

## Item 8.3.1

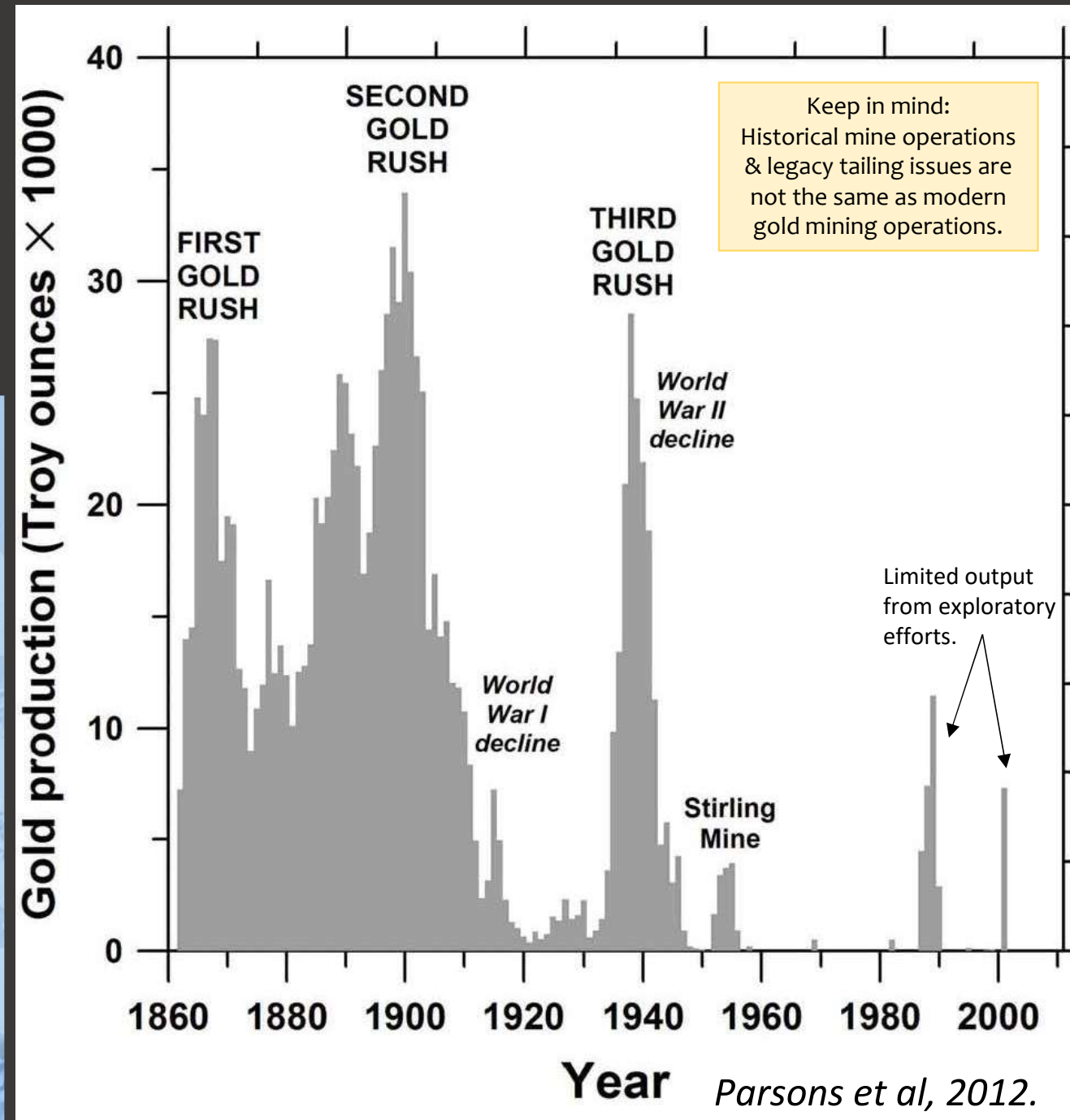
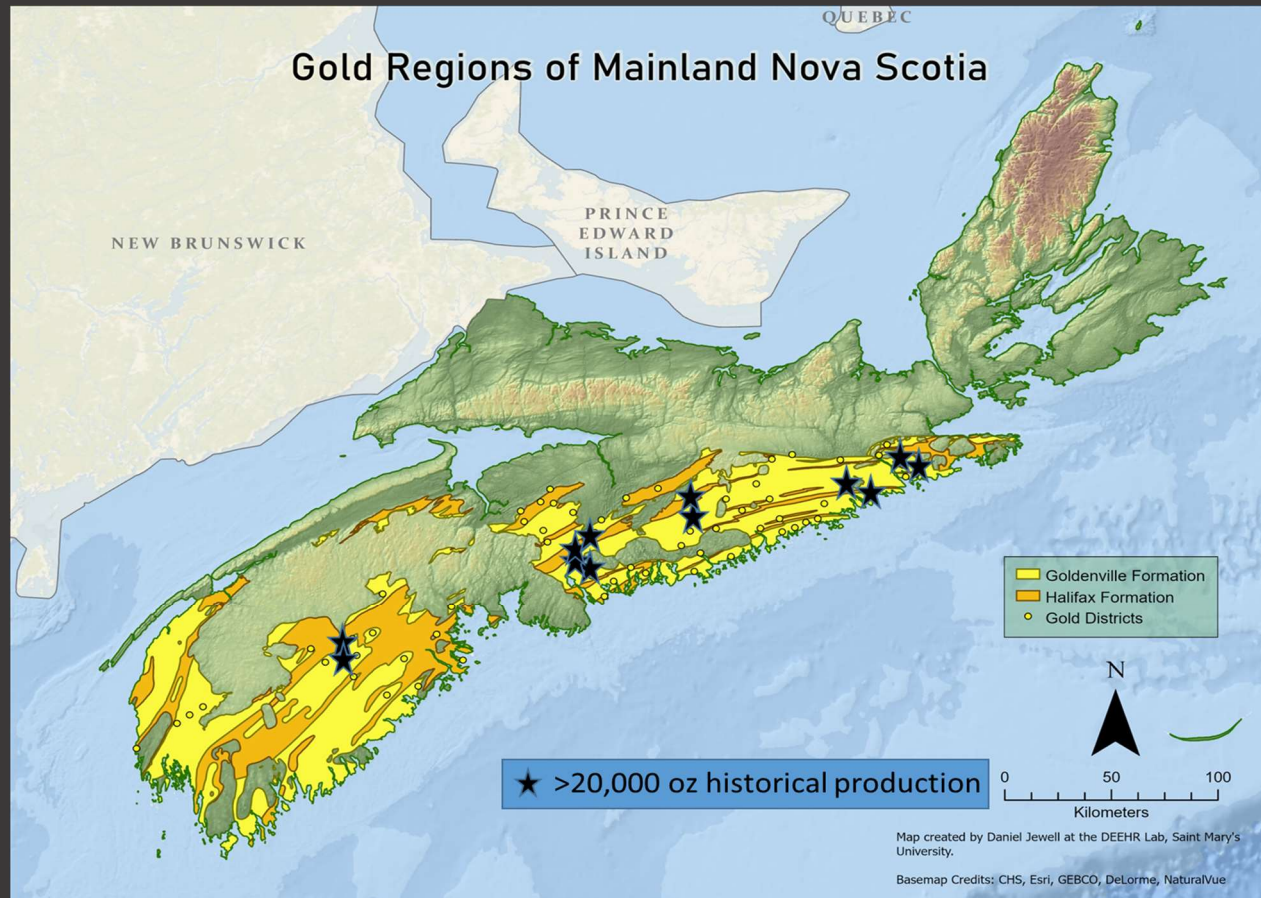
Uncovering long-term impacts of historical gold mining practices **in modern HRM lakes** through sediment analyses  
*Josh Kurek & Linda Campbell*

