

Investigation of legacy methane seepage into freshwater food webs using novel applications in Stoney Creek, New Brunswick, Canada

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Legacy oil, gas, and coalfields in the Maritime region have emitted methane into the surrounding ecosystem for more than 100 years. Methane escaping from these legacy sites may have effects on the surrounding environment; both terrestrial and aquatic. In order to determine if fugitive methane is entering freshwater streams and being incorporated into the local biological food webs, we investigated whether methane could be detected entering freshwater streams via groundwater inputs in an area with abandoned and active oil and gas wells. Introduction of an unnatural compound, such as fugitive methane, could act as an environmental stressor and, if detrimental, should impact the local food web starting at the lowest trophic level. We predicted that if methane was entering freshwater streams and being incorporated into the food web, we could use stable isotopes as a reliable detection tool. Fugitive methane would have a distinct isotopic carbon signature and could be traced through the various biotic compartments. This project also focused on the novel application of using a small thermal imaging camera to help detect subsurface groundwater inputs into the stream for site selection. Using this temperature sensing technology, we found and selected 5 suspected groundwater sources flowing into the stream channel. We aimed to collect biofilm (e.g., bacteria, algae, diatoms), benthic macroinvertebrate, and fish from both upstream and downstream of each input site, but with small streams low summer water levels, we were unable to adequately sample the fish community. Stable isotope analysis of the biofilm and benthic macroinvertebrates did not show obvious incorporation of fugitive methane into the food web, though some values were suspect. There are still some research questions that could be explored before ruling this application out as a tool to find and measure fugitive methane emissions in the environment. Additionally, we completed a diatom community assessment applying the Eastern Canadian Diatom Index (IDEC) as a measure of the biological integrity of streams and were able to show that our study sites in the Stoney Creek region are currently considered “slightly polluted”, with a few select locations bordering on “polluted”. These study results raise more questions than they answer but serve as an exploration and application of tools and techniques that have not previously been applied in this context.