Laurentian
SETAC

LAURENTIAN SETAC 27TH
CONFERENCE & AGM

University of Guelph | Guelph, ON
June 1st - 2nd, 2023

One
TOXICOLOGY

integrating science for holistic solutions

2023 AGM COMMITTEE

A HUGE THANK YOU TO OUR 2023 COMMITTEE! WITHOUT THEIR TREMENDOUS EFFORT, THE 2023 CONFERENCE AND AGM WOULD NOT BE POSSIBLE.

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

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PROGRAM AT A GLANCE
THURSDAY, JUNE 1ST

INTRODUCTION TO STREAM SAMPLING | 08:00 - 12:00

This short workshop will provide a brief, hands-on introduction to a number of stream sampling methods.

Instructors:
Paul Sibley | University of Guelph, Mike White | Ecoreg Solutions
Ryan Prosser | University of Guelph, Moira Ijzerman | University of Guelph, Yaryna Kudla | University of Guelph
Carolyn Brown | Wilfrid Laurier University, Gerald Tetreault | Environment and Climate Change Canada
Robert Hanner and the Hanner Lab | University of Guelph

INTRO TO CONTAMINATED SITE RISK ASSESSMENT | 13:00 - 17:00

This short course will introduce risk assessment as a career path for students, new graduates, and early career professionals in the fields of environmental toxicology and chemistry.

Instructors:
Victoria Restivo | SLR Consulting, Wilson Lau | GEMTEC
Nicole Thackeray | Englobe, Karen Bechard | Geosyntec Consultants

LAURENTIAN SETAC PUB NIGHT FIXED GEAR BREWING | 18:00 TO LATE

Dr. Oana Birceanu will kick off our return to in-person Pub Nights! Join us for a short talk by Dr. Birceanu, followed by Q&A, and a meet and greet with fellow Laurentian SETAC members to start off the 2023 conference!

PROGRAM AT A GLANCE
FRIDAY, JUNE 2ND

8:00 - 9:00 AM	Registration Opens Poster Set-up	SSC Atrium
9:00 - 9:15 AM	**Opening Remarks**	ALEX 200
9:15 - 9:30 AM	**SETAC-North America Update**	ALEX 200
9:30 - 10:30 AM	**Plenary**: ***Theodore Flamand,*** Wiikwemkoong Unceded Territory	ALEX 200
10:30 - 11:00 AM	**Break & Posters**	SSC Atrium
11:00 - 12:00 PM	**AM Concurrent Sessions**	ALEX 200 & 218
12:00 - 1:00 PM	**Lunch & Posters** **Students of L-SETAC meeting**	SSC Atrium
1:00 - 3:00 PM	**PM Concurrent Sessions**	ALEX 200 & 218
3:00 - 3:30 PM	**Break & Posters**	SSC Atrium
3:30 - 4:15 PM	**Plenary:** ***Krista Barfoot,*** SLR Consulting	ALEX 200
4:15 - 4:25 PM	**One minute TOX presentations**	ALEX 200
4:25 - 4:45 PM	**AGM, Closing Remarks, and Updates**	ALEX 200
5:00 - 6:00 PM	**Student Networking**	Brass Taps, University Centre
6:00 - 8:00 PM	**Awards Social**	Brass Taps, University Centre

AM SESSIONS

OMICS RESEARCH

ALEX 218 | 11:00 - 11:45

11:00 - 11:15

A. KHAN: Investigating the Effects of Per- and Poly-fluoroalkyl Substances (PFAS) on the Freshwater Gastropod (Planorbella pilsbryi) in Laboratory Utilizing a Proteomic Approach

11:15 - 11:30

D. McNABNEY: Assessing the toxicity of bisphenol A in the freshwater snail Planorbella pilsbryi: relating fitness components to metabolomic responses

11:30 - 11:45

K. DEORAJ: 'Omics-based investigation of Namew (Lake Sturgeon, Acipenser fulvescens) health in an intact and an impacted watershed in the Moose River Basin

AM SESSIONS

FIELD TOXICOLOGY

ALEX 200 | 11:00 - 11:45

11:00 - 11:15

Z. HAMOODI: Effect of selenium on estrogen, serotonin, and glucocorticoid pathways in the placenta

11:15 - 11:30

M. IJZERMAN: An assessment of the toxicity of pesticide mixtures in periphyton from agricultural streams to the mayfly Neocloeon triangulifer

11:30 - 11:45

J. ROY: Testing in situ benthic toxicity caging at surface waters receiving discharge of landfill-contaminated groundwater plumes

PM SESSIONS

RISK ASSESSMENT & CHEMISTRY

ALEX 200 | 13:00 - 15:00

13:00 - 13:15

A. AUYEUNG: PFAS in Canadian municipal wastewater treatment systems: results from 12 years of monitoring by Environment and Climate Change Canada

13:15 - 13:30

N. GAUVREAU & D. FOUBISTER: A PFAS Puzzle: Characterizing Risk and Developing Site-Specific Standards

13:30 - 13:45

L. FURTADO: Developing Site-Specific Water Quality Management Objectives for Persistent Organic Pollutants During Sediment Dredging and Dewatering

13:45 - 14:00

L. LEON: Consideration of Indigenous values and knowledge in risk assessment

PM SESSIONS

RISK ASSESSMENT & CHEMISTRY

ALEX 200 | 13:00 - 15:00

14:00 - 14:15

M. MONTEIRO FEITOSA: Environmental and human-health risks of As in tropical soils with abnormal arsenic levels in southeastern Brazil

14:15 - 14:30

A. SWEETT: The Development of a Diffusion-based Equilibrium Passive Sampler for PFAS Detection and Exposure Assessment in Sediment Pore Water and Surface Water

14:30 - 14:45

S. VAEZAFSHAR: Pesticides Concentrations in Canadian Low-Income Homes

14:45 - 15:00

E. ZVEREVA: Canadian Building Materials are a Significant Source of PFASs to the Environment

PM SESSIONS

LABORATORY TOXICOLOGY

ALEX 218 | 13:00 - 15:00

13:00 - 13:15

Q. ALLAMBY: Assessing accumulation and toxicity of environmentally relevant microplastics exposures in freshwater macroinvertebrates

13:15 - 13:30

E. BOWYER: nZVI in the field: remediating mine soils contaminated with a metal(loid) mixture

13:30 - 13:45

S. HANG: Acute Toxicity of 6PPD-quinone on Freshwater Mollusks

13:45 - 14:00

W. MARTIN: Comparison of the toxicity of six insecticides on survival and reproduction of Folsomia candida

PM SESSIONS

LABORATORY TOXICOLOGY

ALEX 218 | 13:00 - 15:00

14:00 - 14:15

N. NYKAMP: Effects of Rare Earth Elements on the Hypoxic Ventilatory Response in Fathead Minnows

14:15 - 14:30

J. SALOLE: Investigating the Risk 6PPD Quinone Poses to Freshwater Invertebrate Species in Southern Ontario

14:30 - 14:45

S. ST-HILAIRE: Assessing the Toxicity of Lead from Recreational Fishing Gear

14:45 - 15:00

T. VANDERYAGT: Toxic Effects of Rare Earth Elements Cerium, Europium, and Neodymium both as Single and Ternary Mixture Exposures on Tomato and Durum Wheat

POSTER PRESENTATIONS
SSC ATRIUM

E. DIESBOURG: Influence of Municipal Wastewaters on the Microbiome of Downstream Insects and Riparian Spiders from the Bow River, Alberta

T. DOW: Regional analysis of opioid consumption with wastewater-based epidemiology

R. HUBLEY: The effects of hypoxia on fathead minnow behaviour and glucose

E. HUNG: Understanding the impacts of multiple road-related contaminants on the Daphnia magna transcriptome

G. IZMA: Occurrence of urban-use pesticides in stormwater ponds and their bioconcentration in biofilms

A. JOLLY: Using Wastewater Epidemiology (WBE) to Identify Cancer Biomarkers Across Durham Region

Y. KUDLA: Fate of pristine microplastics in the early life stage of a freshwater mussel (unionidae)

POSTER PRESENTATIONS
SSC ATRIUM

V. KWAN: The Effects of Niclosamide on the Embryonic Development of Freshwater Snail *Planorbella pilsbryi* – A Preliminary Investigation

N. LETWIN: Investigating the Adverse Effects of Microplastics on Earthworms (*Eisenia fetida*)

V. LOOR: Using a Passive Dosing System to Assess the Toxicity of Individual Aromatic Compounds to Juvenile Intertidal Bivalves

S. MARTIN: The differential effect of neonicotinoids on mayfly species Neocloeon triangulifer and Hexagenia limbata to first instar nymphs

J. MASCARENHAS: Multi-organism toxicity assessment of carbene-based metal coating compounds

C. MUSGRAVES: Terrestrial isopods generate microplastics when exposed to weathered plastic fragments

M. RAMZAN: Understanding the effects of chronic metformin exposure on the adult zebrafish stress response

POSTER PRESENTATIONS
SSC ATRIUM

E. ROBSON: Happy as a clam? Abundance of microplastics in bivalves collected from an urban river

K. RONNENBERG: Proteomic profiles of kidney and liver tissues of rainbow trout (Oncorhynchus mykiss) exposed to low concentrations of waterborne nickel

J. SARAYA: Toward Incorporating 8-Thio 2'-deoxy-Adenosine in Functional Oligonucleotide Sequences

S. WOLK: Exposure of Young Children to SVOCs in sleeping Micro-Environment

CONFERENCE LOCATIONS

UNIVERSITY of GUELPH

AM Sessions: 'Omics Research

ALEX 218 | 11:00 to 11:45

Investigating the Effects of Per- and Poly-fluoroalkyl Substances (PFAS) on the Freshwater Gastropod (*Planorbella pilsbryi)* in Laboratory Utilizing a Proteomic Approach.