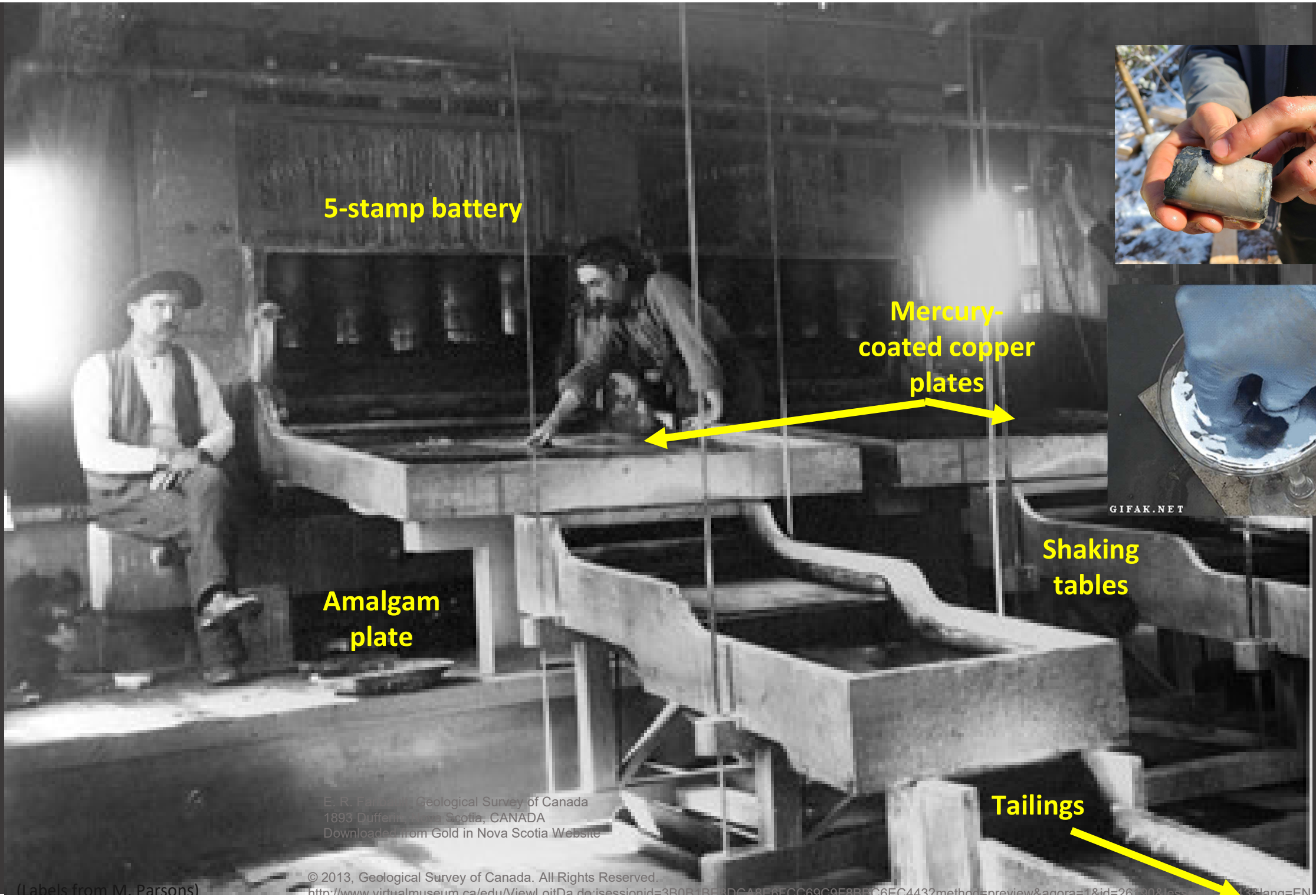


<http://www.ap.smu.ca/~lcampbel/Gold.html>  
<https://www.ecablab.com/media>

# Gold rush history in Nova Scotia by the numbers

- 3 historical Gold Rushes in Nova Scotia.
- 64 Gold mining districts, >360 mines counted to date.
- *Reported* 1.2 million troy ounces of gold from 3 million tonnes of crushed rock.





