microplastics may not only remain in aquatic ecosystems, therefore this research addresses a key gap in our understanding by providing novel and much-needed information on the presence, transfer, and fate of microplastics in the environment.

Estimating the mass of PFAS in exterior surfaces of Toronto buildings

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Keywords: Per- and polyfluoroalkyl substances, Building Materials, Exterior Coatings, Homes

While elevated levels of per- and polyfluoroalkyl substances (PFAS) are frequently observed in water and air samples collected from urban environments, their routes of introduction are poorly described. One potential route is through the use of PFAS in building materials. Here, we investigated exterior building materials as a source of PFAS release into the environment by estimating the mass of PFAS on the exterior surfaces of 50 houses from Toronto. Elevated levels of total fluorine (total F) were detected in approximately 60% of paints, sealants, caulking and textiles using Particle-Induced Gamma-Ray Emission (PIGE) Spectroscopy. Subsequent testing using Fluorine Nuclear Magnetic Resonance (19F-NMR), Liquid Chromatography coupled to High Resolution Mass Spectrometry (LC-HRMS), and Gas Chromatography coupled to Mass Spectrometry (GC-MS), confirmed the presence of PFAS in a subset of these products. To estimate the mass of PFAS that could enter the environment from these materials, we categorized exterior building materials into paints, sealants or caulking made with PFAS. We then calculated the 10th, 50th and 90th percentiles of total fluorine concentrations for product samples with detectable total F measured by PIGE (μmol F/g dry weight). For example, one of the largest residential houses examined, with a floor area of 700 m^2, contained 7, 91 and 342 g of PFAS in coatings on exterior surfaces for the 10th, 50th and 90th percentiles, respectively. With over 334,000 housing units under construction in Canada in 2022, exterior building materials may be a significant source of PFAS in the surrounding environment.

Harmful algal blooms in the Nigerian-Canadian context; measurement and remediation of cyanobacteria and cyanotoxins

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Keywords: Cyanotoxin, Cyanobacteria, Remediation, Monitoring

Harmful algal blooms (HABs) are increasing in frequency and duration in freshwater bodies and these HABs generate cyanotoxins that can cause harm to humans and wildlife (severe liver damage and ultimately result in death) that drink the contaminated water. In order to tackle the United Nations Sustainable Development Goals (SDG - 3 and 6) of 'Good health and Well-being' / 'Clean water and Sanitation', it is necessary to measure and identify cyanotoxins in water which will help prevent mass poisoning events reported in Nigeria. In Canada, there are access to advanced technology that enables freshwater treatment and monitoring programs to protect people and animals from contaminated drinking water. However, some of Canada's abundant freshwater resources have records of HABs, it is therefore necessary to proffer affordable and eco-friendly materials / treatment options for HABs removal. Furthermore, this collaborative project addresses SDG 10 of 'Reduced Inequalities', because water security is something that many Canadians take for granted, and unfortunately is not a privilege that is shared by all nations equally. This project thus aims to evaluate the HABs in Nigerian freshwater and develop materials targeted at their removal and building capacity in this field. The aim will be met by collecting and storing samples of water freshwater sources experiencing HABs in Nigeria and analysing the samples for the presence of cyanotoxins using state-of-the-art detection methods. The project also involves building capacity for future HABs monitoring and bioremediation programs for the protection of freshwater resources. This project will lead to establishing ong-term HAB and cyanotoxin monitoring capability by the Nigeria team. The remediation technology developed will protect public health and freshwater resources with increased water security in Canada and Nigeria.

Evaluating the presence and tissue distribution of the neurotoxin β-methylamino-L-alanine (BMAA) and its isomers in Lake Erie fishes

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Keywords: Harmful Algae, Cyanotoxin, Neurotoxin, Fish Physiology

Harmful algal blooms (HABs) release toxic compounds in water and are increasing in frequency worldwide due to eutrophication. One HAB toxin, the neurotoxin β-methylamino-L-alanine (BMAA), has garnered much attention over the past twenty years, but questions remain regarding its presence and distribution within the bodies of fish exposed to HABs. We evaluated the presence and tissue distribution of BMAA and its isomers, N-(2-aminoethyl) glycine (AEG), 2,4-diaminobutyric acid (DAB), and β-amino-N-methylalanine (BAMA), in yellow perch and walleye sampled in Lake Erie near Point Pelee, Ontario, a region known for its seasonal HABs. BMAA isomers were quantified in eight fish tissues (brain, muscle, liver, heart, kidney, gills, gonads, and scales) using liquid chromatography with tandem mass spectrometry. Overall, BMAA was the isomer detected the least frequently and at the lowest concentrations, while AEG was detected in nearly all samples at consistently high concentrations. Patterns of isomer concentrations varied between tissues, with species differences in the brain (BMAA higher in perch and DAB higher in walleye) and kidneys (DAB higher in walleye). The findings highlight that isomers of BMAA may represent a greater risk to aquatic wildlife than BMAA itself, but more research on exposure route, bioaccumulation, and metabolism of these neurotoxins will be required to better understand the risk they pose to fish.

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PM Sessions: Chemistry & Method Development
DBHSC 1005A I 14:15 – 14:45

Advancing harm reduction strategies in Ontario: Analysis of opioid consumption through wastewater-based epidemiology in the Durham region

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Keywords: Wastewater-Based Epidemiology, Opioid Consumption, Public Health, Time of Flight-Mass Spectrometry

The opioid crisis, intensified by the COVID-19 pandemic, remains a severe public health challenge in Canada, with Ontario observing a steady increase in opioid-related harms for more than a decade, including a significant increase in the Durham Region with 129 deaths in 2021, seven times the number in 2013. This epidemic, therefore, demands informed and targeted interventions, and acquiring accurate data on opioid usage is critical for implementing effective harm-reduction strategies.

Traditional monitoring methods of opioid consumption, such as clinical overdose data, are often expensive, cumbersome, and subject to potential biases. As an alternative, this study explores the application of wastewater-based epidemiology (WBE), a novel approach to assess drug consumption by analyzing municipal wastewater for drugs and their metabolites. We employ WBE to monitor opioid consumption patterns within the Region of Durham, leveraging its capability to provide non-invasive, comprehensive, and real-time data. The selected opioids for this study include morphine, codeine, oxycodone, fentanyl, hydromorphone, methadone, and heroin, as these represent the compounds most closely associated with opioid-related mortalities within Ontario. Our methodology involves collecting 24-hour composite wastewater samples from six regional treatment plants, analyzed through liquid chromatography quadrupole time-of-flight mass spectrometry (LC-QTOF). This approach not only allows for accurate quantification of opioids but also enables the identification of spatial and temporal patterns in opioid usage.

The anticipated outcomes of this research include an enhanced understanding and management of the opioid crisis in the Durham Region. By integrating WBE with traditional monitoring methods, we expect to provide more detailed and timely insights into opioid consumption trends, contributing to more effective public health strategies and harm reduction efforts.

Effects of ethanol preservation on total mercury concentrations, and C:N and stable isotope ratios in dorsal muscle tissues of two salmonid species

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Keywords: Salmonid, Mercury, Stable Isotopes, Ethanol Preservation

Effects of in-field ethanol preservation on the carbon-to-nitrogen (C:N) ratio, stable carbon and nitrogen isotope ratios (δ13C, δ15N), and total mercury concentration ([tHg]) of Lake Trout (*Salvelinus namaycush*) and Round Whitefish (*Prosopium cylindraceum*) tissues were investigated using paired subsamples. Ethanol preservation resulted in significant increases in δ15N and [tHg], and species-specific changes in δ13C. No differences were observed in C:N ratios for either species. Error-in-variables linear models were developed to correct isotope ratios and [tHg] of ethanol-preserved fish tissues.

