Toxic metals and invasive species: what is going on in the Maritimes?

Research in the Dynamic Environment & Ecosystem Health Research laboratory (2021-22)

Saint Mary's University SCIENCE

Our research group website: http://www.smu.ca/LM_Campbell

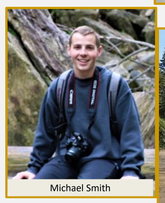
The DEEHR Group

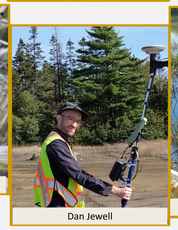

Dr. Emily Chapman


Heidi Gavel

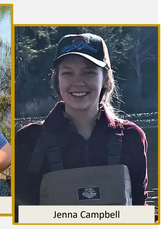

David Lewis


Dr. Dr. Branaavan Sivarajah


Michael Smith

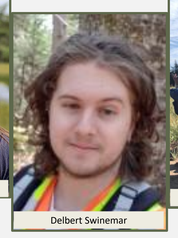

Dan Jewell


Lauren Gaudet


Jenna Campbell

We are currently recruiting!

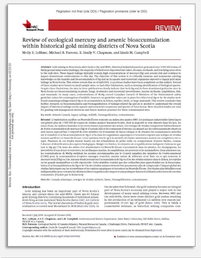

Kaylee MacLeod

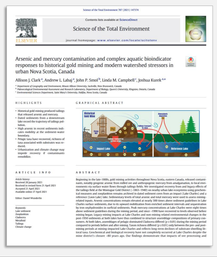

Delbert Swinemar


Erin Francheville


Bradley Knockwood

Some of our recent publications


Review of ecological mercury and arsenic bioaccumulation within historical gold mining districts of Nova Scotia


Arsenic and mercury contamination and complex aquatic bioindicator responses to historical gold mining and modern watershed stressors in urban Nova Scotia, Canada


A review of the non-indigenous Chinese mystery snail, *Cipangopaludina chinensis* (Viviparidae), in North America, with emphasis on occurrence in Canada and the potential impact on indigenous aquatic species


Evaluation of a nanoscale zero-valent iron amendment as a potential tool to reduce mobility, toxicity, and bioaccumulation of arsenic and mercury from wetland sediments

Funding & Collaborations

NSERC CRSNG

Nova Scotia

Clean Nova Scotia — Inspiring environmental change

Natural Resources Canada

Nature Canada

Mitacs

Atlantic Gold — A St Barbara Ltd Company

Fisheries and Oceans Canada

Pêches et Océans Canada

Mount Allison University

Coastal Action

Canada 1842 Geological Survey – Commission géologique

Parks Canada / Parcs Canada

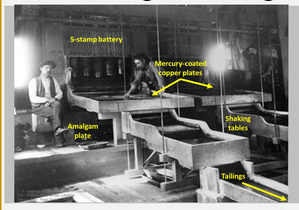
New Brunswick Museum / Musée du Nouveau-Brunswick

Canadian Light Source / Centre canadien de rayonnement synchrotron

University of Regina

Impacts, risks & remediation of contaminated legacy gold mine tailings in wetland ecosystems.

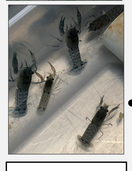
- Dr. Emily Chapman, Heidi Gavel, David Lewis, Dan Jewell, Michael Smith, Jenna Campbell, Lauren Gaudet (& others!) with Atlantic Mining NS, NS Lands Inc, & many collaborators & funders.
- Nova Scotia has a history of gold ore amalgamation between 1860s and 1940s, with 3 million tonnes of mercury (Hg)- and arsenic (As)-contaminated tailings slurried into freshwater.
- Contaminated tailings are located by over 300 freshwater wetlands within 64 gold mining districts and are still unquantified 150 years later.



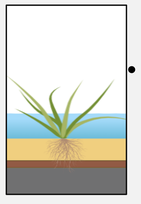
- We are approaching this environmental issue using a triad approach to better understand risks and potential solutions.

- **Ecological effects**: Assessing bioaccumulation and biodiversity of plants, invertebrates, amphibians, spruces, lichen and other living species. We are confirming that Hg and As consistently accumulate to very elevated concentrations in many species.

- **Locating and identifying tailing sites:** We use GIS and spatial databases to map ecological effects in relation to tailing sites, and to identify potential tailing sites using remote sensing and satellite datasets.



- **Geochemistry and mobility:** We are using various sampling and analytical techniques to assess speciation, redox and potential toxicity of As and Hg in field and lab.
- **Ecotoxicity of effects**: Conducting laboratory and field tests using survival, stress, and reproductive indicators. Toxic responses are confirmed and can be severe.

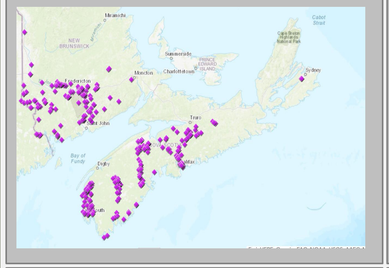


- **Reactive Amendment Protective Capping (RAPC):** R&D and testing for a thin-layer application to support and enhance recovery of impacted wetlands. We have completed Phase 1, and will start Phase 2 this summer.

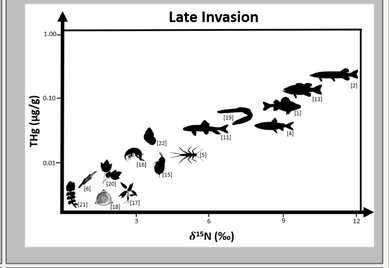
The Chain Pickerel Project: impacts of invasive species on lake ecosystems.

- Delbert Swinemar, Kaylee MacLeod & Erin Francheville, with NS Fisheries & Aquaculture, DFO (Species at Risk & Aquatic Invasive Species), Parks Canada & Coastal Action Foundation.
- Chain pickerel (*Esox niger*) is a widely-introduced invasive species in Nova Scotia and New Brunswick. It is an aggressive ambush predator and is linked with severe declines in native fish, invertebrate and amphibian populations.
- We are looking at how chain pickerel are becoming integrated into and impacting other vulnerable aquatic species, including Kejimkujik NPHS, the LaHave River system, Cape Breton, and Lake Utopia, NB.
- Our projects span a gradient of lakes from few chain pickerel to heavily populated as well as using temporal analyses with pre-invasion / early-invasion datasets.
- We are also examining spatial patterns, mercury trends, and use of scales for aging & elemental analyses.

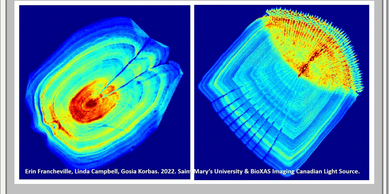
The Atlantic Canada Chain Pickerel Database Project. Swinemar, Knockwood & Campbell. 2021. https://bit.ly/chainpickerelmap



Conceptual model of mercury biomagnification in food webs, using $\delta^{15}N$ for trophic level (based on literature reviews). MacLeod, LeBlanc & Campbell. 2021.



BioXAS Imaging of Mn distribution in chain pickerel (L) & white perch (R) scales (20-µm). Francheville, Korbas & Campbell. 2022.



An example of our public outreach materials about freshwater fish food webs. Campbell, 2014.