Almira Khan[1,2], Ève A.M. Gilroy[1], Maria Villella[1], Jeanne St-Laurent-Guérin[1,2], David W.G. McNabney[1], Denina B.D. Simmons[2], Adrienne Bartlett[1], Stacey Robinson[3]

[1]*Aquatic Contaminant Research Division, Water Science and Technology Directorate, Environment and Climate Change Canada, Burlington, ON, Canada*

[2]*Faculty of Science, Ontario Tech University, Oshawa, ON, Canada*

[3] *Wildlife Toxicology Health Division, Wildlife and Landscape Science Directorate, Environment and Climate Change, Ottawa, ON*

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Key Words: PFAS, PFOS, proteomics, toxicity

Per- and poly-fluoroalkyl substances (PFAS) are widely used in consumer and industrial applications including: non-stick cookware, personal care products, disposable food packaging, stain resistant coatings, and firefighting formulations. These compounds are notoriously environmentally persistent due to the chemical stability of their fluoro-carbon bonds. Specifically, perfluorooctanesulfonic acid (PFOS), an anthropogenic chemical that has been under scrutiny due to its known environmental persistence. PFAS can enter waterways and threaten aquatic life by potentially leading to bioaccumulation and exerting a broad range of toxic effects that can impair growth, development, reproduction, mobility, and survival. Thus, PFAS has become a global health concern worldwide.

The present study focuses on a 28-day chronic laboratory exposure investigating the effects of PFOS on freshwater snails (*Planorbella pilsbryi*). The toxicity endpoints assessed included survival, growth, and fertility. In addition, whole-snail tissues were analyzed using non-targeted proteomic analysis. Preliminary proteome results indicate that PFOS disrupts fertility, promotes acute lung injury, and is linked to carcinogenesis.

Currently, very little is known about the molecular effects of PFAS on freshwater snails in response to exposure. Understanding molecular-level responses in snails will help deduce the mechanisms behind whole-organism effects such as survival, growth, and development. This study will build upon the current knowledge of PFAS effects, and further explore which proteins are affected by PFOS exposure.

Assessing the toxicity of bisphenol A in the freshwater snail *Planorbella pilsbryi*: relating fitness components to metabolomic responses

David WG McNabney[1], Karyn B Robichaud[1], Maria Villella[1], Stacey A Robinson[2], Ève AM Gilroy[1]

[1] Aquatic Contaminants Research Division, Environment and Climate Change Canada, Burlington, ON.

[2] Ecotoxicology and Wildlife Health Division, Environment and Climate Change Canada, Ottawa, ON.

Presenter's email: david.mcnabney@ec.gc.ca

Keywords: bisphenol A, freshwater snails, endocrine disruption, metabolomics.

Bisphenol A (BPA) is a precursor to plastic polymers used in consumer products, including some food containers, food packaging, adhesives and paper coatings. Increasing concerns about its endocrine activity and leaching from plastics have led to the ban or market abandonment of BPA in the production of baby bottles and some reusable water bottles. However, BPA remains in use and alternative compounds with similar structures are being developed and used in consumer products, which could pose comparable health hazards.

In the present study, we assessed the toxicity of BPA and alternative compounds BPS, BPF, and BPAF in the freshwater snail, *Planorbella pilsbryi*. In preliminary research, we determined the relative toxicity of BPA and its alternatives to be BPAF > BPA > BPF > BPS. To follow up with these results, we conducted 28-d tests with adult snails to assess the chronic toxicity of BPA and BPAF. Exposure to BPA concentrations up to 1,000 µg/L did not have any effect on the survival and reproduction of adult snails, however we observed significant decreases in the hatching and viability of F1 embryos exposed at 100 and 1,000 µg/L. Although BPAF was more toxic than BPA, we did not observe similar impacts on F1 embryos.

We assessed the metabolomic responses of the snails after the 28-d chronic exposure to BPA using UHPLC coupled to LTQ Orbitrap mass spectrometry. Preliminary results from the metabolomic assessments indicate differences between the solvent control and highest concentration (1,000 µg/L). We identified potential biomarkers of BPA exposure that will help us identify affected biological pathways and relate the changes in observed fitness components (e.g. altered growth and reproduction, decreased embryo survival) to alterations in the metabolome. We plan to assess the metabolomic responses of the snails chronically exposed to BPAF to see if biomarkers of exposure are similar.

'Omics-based investigation of Namew (Lake Sturgeon, *Acipenser fulvescens*) health in an intact and an impacted watershed in the Moose River Basin

Keisha Deoraj[1], Jennifer Simard[2], Constance O'Connor[3], Claire E Farrell[3], Jacob Seguin[3], Denina Simmons[1]

[1]Aquatic Omics Lab, Ontario Tech University, Oshawa, ON
[2]Resource Protection, Moose Cree First Nation, Moose Factory, ON
[3]Ontario Northern Boreal Program, Wildlife Conservation Society Canada, Thunder Bay, ON

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Key Words: Lake Sturgeon, hydroelectric development, proteomics, metabolomics

Namew (nah-may-yo) (Lake Sturgeon, *Acipenser fulvescens*), a large, long-lived, benthivorous fish, are ecologically and culturally significant to many Indigenous communities. Historically, they were found throughout most of North America's Hudson Bay, St. Lawrence, and Mississippi drainage basins. Overexploitation and extensive habitat loss and alteration since the 1800s caused massive declines in Lake Sturgeon abundance over much of its range. The Moose Cree Homeland includes a diversity of rivers for namew, some of which are heavily impacted by hydroelectric development, forestry, mining, and other impacts, while others are free-flowing and without any development. Therefore, these internationally endangered fish face impacts and threats at varying levels of severity within the Moose Cree Homeland. The People of the Moose River Basin have compiled over a century of knowledge regarding the impacts of hydroelectric development and activity on Moose Cree Peoples, including declines in namew in some areas of the Moose Cree Homeland. Here, our collaborative team examined fine-scale measures of namew health and condition in the Mattagami River, which has been impacted by hydropower, forestry, and other industrial development, and the free-flowing and unimpacted North French River, both tributaries of the Moose River system. We measured proteins, lipids, and amino acids in namew blood plasma using liquid chromatography and non-targeted tandem high-resolution mass spectrometry paired with chemoinformatics and bioinformatics software. We present preliminary results from one sampling season, consider potential health implications for namew in these two river systems, and discuss the next steps of our research.

AM Sessions: Field Toxicology
ALEX 200 | 11:00 to 11:45

EFFECT OF SELENIUM ON ESTROGEN, SEROTONIN, AND GLUCOCORTICOID PATHWAYS IN THE PLACENTA

Zaineb Hamoodi[1], Janelle M Baker[2], Philippe J. Thomas[3], Alison C. Holloway[1]

[1] Department of Obstetrics and Gynecology, McMaster University, Hamilton, Ontario, Canada
[2] Department of Anthropology, Athabasca University, Athabasca, Alberta, Canada
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Key Words: selenium toxicity; placental dysfunction; trophoblast endocrine function.

People living near coal mines have raised concerns on how coal mining affects surrounding communities. Coal mining is a well-documented source of selenium emission, and while there is considerable evidence demonstrating adverse effects of excess selenium on reproductive outcomes in fish, selenium toxicity in mammals is less understood. Studies in humans showed a correlation between high levels of selenium and increased adverse pregnancy outcomes. Many of the observed adverse pregnancy outcomes can be mediated by aberrant placental development/dysfunction, including dysregulation of placental endocrine homeostasis. However, little is known about how excess selenium affects placental endocrine function, specifically estrogen, serotonin, and glucocorticoid homeostasis. The aim of this study was to determine how selenium toxicity affects estrogen, serotonin, and glucocorticoid homeostasis in the placenta.

HTR-8/SVneo cells (human first-trimester trophoblasts) were exposed to environmentally relevant concentrations of sodium selenite (NaSe) or selenomethionine (SeMe) for 24 or 48h. Steady-state mRNA expression of genes for estrogen (*CYP19A1*) and serotonin biosynthesis (*TPH1*), and genes involved in glucocorticoid homeostasis (*11βHSD1, 11βHSD2, GILZ, SGK1*) were measured.

Exposure to NaSe caused a significant increase in *CYP19A1* expression after 48h exposure, and *TPH1* expression after 24 and 48h exposure. There was an upregulation in *11βHSD2* after 24h exposure, which was resolved by 48h. While there were no changes in *11βHSD1* expression, an upregulation in *GILZ* and *SGK1* at 24 and 48h were also noted. Exposure to SeMe caused a significant increase in *SGK1* expression after 48h exposure, while expression of remaining targets was unchanged.

These data suggest that exposure to NaSe, but not SeMe, may perturb trophoblast endocrine function. Estrogens, serotonin, and glucocorticoids are important biomolecules needed for maintenance of pregnancy and placental/fetal development, and perturbations of these molecules increase the risk of poor pregnancy outcomes. Future work will determine if these gene changes reflect perturbations in trophoblast endocrine function.