PM Sessions: Risk Assessment
DBHSC 1005A | 14:45 – 15:15

Completing a human health and ecological risk assessment for on-land disposal of dredged tributyltins

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Keywords: Tributyltins, Risk Assessment, Dredged Sediment, Risk Management

Historically, tributyltin (TBT) was extensively applied as an antifouling additive, principally for application to vessel hulls. This has made their presence common in sediments within working harbours or wharfs, which is concerning as they are highly toxic to aquatic life, and bioaccumulate and biomagnify strongly in aquatic food chains. While federal surface water guidelines exist for aquatic life, there is a lack of federal guidelines related to terrestrial-based exposures to people, plants and wildlife. This is of interest when sediments are dredged to increase navigational depth and must be placed on-land at a disposal site. The objective of this study was to assess the human health and ecological risks posed by TBT in sediment once placed in a containment cell using accepted Canadian Council of Ministers of the Environment (CCME) and Health Canada risk assessment methods. The risk assessment was completed for workers and terrestrial plants and wildlife that could potentially be exposed to TBT placed at the disposal site, as well as for members of the general public and aquatic life that could potentially be exposed from the migration of TBT downgradient of the disposal site. Both qualitative and quantitative risk assessment methods were applied following literature review of toxicological information related to TBT. Negligible health risks to humans, wildlife and aquatic life were predicted under normal operational conditions. Potential risks were identified for on-site terrestrial plants and soil invertebrates, and to off-site aquatic life if the volume of dredged sediment exceeded the operational limits. Ultimately, this study helped to determine the design elements required to mitigate the risks from TBT-contaminated sediments placed on-land within a containment cell. These design elements included a clean soil cap on top of the dredged material and the management of dewatering outputs.

Phthalate exposure from graphic designs in children's clothing

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Keywords: Phthalates, Dermal Uptake, Children, Exposure

Phthalates are commonly used plasticizers added to clothing to increase flexibility and softness. Phthalates pose risk of adverse health impacts, especially to small children due to increased exposure from behavior and body size. 7 phthalates were measured for dermal uptake from 17 different clothing items using silicone rubber samplers (PDMS) over a 72-hour window. Di-n-octyl phthalate (DnOP) was found to be most prevalent among samples with a 53% detection rate and a dermal uptake of 0.007-0.93 ug/kg/day, and Di-isononyl phthalate (DiNP) was found to be second most prevalent with a 47% detection rate. Samples were divided based on presence of graphic (plastisol) designs. It was found that there were greater detection rates of target compounds in the samples that had no plastic designs (18-57%) compared to samples that had graphic designs (10-50%). Bis-2-ethylhexyl phthalates (DEHP) was found to be more prevalent in samples that did not have graphic designs in comparison with samples that did have designs; it was also present in lower amounts than DnOP and DiNP, suggesting an industry shift away from DEHP use as a main plasticizer in clothing.

PM Sessions: Laboratory Toxicology
DBHSC 2032 I 13:00 – 15:15

Assessing microplastics toxicity and accumulation in freshwater macroinvertebrates

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Keywords: Microplastics, Macroinvertebrates, Microbiome

Microplastics (MPs) pollution has become one of the most pressing environmental issues to date. In freshwater systems, high levels of MPs, especially in riverine sediments, have been reported. Concerningly, the effects of MPs to freshwater macroinvertebrates, a key component of freshwater food webs, remains unclear. This study aimed to determine the risk of MPs to freshwater macroinvertebrates through toxicity assessments using ecologically realistic exposures. We used sludge worms (*Tubifex tubifex*), and file ramshorn snails (*Planorbella pilsbryi*), and three types of MPs, polystyrene microbeads (6 and 45 μm) and polyester microfibers (100 μm). For each species, toxicity and accumulation were assessed following exposure to each MPs type. Biofouled MPs were also included to replicate the microbial attachment and biofilm formation typically found on MPs in natural systems. To assess toxicity, reproduction and survival were measured across all tests. MPs accumulation was also assessed following each exposure, with a gut clearance period to determine MPs excretion efficiency. Additionally, the host microbiomes were examined to determine the potential for dysbiosis following MPs exposure. To date, no significant effects to reproduction or mortality have been observed for any species, across any MPs type or condition. Host microbiome analysis is currently underway. In *P. pilsbryi*, significant accumulation of MPs was reported, but it varied according to MPs type, size, and condition. No significant MPs accumulation occurred in *T. tubifex*. However, *P. pilsbryi* were able to efficiently excrete ingested MPs. Overall, results will help understand the potential impacts of MPs to freshwater macroinvertebrates and the risks of MPs contamination in freshwater ecosystems.

Individual and mixture accumulation of rare earth elements (REEs), Nd, Pr, and Y on *Daphnia magna*

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Keywords: Rare Earth Elements, Bioaccumulation, Mixtures, Daphnia magna

Neodymium (Nd), Praseodymium (Pr), and Yttrium (Y) are three rare earth elements (REEs) that occur in the mineral ore bastnaesite, the primary ore of Canada's first REE mine on Thor Lake, Nechalacho, NT. Usage of these elements is an expanding market as they are key components in various modern technologies, including for example, green energy equipment such as wind turbines & electric vehicle batteries. As a result, there is a growing concern for the potential environmental risk due to anthropogenic contamination. Minimal data is currently available regarding toxicity of individual REEs and even less data is available on mixtures. The objective of this study was to investigate the bioaccumulation of Nd, Pr, and Y in *Daphnia magna*, alone and as ternary mixtures. Daphnids were initially exposed to sublethal concentrations in an artificial soft water medium with a hardness of 50 mg CaCO3/L and a pH of 6.8. Surviving daphnids were sampled after 24-h. At doubling concentrations of Pr (100, 200, 400, 800 & 1600 μg/L Pr), the accumulation of Pr was saturable and similar results were observed for Nd an Y. Bmax values for Nd were 50% of those for Pr and Y. Mixture exposures were designed using a toxic unit (TU) approach, based on converting the EC50 concentrations from previously conducted acute toxicity tests to TUs and applying a matrix isobologram approach. For example, at 0.2 TUs of each element (40 μg/L Nd, 133 μg/L Pr & 190 μg/L Y), similar levels of REE accumulation were observed whether it was in single metal exposures or in mixture exposures indicating that accumulation was not influenced by other REEs. A similar independent accumulation of REEs was seen in a bioaccumulation test conducted using Thor Lake water although the degree of accumulation was only 10% of lab tests. This research is supported via an NSERC Alliance Grant with additional funding from Environment and Climate Change Canada, Stantec Inc and Cheetah Resources.

Selenium in focus: Exploring the effect of supra-physiological selenium on trophoblast function

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Keywords: Selenium Toxicity, Placental Dysfunction, Trophoblast Function, Glucocorticoids

In areas with coal mines, there are concerns about increased human exposure to elevated levels of selenium and adverse pregnancy outcomes. Cortisol, which plays a role in the development of the placenta, has been shown to be dysregulated following exposure to selenium. As cortisol is also associated with placental dysfunction, and placental dysfunction underlies many adverse pregnancy outcomes, this study investigated how selenium exposure impacts placental invasion, migration, and angiogenesis, and the role of glucocorticoids in these processes.

HTR-8/SVneo cells (human first-trimester trophoblasts) were exposed to environmentally relevant concentrations of sodium selenite (NaSe) for 24 or 48h. Cortisol was measured via ELISA, migration and invasion were measured via a wound-healing assay and invasion assay, respectively, and steady-state mRNA expression of genes involved in glucocorticoid homeostasis, and invasion, migration, and angiogenesis were measured by qPCR.

NaSe treatment caused increased cortisol and induced genes that are indicative of glucocorticoid receptor (GR) activation. NaSe also induced genes involved in the regulation of invasion, migration and angiogenesis. NaSe decreased migration but did not affect invasion. When cells were co-treated with NaSe and either 1) metyrapone (inhibitor of cortisol synthesis), or 2) mifepristone (GR antagonist), the expression of genes associated with increased cortisol did not decrease, suggesting that selenium may be activating the glucocorticoid pathway through alternate means.

These data suggest that exposure to NaSe perturbs trophoblast function and glucocorticoid regulation. Perturbations of trophoblast cell function may lead to problems in placental function, increasing the risk of poor pregnancy outcomes. Future work will identify how selenium is activating the glucocorticoid pathway to understand selenium's impact on trophoblast function.