**5-stamp battery**

**Mercury-coated copper plates**



**Shaking tables**

**Amalgam plate**

**Tailings**

E. R. Fairbridge, Geological Survey of Canada  
1893 Dufferin Mine, Scotia, CANADA  
Downloaded from Gold in Nova Scotia Website

# Historical gold mine tailing sites & wetlands go together.



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<http://www.virtualmuseum.ca/edu/ViewLoitDa.do?sessionId=3B0B1BE8DCA8E6FCC69C9F8BBC6EC443?method=preview&agora=1&id=26190&lessonId=1043&lang=EN>



Stamp mill engine house and shaft house, Mooseland Gold Mining Co., 1897.  
Historical Photograph by E. R. Faribault. Geological Survey of Canada Photo #5297.



# The problem of legacy tailings in Nova Scotia wetlands today

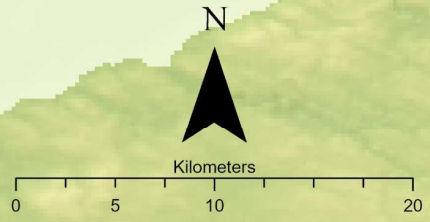
Over **300 wetland areas** in 64 abandoned gold mining districts potentially impacted.

- many of these with extremely elevated sediment concentrations of Hg and As .
- Very limited data available on impacts.

## Knowledge gaps:

- *Where are the tailings? Need delineation data (area/depth/volume)*
- *Characterization of human health/ecological risks.*
- *Is this legacy contamination impacting wetland functions?*
- *Are impacted wetland areas sources of contaminants in downstream environments?*
- *What wetlands should be prioritized for risk management and how should this be done?*