An assessment of the toxicity of pesticide mixtures in periphyton from agricultural streams to the mayfly *Neocloeon triangulifer*

Moira M. Ijzerman[1], Melanie Raby[2], Gab B. Izma[3], Yaryna M. Kudla[1], Nicholas V. Letwin[1], Melanie J. Gallant[4], Stephanie R. Schiffer[4], Brian J. Atkinson[5], Rebecca C. Rooney[3], Paul K. Sibley[1], Ryan S. Prosser[1 *]

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[5] Laboratory Services Division, University of Guelph, Guelph, ON, Canada

Residual concentrations of pesticides are commonly found outside the intended area of application in Ontario's surface waters. Periphyton are a vital dietary component for grazing organisms in aquatic ecosystems but can also accumulate substantial levels of pesticides from the surrounding water. Consequently, grazing aquatic organisms are likely subjected to pesticide exposure through the consumption of pesticide contaminated periphyton. The objectives of this study were to determine if pesticides partition into periphyton in riverine environments across Southern Ontario, and if so, to determine the toxicity of pesticides in periphyton when fed to the grazing mayfly *Neocloeon triangulifer*. Ten sites across Southern Ontario were sampled between May and September 2021. Sites with low, medium, and high pesticide exposure based on historic water quality monitoring data were selected to incorporate a pesticide exposure gradient into the study design. Artificial substrate samplers were utilized to colonize periphyton *in situ*, which was then analyzed for the presence of ~500 pesticides. Results from this study demonstrate that periphyton is capable of accumulating pesticides in agricultural streams. A novel 7-day toxicity test method was created to investigate the effects of pesticides partitioned into periphyton when fed to *N. triangulifer*. Periphyton collected from the field sites were fed to *N. triangulifer* and survival and biomass production were recorded. Survival and biomass production significantly decreased when fed periphyton colonized in streams with catchments dominated by agricultural land use ($p<0.05$). However, the relationship between pesticide concentration and survival or biomass production was not consistent. Using field colonized periphyton allowed us to assess dietary toxicity of environmentally relevant concentrations of pesticide mixtures, however nutrition and taxonomic composition of the periphyton may vary between sites. We recommend future research to test priority pesticides exposures to periphyton in the laboratory prior to performing these novel dietary toxicity assessments.

Testing in situ benthic toxicity caging at surface waters receiving discharge of landfill-contaminated groundwater plumes

James W. Roy, Lee Grapentine

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Presenter E-mail: jim.roy@ec.gc.ca

Key words: field toxicology, benthic invertebrates, groundwater contamination

In situ toxicity testing with caged organisms is commonly applied to assess toxicity in surface waters but has rarely been applied to areas receiving discharge of contaminated groundwater. The objective of this research was to demonstrate and evaluate in situ caging for assessing the toxicity risk to benthic organisms from exposure to discharging groundwater plumes contaminated by historic landfill leachate. The caging tests (1-4 week deployments) were performed at one pond and one stream site, with toxicity metrics including organism survival and growth for an amphipod (*Hyalella azteca*; both sites) and midge larvae (*Chironomus riparius*; stream site only). Different cage designs and orientations (horizontal, vertical, mix of both) were examined. Key findings include that the vertical cages showed a greater response to groundwater contaminants and conditions than horizontal cages, while a new design (mix of both) worked well in its first and only test. Also, organism survival (both species) provided a clearer metric of groundwater contaminant toxicity than did organism growth. Observations on potentially problematic or confounding site conditions, and helpful tips, will also be shared. This type of in situ toxicity cage testing holds promise for providing additional field-based information for aquatic ecosystem toxicity assessments at groundwater-contamination sites.

PM Sessions: Risk Assessment & Chemistry
ALEX 200 | 13:00 to 15:00

PFAS IN CANADIAN MUNICIPAL WASTEWATER TREATMENT SYSTEMS: RESULTS FROM 12 YEARS OF MONITORING BY ENVIRONMENT AND CLIMATE CHANGE CANADA

Sarah B. Gewurtz[1], Steven Teslic[1], Alexandra S. Auyeung[1], Shirley Anne Smyth[1]

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Key Words: wastewater, biosolids, per- and polyfluoroalkyl substances, trace contaminants

Environment and Climate Change Canada's (ECCC) wastewater monitoring program was initiated in 2008 to monitor concentrations of chemical substances in wastewater systems as potential environmental exposure pathways in support of risk assessment and risk management activities. We have collected samples from over 80 wastewater treatment plants (WWTPs) across Canada which have been analyzed for a multitude of substances including per- and polyfluoroalkyl substances (PFAS). The objectives of this study were to evaluate the fate of PFAS through the liquid and solids trains of typical treatment process types used in Canada, and to assess time trends of PFAS in wastewater influent, effluent, and biosolids between 2009 and 2021.

PFAS were consistently detected in wastewater influent, effluent, and biosolids at WWTPs across Canada. Recently collected (2018 to 2021) data indicate both negative and positive removals of PFAS. Negative removals are attributable to transformation of unmeasured PFAS precursors during wastewater treatment.

Concentrations of short-chain PFAS in wastewater influent and effluent showed consistent significant increases between 2009 and 2021. Such increasing patterns reflect the use of short-chain PFAS as replacements for phased-out and regulated longer-chained PFAS. Short-chain PFAS were not consistently detected in biosolids. Concentrations of consistently detected long-chain PFAS such as perfluorooctanoate (PFOA) and perfluorononanoate (PFNA) generally decreased over time in influent, effluent, and biosolids, which is attributable to industrial phase-outs and regulations. Interestingly, concentrations of perfluorooctanesulfonate (PFOS) increased significantly in influent and did not change over time in effluent and biosolids.

Our results show that regulatory action and industrial phase-outs of PFOS are slow to be reflected in wastewater media, perhaps due in part to the continued presence of this substance in household products. These data will be useful as a baseline as the Government of Canada moves forward to address the broad class of PFAS.

A PFAS Puzzle: Characterizing Risk and Developing Site-Specific Standards

Nicole Gauvreau, M.Sc. and Darren Foubister, M.Sc, P.Biol.

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Key Words: Risk Assessment, PFAS, site condition standards.

A risk assessment (RA) is a tool that can be used for the assessment and management of environmental contamination caused by historical or current activities at a Site. Under Ontario Regulation 153/04, the Ministry of Environment, Conservation and Parks (MECP) has developed Site Condition Standard (SCS) for > 120 substances representing background conditions and/or considered protective of human or ecological health. Under the RA process, the MECP requires that all Contaminants of Concern (COCs) found at a site be evaluated, and that Property Specific Standards (PSS) be developed for each COC which is protective of both human and ecological health. Yet, how do you evaluate risk and develop PSS for substances with no Ministry backed standards? This is the case for Per- and Polyfluoroalkyl Substances (PFAS) contamination found at a site requiring a Record of Site Condition (RSC). PFAS are a group of > 4700 human-made substances containing linked carbon and fluorine atoms which are found in many everyday items. With increasing awareness and concern regarding PFAS contamination due to its toxicity, persistence and mobility in the environment, recent years have seen advancements in analytical technologies and research on human and ecological health effects that have prompted several proposed regulatory guidelines and interim recommendations from provincial, federal and international governs, especially in the last six months. However, most guidance and focus are on protecting public drinking water systems. The challenge becomes two-fold: this Ontario Site receives municipally sourced drinking water, so the recently proposed criteria are not all directly relevant, and limited information is available for most of the PFAS present. In a case study example, we discuss the ‘guidance’ for assessing PFAS in Ontario and the challenges of using a “New Science” approach for conducting a RA under O. Reg. 153/04 with various PFAS detected in soil and groundwater.

Developing Site-Specific Water Quality Management Objectives for Persistent Organic Pollutants During Sediment Dredging and Dewatering

Lindsay Furtado, MSc, RPBio

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Key Words: site-specific water quality management objectives, remediation, persistent organic pollutants

For persistent organic pollutants (POPs), environmental management is often based on sediment quality rather than water quality given their low water solubilities. However, little is known about the environmental fate and toxicity of POPs released from sediment following disturbances, and therefore, there is minimal precedence on how to manage water quality during remediation of sediment. Based on a case study with dioxins and furans (PCDD/F), we outline how site-specific water quality management objectives (WQMOs) can be derived for implementation during sediment dredging and dewatering activities. Using findings from the literature, site-specific data [Dredging Elutriate Test (DRET)], and three-phase partitioning modelling, we demonstrate how WQMOs based on total suspended solid (TSS) thresholds can also protect against unacceptable exposures to aquatic life from PCDD/Fs released into the water column during dredging and dewatering. Further, we demonstrate how turbidity can be used as a surrogate for TSS and PCDD/F exposures, where turbidity monitoring can be conducted on a “real-time” (i.e., operational) basis with an in-situ field meter without costs or delay associated with laboratory analysis and turnaround time. Overall, the study demonstrates how the management of TSS during sediment disturbance will result in minimal influence of aqueous-phase PCDD/Fs, improving the feasibility of sediment remediation both on an operational and cost-basis.

CONSIDERATION OF INDIGENOUS VALUES AND KNOWLEDGE IN RISK ASSESSMENT

Leah Leon[1], Stacey Fernandes[1], Harriet Phillips[1]
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Key Words: Risk assessment, Indigenous, holistic, exposure

Human Health and Ecological Risk assessment (HHERA) plays a very important role in confirming whether or not chemical contaminants identified at a site exceed toxicity-based exposure limits and therefore have the potential to produce health effects in people or ecological receptors. While HHERA estimates whether carcinogenic or non-carcinogenic toxicity-based thresholds might be exceeded in certain exposure scenarios, it is very important to understand that HHERA cannot provide direct information on individual or community health and wellbeing, especially with respect to Indigenous values and customs. For example, chemical emissions in a specific region can result in communities avoiding that area, resulting in less hunting, cultural/spiritual activities, and time on the land. An inability to move freely on traditional territories undermines key determinants of health. If these ecosystem services cannot be adequately remediated, reclaimed, or restored, the overall wellbeing of the community may be affected.

Furthermore, HHERAs that consider Indigenous communities must reflect the local community and site-specific considerations. For example, the frequency and consumption rates of country foods can vary widely depending on the geographical location, species available, and traditional values of a community. Without obtaining site specific consumption rates and baseline parameter concentrations, risk assessments must rely on generic rates and the available literature may not reflect the consumption rates of certain traditional foods.