The Effects of Neurochemical Manipulation on the Behaviour of *Capitella teleta*

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Keywords: Physiology, Behaviour, Toxicology, Invertebrate

Capitella teleta are annelid polychaete worms that live in the sediment of marine estuarian environments. They represent excellent organisms for testing behavioural changes in response to chemical exposures that are common in coastal waters. Serotonin, dopamine, and acetylcholine pathways play important roles in cognitive and behavioural functions, such as locomotion. Exposure to chemical toxicants found environmentally can impact these pathways, potentially altering behavioural responses of *Capitella*. Our previous work identified conserved locomotory responses of adult *Capitella*, developing an assay to screen in exogenous chemicals, such as nicotine and estradiol. However, as early-life stages are typically more sensitive in animals, the objective of this study was to modify this assay for juvenile stages, to test the responses of this animal to neurochemicals. As we previously measured behavioural responses using petri dishes, to increase throughput, we characterized the distance moved (mm), velocity (mm/s), and time spent at the edge (s) using 6-well plates to increase throughput. Juvenile *Capitella* exhibit similar behavioural responses to adults, beginning the onset of movement after 1 h of being in the 6-well arena. In adults, there was a decrease in the distance moved, time at the edge, and maximum velocity when exposed to 20 μM of nicotine. In juveniles, 2 μM of nicotine increased the distance moved and maximum velocity, but decreased distance moved at 20 μM. Fluoxetine increased the time at the edge at 1 μM, and apomorphine increased the distance moved at 1 μM.

Together, these results suggest that a range of neuronal targeting chemicals may influence locomotion. This assay may be useful in environmental toxicology testing by creating a higher throughput assay to screen the impact of chemical contaminants on invertebrates, particularly as this organism represents marine environments, which is essential for understanding ecological risks of human activities.

Lethal effects of granular Bayluscide® on the early life stages of a freshwater mussel (*Lampsilis siliquoidea*)

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Keywords: Unionid, Lampricide, Freshwater

Sea lampreys (*Petromyzon marinus*) are an invasive species that pose an ecological threat to the Great Lakes since their introduction. To control sea lamprey populations, biologists have been dosing Great Lake tributaries with lampricides to target the larval form of the lamprey since the 1950s. Granular Baylusicde® is a lampricide used since the 1990s that is applied to slow-moving and deeper waters. Despite being registered with Health Canada, there is currently limited toxicological data that informs the risk of this lampricide to non-target species. Freshwater mussels in the Unionidae family are a group of filter-feeding organisms that have experienced notable population declines due to habitat destruction, invasive species, and poor water quality. The range of many of these mussel species coincide with the zones of Bayluscide® application. Past research has shown that Unionidae species are sensitive to environmentally relevant concentrations of Bayluscide®, but the earliest life stages have yet to be tested. In this study, early metamorphosed and sub-adult *Lampsilis siliquoidea* (fatmucket) mussels were exposed to 0.0625 to 3 times the Bayluscide® application rate in kg/ha to determine an LC50 (lethal concentration). In addition, burial was monitored for sub-adults and growth for early metamorphosed mussels. The LC50 for sub-adult *L. siliquoidea* was 0.55 (0.41 – 0.68) x the application rate (kg/ha), and <0.0625 x the application rate (kg/ha) for the early metamorphosed stage. Both life stages were found to be relatively sensitive to the lampricide, especially the early metamorphosed stage which was affected in each concentration tested in this study. *Lampsilis siliquoidea* have often served as a surrogate species for other mussels that are threatened or endangered, and their sensitivity to various chemicals have proven to be significantly similar. Based on these findings, the inclusion of Unionidae data is crucial to an updated risk assessment of Bayluscide®.

Use of a mummichog (*Fundulus heteroclitus*) laboratory bioassay to assess the effects of 17α-Ethinylestradiol (EE2) and increased temperature on growth and the GH-IGF1 pathway

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Keywords: Mummichog, 17α-Ethinylestradiol, Growth, GH-IGF1 Pathway

17α-Ethinylestradiol (EE2), a synthetic estrogen, enters aquatic environments via wastewater treatment plant effluents. Increased temperatures are of environmental concern due to climate change. These stressors influence fish growth, but the mechanism(s) remain unclear. Flow-through exposures of mummichog (*Fundulus heteroclitus*), an estuarine teleost, were conducted, with weight measurements taken every three days. Liver gene expression was examined by qPCR for genes known to regulate growth, including growth hormone (gh), insulin-like growth factor 1 (igf1), and their respective receptors. In Experiment 1, three-month-old mummichog were exposed to 0 or 250 ng/L EE2 at 20 and 25°C for 21 days. EE2 did not affect body weight or length; however, exposure to 25°C increased control and EE2-exposed mummichog weights by Day 12 and 18, respectively. Liver igf1ra and igf1rb mRNA expression increased in EE2-exposed mummichog at 20°C compared to their 20°C control. In Experiment 2, adult post-spawning female mummichog were exposed to the same conditions as Experiment 1. An increased temperature combined with EE2 significantly increased mummichog weights compared to the 20°C treatment groups, but not compared to the 25°C control. Mummichog at 25°C had a significantly higher gonadosomatic index (% gonad weight relative to body weight) than mummichog at 20°C. Exposure to EE2 did not affect liver somatic index (% liver weight relative to body weight). Liver igf1 and igf1rb mRNA expression increased in EE2-exposed mummichog at 25°C compared to their respective control. Variability in molecular endpoints indicates the need for further studies and to consider alternate mechanisms, including other hormonal pathways; the GH-IGF1 pathway may not be the primary mechanism involved in these growth changes when exposed to EE2 or increased temperatures.

Assessing the variation in ventilation rate and activity of fathead minnows exposed to Pb and Ni

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Keywords: Hypoxia, Fathead minnows, Lead, Nickel

Eutrophication from nutrient pollution can result in hypoxic waters leading to overall stress of aquatic ecosystems. Fishes have evolved strategies to cope with hypoxia, such as increasing their ventilation and changing their behavior. However, fishes are often exposed to more than one stressor in the wild. Nickel (Ni) has been included on Canada's critical mineral list because of its importance in clean technology and the significant reserves that are being mined in Canada. Lead (Pb) is also mined in Canada and has great economic value due to large scale mining and manufacturing operations. This study examined the effects of Pb and Ni on the oxygen regulation in fathead minnows (*Pimephales promelas*). Fish were exposed to the metal for 48 hours prior to observation, and the ventilation rates and behaviors of the fish were assessed under normoxia and hypoxia. Loss of equilibrium experiments were performed to determine the hypoxia tolerance of the fish under each condition. These experiments show the fishes ability to withstand a loss of equilibrium during progressive hypoxia. Gills were dissected and tested to determine if there is a correlation between ventilation and behavioral differences and metal accumulation in the gills. Results showed that Ni (150 ug/L) and Pb (100 ug/L) exposure both caused a significant increase in activity, with no impact on ventilation rate. Exposure to Ni and Pb both show no impact on PLOE (PO2 at which fish loses equilibrium). Pb and hypoxia caused a significant increase of metal accumulation in the gills. By emphasizing a multiple stressor approach, this research is essential for developing Canadian Water Quality Guidelines that can be used to effectively protect our aquatic species, as it reflects environmentally relevant challenges faced by Canadian aquatic ecosystems.

How much is too much? A novel approach for assessing imidacloprid's impact on soil insects, utilizing the common agricultural ant *Lasius neoniger*

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Keywords: Ecotoxicology, Laboratory Methods, Neonicotinoids, Soil Toxicology

Imidacloprid, a commonly used insecticide, has been shown to adversely affect non-target insects at concentrations typically used in agricultural fields. While the bulk of studies have focused on the effects of imidacloprid on pollinators through ingestion, recent findings indicate that soil insects may also be at risk from direct contact with contaminated soil. Currently, there is no standardized approach for assessing the impact of pesticides on non-target soil insects with realistic field applications. In this study, we introduce a novel method designed to evaluate the effects of soil mediated contact exposure on the behaviour and survival of the soil-nesting ant species, Lasius neoniger. We found that exposing colonies to a soil drench representing 25% of the recommended imidacloprid application rate led to complete colony mortality. Furthermore, even minimal exposure levels—0.03% of the typical application rate—significantly decreased the ants' ability to move soil and halted colony growth altogether. These results mirror those seen in target insect species. Our testing method is both field realistic and replicable for evaluating the ecological risks of imidacloprid and potentially other pesticides. This new approach holds promise for advancing research in agricultural ecotoxicology across North America and may be adapted for use with other contaminants and other soil-nesting insects.