# Historic Gold Mine Districts in the Shubenacadie Watershed



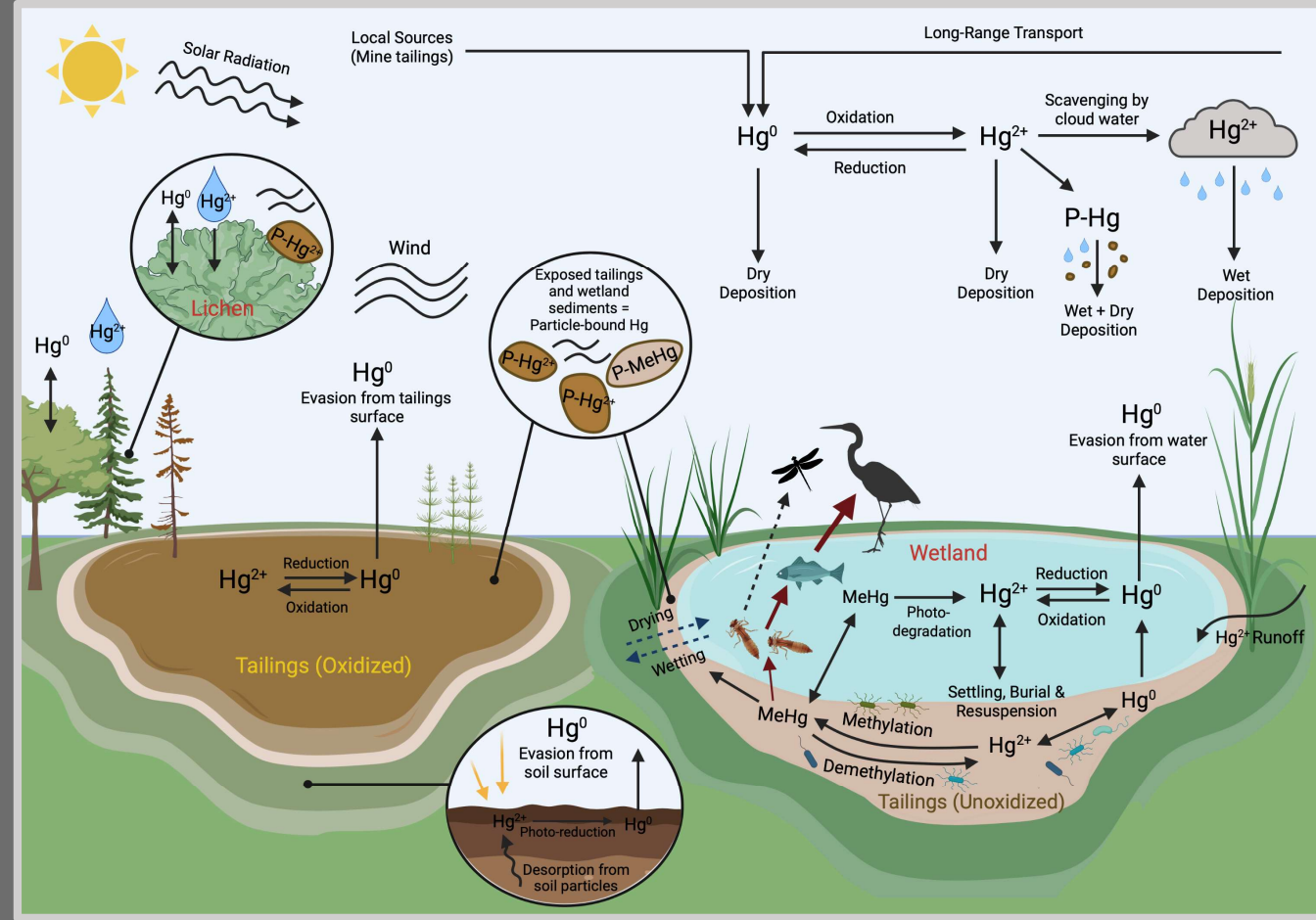
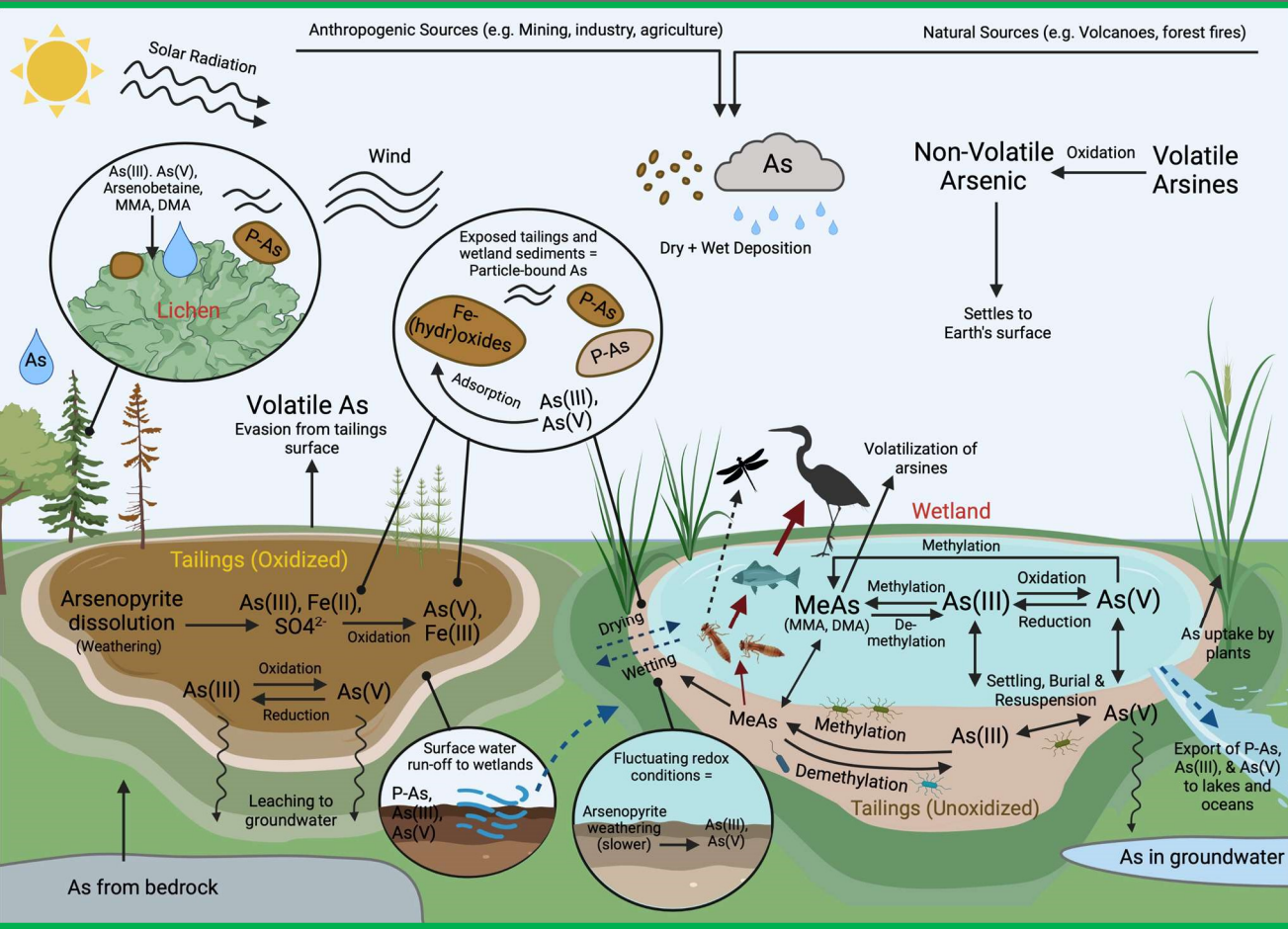
tribution:

ne districts: Smith, P.K. and Goodwin, T.A. 2009:  
istorical gold mining maps, Nova Scotia DNR  
ova Scotia Topographic Database: NS Open  
overnment License