This presentation will discuss the limitations of the western science approach and provides some suggestions for the consideration of health in the risk assessment framework in a more holistic manner. It will also provide some examples of HHERAs we have completed using direct input from local Indigenous communities.

Environmental and human-health risks of As in tropical soils with abnormal arsenic levels in southeastern Brazil

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Key Words: Arsenic bioaccessibility, Risk assessment, Environmental pollution

Concerns about arsenic (As) exposure via ingestion of water and food are frequent, yet little is known about the behavior of As in irrigated agricultural soils in Brazil. The municipality of Paracatu (Brazil) is known for its large irrigated agricultural area and for its soils naturally rich in As. This work evaluated environmental and human-health risks of As in agricultural tropical soils cultivated under irrigation and in soils under native vegetation in Paracatu, State of Minas Gerais, southeastern Brazil. Soil (different depths) samples were collected in 2 irrigated agricultural areas (A1 and A2) and 2 reference areas (R1 and R2). Total soil-As did not differ between soil depths, reinforcing that the source of As in agricultural soils is natural. In this study, PERI (potential ecological risk index) values ranged from 0.66 to 46.15. Our findings revealed that irrigated soils have low ecological risks, except for A1, in which PERI was moderate in the first layers. There is no noncarcinogenic risk for the local population, except for children in R1, which had a value of 3.16 in the superficial layer (0–5 cm). The values of non-cancerous HI for adults and children ranged from 0.10-0.65 and 0.47-3.16, respectively. The estimated carcinogenic risk for children followed the order R1 > A1 > A2 > R2, and for adults, R1 > A1. Total As concentrations found in soil, except for R1, are below Brazilian regulatory levels for agricultural use, which are based on environmental and human-health risks. However, periodic monitoring of As bioavailability in these areas is recommended. The next step of this study is to perform in vitro As oral bioaccessibility tests on these soils in this region for a better understanding of the risks to human health.

The Development of a Diffusion-based Equilibrium Passive Sampler for PFAS Detection and Exposure Assessment in Sediment Pore Water and Surface Water

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Anh Pham, Blessing Medon (University of Waterloo);
Florent Risacher, Lisa D'Agostino, Rachel Zajac-Fay, Jason Conder (Geosyntec Consultants); Jeremy Gauthier, Scott Mabury (University of Toronto);
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Per-and Polyfluoroalkyl Substances (PFAS) have emerged as a concern in the environment due to their persistence, bioaccumulation in living organisms, and toxicity. The established sampling protocols and PFAS concentration determination in sediment and surface water currently only captures the total concentration at a single timepoint and represents the entire mass of PFAS present, which may result in an overestimation of the bioavailable PFAS exposure to human and ecological receptors. Equilibrium passive sampling is a popular approach used to assess bioavailability and risk through the dissolved phase of contaminants but as PFAS are emerging contaminants, researchers have only started investigating potential passive sampling solutions. Given their partial water-solubility and the ability of analytical laboratories to detect trace amounts of PFAS in water, a diffusion-based equilibrium passive sampler was hypothesized to be a good passive sampling device candidate. When deployed, analytes dissolved in the water or sediment equilibrate with the water in the sampler through the semi-permeable membrane. The results of several lab-scale experiments suggested that a polycarbonate membrane-based sampler did not influence the PFAS uptake, PFAS were not lost to sorption or was not produced from sampler materials and that this sampler could be used to monitor multiple PFAS compounds.

The laboratory validated sampler was further tested in an *in-situ* field pilot to measure PFAS in sediment porewater and surface water. Targeted analytical results (Modified EPA 537, EPA 1633) were successful and suggested that equilibrium was reached in 14 days for surface water, an average 75% equilibrium for all target compounds detected in porewater after 28 days and were all within a factor of 2 or less with averaged grab sample results. Future experiments include direct comparison with tissue samples to further validate the relationship between passive sampling results and exposure, risk and bioaccumulation.

Pesticides Concentrations in Canadian Low-Income Homes

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Keywords: current use and legacy pesticides, indoor air, low socio-economic status, social housing

Human exposure to indoor pesticides is a concern due to adverse health impacts, particularly in vulnerable marginalized and racialized populations. Residents of social housing with low socioeconomic status (SES) are a vulnerable population since they live in low-quality housing (e.g., structural deficiencies, poor maintenance). Of concern are pesticides used in residential environments, especially low-quality social housing, to control pests, also use on pets, emissions from treated consumer products and building materials, and intrusion from outdoor. Since pesticide exposure poses health risks, many countries have restricted use of some organochlorine and organophosphorus pesticides entirely. Currently, pyrethroids and pyrethrins are used in domestic applications worldwide.

We investigated the concentrations of legacy and current pesticides in the indoor air of in social housing apartments. During winter 2017, we used portable air cleaners with high-efficiency filters to sample indoor particulate matter from 46 apartments in seven multi-unit residential buildings with low SES. These buildings were constructed in Toronto, during the 1970s, before DDT and heptachlor registrations were revoked. We also estimated equivalent total air concentrations of detected pesticides.

At least one pesticide was detected in 89% of samples, including both current and legacy pesticides. We found detection frequencies of up to 50% for some legacy organochlorine and organophosphorus pesticides prohibited for residential use. The highest estimated total air concentrations were for the heptachlor and lindane, supporting observations of long-term indoor persistence. Current use pesticides, pyrethroids, had the highest detection frequencies and particle-phase concentrations (e.g., pyrethrin-I). Five pesticide concentrations associated with tobacco production were significantly higher in residents reporting smoking activity (chlorothalonil, permethrin, pyrethrin I, pyriproxyfen, and pendimethalin). We noted that pesticide profiles were similar in units of a particular building (e.g., permethrin with DF>70% in some buildings). These results reinforce the need for integrated pest control programs to reduce the use of indoor pesticides.

Canadian Building Materials are a Significant Source of PFASs to the Environment

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Key Words: Per- and polyfluoroalkyl substances, building materials, side-chain fluorinated polymers

Cities are significant sources of per- and polyfluoroalkyl substances (PFASs) to the environment, e.g., through stormwater runoff and atmospheric releases. We hypothesized that building materials and products, used to reduce deterioration due to weather, are likely sources of PFASs to the environment. To test this hypothesis, three categories of outdoor products sold on the Canadian market, namely outdoor textiles, paints and sealants, were collected and analyzed by a variety of approaches, covering ^{19}F nuclear magnetic resonance (^{19}F NMR), liquid chromatography with tandem mass spectrometry (LC-MS/MS) and gas chromatography mass spectrometry (GC-MS). ^{19}F NMR results showed that the organic fluorine in these products mainly consisted of five types of PFASs: non-polymers with an aromatic-CF3 group, non-polymeric 6:2 fluorotelomers (FTs), and side-chain fluorinated polymers derived from 6:2 FTs, 8:2 FTs, and perfluorobutane sulfonyl fluoride (PBSF). LC-MS/MS results showed the dominance of three non-polymeric 6:2 FTs, including two 6:2 FT phosphate esters (PAPs) and one polyfluoroalkyl pyrophosphate, in paints and sealants containing mainly non-polymeric 6:2 FTs. These three compounds constituted 23–61% of the total organic fluorine, indicating the presence of additional unidentified 6:2 FTs. Weathering experiments, involving exposure to UV radiation in a chamber, showed that two textiles with PBSF-derived side-chain fluorinated polymers, one paint with non-polymeric 6:2 FTs, and one sealant containing 6:2 FT side-chain fluorinated polymers all released short-chain PFASs. These results support the hypothesis that outdoor textiles, paints and sealants are significant sources of short-chain mobile PFASs to the environment.

PM Sessions: Laboratory Toxicology
ALEX 218 | 13:00 to 15:00

Assessing accumulation and toxicity of environmentally relevant microplastics exposures in freshwater macroinvertebrates

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Key Words: freshwater, microplastics, macroinvertebrates

Microplastics (MPs) pollution has quickly become one of the most pressing environmental issues to date. However, freshwater macroinvertebrates are vastly underrepresented within the current MPs literature, despite their extensive use in aquatic biomonitoring. Therefore, this study aimed to address this gap through ecologically realistic exposures using freshwater macroinvertebrates. For the experiments, three macroinvertebrate species, *Tubifex tubifex*, *Planorbella pilsbryi*, and larval *Hexagenia* spp., and two MPs types, polystyrene microbeads (6µm) and polyester microfibers (100µm), were used. For each species, four tests were conducted: pristine microbead and microfiber exposures, and "aged" microbead and microfiber exposures, across a range of concentrations. MPs "aging" was incorporated into this experiment to replicate the microbial attachment and biofilm formation on MPs within the environment. To assess toxicity, reproduction and survival were measured across all tests following MPs exposure. To date, no significant effects to reproduction or mortality have been observed for any of the three species, or for either type of MPs, aged or pristine. However, preliminary results suggests that organisms are ingesting MPs, with large amounts of MPs present in feces. Bioaccumulation analysis is currently underway. This study will provide new insights regarding the potential impacts of MPs to freshwater macroinvertebrates to determine the risks of implications of MPs contamination in freshwater ecosystems.

nZVI in the field: remediating mine soils contaminated with a metal(loid) mixture

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Key Words: soil remediation, metal(loid)s, nZVI, phytotoxicity

Globally, metal(loid)s released from industrial and anthropogenic processes are causing enrichment in surface soils potentially leading to harmful concentrations. Nano zerovalent iron (nZVI) is frequently used to reduce toxicity of organic compounds in groundwater and is being investigated for the same functions in soils. There is a lack of understanding regarding the effectiveness of nZVI on aged soils contaminated in the field with a mixture of many metals. The current study compares the effectiveness of 5% nZVI and 0% nZVI in remediating 16 soils with varying characteristics collected from the decommissioned Deloro Gold Mine, including contamination with trace elements – especially As but also Co, Cr, Cu, Ni and Pb in concentrations greater than regulatory guidelines. The control soil used was collected from the Elora Research Station. The objectives of this research are to determine how nZVI alters the soil including physicochemical properties and metal(loid) availability as well as assess how nZVI alters the plant's response to the soil including growth and uptake of metal(loid)s. The expected outcome that nZVI would reduce the extractable metals was true in some (As, Co) but not all cases (Cr, Cu, Ni, Pb). Growth indices (shoot length and root length) were determined for barley (*Hordeum vulgare* L.) and tomato (*Solanum lycopersicum* L.) after a 14-day and 21-day growth study respectively. The results showed little change in shoot length and an increase in root length in the 5% nZVI treatment. Each soil physicochemical property of the soils tested was affected by nZVI where the greatest change was in soil pH, decreasing with 5% nZVI. The results indicate that 5% nZVI may be able to aid in the remediation of field soils contaminated with a metal mixture.