Glyphosate-based herbicide (Roundup©) alters prostaglandin biosynthesis and angiogenesis pathways in human trophoblasts.

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Keywords: Glyphosate-Based Herbicide, Prostaglandin Biosynthesis, Angiogenesis, Placenta

Introduction: Roundup© (RU), a glyphosate-based herbicide (GBH) is widely used for agriculture, forestry, and residential weed control. While GBHs are considered to have low toxicity in mammals, new evidence suggests that exposure to GBHs may cause reproductive deficits by disrupting placental function and altering arachidonic acid (AA) metabolism. AA is the precursor for prostaglandin (PG) synthesis; PGs are important for regulating angiogenesis in the placenta. Disruptions in PG synthesis have the potential to cause altered placental vascularization; an effect which could underlie poor pregnancy outcomes. Therefore, this study explores the impact of RU exposure on placental PG biosynthesis and angiogenesis. Methods: Htr-8/SVneo human trophoblast cells were exposed to 0.0001%, 0.001%, and 0.01% RU for 48h. We assessed the mRNA expression of proangiogenic targets (vascular endothelial growth factor (VEGFa), VEGF receptor (VEGFR1), endocrine gland-derived VEGF (PROK1), angiopoietin-like factor 4 (ANGPTL4), placental growth factor (PGF) and enzymes involved in PG biosynthesis (PTGS1, PTGS2, PTGIS, PGES, PTGDS). Prostaglandin E2 (PGE2) was measured using ELISA. Results: RU treatment significantly reduced the expression of PROK1, ANGPTL4, PLGF at all doses. VEGFa expression was not affected by RU exposure, but expression of its receptor was significantly decreased at 0.01% and 0.0001%. Expression of PTGIS and PTGDS decreased significantly across all doses, while PTGS2 and PTGES were inhibited at 0.01% and 0.0001% RU. Consistent with these changes there was a trend towards decreased PGE2 output ($p=0.09$). Conclusions: Exposure to RU significantly downregulates genes involved in PG biosynthesis, alongside inhibiting pro-angiogenic factors. As placental angiogenesis is critical for establishing the materno-fetal blood supply, these data suggest that altered PG synthesis may impair angiogenesis, potentially resulting in adverse pregnancy outcomes associated with GBH exposure.

Posters:
Chemistry & Method Development

Detection of pharmaceuticals in biofilm exposed to municipal effluents using UPLC-MS/MS

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Keywords: Pharmaceuticals, Biofilm, LC-MS

Wastewater treatment plants (WWTPs) release complex mixtures of contaminants along with effluents post treatment process, including multiple classes of pharmaceuticals. Organic contaminants like pharmaceuticals can accumulate in biota after entering aquatic systems exposed to WWTP effluents. Many studies on the accumulation of organic contaminants focus on higher order organisms rather than reservoirs at lower trophic levels. Biofilm is an important found source for primary consumers and represent a point of entry for contaminants into aquatic food webs. Previous research has demonstrated the bioaccumulation of pharmaceuticals in biofilm downstream of effluent discharge but is limited. The goal of this research was to quantify the concentrations of pharmaceutical compounds in biofilm upstream and downstream of WWTPs utilizing a simple extraction method. Biofilm samples were collected from nearshore rocks across 3 time points, at 4 WWTPs, during the summer of 2023. Extraction methods were based on a modified liquid-liquid extraction followed by analysis using ultra-performance liquid chromatography – tandem mass spectrometry (UPLC-MS/MS). One antidepressant (Venlafaxine) and its metabolite (O-desmethylvenlafaxine) were detected at higher concentrations at all downstream sites in two thirds of time points sampled. Total pharmaceutical concentrations were higher downstream than upstream at 75% of all sites sampled across all time points. Using a subset of known pharmaceutical contaminants, this research observed the potential for these compounds to accumulate in biofilm downstream of municipal WWTPs. This research adds more data on a potential route of exposure for other organisms and the overall fate of pharmaceuticals in aquatic ecosystems exposed to effluents.

Microplastic extraction methods in complex water samples- effects on aged and pristine microplastics

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Keywords: Microplastics

Harmonized methods for optimal extraction of microplastics (MP) from surface waters containing considerable complex natural organic matter are needed that also consider aged in addition to pristine MP. We report on a systematic study of extraction procedures to effectively remove unwanted organic matter (OM) while balancing the retention of aged and pristine MP. Sequential combinations of oxidative-alkaline protocols (e.g., potassium hydroxide, hydrogen peroxide, Fenton's reagent) were applied to polymeric particles (olefins, polystyrene, polyamide, polyesters, tire rubber) of various shapes and sizes from 63 to 1000 µm with and without OM. Recoveries of MPs from digested water samples depended on the polymer type, aging, and shape. Recoveries of easily degraded aged particles (e.g., polyurethane and polystyrene foams, polyester fibers) were up to 6 times lower than that of their pristine version after applying the same digestion method (2-35% vs. 12-79% after alkaline-oxidative digestion without OM). A Response Optimization Model indicated that, for OM concentrations <2 g/L, using a single-step digestion method can minimize MP losses while effectively digesting OM. Samples with OM concentrations exceeding 10 g/L require a sequential combination of two or more digestion solutions to balance efficiency and effectiveness while minimizing MP losses, especially for the highly weathered MP. Adding recovery spikes of known MP with OM prior to digestion is highly recommended, while both chemical characterization and morphometric methods are recommended to evaluate the MP degradation

Posters:
Field Toxicology & Environmental Monitoring

In-situ assay development for testing soil and waterborne contaminant effects on wetland vegetation

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Keywords: Bioassay, Contaminants, Wetland Vegetation, Ecological Monitoring

Water quality deterioration poses a threat to the essential functions of valuable wetland ecosystems by influencing the health of their vegetation. Accurately quantifying and monitoring plant responses to waterborne contaminants is indispensable for preserving, enhancing, and restoring the ecosystem's functionality. Existing approaches utilizing greenhouse/growth room bioassays fail to capture temporal heterogeneity in water quality, potentially misrepresenting the health of an ecosystem or environment. My laboratory has developed a patented technology (US 10,603,700 B2, Mar. 31, 2020; CA 02891136 2015-08-07) which is an ecological monitoring device that can be used for plant germination and early-stage growth assays in field environments. These assays utilize commonly used and understood endpoints (seed germination/emergence, root/shoot length, and dry weight) along with ecologically relevant plant subjects to provide the most appropriate and tailored representation of how a specific environment may be impacted by its given water quality condition. As a result of these assays being conducted in-situ, they offer a more wholistic assessment of soil/water toxicity in the face of highly variable environmental conditions that traditional assessment methods may not capture. Moreover, our assays provide a versatile platform for evaluating an extensive variety of wetland plant species, spanning from emergent species to submerged macrophytes. This broad scope enables a comprehensive exploration of how different types of wetland vegetation interact with and respond to specific environmental parameters. By encompassing a diverse range of species, our assessments can contribute to a more nuanced understanding of specific wetland ecosystems.

Accumulation of microplastics in the littoral-shoreline: Analysis of rock rings, shoreline surface water and macrophytes

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Keywords: Microplastics, Shoreline Accumulation, Ecotoxicology

Microplastic pollution is ubiquitous in lakes and rivers. Most studies look at contamination in the pelagic waters and animals. Exploring the interaction between macrophytes and plastic pollution represents a novel and emerging field of investigation. Moreover, researchers are trying to understand how shorelines are reservoirs for microplastics. The primary objective of this study is to examine the entrainment and accumulation of microplastic on shorelines, including in macrophytes and other relevant matrices. This research is part of the pELAstic project – a multiyear whole ecosystem experiment assessing the fate, transport, and effects of polyethylene (PE), polystyrene (PS) and polyethylene terephthalate (PET) microplastics in a remote boreal lake. In Summer 2023, we sampled microplastics from rock rings, the surface water surrounding macrophytes, and the macrophytes themselves along the littoral shoreline of L378 at the International Institute for Sustainable Development's Experimental Lakes Area (IISD-ELA). Our investigation focuses on two distinct types of macrophytes, floating macrophytes and emergent macrophytes. In each matrix, we quantified and characterized microplastics in each matrix at six stations across the lake. There are relatively large amounts of microplastics on the shoreline, with more in locations that align with where the wind blows onto the shore. Moreover, the plastic that is visible on the shoreline is predominantly PE, a buoyant plastic. Within the macrophytes we are seeing large amounts of accumulation. By observing the amount accumulated at each station within each matrix we can understand the fate of microplastics on the littoral shoreline and how they may accumulate in each matrix. This study will contribute valuable insights into the dynamics of microplastic fate and their interaction with macrophytes and other littoral shoreline matrices in aquatic ecosystems.

