ISME: 5000 words, max 8 tables and figures, max 100 references (if Open Access, colour charges do not apply)

Ecology Letters: Words: 5000; Figures/Tables/Text boxes: 6

Title: Diverging DNA and RNA communities along a boreal terrestrial-hydrological continuum

Masumi Stadler1,\*, Paul del Giorgio1

Affiliation:

(1) Groupe de Recherche Interuniversitaire en Limnologie (GRIL), Département des Sciences Biologiques, Université du Québec à Montréal, Montréal, QC, Canada

Institutional e-mail addresses: MS (stadler.masumi@courrier.uqam.ca), PdG (del\_giorgio.paul@uqam.ca)

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\*Contact corresponding author: Masumi Stadler

E-mail: m.stadler.jp.at@gmail.com

Phone: +1 (514)297-5330; Fax: ??

Address: Département des Sciences Biologiques, Université du Québec à Montréal, Case Postale 8888, Succursale Centre-Ville, Montréal, QC, H3C 3P8, Canada

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**Authorship**

PdG designed the sampling, MS collected the data, MS analysed the data, MS and PdG discussed the results and wrote the manuscript.

**Data accessibility**

Abstract

Ecol.Let.: 150 words; ISME: 200 words

Introduction

Material and methods

Catchment characteristics and sampling design

To follow the movement of microbial communities within a watershed, samples were taken along the La Romaine (LR) river (Côte-Nord region, Québec, Canada)(Fig. 1) for three years from 2015-2017. The LR catchment belongs to the eastern black spruce-moss bioclimatic domain and drains an area (*A*) of approximately 14,500 km2. The catchment was glaciated 7,000 – 10,000 years ago and left mostly a till blanket and veneer as surficial material. It is mainly dominated by acid rocks (e.g. granodiorite, granite, quart diorite) with granitised sedimentary and volcanic rock, and has isolated patches of permafrost (0-10%)(Natural Resources Canada). The soil is roughly composed of 61.4 % sand, 31.9 % silt, 6.7 % clay and stores approximately 140.4 t ha-1 of organic carbon (in top 5 cm; given are catchment averages)(Lehner and Grill, 2013)(Hengl et al 2014).

The river springs between the Atlantic and Saint Lawrence watersheds, and consequently flows through a series of lakes (hereafter headwater lakes) including the biggest lake in the catchment – Lake Brûlé (*A*: 127.11 km2). The maximum distance from the northern headwaters to the river mouth expand to 475.1 km. The northern part of the catchment is characterised by a flat open black spruce (*Picea mariana)*-lichen forest with shrubs and moss-lichen (Fig. S1a). As one follows the river downstream, the relief changes drastically to a steep mountainous stretch that forms sections of canyons (Fig. S1b). Nearly half of the catchment is covered by coniferous forests (*P.mariana*-moss), with mixed forests being rather minor (11%) and deciduous stands with white birch (*Betula papyrifera*) and trembling aspen (*Populus tremuloides*) are even more rare (2%). The river looses xx m of elevation until it makes a sharp turn to the west. This lower coastal plain is characterised by peatland areas with swamps and shallow waters that are completely permafrost free (Fig. S1c). There are two larger tributaries in the coastal plain that flow through the lakes Puyjalon (*A*: 13.10 km2) and Allard (*A*: 19.24 km2). A weather station located in the lower coastal plain (50°16'55.000" N, 63°36'41.000" W, Havre-Saint-Pierre Airport, Natural Resources Canada) recorded an annual precipitation of 810.77 ± 35.25 mm and 1.18 ± 0.73 °C, -32.63 ± 1.36 °C, and 25.8 ± 0.66 °C for mean, minimum and maximum temperature over the sampled years.

The LR river has been dammed during the sampling period, forming a reservoir cascade complex with 4 reservoirs by 2020. The reservoirs Romaine 2 (RO2, *A*: 81.15 km2), Romaine 1 (RO1, *A*: 13.22 km2) and Romaine 3 (RO3, *A*: 35.18 km2) were flooded in the years 2014, 2016, and 2017, respectively. The consecutive flooding of the reservoirs creates a unique opportunity to study the transformation process of a running system into a standing water body. The shifts mainly imposed due to the increased residence times are likely to influence not only biogeochemical properties but also their microbial assemblages.

Overall, xx samples were collected for DNA (D) and xx for RNA (R), of which xx, xx and xx are spring, summer and autumn samples, respectively. RNA samples were sampled from 2016 onwards. To create a terrestrial-aquatic continuum we have sampled soils (xx), soil-waters (xx), hyporheic-waters (xx), streams (xx), the river (xx), reservoir surface waters (xx) and the estuary (xx). Other reference systems that were sampled within the catchment are tributaries (xx), lakes (xx) and lake sediments from the headwater lakes (xx). Due to the remoteness and inaccessibility of the northern most headwaters, we have sampled a headwater stream network within the Petite Romaine sub-catchment (*A*: xx, Fig. 1).

Surface soil samples were collected with a 50 cm corer in proximity of installed piezometers to sample soil-water. The upper 5 cm including surface vegetation were removed before the soil was transferred into a sterile plastic bag. Piezometers were installed in proximity to streams. However, if the piezometers were installed too close to the stream main channel, hyporheic water was sampled instead. Piezometers were emptied 3 times before sample water was collected. All samples were stored at 4 °C upon arrival at the laboratory until further processing on the same day of sampling.

Bacterial community composition

Bioinformatic analysis

Results

Discussion

Conclusions

**Conflict of interest**

The authors declare no conflict of interest.

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References