Acute Toxicity of 6PPD-quinone on Freshwater Mollusks

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Keywords: 6PPD Quinone, Toxicity, Mollusks

Tire wear particles have been identified as an emerging contaminant within recent years with one chemical, 6PPD-quinone, being of great interest. Also known as N-(1,3-dimethylbutyl)-N′-phenyl-p-phenylenediamine, this antioxidant is used to prevent ozone from degrading rubber compounds in tires and other rubber products. Studies have shown that 6PPD-quinone has acute toxicity on coho salmon at extremely low concentrations and is the cause of mortality events on the West Coast of the United States. Other studies have generated toxicity data for this chemical, but is limited to fish species. The goal of current research was to fill this gap in our knowledge on toxicity to aquatic invertebrates. In this study, acute toxicity tests were conducted on *Planorbella pilsibyri* (file ramshorn snail) embryos and adult *Megalonias nervousa* (washboard mussel). Snail egg masses were exposed to 32.5, 75, 150 and 300 µg/L of 6PPD-quinone for 24 hours and mortality was measured over 10 days. Adult washboard mussels were exposed to 125, 250 and 500 ug/L for 24 hours and observed daily over a period of 8 days for mortality, and then kept under observation for 4 months post-acute testing to determine any chronic toxicity effects. Road runoff was also sampled during rainstorm events across Guelph, Ontario and analyzed for 6PPD-quinone content. No mortalities occurred during either the acute or chronic toxicity tests. However, measured concentrations were 1-2 orders of magnitude lower than nominal concentrations, with the highest concentrations in the embryo and mussel tests being 11.7 and 17.9 µg/L, respectively. These NOAEC values are higher than the highest concentration of 0.198 µg/L of 6PPD-quinone measured in environmental samples. These results suggest that freshwater mollusks have a lower sensitivity to 6PPD-quinone than some other species and would not be affected by reported concentrations in the environment.

Comparison of the toxicity of six insecticides on survival and reproduction of *Folsomia candida*

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Key Words: Springtails, insecticides, neonicotinoids, soil ecotoxicology

Neonicotinoid insecticides have been among the most widely and abundantly used insecticides worldwide for the last 20 years. The impact of these substances on non-target terrestrial and aquatic organisms has been well documented and has resulted in a significant decrease in their use in many parts of the world. In response, the application of several novel classes of insecticides including diamides, ketoenols, pyridines, and butenolides has significantly increased. The Collembola are a hexapod subclass that is ecologically significant and widely distributed that includes many species found in leaf litter and in surficial soils. In this study, the soil dwelling parthenogenic collembolan species Folsomia candida was exposed to six insecticides in a sandy loam soil for 28 days. The insecticides studied include two neonicotinoids (thiamethoxam, clothianidin) and four novel insecticides: a diamide (cyantraniliprole), a ketoenol (spirotetramat), a pyridine (flonicamid), and a butanolide (flupyradifurone). The purpose of these six tests was to assess the effect of each insecticide on survival and reproduction in the test species. Clothianidin, thiamethoxam, and cyantraniliprole were found to have a greater effect on survival and reproduction of F. candida than flupyradifurone, spirotetramat, and flonicamid. All significant impacts observed in this study were observed at concentrations below concentrations of the active ingredients that would be expected in agricultural soils.

Effects of Rare Earth Elements on the Hypoxic Ventilatory Response in Fathead Minnows

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Key Words: neodymium, hypoxia

There is a lack of research and understanding regarding the effects of rare earth elements on the hypoxic ventilatory response of aquatic animals. Toxicity testing with rare earth elements is essential at this time due to their growth in the low-carbon economy. Hypoxic conditions, such as in the hypolimnion (cold bottom waters) of lakes, results in a normal physiological hyperventilation response so that fish can maintain adequate oxygen uptake. This study examined the effect of the rare earth element neodymium on the fathead minnow *(Pimephales promelas)* hypoxic ventilatory response. Using a recirculating water system and individual fish chambers, the ventilatory rate was recorded under different conditions of normoxia, hypoxia, and neodymium. Fish exposed to 836 µg/L neodymium showed a 17% decrease and 31% decrease in ventilation rates under normoxic and hypoxic (40% dissolved oxygen) conditions, respectively, in comparison to control groups. This blunting of ventilation during hypoxic conditions can ultimately have lethal effects on the fish due to the deficient oxygen uptake. The gill tissues of the neodymium group were digested to measure concentrations of neodymium. Results showed negligible levels of neodymium accumulation. This data provides evidence that neodymium exposure causes a blunt in the the hypoxic ventilatory response of fathead minnows and can contribute to the development of Water Quality Guidelines pertaining to neodymium in aquatic ecosystems.

Investigating the Risk 6PPD Quinone Poses to Freshwater Invertebrate Species in Southern Ontario

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Keywords: runoff, USMS, Risk assessment

Tire wear particles are a common source of microplastic pollution to surface waters. 6PPD quinone [N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine-quinone] is a chemical found in tire wear particles that has recently been recognized as the cause of urban runoff mortality syndrome. This phenomenon results in the mass mortality of coho salmon in urban watersheds. As 6PPD quinone has since been detected in several waterbodies at sufficient levels to cause these effects, assessing the toxicity and exposure to other species is an important step in determining the risk this compound may pose to aquatic ecosystems. In this study, D. magna and hexagenia species were exposed to 6PPD quinone for 21-d and 96-h exposures, respectively. Road runoff samples were also collected around Guelph, Ontario to assess potential exposure to aquatic ecosystems in southern Ontario. Neither species showed any sign of toxicity at relatively high concentrations of 6PPD quinone (55 µg/L and 306 µg/L, respectively). The concentration of 6PPD quinone in road runoff in the Guelph area ranged from 0.0603 to 0.262 µg/L, which is considerably lower than concentrations reported in the literature. The relatively low exposure measured in road runoff around Guelph combined with the relatively low toxicity of the two test invertebrate species indicates that 6PPD quinone likely poses a low risk to freshwater invertebrate populations.

Assessing the Toxicity of Lead from Recreational Fishing Gear

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Key Words: lead, *Daphnia magna*, recreational fishing gear, fish

Lead (Pb) is a highly toxic element with no known biological function. The loss of Pb sinkers and jigs due to recreational fishing poses a health risk to aquatic ecosystems. Although the toxicity of Pb salts is well studied, the toxicity of Pb from fishing gear remains unknown. Water, sediment, and fish tissue (brown bullhead (*Ameiurus nebulosus*), yellow perch (*Perca flavescens*), and walleye (*Sander itreus*) were collected from highly fished sites in Ontario along the Bay of Quinte and Hamilton Harbour. Sediment samples exceeded the Canadian Sediment Quality Guidelines by three-fold and muscle Pb concentrations of yellow perch and walleye exceeded Tissue Residue Guidelines for Consumption by two-fold, on average. Environmental water samples did not exceed the Canadian Water Quality Guidelines for Pb. Lab toxicity tests examined effects of solutions made by spinning Pb sinkers in water at different concentrations, temperatures, and time periods. Concentrations of Pb in lab solutions exceeded Water Quality Guidelines by over 20-fold, however temperature and depuration time of sinkers had no effect on the dissolved concentration of Pb. Acute 48 h toxicity tests were completed using NaCl (LC50 = 5.2 g/L (C.I. 3.4-7.7)) and $Pb(NO_3)_2$ (LC50 = 482 µg/L (C.I.116-2616)) to assess health of *D. magna* and compare LC50 values with previous studies, respectively. Pb from sinkers was not acutely toxic to *D. magna* as concentrations did not exceed predicted 48 h LC50 values. Future research should investigate the chronic toxicity of Pb from fishing gear to assess effects on growth and reproduction to *D. magna*. Isotope analysis would be beneficial to determine the source of Pb in environmental samples. Understanding the toxicity of Pb from fishing gear is crucial for the protection of aquatic biota.