Identifying sources of atmospheric anthropogenic particles and evaluating their transport to urban watersheds

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Keywords: Atmospheric Anthropogenic Particles, Source Identification, Source to Sink Dynamics, Impacts on Microplastic Deposition

Anthropogenic particles (AP) are ubiquitous in the environment. Recent research has shown that the atmosphere may be a significant source and transport mechanism of AP into aquatic environments through wet and dry deposition. Source to sink dynamics of AP in the environment is important to consider for the development of risk assessments considering AP exposure. This study aims to determine the relative contributions of known urban sources of AP into the atmosphere, what factors may increase AP deposition, and to determine transport potential into Etobicoke Creek, an urban watershed. Samples were collected passively and actively at four sites in Toronto Ontario including the University of Toronto St. George Campus (UofT), the Ministry of Environment Conservation and Parks (MoE), High Park, Pearson Airport, and The Centre for Atmospheric Research Experiments (CARE). Passive sampling was done over a period of two weeks using a bottle and funnel to collect bulk (wet and dry) deposition, as well as a copper-based adhesive microscope slide left in a sampling house. Active sampling consisted of using a total suspended particulate (TSP) sampler to capture total suspended particulate matter in ambient air over 24 hours. Particles greater than 106μm were counted and characterized using an Olympus SZ61 stereo microscope, and particles less than 106μm were identified using μ-Fourier Transform Infrared Spectroscopy (μ-FTIR). The particles that have been identified and characterized so far are from UofT and CARE. Pre-liminary results show that during the winter, there is a greater abundance of particles at UofT (2462.85 particles/m2), a heavily urbanized site, compared to CARE (1963.91 particles/m2), a rural site. Fibres were determined to be the dominant AP morphology in bottle and funnel samples at both UofT and CARE. Finally, a positive correlation between average precipitation and particle abundance was found within bottle and funnel samples collected at UofT.

Posters:
Laboratory Toxicology

The ecotoxicity of a n-heterocyclic carbene species on Dugesia dorotocephala

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Keywords: Anticorrosion, Mortality, Planaria, pH, Toxicity, Carbenes

Anticorrosion materials often contain chemicals such as metals, organic solvents, or corrosive substances. When these materials are applied to surfaces exposed to water, such as bridges and pipelines, there's a risk of chemicals leaching into aquatic environments, which can lead to adverse effects, depending on the concentration and nature of the chemicals involved. Current research shows that the unique properties of N-heterocyclic carbenes (NHC) make them attractive candidates for the development of advanced anticorrosion materials; however, their effects on the toxicology of organisms found in freshwater systems remains understudied. Using brown flatworms (*Dugessia dorotocephala*) as a model, the relationship between NHC concentrations and planarian toxicity were investigated under various pH and temperature conditions over a 96-hour exposure. The greatest mortality in both experiments was found in the highest concentration of NHC. However, the percentage and rate of mortality differed for each pH and temperature experiment. Results indicate that higher NHC concentrations lead to increased mortality rates, with abiotic factors playing a significant role in modulating toxicity. Further research into the accumulation and distribution of NHCs in aquatic organisms is required to fully assess their environmental impact and inform the development of safer anticorrosion materials. Ultimately, this study contributes valuable insights into the complex interactions between NHCs and freshwater ecosystems, highlighting the importance of considering abiotic factors in toxicity assessments and environmental risk evaluations.

Testing effluent samples from Canadian pulp and paper mills and metal mines with Ceramium tenuicorne at a Canadian commercial laboratory

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Keywords: Ceramium Tenuicorne, Sublethal Toxicity Testing, Method Refinement

Canadian Pulp and Paper Effluent Regulations and Metal and Diamond Mining Effluent Regulations require sublethal toxicity testing using a marine algae species for effluent discharged into marine and estuarine environments. Historically, the marine macroalgae *Champia parvula* was used in sublethal toxicity testing; however, this test species is no longer used at Canadian testing laboratories due to data quality concerns. As a result, Environment and Climate Change Canada recently drafted an add-on procedure to the ISO 10710:2010 method for the marine macroalgae *Ceramium tenuicorne* to facilitate its use in Canadian sublethal toxicity testing. The add-on procedure for *C. tenuicorne* testing was refined by conducting two series of exposures. First, simultaneous toxicity testing was conducted using two distinct size classes of C. tenuicorne (the current add-on requirement of 0.6-1.2 mm and a slightly larger size of 1.2-1.8 mm) to determine if plant size at test initiation influenced test sensitivity. Results show that *C. tenuicorne* test sensitivity was largely unaffected by plant size at test initiation when initial plant size ranged from 0.6-1.8 mm. The required plant size range for test initiation can therefore be widened to 0.6-1.8 mm to facilitate test initiation at commercial laboratories without compromising test sensitivity. The second series of exposures tested effluent samples voluntarily submitted by Canadian pulp and paper and mining facilities to characterize the sensitivity of the *C. tenuicorne* growth inhibition test. Overall, the growth rate of *C. tenuicorne* is a sensitive endpoint that produced typical dose-response curves and varies in response to diverse effluent types and quality. Collectively, results demonstrate that *C. tenuicorne* can be successfully used as a test species for sublethal toxicity testing of effluent samples from Canadian pulp and paper and mining facilities.

Acute sensitivity of adult washboard mussels (*Megalonaias nervosa*) to granular Bayluscide®

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Keywords: Bayluscide®, Freshwater Mussels, Ecotoxicology

Since their invasion a century ago, sea lampreys have posed a threat to the Great Lakes because of their economic and ecological repercussions. Various control measures have been implemented to limit their abundance, with lampricides (TFM and Bayluscide®) becoming one of the most effective treatments. There is growing concern about the risk posed to non-target organisms like mussels, not only because many endangered species reside in areas overlapping application sites, but because Bayluscide® was initially developed as a molluscicide. To determine susceptibility of mussels to this toxin, adult washboard mussels (*Megalonaias nervosa*) were exposed to varying concentrations of Bayluscide® (ranging from 0.0002 – 0.014 g) for 7 days followed by a 7-day recovery period to estimate mortality. In addition, scope for growth was determined for 6 mussels exposed to 0.005 g Bayluscide® for 24 hours. To do so, their filtering ability (clearance rate), rate of oxygen consumption, and absorption efficiency were measured following exposure and calculated based on Widdow et al. (2006). No mortalities were observed in any of the treatments following the 7-day exposure. There was no significant difference between the scope for growth of control mussels and those exposed to Bayluscide®, although notably one individual appeared to be severely affected by exposure. This individual may have ingested a granule of Bayluscide®, which sparked a closer look at the effects of mussels accidentally ingesting a granule. Although our results show that washboard mussels can withstand low amounts of Bayluscide® exposure, there is potential for considerable effects to occur when a pellet is ingested.

Sodium selenite exposure in placental trophoblasts alters markers of cellular senescence

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Keywords: Selenium Compounds, Cellular Senescence, Placenta, Trace Elements

Introduction: Active coal mining and other human activities contribute to the accelerated release of selenium (Se) into the surrounding environment. Although Se is an essential trace element that is vital for antioxidant defense, its bioaccumulation raises concerns due to its toxic reproductive effects in various species. Studies have previously shown that increased Se exposure can produce reproductive deficits in fish, but its role in mammalian reproductive function has not been fully characterized. Notably, Se exposure has been reported to cause premature aging (senescence). Since increased cell senescence in the placenta is associated with adverse pregnancy outcomes, the goal of this study was to determine if exposure to NaSe alters markers of cellular senescence in placental trophoblast cells.

