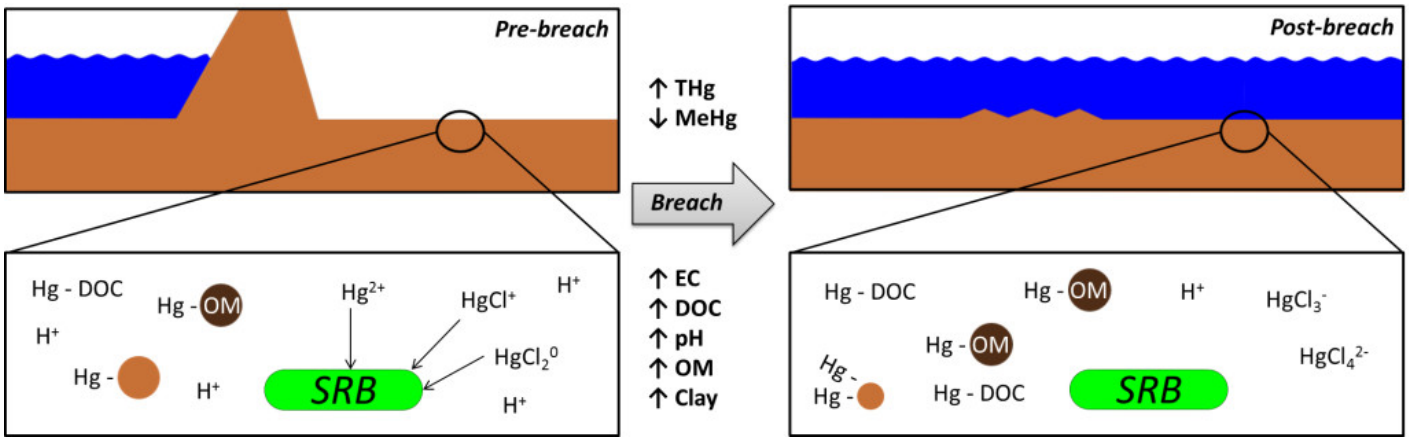
Salt marsh restoration reduces mercury methylation

In this paper we describe analysis of mercury in sediment cores collected from an area of land behind a dyke one year before, and one year after, it was intentionally breached as part of a managed retreat project.

Managed retreat of coastal defenses has led to an increase in the number of sites where dykes are breached, agricultural fields are inundated with seawater, sediment is deposited over soils, and new salt marshes are created. This inundation of previously dyked farmland leads to considerable biogeochemical changes and we wanted to see what implications this had for mercury biogeochemsitry in the Bay of Fundy, a biological mercury hotspot.



Mercury concentration doubled in sediments after coastal flooding but methylmercury concentration deceased

We visited Beaubassin Research Station between Nova Scotia and New Brunswick in Canada and collected sediment cores from an area of land that was due to be inundated with seawater after a failing dyke was intentionally breached. We returned two years later, re-sampled the dyke cell and also collected sediment cores from an adjacent mudflat and a salt marsh.

We analysed the total mercury and methylmercury concentrations of the sediments in the cores and discovered that although the concentration of total mercury had doubled in the dyke cell after the dyke was breached, the concentration of methyl mercury has decreased by 27%. To complement our mercury analysis we analysed the sediments for a range of physical and chemical parameters. These parameters demonstrated that the sediments in the dyke cell after the dyke was breached were chemcially more similar to the salt marsh and the mudflat than the dyke cell sediments prior to breaching.

Acadia University student Adam Godfrey collecting sediment cores in the Bay of Fundy Mudflats

We used these paramaters to construct multiple linear regression models to see if we could them to predict the mercury and methyl mercury concentrations. Our regression model for total mercury predicted 53% of the variability in our samples and showed that total mercury was influenced by soluble carbon, sediment particle size, pH and salinity. Methyl mercury concentrations were, however, poorly predicted using the available measurements

Because we found greater concentrations of total mercury and lower concentrations of methylmercury after the sediments were inundated we can conclude that the reduction in methylmercury was due to a low bioavailability of mercury to sulphate reducing bacteria. This may have occurred due to higher organic matter levels, greater sediment pH, and higher ionic strength.

Overall we did not find any evidence to suggest that coastal managed retreat resulted in an elevated risk of mercury methylation during the first year after inundation.

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Publication

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