Toxic Effects of Rare Earth Elements Cerium, Europium, and Neodymium both as Single and Ternary Mixture Exposures on Tomato and Durum Wheat

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Keywords*:* rare earth elements, phytotoxicity, soil, mixture interactions

Rare earth elements (REEs) are increasingly important in today's technologies due to their unique physicochemical properties. They co-occur naturally in mineral deposits of varying concentrations, with bioaccessibility dependent on soil factors such as pH and organic matter. At high concentrations in soils, some REEs have been shown to be toxic to plants. However, at low concentrations, plant growth may be stimulated. For singular exposures toxicity has been determined for some REEs but quantitative understanding of mixture ecotoxicity and interactions of REEs is limited, especially higher-order mixtures in Canadian soils. Given the potential for extractive mining of REEs in Canada's north, this is an important knowledge gap to be filled. Thus, the current study determined toxic effect concentrations for tomato and durum wheat for three REEs, Cerium, Neodymium, and Europium, using an Ontario loam soil. Three singular and one ternary mixture exposure of increasing concentrations were used. Singular thresholds revealed Ce as the most toxic element, with all REE thresholds (EC10) ranging from 23- 596 mg/kg^{-1} based on total soil concentrations. Internal tissue concentrations were more similar between all three REEs and may serve as a better predictor of toxicity compared to external exposures. Endpoint responses to ternary mixture exposures were mostly antagonistic or additive depending on plant specie and concentration descriptors (ie. Internal vs external dose). Environmental protection from these REEs could be achieved using single-metal toxicity thresholds, but lack of research assessments continues to prevent the establishment of risk assessment guidelines.

POSTERS

Influence of Municipal Wastewaters on the Microbiome of Downstream Insects and Riparian Spiders from the Bow River, Alberta

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Key Words: Microbiome, Municipal wastewater effluent, Emerging contaminants, Dysbiosis

The host microbiome is vital to the health of a host as it aids in nutrient acquisition and protects against pathogens. Freshwater ecosystems receive nutrients, bacteria, and pharmaceuticals from municipal wastewater treatment plants (WWTPs) that can potentially alter the normal composition of these essential microorganisms, resulting in dysbiosis. Aquatic insects are integral components of food webs, providing critical energy linkages across the aquatic-terrestrial boundary; however, this linkage may expose riparian predators to aquatic-derived contaminants. Our study examined the effects of effluents from three WWTPs on the microbiome of downstream macroinvertebrates in the Bow River, AB, across two timepoints in 2022, and whether these effects are then transferred to riparian spiders via emerging insects. Whole-body bacterial genomic DNA was extracted from macroinvertebrates and spiders for sequencing of the V3-V4 hypervariable region of the 16S rRNA gene. The use of wastewater derived nutrients by macroinvertebrates and spiders was examined through variations in whole-body stable carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotope values. Further, we assessed how WWTP effluents might alter animal-mediated nutrient recycling rates. Preliminary results indicate that microbiome communities were dissimilar between most collection sites and invertebrate families; however, there were no spatial changes in the relative abundance of major bacterial phyla, nor alpha diversity of most macroinvertebrates and spider microbiomes. Common effluent-associated bacteria were found in most invertebrates, although the relative abundance and types varied across sites. While $\delta^{15}N$ values were enriched in most organisms collected at one of two effluent exposed sites, there was little effect of wastewater effluents on animal-mediated nutrient recycling rates. Overall, our study demonstrated that among-site differences in host microbiomes were mainly unrelated to point sources of effluents and this translated into few site-specific effects on nutrient cycling in this reach of the Bow River.

REGIONAL ANALYSIS OF OPIOID CONSUMPTION WITH WASTEWATER-BASED EPIDEMIOLOGY

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Key Words: opioids, wastewater, epidemiology, LC-QToF

The opioid crisis, intensified by the COVID-19 pandemic, continues to be identified as a leading health concern in Canada, with Ontario witnessing a 60% increase in opioid-related deaths in 2020 compared to 2019. Preliminary 2021 data suggests a continuation of this upward trend. The Region of Durham specifically is experiencing a rise in opioid-related fatalities, with 130 deaths in 2021. The crisis demands urgent attention, and acquiring relevant information on opioid use is crucial for developing effective harm-reduction strategies.

Traditional data analysis methods rely on clinical overdose data and are often expensive, cumbersome, and subject to biases. Conversely, municipal wastewater contains valuable information, making it an essential, cost-effective strategy for public health monitoring and forensic applications. The study of public health information in wastewater is termed wastewater-based epidemiology (WBE). Municipal wastewater contains numerous parent compounds and metabolites excreted by individuals after consuming licit and illicit substances. By pairing established metabolic pathways for illicit compounds with data on wastewater flow, biomarker concentrations can estimate collective drug consumption. WBE's main advantage is its objectivity and suitability for near real-time consumption pattern estimates.

We propose a novel approach to explore WBE's utility in detecting and quantifying opioids and associated metabolites at multiple spatial scales within the Durham region. Our aim is to develop and validate a reliable method for detecting and quantifying a suite of opioids and their major metabolites in wastewater using LC-HR-MS/MS. By identifying spatial patterns, temporal trends, and consumption estimates, our research will offer valuable information on the region's opioid usage. This information can guide targeted interventions, resource allocation, and policy decisions to address the opioid crisis. By leveraging WBE, our study aspires to significantly contribute to the development of more effective harm reduction strategies and mitigate the opioid epidemic's devastating impact on communities.

THE EFFECTS OF HYPOXIA ON FATHEAD MINNOW BEHAVIOUR AND GLUCOSE

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Key Words: Hypoxia, Fathead minnow, Tank location activity, Foraging behaviour

Behaviour is a useful parameter for monitoring the health of vertebrates in the context of environmental changes. Behavioural monitoring is non-invasive and could be utilised as a refinement for fish studies in both the lab and field environments. Dissolved oxygen 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 determine the effect of hypoxia on Fathead minnow (*Pimephales promelas*) behaviour. We exposed 60 Fathead minnows to hypoxic (2.10-2.80 mg/mL DO) and normoxic (5.80-7.00 mg/mL DO) conditions over a 7-day period. Fish were video recorded on days 1, 3, 5, and 7. Three blind observers analysed 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 and also measured blood glucose. Mucus filtrate, retentate, blood plasma, and brain samples were flash frozen and stored under -80 ℃ for future proteomic and metabolomic analysis. Behavioural data was analysed using RStudio. We found that hypoxia altered Fathead minnow activity levels over the course of the 7-day treatment. Fish behaviour and blood glucose data will be presented.

Understanding the impacts of multiple road-related contaminants on the *Daphnia magna* transcriptome

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Key Words: ecotoxicology, multi-stressor, daphnia, gene expression

Toxicity experiments are informative tools to understand biological responses of organisms to anthropogenic contaminants. Anthropogenic contaminants such as salt, polycyclic aromatic hydrocarbons (PAHs), tire wear particles, and heavy metals are associated with roads, and enter aquatic ecosystems as runoff during rainfall or snow melt events. This mixture of contaminants can interfere with the physiological processes of organisms, such as gene expression, which can lead to effects at higher levels of biological organization (i.e., ecosystems). Although a significant amount of research has been conducted on individual anthropogenic contaminants, assessing the impact of these contaminants in combination has not been well studied. *Daphnia magna* are an ideal organism to investigate genomic responses to multiple stressors because of their frequent use in standard toxicity tests and ecological relevance to the Laurentian Great Lakes. In addition, the *Daphnia magna* genome has been extensively characterized allowing for robust transcriptomic analysis. The purpose of this project was to investigate the effects of a combination of road-related contaminants on the survival and gene expression of *Daphnia magna*. Daphnia were exposed to fifteen combinations of salt, copper, tire wear particle leachate, and pyrene as part of a two-day, acute toxicity test. Surviving organisms from this test were subsequently preserved to extract RNA from and perform transcriptome analysis. Preliminary analysis shows that different combinations of stressors have varying impacts on daphnia survival and that any concentration of copper killed the organisms. Overall, this project will help us to better understand how multiple stressors interact with each other to impact aquatic biota, bring environmental relevance into toxicity tests, and ultimately provide protection and monitoring of aquatic systems in the Laurentian Great Lakes.

Occurrence of urban-use pesticides in stormwater ponds and their bioconcentration in biofilms

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Key Words: stormwater, pesticides, biofilms, bioconcentration

Urban-use pesticides have widespread occurrences in Ontario's surface waters, however little is known about their presence in urban stormwater ponds. Biofilms are known to bioconcentrate a wide range of aquatic contaminants, paradoxically providing water purification services while concurrently posing a potential toxic threat to the food web. Thus, sampling biofilms may be a useful and biologically relevant tool for characterizing pesticide contamination and toxicity in freshwater ecosystems. Here, we aimed to illustrate pesticide incidences in a heavily urbanized stormwater system and quantify their bioconcentration in biofilm. We surveyed 21 stormwater management ponds (SMPs) in Brampton, Ontario, situated across a gradient of urbanization. We deployed artificial substrates for nine weeks in each pond to grow and harvest biofilm. We submitted time-integrated composite water and biofilm samples for analysis of ~500 current-use and legacy pesticides. Thirty-two pesticide compounds were detected across both substrates, with 2,4-D, MCPA, mecoprop, azoxystrobin, bentazon, triclopyr, and diuron having near-ubiquitous occurrences. Herbicides and insecticides were more likely to be detected in water samples, whereas fungicides and other biocides were more likely to be detected in biofilm samples. Several compounds unique to urban environments, such as melamine and nicotine, were only detected in biofilm samples. Overall, 56% of analytes detected in biofilm samples were not found in water samples, signifying a critical flaw in traditional pesticide monitoring techniques, as even when contaminants are below detectable levels in water, biota may still be exposed via dietary pathways. Calculated bioconcentration factors ranged from 4.2 - 1275, supporting our prediction that monitoring biofilms provides a sensitive supplement to water sampling for pesticide quantification. Further research is needed to investigate if this accumulation poses a toxic risk to biofilm consumers and whether pesticide bioconcentration in SMPs represents a route through which contaminants are mobilized into the surrounding terrestrial and downstream aquatic environments.