Methods and Results: HTR-8/SVneo cells, a trophoblast model, were exposed to NaSe (0.1, 0.2, 0.5, 1 and 2 μM) for 24 hours to assess the mRNA expression of the following gene markers of cell senescence (TP53, P21, P16Ink4a) and cytokines indicative of the senescence-associated secretory phenotype (IL1β, IL15, IL6). Active coal mining in Alberta and British Columbia have increased Se concentrations in surrounding waters; the Se concentrations for this study were determined to be representative of Se exposure in regions affected by anthropogenic activities. NaSe exposure at lower concentrations (0.1, 0.2 and, 0.5 μM) significantly increased TP53 and IL15 mRNA expression while higher doses (1 and 2 μM) significantly increased P16Ink4a and P21 expression, respectively. IL1β expression increased significantly at both 0.1 and 0.2 μM whereas IL6 expression decreased at lower doses, and increased significantly at 2 μM.

Conclusion: These findings suggest that NaSe exposure may induce cellular senescence in placental trophoblasts, providing further insight into the mechanisms by which Se may adversely impact reproductive function in mammals.

Investigating the effect of venlafaxine on the behaviour of washboard mussels (*Megalonaias nervosa*)

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Keywords: Unionidae, Antidepressants, Pharmaceuticals, Aquatic Toxicity

The presence of pharmaceuticals in aquatic ecosystems has raised concerns about their potential impact on the organisms that thrive there. Venlafaxine, a commonly prescribed antidepressant, is among the emerging contaminants found in aquatic environments. This study examines the behavioral response of washboard mussels (*Megalonaias nervosa*) to venlafaxine exposure, aiming to elucidate potential sublethal effects on this ecologically important species. Mussels were exposed to environmentally relevant concentrations of venlafaxine in controlled laboratory conditions for 5 days. The mussels were observed during exposure using timelapse photograph for 8 hours per day. Behavioral endpoints include valve opening, ability to bury, and foot presence over time. Preliminary results suggest significant alterations in mussel behavior following exposure to venlafaxine, with potential implications for mussel health. Mussels that are incapable of burying or retracting their foot into their shells will have difficulty feeding, reproducing, and will be at greater risk of being dislodged by the current and predation. Understanding the behavioral responses of mussels to pharmaceutical contaminants like venlafaxine is crucial for assessing the broader ecological consequences.

Sensitivity of brown flatworms (*Dugesia dorotocephala*) to the lampricide TFM

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Keywords: Pesticide, Planaria, Toxicity, 3-trifluoromethyl-4-nitrophenol

The lampricide, 3-trifluormomethyl-4-nitrophenol (TFM) is used to control invasive sea lamprey (Petromyzon marinus) populations in the Great Lakes. TFM uncouples mitochondria oxidative phosphorylation, leading to a mismatch between energy supply and demand, which eventually kills the animal. Recent studies have raised concern about risks of TFM resistance developing in the sea lampreys due to longstanding use, but studying multigenerational effects of TFM in fishes is time consuming and resource draining. The brown flatworms (*Dugesia dorotocephala*) could be used as a model for testing resistance, due to its ability to multiply by fission, with a short regeneration time. However, before modelling resistance, we need to have a better understanding of the effects of TFM on brown flatworm physiology. The current study is the first to determine how TFM affects behaviour, metabolites and energy reserves in brown flatworms. To this end, we exposed worms to increasing concentrations of TFM in soft water (alkalinity 100mg/L CaCO3, pH 7.59, temperature 20.2°C) and determined the 2h LC50 to be 2.79 mg/L. Locomotion was reduced within 5 min of exposure to TFM, in a dose-dependent manner, suggesting that the lampricide impacts motility. Next, animals were exposed to the 2h LC50 and samples were collected to measure whole-body lactate, glucose and glycogen at 0.5, 1.0, 1.5, 2.0 h of exposure. Our work to date has shown that flatworms are highly sensitive to TFM at environmentally relevant concentrations, leading to decreased locomotion and mortality that could be due to impaired ATP production.

An improved method to assess growth rates of the freshwater diatom *Navicula pelliculosa* and applicability for mayfly toxicity testing

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Keywords: Mayfly, Navicula, Toxicity Testing,

The Ephemeroptera, Plecoptera and Trichoptera taxa, or “EPT” are widely used as indicators of aquatic ecosystem health due to their sensitivity to waterborne toxicants and environmental change, but are typically excluded from standardized testing as they represent a challenge to culture in the laboratory. It is critical to develop standardized methods that are representative of the most sensitive species present in aquatic ecosystems in order to accurately quantify risk and develop protective guidelines. Recently, research has begun exploring the potential of using the triangle small minnow mayfly *Neocloeon triangulifer* as a candidate species for laboratory-based toxicity testing. While progress has been made to develop toxicity test protocols with N. triangulifer, toxicological endpoints such as body weight, growth and survival have relatively high intra-treatment variability, which inhibit the ability to elucidate treatment effects. A methodological gap that has been identified as a potential source of variability is culturing of their preferred food, diatoms from the genus *Navicula*. Nutritional composition and age of the *Navicula* culture may influence the sensitivity of *N. triangulifer* to contaminates. The objective of this study was to develop a method to characterize growth curve profiles for *Navicula* using live cell counts. It is hypothesized that the nutritional composition (protein, fatty acid and total caloric content) of the *Navicula* diatom culture changes at different growth stages (lag, exponential, stationary, and death phase). *N. triangulifer* will be fed a diet of *Navicula* from each of these different growth phases. Developmental endpoints including head capsule width, body length and weight will be assessed to determine the optimal diet for these insects. While growth stages of *Navicula* diatoms are currently unknown, we hypothesize that feeding *N. triangulifer* diatoms exclusively from the exponential growth phase will optimize mayfly health.

The toxicity of firefighting water additives on the embryos of the freshwater pulmonate snail *Planorbella pilsbyri*

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Keywords: Firefighting Additives, Planorbella pilsibyri, Toxicity

With the rise of climate change resulting in drier seasons, the prevalence and intensity of forest fires have increased globally. Consequently, the use of firefighting additives on forest fires has increased globally. Firefighting water additives are mixed with water to increase the extinguishing efficacy and more effectively inhibit fire reignition. The purpose of this study was to determine the acute toxicity of five additives used in Canada, WD881®, WD881C®, LC95A®, Ecogel AB, and FireIce 561® on snail embryos. The egg masses produced in a 12 h period by mature adult snails of the species *Planorbella pilsibyri* (file ramshorn snail) ranging in sizes from 13-16 mm were collected for use in this study. Embryos were exposed to five concentrations of each firefighting water additive for 24 h and observed every 48 h over ten days following a water change. EC50 values for WD881®, WD881C®, LC95A®and FireIce 561® were 0.00632%, 0.00370%, 0.02574% and 0.26996%, respectively. These values are considerably lower than the recommended mixing ratios suggested by the manufacturers, and they suggest that the use of these additives over water could present a hazard to aquatic invertebrates.

Usage of x-ray microtomography to assess microplastic movement within earthworm tissues

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Keywords: Microplastics, Earthworms, Bioaccumulation, Ecotoxicology

Microplastics are ubiquitous within the environment and their potential toxic effects are not fully understood. Potential physiological changes from the ingestion of microplastics depend on their accumulation within the body, and their ability to translocate from the gut to extraintestinal locations. According to Mehinto et al. 2022, plastic particles less than 83mm in size are at risk of tissue translocation. To test this, soil was spiked to a concentration of 100,000,000 particles/kg (dw) with two sizes of barium-sulfate polyethylene microspheres purchased from CospericÔ (10-27mm and 45-53mm). 10 earthworms (*Eisenia fetida*) were introduced to each treatment, as well as a control, and they were allowed to feed for 24 hours. Earthworms were then preserved with formalin and dehydrated using an ethanol dilution series. X-ray microtomography was performed using the BMIT-BM beamline from the Canadian Light Source synchrotron located in Saskatoon, Saskatchewan. Resulting images showcased that there is little evidence for tissue translocation of both the 10-27mm and 45-53mm polyethylene microbeads. Additionally, there was no clear location withing the earthworm gastrointestinal tract that showcased microplastic accumulation for both size fractions. Nevertheless, X-ray microtomography can be seen to be a valuable tool for assessing microplastic deposition and movement within organisms.