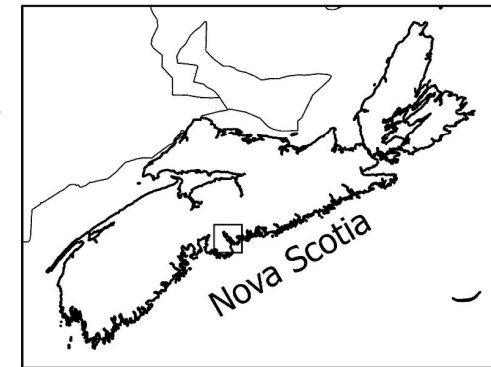
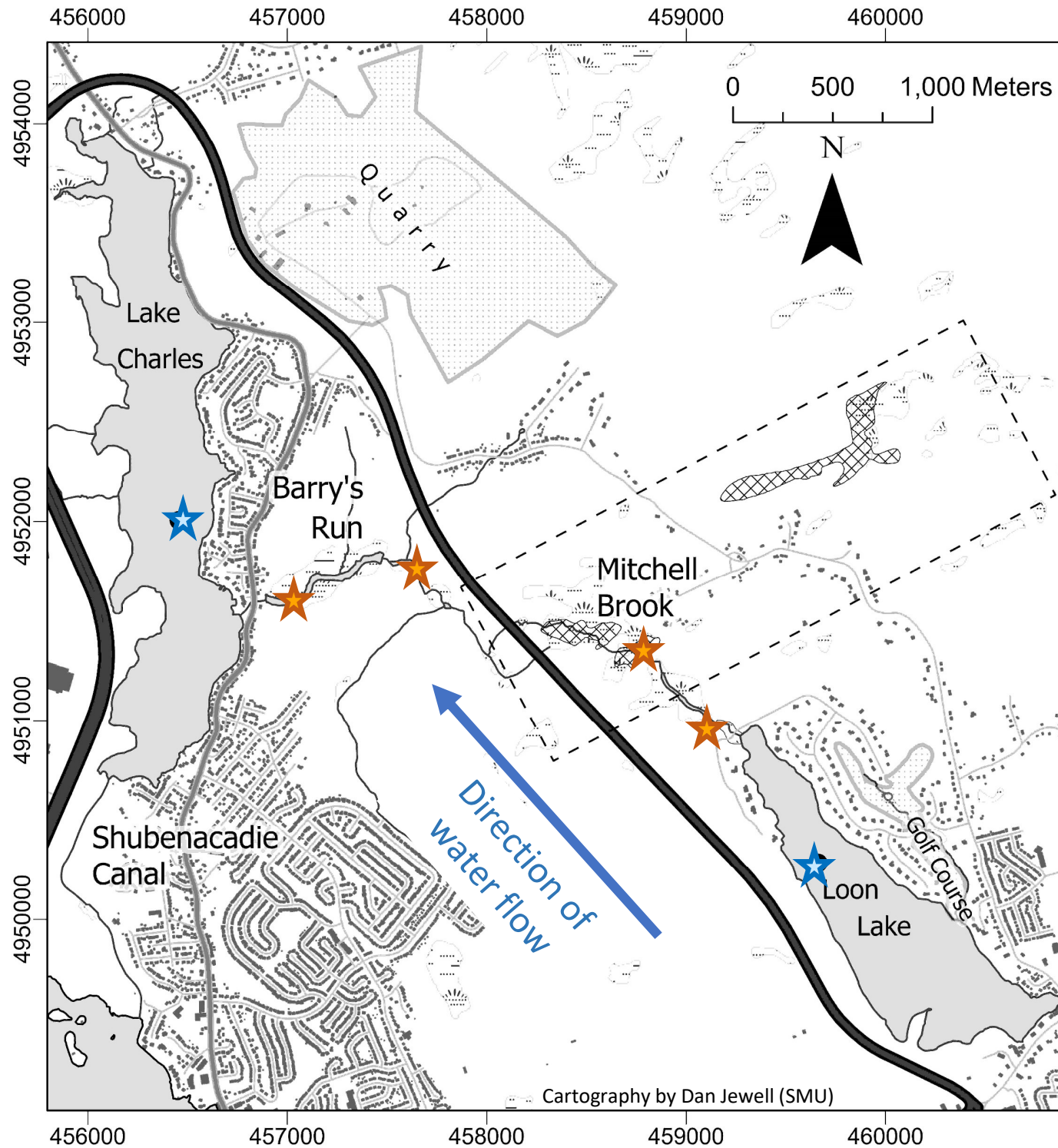
semap: CHS, Esri, DeLorme, NaturalVue



# Arsenic and mercury have very different environmental chemistry & ecotoxicology.



Figures designed by Michael Smith (SMU)



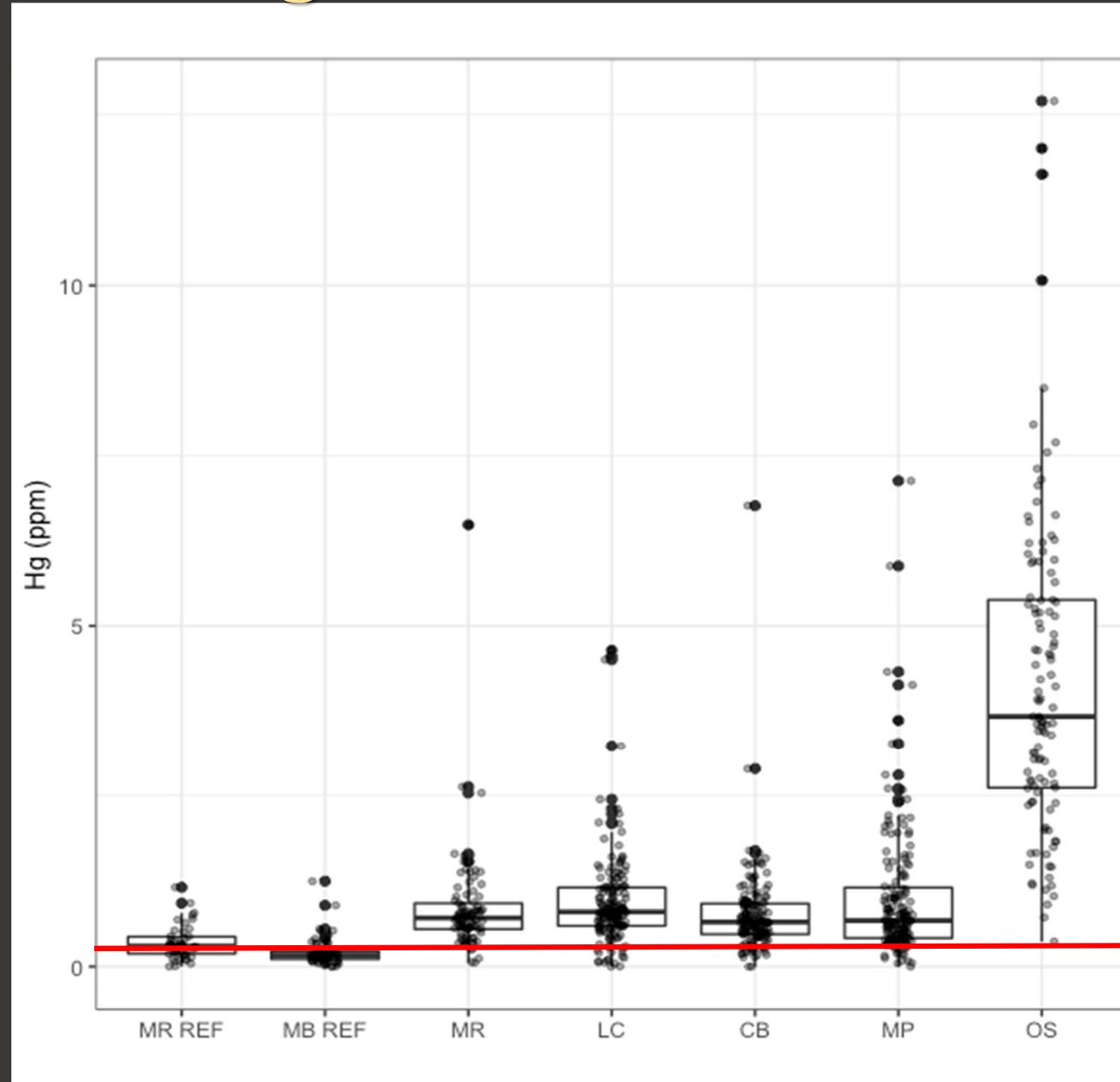
- Buildings
  - Anthropogenic Features
  - Tailings
  - Montague Gold District
  - Coring Locations
- Roads**
- Highway
  - Collector Highway
  - Local Road
- Water Features**
- Lakes
  - Wetland
  - Streams