Using Wastewater Epidemiology (WBE) to Identify Cancer Biomarkers Across Durham Region

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Key Words: wastewater, epidemiology, cancer biomarkers

H. pylori infections are known to increase the risk of gastric carcinoma. While the risk factors for the disease include poor hygiene, crowded living conditions and nonfiltered water, many individuals with the bacteria may not present with any symptoms. Gastric carcinoma presents poor early-stage detection. Most individuals are often diagnosed under the advanced stage, with a poor prognosis (less than a 15% chance of 5-year survival). For these reasons, there is a need for practical, sensitive hallmarks of gastric carcinoma to improve clinical outcomes. Human waste contains versatile parent compounds and metabolites. Analyzing municipal wastewater can assist in identifying biomarkers of diseases like cancer and monitor trends and spread. This study utilized LC-MS/MS to identify gastric cancer biomarkers in influent wastewater across Durham Region, over four weeks, as an attempt to validate wastewater-based epidemiology (WBE) as an effective public health surveillance tool. The detected proteins were categorized into three proteomes: human, H. pylori and human cancer. Across the Durham region, 249 proteins were detected in the human proteome, out of which 38 proteins were identified to hold a connection to cancer and related processes. Finally, 21 proteins were identified in the H. pylori proteome. The integration of epidemiological data, not limited to hospital records or population surveys, is encouraged to facilitate a more comprehensive understanding of the population's health status. Utilizing WBE to monitor public health in combination with diagnostic testing tools may assist public health officials and healthcare professionals in improving the detection and treatment of diseases such as cancer and more.

FATE OF PRISTINE MICROPLASTICS IN THE EARLY LIFE STAGE OF A FRESHWATER MUSSEL (UNIONIDAE)

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Key words: unionid, microplastics, freshwater

Plastic debris polluting our waterways has been a concern for decades. Recently increased attention has been placed on microplastics (MPs) in aquatic ecosystems. These small plastic particles (<5 mm) have been observed in marine and freshwater ecosystems globally. To date, freshwater studies have focused on the presence and/or concentration of MPs in surface waters. To assess their risk, there is a need to compare environmental concentrations of MPs to concentrations that cause adverse effects. Freshwater mussels are a group of filter-feeding organisms that have experienced a decline due to habitat destruction and poor water quality, and they are under-represented in MPs research. A sub-chronic 28-day exposure test followed by a 7-day depuration period was conducted with ~2 cm juvenile *Lampsilis siliquoidea* (fatmucket mussel). Tests were performed with a range of polymers, which are commonly used in toxicity studies and typically found in environmental samples such as wastewater effluent. Algal food stocks were spiked with microplastics, with treatment concentrations ranging from 100 – 300,000 MP/L. Mortality was monitored throughout the entire test, and burial assays were run every 7 days following full static water changes. Ingestion of MPs was determined by whole tissue digestion of individual mussels. Tissues from the depuration stage were compared to non-depurated mussels to assess whether juveniles have the potential to eliminate MPs within a 7-day period. Less than 10% mortality observed, and burial ability was not affected with any MP type as concentrations increased. Mussels were found to efficiently depurate microplastics ingested after 7 days, especially at the highest concentrations tested. However, mussels were not able to fully expel all microplastics ingested during the exposure period after 7 days. Such findings will inform the risk assessment of MPs to freshwater biota, specifically mollusks which can be sensitive to certain contaminants.

The Effects of Niclosamide on the Embryonic Development of Freshwater Snail *Planorbella pilsbryi* – A Preliminary Investigation

Vesta Kwan, Ryan Prosser

Niclosamide on its own or as an adjuvant to 3-trifluoromethyl- 4-nitrophenol (TFM) has been used as an effective lampricide in the Great Lakes basin for the past 60 years. It is also a potent molluscicide used to control snail vectors of schistosomiasis. Gastropods are widespread in freshwater ecosystems and play critical roles as primary consumers, however, their limited motility and greater ecological sensitivity make them vulnerable to environmental changes. File ramshorn snails (*Planorbella pilsbryi)* are native and widespread across Canada and the Great Lakes Basin and may be vulnerable to niclosamide application. Thus, the objective of this study was to examine the effect of niclosamide on ramshorn snail *Planorbella pilsbryi* embryos, which were exposed to test solutions (5.9, 11.8, 16.5, 23.6, 25.3, 58.9 µg/L) for 48h. Percent mortality and failure to hatch were recorded over 10 days through stereomicroscope imaging and live counting. The 48-h LC50 for *P. pilsbryi* embryos exposed to niclosamide was 33.73 µg/L (±1.09, CI: 31.59-35.87) and the 48-h EC50 for failure to hatch was 33.18 µg/L (±1.11, CI: 31.01-35.35). These values suggest cause for concern as niclosamide concentrations used for sea lamprey treatments range from 30 µg/L to 50 µg/L, thus niclosamide application may be a potential environmental hazard. Few studies have investigated niclosamide toxicity to non-target organisms following lampricide application, and toxicity studies utilising embryonic endpoints in freshwater gastropods are also scarce.

Investigating the Adverse Effects of Microplastics on Earthworms (*Eisenia fetida*)

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Earthworms are soil invertebrates that are critical to the health and function of soil ecosystems. Unfortunately, they are extremely sensitive to minor changes in soil structure. Due to their persistence in the environment, microplastics (<5mm diameter) are an emerging topic of concern to soil ecosystems. To date, the effects of microplastics on earthworm communities are inconsistent, so further research is needed. In this study, a 56-day earthworm toxicity test was performed according to ISO 11268-2 guidelines using *Eisenia fetida* (red wigglers). Worms were introduced to artificial soil that had been spiked with different concentrations of fluorescent 6-µm polystyrene microbeads (10,000 particles/kg – 50,000,000 particles/kg). Each test vessel was monitored for 28 days before all the adult worms were removed and assessed for changes in their survival and body mass. The test vessels were then monitored a further 28 days to assess reproduction via the number of juveniles and cocoons per test vessel. Results of this study showed that there was no significant change in the body mass or survival of *E. fetida* adults following a 28-day exposure. Furthermore, this study showed that there was no significant difference in the number of juveniles or cocoons that were produced among the test concentration. Future work for this study will include testing different types and sizes of microplastics, including 45-µm polyethylene beads, 100-µm polyethylene beads, 20-µm polyester fibres, 100-µm polyester fibres and 45-µm polypropylene fragments.

Using a Passive Dosing System to Assess the Toxicity of Individual Aromatic Compounds to Juvenile Intertidal Bivalves

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The Nathan E. Stewart sank on the central coast of British Columbia resulting in 110,000 L of marine diesel oil (MDO) and other on-board petroleum products to spill into waters within Haíłzaqv (Heiltsuk) First Nation territory. The shellfish populations of this area have not recovered since the spill, which has highlighted our limited understanding of the effects of oil products on marine bivalves. Understanding the biological effects of individual aromatic compounds (ACs) can allow for the modelling of the overall effects of MDO and other oil products on important bivalves. This present study investigated the acute toxicity of 3 ACs on juvenile Manila clams (*Venerupis philippinarum)* and Pacific Oysters (*Crassostrea gigas*) using a passive dosing test design over a 7-day exposure period. The ACs examined covered mono- and polycyclic classes and a range of log octanol-water partition coefficient values (Kow; 2.9-4.5). PDMS O-rings were used to partition ACs into artificial seawater and deliver uniform exposures. The test design consisted of three nominal exposure concentrations for each AC relative to their respective sub-cooled water solubilities, and the analytically confirmed exposures were used for the analysis of time-dependent median lethal/effect concentration (L/EC50) values. The control and exposed species were monitored every 24 h for survival. Of the ACs investigated, 1-methylnaphthalene (1-MN) and styrene (STY) had significant effects on the survival of *V. philippinarum* and *C. gigas* over the 7-day period, while phenanthrene (PHE) resulted in greater mortality in *V. philippinarum* than *C. gigas.* The results contribute to future time-dependent toxicity tests with individual aromatic compounds of different classes and log Kow values and to developing models for predicting oil spill environmental impacts to intertidal bivalves and similar coastal marine life.

The differential effect of neonicotinoids on mayfly species *Neocloeon triangulifer* and *Hexagenia limbata* to first instar nymphs

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KEY WORDS: pesticide, benthic invertebrates, ecotoxicology

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Insecticides are an important tool in the management of pests that could reduce productivity in agriculture. Though popular and widely used, the potential variation in effect of insecticides on different species and life stages of aquatic invertebrates remains ill-defined. To examine the risk that insecticides may pose to aquatic invertebrate communities, it is important to identify the most sensitive species and most sensitive life stage of those species. In this study, the newly hatched larvae of two species from the order Ephemeroptera were studied to investigate the difference in sensitivity to neonicotinoid insecticides and insecticides identified as potential replacements of neonicotinoids. *Neocloeon triangulifer* and *Hexagenia* sp. (mixture of *H. rigida* and *H. limbata*) were exposed to thiamethoxam, flupyradifurone, or clothianidin in a *Navicula* sp. diatom slurry for 96 hours. Test species were exposed to five different concentrations of each pesticide and mortalities were monitored daily. Greater mortality was observed in *Neocloeon triangulifer* compared to *Hexagenia limbata* when exposed to flupyradifurone. Additionally, *Neocloeon triangulifer* mortalities occurred much earlier in the study duration, resulting in almost no survivals in the two highest flupyradifurone concentrations by hour 72. The results of this study provides important insight on the variation in sensitivity among species of aquatic insects and between insecticides, which is essential for a protective risk assessment.

