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Conference Abstract

Investigating Microbial Triggers of Nitrous Oxide Emissions in Agriculturally Influenced Aquatic Ecosystems

C Evelyn Crundwell[‡], Lori Phillips[§], Chris Weisener[‡]

‡ University of Windsor, Windsor, Canada
§ AAFC, Harrow, Canada

Corresponding author: C Evelyn Crundwell (crundwe1@uwindsor.ca)

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Abstract

The agricultural sector in Canada is responsible for approximately 9% of greenhouse gas (GHG) emissions in Canada, accounting for 54 MT of carbon dioxide (CO_2), as well as 31% of methane (CH_4) and 75% of national nitrous oxide (N_2O) emissions in 2021 (Environment and Climate Change Canada 2021). However, these estimates do not include the indirect GHG emissions that occur in agriculturally impacted waterways. Ontario is home to over 45 000 kilometers of agricultural drainage ditches, with tile drains directly connecting terrestrial and aquatic environments. Microbial biogeochemical cycles in the causeways experience fluxes of nutrients leading to hotspots for GHG at the sediment-water interfaces. Along with fluxes of nutrients, the causeways are regularly disturbed by anthropogenic effects (e.g., dredging, removal of vegetative buffers) and increasing frequency of storm events. Previous studies have used static chambers to evaluate GHG emissions from aquatic systems (Mu et al. 2022, Xiao et al. 2016). However, this approach can be time consuming and labour intensive and is impractical in aquatic systems due potential extensive underestimation of fluxes from diffusion. To resolve driving factors contributing to GHG in these systems a detailed study investigating the activity of the microbial community is warranted. In this study we hypothesize microbial activity within the sediment will correlate with N_2O emissions. To test the response of the microbial

community a combination of molecular approaches (i.e., qPCR and Ion torrent) targeting archaeal and bacterial nitrifiers and denitrifies was used. These functional responses were evaluated with respect to N_2O emissions, which were measured in the field at the time of sampling using Unisense N_2O probes. In this study, N_2O sensor response was calibrated to a functional gene index for rapid risk assessment of GHG hotspots.

Keywords

Greenhouse Gas, Nitrous Oxide, Agriculture, Biogeochemical Cycles, In-Situ, Aquatic

Presenting author

C Evelyn Crundwell

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Conflicts of interest

The authors have declared that no competing interests exist.

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