Limnologica 63 (2017) 27–30

Contents lists available at ScienceDirect

Limnologica

journal homepage: www.elsevier.com/locate/limno

Can the substrate influence the distribution and composition of benthic macroinvertebrates in streams in northeastern Brazil?

Tiago da Silva Pereira, Jéssica Fernanda Gomes Pio, Adolfo Ricardo Calor, Carlos Eduardo Copatti *

Universidade Federal da Bahia, Instituto de Biologia, Departamento de Zoologia, PPG Diversidade Animal, Rua Barão de Jeremoabo, 147, Campus Ondina, Ondina, CEP 40170-115, Salvador, Bahia, Brazil

ARTICLE INFO

Article history:
Received 25 July 2016
Received in revised form
26 November 2016
Accepted 22 December 2016
Available online 29 December 2016

Keywords:
Season
Tropical stream
Abundance
Stones

ABSTRACT

We sampled different substrates (sand, gravel, leaf litter and stones) in the rainy and dry season to study the distribution and composition of benthic macroinvertebrates in tropical streams (northeastern Brazil). Benthic macroinvertebrates were distributed according to the substrates, with stones showing a higher richness and abundance of species and abundance of collector-gatherers and filter-collectors. The results of the PCoA showed a separation of stones from the other substrates and similarities between sand and gravel.

© 2016 Elsevier GmbH. All rights reserved.

Streams can be studied at different spatial scales, ranging from macrohabitats (watersheds) to microhabitats (substrate) which form ecosystem fragments that are characterised by different disturbance regimes in terms of structure and dynamics (Allan and Castillo, 2007). Substrates are major drivers of benthic macroinvertebrates richness, abundance and ecological processes (Kovalenko et al., 2012; Copatti et al., 2013). The differences between benthic macroinvertebrates communities might be greater between different substrates of the same stream than between different streams (Costa and Melo, 2008). The richness and abundance of benthic macroinvertebrates increase in more stable substrates and with a good supply of shelters and food resources, such as stones (Bueno et al., 2003). Alternatively, fine sediment (sand and gravel) reduces benthic macroinvertebrates diversity due to abrasion, clogging and burial (Jones et al., 2012), reducing the amount of organic compounds and food resources, as well as leading to the absence of refuges (Bueno et al., 2003).

Aquatic ecosystems are characterised by natural hydrodynamic disturbances, which determine the distribution and composition of benthic macroinvertebrates between the seasons and can vary due to different rainy and dry seasonal patterns as well as different levels of stability and ability to colonisation after rainfall (Nava et al., 2015). In tropical regions, variations in rainfall throughout the year result in changes in temperature, dissolved oxygen (Ferreira et al., 2014) and current velocity.

The objective of this study was to assess the effect of substrates on benthic macroinvertebrate communities in the rainy and dry season in tropical streams of northeastern Brazil. We hypothesised that substrates on stones present greater richness and abundance of benthic macroinvertebrates and food functional groups than those on other substrates (gravel, sand and leaf litter) and that stones differ in terms of organism distribution in relation to other substrates.

The study was conducted in streams in the Recôncavo do Sul Basin, northeastern Brazil. The streams are located within the ecological reserve Michelin (3096 ha), in the Atlantic Forest. The climate in the region is Af according to Köppen classification, with hot and prolonged summers. The region is characterised by a mean rainfall of 2000 mm/year and a mean air temperature of 21–28 °C (Flesher and Laufer, 2013).

Sites were selected based on the presence of the all following substrates: (a) sand (0.06–2.00 mm dimension), (b) gravel (2–64 mm dimension), (c) leaf litter and (d) stones (64–256 mm dimension). Additionally, sites were selected on the basis of ease of access, size (width and depth between 2.5–4.5 m and 20–40 cm, respectively), the presence of abundant riparian vegetation, pristine condition and geological characteristics (20–40 m altitude, 2nd stream order).

* Corresponding author.
E-mail address: carloseduardocopatti@yahoo.com.br (C.E. Copatti).

http://dx.doi.org/10.1016/j.limno.2016.12.003
0075-9511/© 2016 Elsevier GmbH. All rights reserved.