SMU long-term study sites (2014- 2021, with plans to sample to 2026)

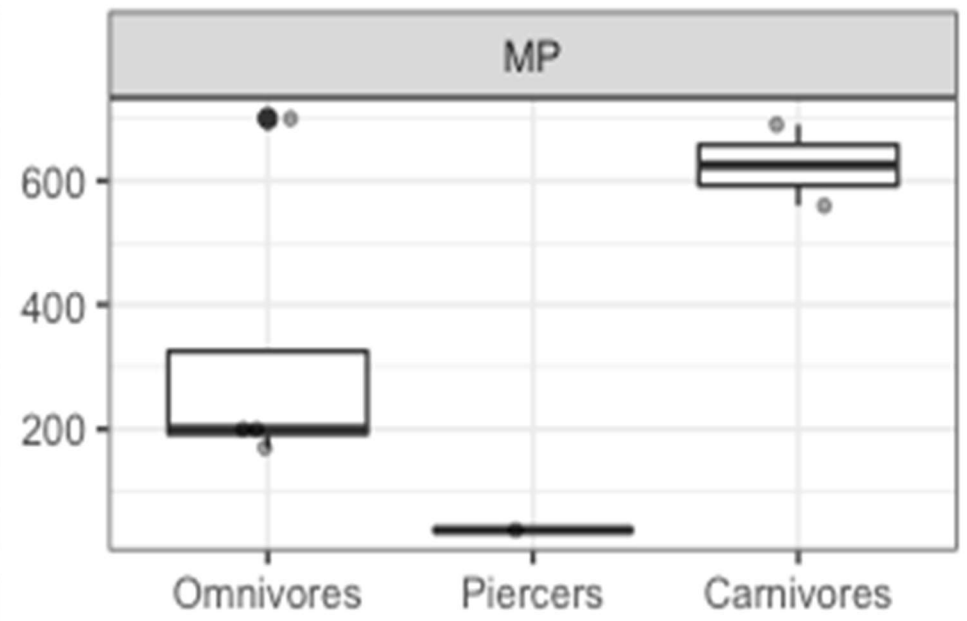
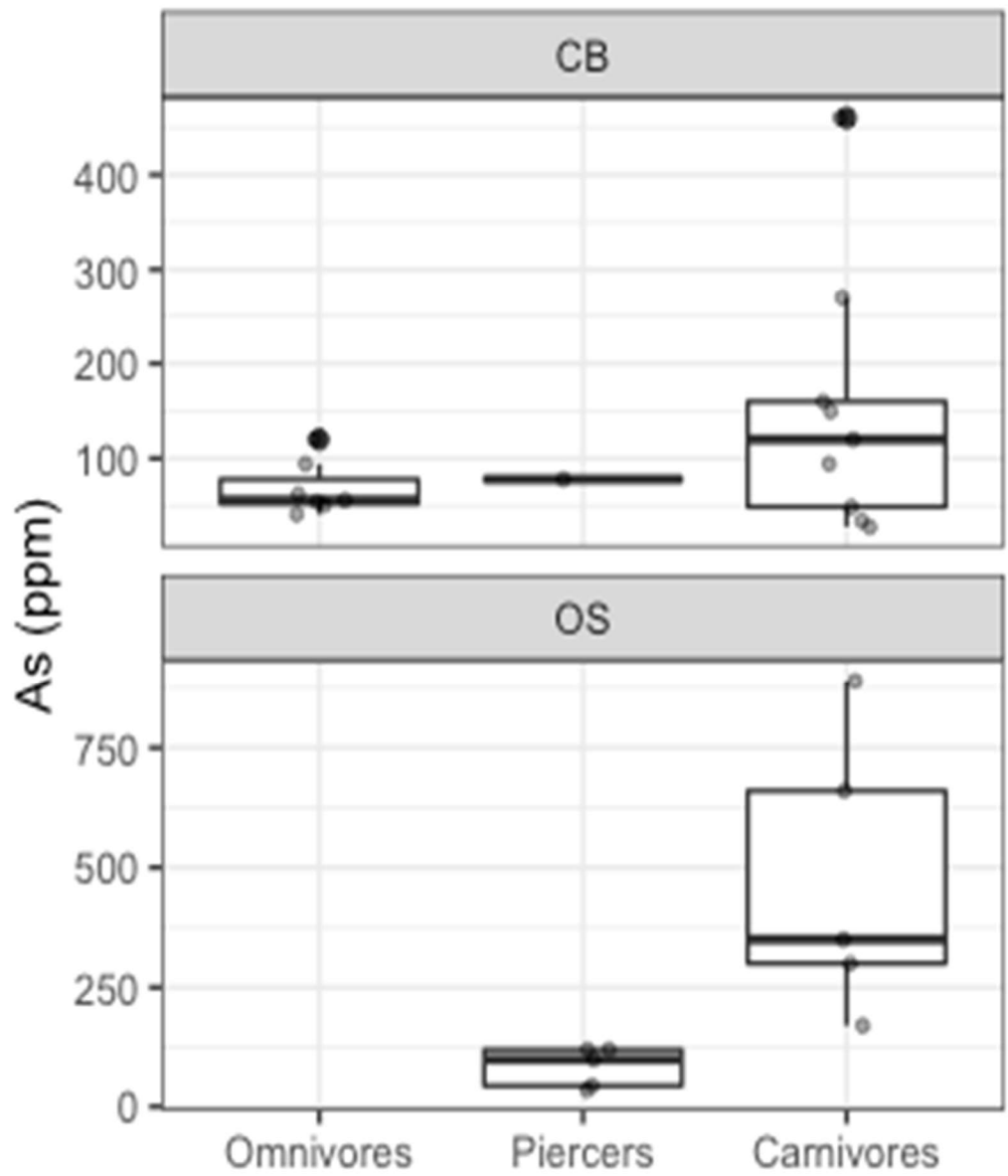