Using a passive dosing system to assess the aquatic toxicity of five individual aromatic compounds to different life stages of Manila clam (Ruditapes philippinarum)

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Keywords: Aromatic Compounds, Marine Bivalves, Oil Spill Toxicity, Passive Dosing.

The Nathan E. Stewart tug barge sank on the coast of British Columbia resulting in 110 000 L of marine diesel oil (MDO) and other oil products to spill into waters within Haíłzaqv (Heiltsuk) First Nation territory. The lack of recovery of the surrounding bivalve populations since has highlighted our limited knowledge of the impact of oil products to these animals. Understanding the biological effects of individual aromatic compounds (ACs) can allow for modelling of the overall effects of oil products to bivalves. This study investigated the acute aquatic toxicity of five ACs to juvenile and adult life stages of Manila clams (*Ruditapes philippinarum*) using a passive dosing system design. The ACs chosen were styrene, naphthalene, 1-methylnaphthalene, dibenzothiophene, and phenanthrene, and covered mono- and polycyclic classes of ACs within a range of log octanol-water partition coefficient (Kow; 2.9-4.5) values. The passive dosing system design used PDMS O-rings to administer detectable and uniform concentrations of hydrophobic ACs into aquatic environments. Parallel water samples were collected throughout the test period and the analytically confirmed concentrations were used to analyze time-dependent median lethal/effect concentration (L/EC50) values in prepared seawater. All tested individual ACs had significant effects to juvenile *R. philippinarum* survival with a positive correlation between the toxicity and Kow values. These results were used as a basis to determine methods for adult toxicity testing and preliminary results will be discussed.

Assessing the impacts of individual aromatic compounds on Pacific purple sea urchin behaviour

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Keywords: Polycyclic Aromatic Compounds, Marine Diesel Oil, Sea Urchin Behaviour

Marine diesel oil (MDO) is a ubiquitous fuel used by marine traffic on all coasts of Canada. Despite its common use, its environmental effects in the event of spills are difficult to predict due to the variation in its composition. The Haíłzaqv (Heiltsuk) First Nation has identified the need for better understanding of the effects of MDO due to its presence in vessels in their territory (and the broader coast), to inform stewardship work and mitigation of any potential spills. In MDO, polycyclic aromatic compounds (PACs) are attributed as the primary toxic ingredients. Testing the effects of individual PACs can allow for modelling of overall impacts of petroleum products on a given species. The species of interest in this study, the Pacific purple sea urchin (*Strongylocentrotus purpuratus*), was chosen due to ecological and cultural significance to the Haíłzaqv First Nation. Consequently, in collaboration with and at the request of the Haíłzaqv Nation, this study is assessing acute toxicity of 5 individual PACs on the purple sea urchin by investigating the effects on behaviour. The individual PACs used cover a range of affinities for lipids, described by octanol-water partition coefficient values (logKOW; 2.9-4.5). Sea urchins were exposed to artificial seawater with known concentrations of PACs present over a 48-hour period. A righting response assay was used to quantify the effect of PAC exposure on urchin vigour. Preliminary findings of behavioural tests will be presented, along with predictions on how PACs combined might affect urchins and the broader marine environment.

Replacing fish use in effluent toxicity testing with the RTgill-W1 cell line

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Keywords: NAMs, Regulatory Effluent, Aquatic Toxicology

In 2021, over 1 million fish were used for research, testing, and teaching in Canada alone representing 33.9% of all reported animal use (CCAC, 2022). Many of these fish were used in compliance with the Fisheries Act to determine the toxicity of industrial and municipal effluent in accordance with the EPS1/RM13 test method, which exposes fish to effluent for 96 hours. Recently, the Government of Canada stated its intent to amend the Canadian Environmental Protection Act to reduce reliance on vertebrates in toxicity testing; however, despite global efforts to replace, reduce, and refine animal use in science, few alternatives have been accepted as regulatory tests. One new approach that shows promise is the OECD 249 test that uses a fish gill cell line (RTgill-W1) to evaluate toxicity. This test method has been standardized and validated for testing chemicals (OECD, 2021), but not for effluents, as the complex composition of industrial effluents could allow for matrix effects that increase or reduce toxicity. The current research aims to evaluate if the new in vitro test method (OECD 249) is a suitable surrogate for the in vivo test method (EPS1/RM13) currently used to assess effluent toxicity. Specifically, the proposed research will investigate matrix interactions and assess the suitability of the OECD 249 to replace, reduce, and refine animal use in effluent testing. This work has the potential to decrease animal usage in regulatory toxicity testing and advance the use of new approach methods in regulatory frameworks.

Venlafaxine exposure alters mitochondrial respiration and mitomiR abundance in zebrafish brains

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Keywords: Pharmaceuticals, MicroRNA, Mitochondria, Metabolism

Wastewater treatment plant (WWTP) effluent containing pharmaceuticals is released into freshwater ecosystems where it can have negative effects on fish. Venlafaxine (VFX), an SNRI antidepressant detected in WWTP effluent, impacts fish metabolism and can accumulate in fish tissues. Due to its potential to accumulate in mitochondria, VFX may have effects on zebrafish brain mitochondrial respiration. For example, in rat brains, VFX impacts activity of mitochondrial oxidative phosphorylation complexes. In addition, since mitochondria contain their own DNA, mechanisms that regulate mitochondrial gene expression may play a role in responding to metabolic stressors like VFX. MicroRNA (small RNA molecules) regulate mitochondrial gene expression post-transcriptionally and are known to translocate into the mitochondria. Here, they can regulate expression of mitochondrial mRNAs and have predicted targets in fish. This study sought to identify if VFX exposure impacts mitochondrial respiration in zebrafish brains at environmentally relevant concentrations (1 ug/L) and determine if mitochondrial microRNA (mitomiRs) are differentially abundant with VFX exposure. We found that in vitro exposure to VFX caused a decrease in mitochondrial respiration at below environmentally relevant concentrations of VFX. To identify whether these effects also occur in vivo, zebrafish were exposed to 1 ug/L VFX for 0, 1, 6, 12, 24 and 96 hours. We found no changes to mitochondrial respiration indices at any time points. However, we also quantified mitomiRs (dre-miR-301a-5p, dre-miR-301b-3p, dre-miR-301c-3p) that were bioinformatically predicted to regulate mitochondrial cytochrome c oxidase subunit I (COI), and saw changes in their abundance based on exposure to VFX, sex, and time sampled. Overall, VFX had demonstrated effects in vivo, which may have been mitigated during in vivo exposure due to the ability of the fish to respond on a whole organism level through mechanisms like mitomiR regulation.

Screening for potential stress-disrupting compounds using the SR4G transgenic zebrafish line.

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Keywords: Zebrafish; Screening; Endocrine Disruption; SSRI.

Selective serotonin reuptake inhibitors (SSRIs) are widely used to treat anxiety, depressive and affective disorders. SSRIs enter the aquatic environment due to insufficient wastewater treatment, exposing non-target species. Adult male zebrafish (*Danio rerio*) exposed to Fluoxetine (FLX; Prozac) during early development exhibit reduced exploratory behaviour and hypocortisolism, as did their offspring over three generations. Developmental exposure to FLX causes life-long dysregulation of pathways involved in nervous system development, stress response, and lipid metabolism. In this study, we characterized the effects of different SSRIs: FLX, Citalopram (CIT; Celexa), and Escitalopram (ECIT; Cipralex), at environmental and pharmacological concentrations. We used the stress-responsive SR4G (Stress Responsive 4h half-life eGFP) transgenic zebrafish reporter line, with a cortisol-inducible enhanced green fluorescent protein (eGFP). After exposure for six days post-fertilization, larvae undergo a standardized net-handling stress protocol, to assess the effects of SSRIs on whole-body cortisol and eGFP mRNA levels. This study provides essential data to establish eGFP expression as an amenable and reliable biomarker of cortisol responses. Untreated larvae in stressed conditions presented a significant increase in whole-body cortisol and eGFP expression, compared to unstressed conditions. We detected a similar stress response in larvae exposed to FLX, CIT and ECIT, suggesting no effect of SSRIs on the stress axis under the applied experimental conditions of this study. However, positive correlation coefficients ($0.82<r<0.93$) between cortisol levels and eGFP expression reinforce confidence in eGFP mRNA as a biomarker. Our findings demonstrate the potential of eGFP mRNA as a biomarker for high throughput evaluation of the stress axis responsiveness, with perspectives for environmental risk assessment.