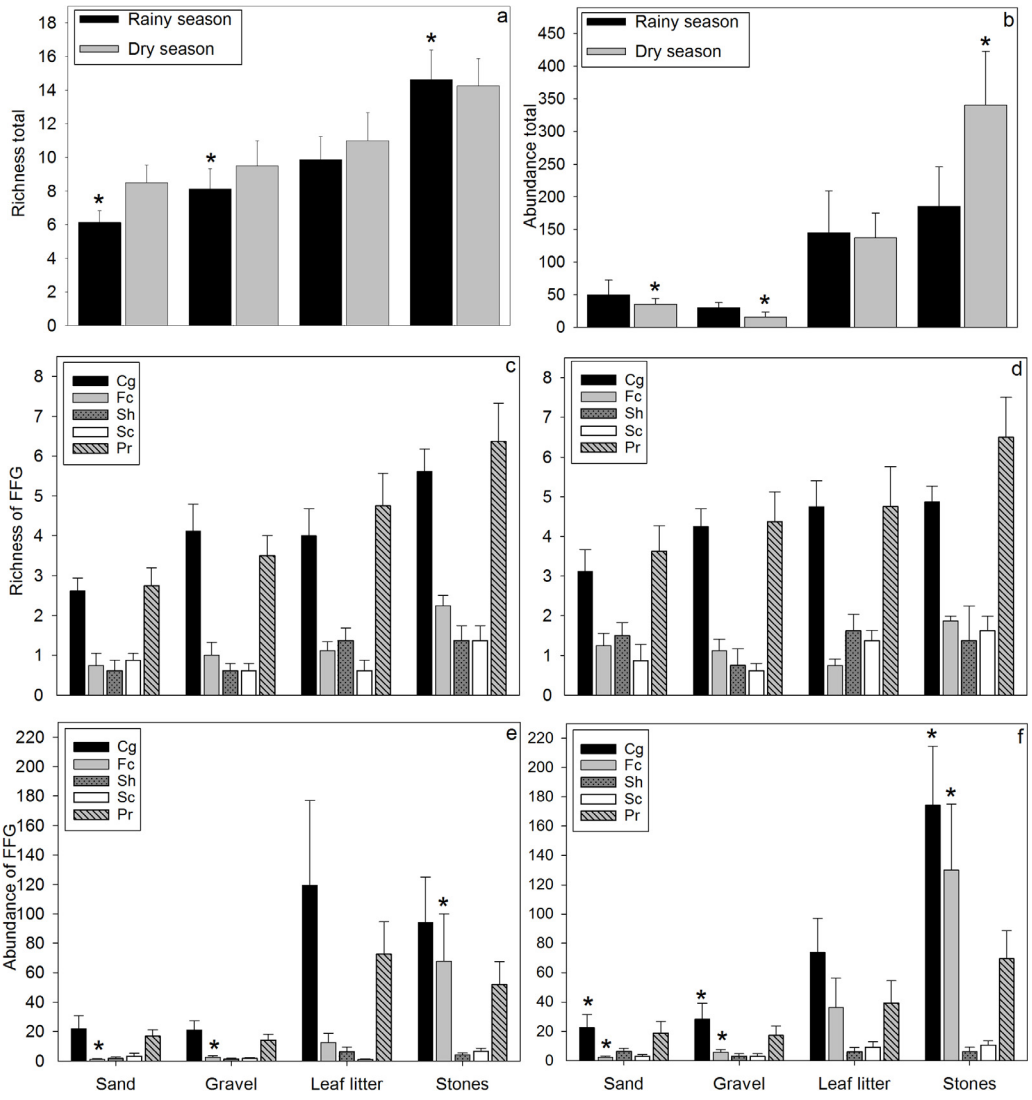

Fig. 1. Richness (A) and Abundance (B) total for aquatic arthropods at the family level and Richness (C = Rainy season and D = Dry season) and Abundance (E = Rainy season and F = Dry season) (mean ± SEM) of functional feeding groups of benthic macroinvertebrates for different substrates and seasons in streams in the Recôncavo do Sul Basin, BA, Brazil. Cg = Collector-gatherer. Fc = Filter-collector. Sh = Shredder. Sc = Scraper. Pr = Predator. * Indicate significant differences between substrates ($p < 0.05$).

We selected eight sampling sites: three sites in the Das Matas stream: A = 13°96′75.0″S, 39°16′10.2″W; B = 13°95′60.6″S, 39°17′56.2″W and C = 13°94′72.5″S, 39°18′30.2″W; two sites in the Igrapiúna stream: D = 13°83′99.1″S, 39°26′44.8″W and E = 13°81′56′.0″S, 39°25′45.9″W; three sites in the Cachoeira Grande stream: F = 13°90′58.2″S, 39°22′44.1″W; G = 13°89′41.7″S, 39°21′05.6″W and H = 13°88′38.0″S, 39°19′70.3″W.

Sampling was carried out in the rainy season (May 2013) and in the dry season (October 2013). Benthic macroinvertebrates sampling was performed using a Surber sampler (mesh = 0.25 mm; area = 0.1 m^2). Ten sub-samples per substrate were taken at each sampling site and preserved in 10% formaldehyde solution in plastic containers. A mixed-design analysis of variance model was used with the substrates nested in streams.

After screening, the identified organisms were preserved in 80% ethanol. The specimens and their functional feeding groups (FFG) were identified to the genus level for Ephemeroptera, Plecoptera and Trichoptera and to the family level for other groups (except Platyhelminthes and Annelida), using the taxonomic keys of Cummins et al. (2005) and Domínguez and Fernández (2009).

We analysed the following physical and chemical water variables: dissolved oxygen and temperature were determined with a digital oxygen meter in situ, pH was determined with a pH meter and total ammonia, nitrite, alkalinity and hardness were determined using a kit (Alfatecnoquímica, Florianópolis) in the laboratory. Current velocity was calculated as the time taken for a floating object to travel a distance of 3 m.

The values of the physical and chemical water variables and the abundance (species and FFG) were logarithmically transformed [y = log(x + 1)]. To evaluate whether differences were significant, a two-way ANOVA (substrate versus season) followed by post-hoc Tukey's test was performed ($p < 0.05$).

To evaluate our hypothesis that stones exhibit a greater richness and abundance of benthic assemblages, taxonomic uniformity was considered to the family level for arthropods and richness and abundance were estimated. Additionally, abundance and richness of FFG were measured. The data were analysed using a two-way ANOVA (substrate versus season) followed by Tukey's post-hoc tests ($p < 0.05$).

We summarised the structure of the benthic macroinvertebrates abundance among sites in relation to the substrates, streams and seasons using Principal Coordinates Analysis (PCoA). The PCoA was obtained using the Bray–Curtis (abundance transformed in log(x + 1)) index. To test whether the differences were significant,

Download English Version:

https://daneshyari.com/en/article/5744931

Download Persian Version:

https://daneshyari.com/article/5744931

Daneshyari.com