Multi-organism toxicity assessment of carbene-based metal coating compounds

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Key words: corrosion, zebrafish, carbene, planaria, toxicology

Metals are extensively used in our society due to their unique physical and chemical properties. Developing effective anti-corrosion strategies and technologies is essential for reducing costs, conserving resources, and ensuring the longevity and safety of metal structures in various fields. Reducing corrosion not only has economic benefits but also environmental and public health benefits. Coating metals with *N*-heterocyclic carbene (NHC) as a glue between them and a top coat can provide a protective barrier against corrosion by limiting the interaction between metals and oxygen. NHCs are highly reactive organic compounds which can bind to a variety of metals. Like many other chemicals, NHCs can end up in aquatic ecosystems through various pathways, such as wastewater effluent and runoff, among others. To ensure a safe-by-design approach, the Carbon to Metal Coating Institute studies ecotoxicity of candidate NHCs on aquatic organisms. The present study investigates the toxicity of a novel *N*-heterocyclic carbene (NHC) in several aquatic species, such as zebrafish (*Danio rerio*), daphnia (*Daphnia magna*) and brown flatworms (*Dugesia dorotochephala*). Work in zebrafish embryos following exposure to 1-10,000 µg/ml NHC from 1-8 cell-stage to 120 hours post-fertilization (hpf) suggests that higher concentrations lead to increased mortality and lower heart rates in embryos at 48 hours post-fertilization (hpf). In flatworms, exposure to the same concentrations of NHC over 96 h led to mortality by 24 hours of exposure in the highest concentration. Future work will explore the effects of NHC on daphnia, following USE EPA pre-established toxicity and life-cycle studies. In addition, this work will further explore the impacts of different NHCs on several species-specific endpoints, such as long-term development and growth in zebrafish, life-cycle assessment in Daphnia and regeneration abilities and behavioural effects in flatworms. Ultimately, this work will lead to a better understanding of the ecotoxicity of NHCs on multiple species.

Terrestrial isopods generate microplastics when exposed to weathered plastic fragments

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With concern growing regarding the potential impact of microplastics in terrestrial ecosystems, it is vital to assess the role invertebrates may play in the fate of microplastics within these ecosystems. Microplastics commonly enter these environments through improperly discarded waste or the application of biosolids on agricultural soils. Invertebrates such as isopods play an important role in terrestrial ecosystems by breaking down waste and unlocking nutrients for plants and other organisms. This study investigated whether 3 species of isopods (*Porcellio scaber, Porcellio laevis,* and *Porcellionides* pruinosus) would attempt to feed on plastic and generate microplastics. Treatment vessels were designed to expose mature isopods to plastic fragments weathered in soil. The size and number of microplastics generated by isopods was monitored over a 2-week duration. Isopods were sampled after 1, 3, 7, and 14 days of exposure. Isopods exposed to the weathered plastics generated microplastics with no adverse health effects or mortality observed. Results of the study show all 3 isopod species combined cumulatively generated more than 6,400 microplastic fragments after a 14-day exposure to the macroplastic.

Understanding the effects of chronic metformin exposure on the adult zebrafish stress response

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Key Words: Glucose, Cortisol, Lactate, Male, Female

Metformin (Met) is commonly prescribed in the management of type-2-diabetes mellitus. Met increases the body's sensitivity to glucose by impacting energy producing pathways in the mitochondria, leading to increased glucose utilization and decreased glucose production in the body. Recent studies in fish have shown that Met impacts the steroidogenic pathways, although the mechanisms behind such effects remain unknown. This study aimed to understand the impact of Met on the stress physiology of adult zebrafish, following a 30-day exposure. We hypothesized that chronic Met exposure would result in altered stress response in a sex-specific manner. The objectives of this study were (1) to investigate the impact of chronic 30-day Met exposure on muscle, cortisol, lactate, and glucose profiles of zebrafish following an acute stressor and (2) determine whether these effects were male or female-specific. Healthy adult zebrafish (n= 15 male and 15 females per tank) were exposed to 0, 4, and 40µg/L Met for 30-days in controlled laboratory conditions, in triplicate. After the 30-day exposure, zebrafish were stressed for 3 minutes by chasing with a net, following established protocols. Muscle was collected at 0h (pre-stress), 1h, and 6h post-stress. There was no effect of Met or stress on muscle lactate levels, irrespective of sex. However, Met had a sex-specific effect in muscle glucose, with levels remaining elevated in males exposed to Met. There was no effect of Met on muscle glucose in females and no effect on muscle cortisol levels in male or female fish. Based on the current findings, chronic Met exposure appears to have sex-specific effects on male muscle glucose mobilization in zebrafish, with transient effects in females. Therefore, future research focusing on sex-specific effects of Met is warranted. In addition, multigenerational studies exploring paternal and maternal effects should be conducted, exploring both reproductive and developmental processes in offspring.

Happy as a clam? Abundance of microplastics in bivalves collected from an urban river

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Key Words: microplastics, freshwater, bivalves, wastewater

Microplastics (MPs) monitoring in aquatic organisms is critical to understand exposures and potential risks of these emerging contaminants in freshwater ecosystems. MPs enter aquatic environments through many sources, including wastewater treatment plants (WWTPs), but their uptake by aquatic organisms is poorly understood. Freshwater bivalves accumulate multiple contaminants, making them potential indicators for MP pollution. This study aims to understand the abundance and characteristics of MPs that accumulate in wild bivalves. Samples were collected upstream and downstream of 3 municipal WWTPs and at 2 reference sites along the Grand River (Ontario) in 2021. At each site, fingernail clams (*Sphaeriidae*, n=5 composite samples), flutedshell mussels (*Lasmigona costata*, n=10), and surface water (n=3) were sampled and MPs quantified. Results show that fibers are the dominant morphology across samples, but colours vary among sites and sample types. Additionally, the abundance of MPs varies significantly across sites; although no significant difference between upstream and downstream sites was observed at any WWTPs. To assess suitability as an effective bioindicator for MPs, the abundance and type of particles in bivalves will be compared between species and to environmental levels observed in water samples. This study will guide future monitoring and toxicity studies to fully assess the risk of MPs to vulnerable freshwater bivalves and other aquatic organisms.

Proteomic profiles of kidney and liver tissues of rainbow trout (*Oncorhynchus mykiss*) exposed to low concentrations of waterborne nickel

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Key Words: proteomics, nickel, kidney, liver

The nickel rich ore of the Ontario Ring of Fire in Northern Ontario is presumed to be a lucrative mining site. It is crucial to understand environmentally relevant concentrations of metals that can negatively affect wildlife prior to the commencement of mining efforts. We examined changes in protein profiles of kidney and liver tissues of rainbow trout using untargeted proteomics to study the impacts of low concentration nickel (1 - 46 ppb). Findings suggest that the organs' proteomes showed fewer significant protein changes compared to non-lethal and non-invasive sampling types, like mucus and plasma collection with regard to nickel toxicity. The proteome of the kidney as compared to the liver was more significantly affected by low dose nickel. Additionally, preliminary findings suggest that proteins involved in the regulation of biological and cellular processes were impacted and that the kidney proteome of rainbow trout is sensitive to low concentrations of nickel.

Toward Incorporating 8-Thio 2'-deoxy-Adenosine in Functional Oligonucleotide Sequences

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Key Words: oligonucleotides, biotechnology

Hydrogen bonding patterns drive the structure and topology of DNA and RNA. In addition to being information carriers, DNA and RNA have shown capability for other functions like molecular recognition and catalyzing chemical reactions. Nucleic acids consist of a furanose ring (2´-deoxyribose for DNA, ribose for RNA), a nucleobase (pyrimidines and purines), and a phosphodiester backbone. Canonically, the nucleobase is in an *anti*-configuration with respect to the sugar ring. Nucleobase modifications may disrupt this conformation and cause a rotation of the glycosidic bond to a *syn*-confirmation. These modifications are well documented in purines, whereby modifications at the C8 positions result in *anti*- to *syn*-conformational changes. The addition of a simple thiol to this position provides a means to alter the conformation, in addition to changing hydrogen bonding of the nucleobase. We seek to use this modification to modulate nucleic acid structure and function, as it should be possible to selectively remove the thiol functionality, thus restoring the canonical nucleobase. This work focuses on the incorporation of thiol modifications to the 8-position of 2´-deoxyadenosine as a novel biotechnological tool.

Exposure of Young Children to SVOCs in sleeping Micro-Environment

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Key Words: SVOCs, Sleeping environment, Children

Young Children (aged less than four years) spend up to 15 hours in their sleeping micro-environments (SME), which are comprised of their mattress, blankets, stuffed animals, and other items in the child's immediate vicinity. Children are likely to be exposed to semi-Volatile Organic Compounds (SVOCs) in these environments. Routes of exposure include dermal transfer and inhalation, as children spend time with their skin and airways exposed to the SME.

We employed passive silicone rubber samplers to investigate the concentrations of four classes of SVOCs in newly purchased mattresses. Target compounds consisted of organophosphate esters (n=28), phthalates (n=8), benzophenones (n=3), and salicylates (n=5). Organophosphate esters and phthalates are used as plasticizers, some organophosphate esters are used as flame retardants, and benzophenones and salicylates serve as UV blockers. Mattresses were sampled under different treatments (n=8) with n=3 replicates and n=8 different mattresses. Additional samples of the foam and covers were taken from each mattress and extracted. These direct product samples were analyzed using GC-MS, to be compared to the passive silicone sampler data. Extracts of the passive samplers were analyzed with GC-MS.

We found that every new mattress sampled had salicylates and phthalates. At least one target compound was detected in every mattress. Dominant compounds included phenyl salicylate, which was detected in seven of the eight mattresses. Hexyl salicylate was detected in five mattresses, di-isobutyl phthalate (DIBP) was detected in four mattresses, and ethylhexyl diphenyl phosphate (EDHPP) was detected in four mattresses. Additional data will be presented on detection frequencies of all target compounds in each mattress and mapping of the product foam and cover samples to the passive sampler data.

Evidence from this study strongly supports that the SME serves as a route for SVOC exposure.