Institut national de la recherche scientifique

CENTRE EAU TERRE ENVIRONNEMENT

Aquatic Biogeochemistry

2019-2020

Water pollution is a key environmental issue

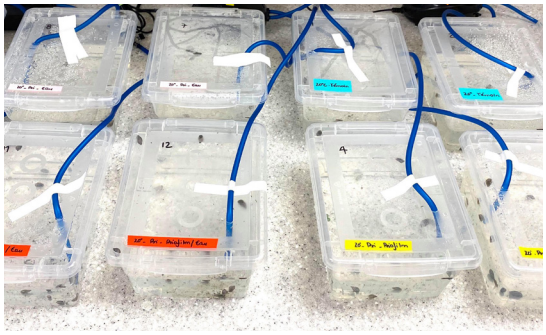
Pollutants entering aquatic ecosystems accumulate in sediments and concentrate up the food chain. Understanding the processes controlling the exchange of toxic substances between sediments, the water column, and aquatic organisms, and the effects of these substances on ecosystems, is essential in order to remediate the problem.

The INRS Eau Terre Environnement Research Centre makes a unique contribution to remediation efforts through its capacity to combine research on the dispersion of contaminants in the environment, their assimilation by and effects on aquatic organisms, and the detection of environmental changes in ecosystems. The group also contributes to research on climate change by studying how aquatic ecosystems work and how they affect climate.

Examples of research and training applied to current challenges

Metal toxicity

Bismuth (Bi) is increasingly used in products ranging from alloys to cosmetics, in some cases as a substitute for lead. Although Bi is now commonly found in natural environments, its toxic potential is largely unknown. It is important to include this metal in risk analyses and environmental impact studies. Like other metals, Bi can threaten the integrity of aquatic ecosystems and alter the food chain. The objective of this INRS research project is to quantify the effects of the metal on the first trophic levels in freshwater environments, which are likely to have significant impacts on the ecosystem. The project will also help develop new tools for assessing and monitoring contaminated environments.

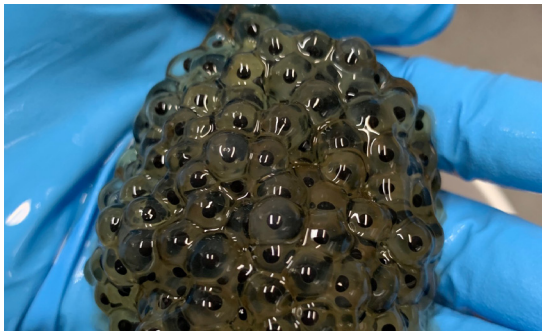


Permafrost melt

With global warming, permafrost is thawing. When the melting permafrost is rich in ice and organic matter, the small ponds created emit large amounts of greenhouse gases (GHGs). An interdisciplinary research project involving researchers at INRS, McGill University, and the Université de Montréal is examining the role of soil microbial processes in these emissions. Soil adjacent to these ponds often collapses and erodes, but in some places aquatic plants and biofilms take over and stabilize the soil. Field sampling in a soil–water continuum will be combined with incubation experiments on soil and pond sediment to identify the microbial and biogeochemical variables that control the GHG emissions and the age of the carbon emitted.

Disrupted balance

Wetlands are home to a wide variety of species. Many insects breed in wetlands, where they feed amphibians that are then eaten by birds. An INRS team conducting research on frogs has begun to study the effects of the biopesticide Bti, which is applied in wetlands near inhabited areas to reduce the reproduction of biting insects. By attacking insect larvae, Bti removes this link from the food chain. Frogs could also be affected directly by Bti, and in that case they would no longer play their role in controlling insect populations. The whole ecological balance of the ecosystem would be disrupted.



Main study themes and researchers involved




ECOTOXICOLOGY

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Examples of recent publications

(Names of ETE Centre's authors are in **bold**)

- **Chen Aharchaou I, Beaubien C, Campbell PGC** & **Fortin C** (2020). Lanthanum and cerium toxicity to the freshwater green alga *Chlorella fusca*: applicability of the biotic ligand model. *Environmental Toxicology and Chemistry*, 39 (5): 996-1005. http://dx.doi.org/10.1002/etc.4707

- Beirao J, **Baillon L**, Litt MA, **Langlois VS** & Purchase CF (2019). Impact of crude oil and the dispersant Corexit™ EC9500A on capelin (*Mallotus villosus*) embryo development. *Marine Environmental Research*, 147: 90-100. http://dx.doi.org/10.1016/j.marenvres.2019.04.004

- Bertucci A, Pierron F, Ye T, Gonzalez P, **Couture P** & Baudrimont M (2019). Identification and expression of microRNAs in european eels *Anguilla anguilla* from two natural sites with different pollution levels. *Environmental Pollution*, 250: 274-283. http://dx.doi.org/10.1016/j.envpol.2019.04.029

- **Kochoni GMÉ** & **Fortin C** (2019). Iron modulation of copper uptake and toxicity in a green alga (*Chlamydomonas reinhardtii*). *Environmental Science & Technology*, 53 (11): 6539-3545. http://dx.doi.org/10.1021/acs.est.9b01369

- **Lavoie I**, Morin S, **Laderriere V, Paris L-E** & **Fortin C** (2019). Assessment of diatom assemblages in close proximity to mining activities in Nunavik, Northern Quebec (Canada). *Environments*, 6 (6): Art. 74. http://dx.doi.org/10.3390/environments6060074

- Matveev A, **Laurion I** & Vincent WF (2019). Winter accumulation of methane and its variable timing of release from thermokarst lakes in subarctic peatlands. *Journal of Geophysical Research - Biogeosciences*, 124 (11): 3521-3535. http://dx.doi.org/10.1029/2019JG005078

Examples of research partners

- AGAT Laboratories
- Centre d'expertise en analyse environnementale du Québec
- International Institute for Sustainable Development Experimental Lakes Area
- Genome Québec
- Government of Quebec (Environment and Climate Change; Forests, Wildlife, and Parks)
- Régie intermunicipale de gestion des déchets solides de la région de Coaticook