The effects of heat stress on Fathead Minnow behaviour

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Keywords: Fathead Minnows, Heat Stress, Behaviour

Climate change poses significant challenges to aquatic ecosystems, particularly affecting ectothermic organisms like fish. Understanding the behavioural responses of fish to rising temperatures is crucial for predicting their survival in changing environments and the effects of climate change. This study aimed to investigate the effects of heat stress on fathead minnow (*Pimephales promelas*) behaviour, focusing on activity levels, tank location activity, and foraging behaviour. Ninety fathead minnows were subjected to heat stress in a controlled laboratory setting. Behavioural trials were conducted using GoPro cameras to observe fish responses to temperature-induced stressors. Water quality parameters were monitored to ensure optimal conditions throughout the experiment. The analysis revealed significant differences between control and elevated temperature groups in activity levels, tank location activity, and foraging behaviour. Elevated temperatures prompted increased overall activity and altered spatial preferences, with fish displaying bolder behaviours. Furthermore, fish subjected to heat stress exhibited prolonged foraging durations, indicating potential challenges in food acquisition and maintenance. These findings demonstrate that heat stress significantly influences fathead minnow behaviour, highlighting the importance of temperature regulation in aquatic habitats.

Posters:
‘Omics

The chemical defensome in the gut and gill of zebrafish

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Keywords: Transcriptomics, Toxicokinetics, Detoxification, Zebrafish

Toxicokinetics is the movement and fate of chemicals in the body and is dictated by chemical uptake, distribution, metabolism, and excretion. When exposed to foreign chemicals, animals respond by upregulating genes that work to detoxify and eliminate the substance. In fish, we know little about the major chemical defense genes, their regulation, and the tissue-specific patterns of gene expression. Chemical defense is coordinately regulated across major organs such as the gills, intestines, liver, and kidney. Yet, most fish studies have focused primarily on a few chemical defense genes within the liver. My research explores this gap in knowledge by determining the expression of the gene families involved in chemical defense across organs significant to toxicokinetics and in response to specific chemicals in the well-established zebrafish model (*Danio rerio*). Using existing transcriptomics data, I have examined the basal expression of the chemical defensome gene families in the gut and gills of unexposed male zebrafish. The raw reads were analyzed using two different pipelines to understand how the output from pseudo-mapping and quantification of estimates differs from the use of splice-aware mapping and read counting tools. The GO enrichment analysis revealed that the gut upregulated defensome genes related to xenobiotic stimulus, detoxification, sulfation, and various metabolic processes. The gill upregulated responses to temperature stimulus, heat, oxidative stress, and protein folding. Although both the gills and intestines play critical roles in chemical uptake, our preliminary RNA-seq analysis suggests that the intestine has a greater ability to respond and metabolize chemicals. Importantly, impacts on underlying gene expression have the potential to determine the animal’s ability to metabolize and remove chemicals from their system and may alter adverse effects of chemical exposure.

The effects of heat stress on Fathead Minnow metabolomics

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Keywords: Metabolomics, Heat stress, Fathead Minnow

Climate change has become an increasingly important threat to freshwater systems, with rising temperatures and extreme thermal variability impacting ectotherms. Fish are left with little capacity to cope with the fluctuations of climatic events, including temperature changes in their environment. By replicating heat fluctuations in the lab, we can better understand the effects of heat stress on fish. As metabolites play a crucial role in physiological processes, by observing alterations of metabolites found in fish, we can enhance our understanding of these processes. We exposed 95 Fathead minnows (*Pimephales promelas*) to heat treatment tanks (34°C) and normal tanks (24°C) over a 7-day period. The temperature in the heat treatment tanks were gradually increased to 34°C over a span of 3 days (day -2, day-1, day 0). On Day 8, blood glucose was measured, and the fish were euthanized, dissected, mucus, plasma, gill, and brain samples were collected. Upon completion of the experiment, we observed statistically significant changes in the abundance of metabolites from the Fathead minnows, suggesting an impact on the temperature of Fathead minnow health.

Posters:
Risk Assessment

Developing a standardized water-based brewing protocol for Labrador tea

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Keywords: Labrador Tea, Protocol, Herbicides, Indigenous

Labrador tea (Rhododendron groenlandicum) is a plant native to boreal forests worldwide. Many Indigenous Peoples use tea from its leaves for various ailments such as sore throats and indigestion. Bigstone Cree Nation in Alberta (AB) is concerned about the use of glyphosate-based herbicides (GBH) in the forestry industry, and its potential impact on traditional plants and medicines like Labrador tea. Therefore, Bigstone Cree Nation initiated a collaborative investigation on GBH residues altering the plant's medicinal properties. The first objective was to develop a standardized protocol for a water-based Labrador tea infusion, similar to the preparation by Bigstone Cree Nation members, for use in lab studies. Guided by a Bigstone Cree Nation Elder, Labrador tea leaves were picked in Wabasca-Desmarais (AB) to test various brewing methods in medicinal plant books and cookbooks, discussions with Bigstone Cree Nation Elders, and prior scientific reports. Instructions included brewing 1 tablespoon (tbsp) of leaves in 1 cup of water for 3 minutes, 50-75 leaves in 1L of water for 5 minutes, a pinch of leaves per cup for 5-10 minutes, 1 tbsp of leaves per pint of water for 20 minutes, a handful of leaves in a kettle for 15-20 minutes, 5g of tea leaves per cup, and 30 leaves per cup. For each of these conditions, we recorded leaf counts and the average weight in a standard measure (e.g., tbsp, handful, counts). Once we established average weights for the tea leaves, we brewed tea using the following conditions: 1 tbsp of leaves (0.80g), 30 leaves (0.64g), 75 leaves (1.67g), and 5g of leaves in 1 cup (250ml) of boiling double-distilled water, left to steep for 3, 5, 10, 15, and 20 minutes. Photos were taken at each brewing time. The next steps include showing the photos of the tea to Bigstone Cree Nation community members to assess if these protocols match their tea preparation, chemical analysis of the prepared tea, and use of the tea in cell-based assays.

From rain to drain: Understanding urban pond pollution

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Keywords: Stormwater, Urban Contaminants, Monitoring, Exposure Characterization.

Assessing the environmental risk pollution poses to aquatic biota depends on adequately evaluating the exposure to contaminants. Traditional approaches to exposure characterization often rely on the instantaneous sampling of water or sediment, which can miss toxicologically important temporal variations in contaminant occurrences and concentrations. In urban aquatic ecosystems, where temporal variation in hydrology and contaminant loads can be extreme, misinterpreting contamination dynamics can lead to underestimating risk, and consequently insufficient mitigation action. A lack of comprehensive screening can also mischaracterize exposure; particularly in urban areas where a high density and diversity of activities, and thus contaminant sources, can occur resulting in a large number of potential contaminants that could end up in the aquatic environment. As a common end-of-pipe control in stormwater management regimes in Ontario, stormwater management ponds can receive large contaminant loads, yet are often neglected from water quality monitoring schemes despite the known ecological consequences of their effluent on receiving water bodies. We surveyed the presence of urban-use contaminants at 21 stormwater management ponds in Brampton, Ontario using 3 sampling methods: weekly grab water samples, biofilms cultured on artificial substrates, and passive diffusive samplers (o-DGTs). We analyzed the water and biofilm samples for 542 current-use and legacy pesticides, and the o-DGT samplers for 492 urban contaminants. We also analyzed 15 biofilm samples for 21 metals and metalloids. Additional water grab samples were taken during the survey period to measure nutrient loads, chloride concentration, and coliform bacteria. We will present the detections of contaminants found by these sampling methods and discuss the relative sensitivity, biological relevance, practicality, and reproducibility of each monitoring approach.