# Macroinvertebrates are good biomonitors

## THg Analysis



Health Canada /  
Canadian Food  
Inspection Agency  
Retail fish & seafood  
"action level" Hg limit

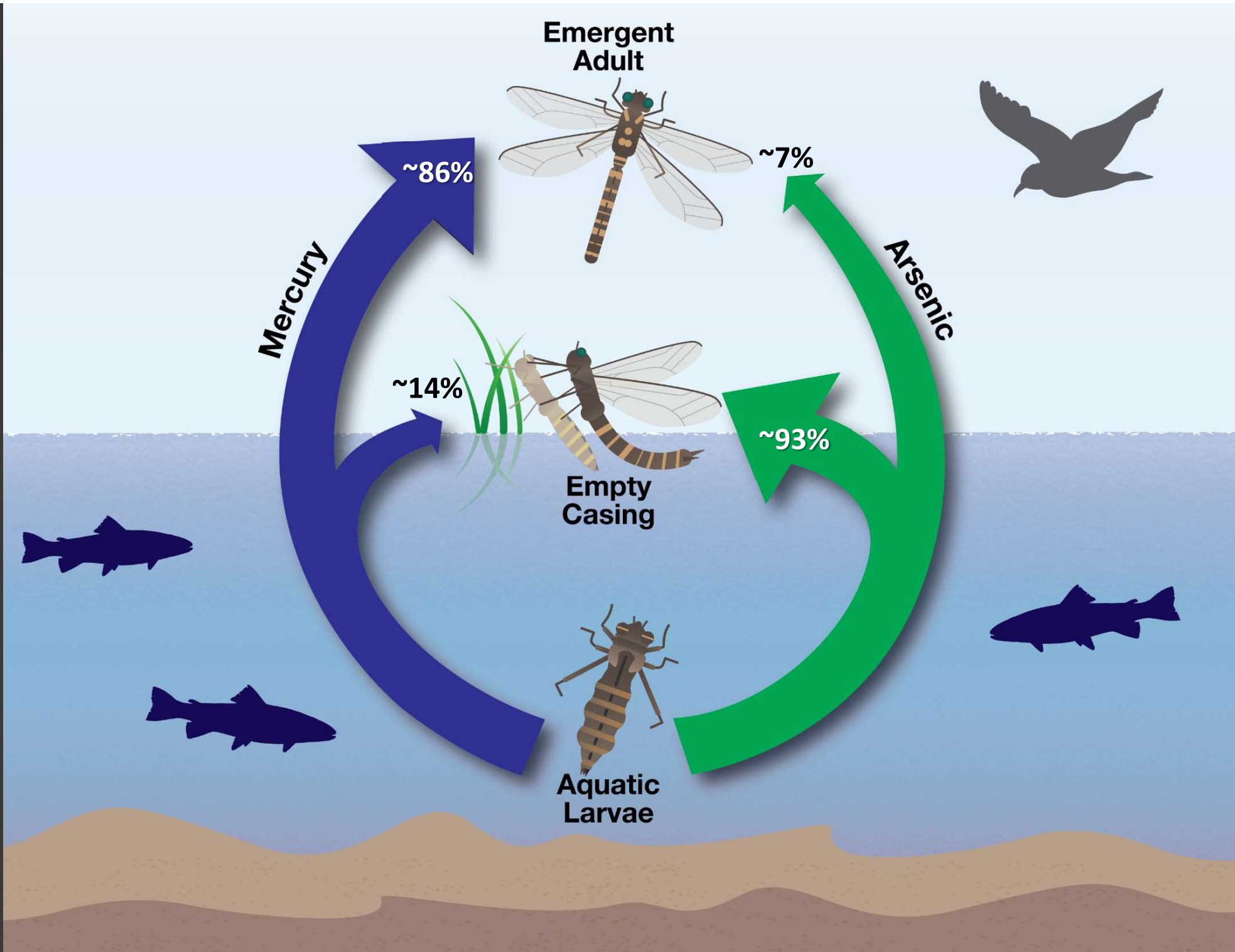


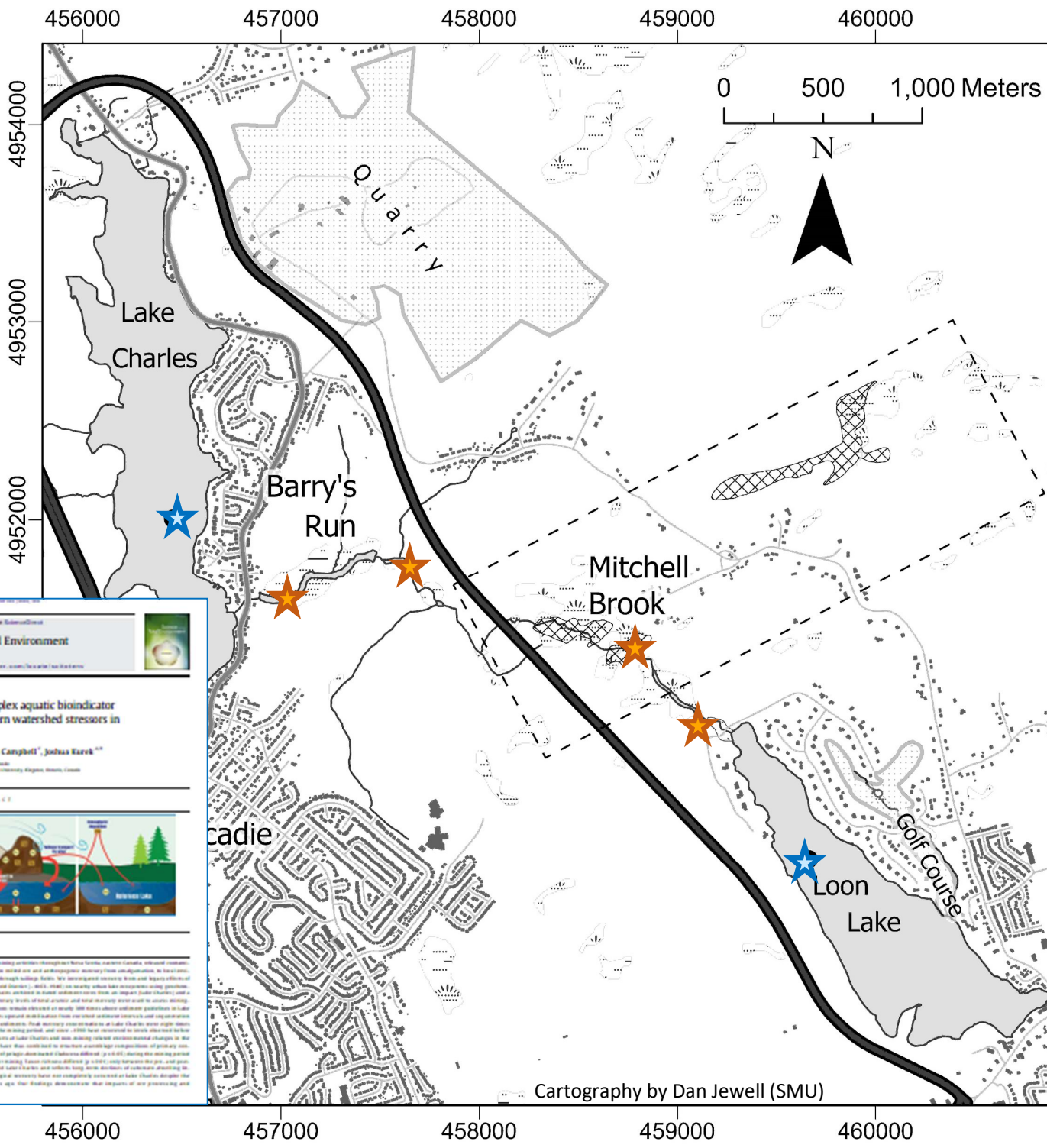
Health Canada / Canadian Food Inspection Agency retail fish & seafood As “action level” limit: 3.5 ppm



# Can emergent insects transfer Hg and As out of aquatic ecosystems?







- Buildings
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Science of the Total Environment  
 Elsevier  
 journal homepage: www.elsevier.com/locate/scototenv

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

Allison J. Clark<sup>a</sup>, Andrew L. Labaj<sup>b</sup>, Jova P. Sene<sup>c</sup>, Linda M. Campbell<sup>d</sup>, Joshua Karst<sup>e</sup>

**HIGHLIGHTS**

- Arsenic and mercury contamination in urban Nova Scotia
- Complex aquatic bioindicator responses to historical gold mining and modern watershed stressors
- High arsenic and mercury concentrations in urban Nova Scotia
- Phytoplankton and zooplankton communities have responded to arsenic and mercury contamination
- Urbanization and climate change may impact recovery of contaminated ecosystems

**GRAPHICAL ABSTRACT**

**ARTICLE INFO**

**ABSTRACT**

Residing in the now active gold mining belt in urban Nova Scotia, Canada, arsenic and mercury contamination in the water, sediment, and biota of the Montague Gold District (MGD) is a complex and multi-faceted problem. The MGD is a small, urban watershed with a long history of gold mining and modern urban development. This study examines the spatial and temporal variability of arsenic and mercury contamination in the MGD, and the response of aquatic bioindicators to this contamination. We found that arsenic and mercury concentrations in the water, sediment, and biota of the MGD are high, and that these concentrations are related to historical gold mining and modern urban development. We also found that aquatic bioindicators, including phytoplankton and zooplankton, have responded to this contamination in complex ways. Our findings suggest that arsenic and mercury contamination in the MGD is a complex problem that requires a multi-faceted approach to address. We recommend that future research focus on understanding the sources and pathways of arsenic and mercury contamination in the MGD, and on developing effective remediation strategies to reduce these contaminants in the water, sediment, and biota of the MGD.

Cartography by Dan Jewell (SMU)