Effect of Bioturbation by Freshwater Invertebrates on N fluxes and Sediment Bacterial Community Composition

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Introduction

- Bioturbation is a process by which animals rework soil/sediment. (Meyssman et al. 2006)
- Burrowing is a form of bioturbation. Hexagenia bilineata forms U-shaped burrows and Lumbriculus variegatus forms gallery network burrows

Objectives of the study:
- Assess impact of different modes of burrowing on N fluxes.
- Examine how bacterial community composition and bacterial abundance alter in the presence of distinct burrowing bioturbators.

Methods

- Study organisms were obtained from The Reel Thing and Carolina and sediment was collected from observatory wetlands (KSU)
- Replication: 3 for 3 treatments: Control, Mayfly (H. bilineata), Worm (L. variegatus)
- Interstitial and surface water were assessed for nitrate and ammonia
- Potential denitrification rate (according to Baxter et al. 2013), bacterial enumeration (using DAPI) and bacterial community composition (16S RNA) was examined at 4 different sediment depths (2,4,6, and 8 cms).

Results

- Surface water nitrate and ammonia concentrations varied significantly among treatments and dates of sampling.
- DAPI results reveal that presence of bioturbators increase the number of bacterial cells at greater sediment depths.
- The overall potential denitrification rate is higher in bioturbated sediments.

Discussion

Different modes of burrowing facilitate oxygen and nutrient transport differently:
1) Surface water nitrate concentrations decrease in presence of mayflies indicating physical sorption or uptake due to microbial processes like denitrification.
2) Ammonia concentrations increase in presence of mayflies indicating release from sediment or microbial processes like nitrification.
3) Reduction in nitrate concentration, increase in ammonia concentration and overall increase in potential denitrification rate indicate possible coupling between nitrification and denitrification

Increase in bacterial cells at greater sediment depths indicate availability of nutrients and oxygen, while lower counts at upper depths indicate feeding in treatments with bioturbators.

Ongoing Research:
- Analysis of nitrate and ammonia concentrations in the interstitial water.
- Examining bacterial community composition at various depths of the sediment of all the 3 treatments.

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References