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Meiofauna in stream habitats: temporal dynamics of abundance, biomass and secondary production in different substrate microhabitats in a first-order stream

Henrike Brüchner-Hüttemann · Christoph Ptatscheck · Walter Traunspurger

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Abstract Meiofaunal abundance, biomass and secondary production were investigated over 13 months in an unpolluted first-order stream. Four microhabitats were considered: sediment and the biofilms on dead wood, macrophytes and leaf litter. The relative contribution of the microhabitats to secondary production and the influence of environmental factors on meiofaunal density distribution were estimated. We expected (1) meiofaunal abundance and biomass to exhibit seasonal patterns, with more pronounced seasonal fluctuations on macrophytes and leaf litter than in the other microhabitats, (2) annual secondary production to be highest in sediment; however, the relative contribution of the microhabitats to monthly secondary production would change during the year, and (3) a bottom-up driven influence on meiofaunal density distribution in the microhabitats. Meiofaunal annual mean abundance, biomass and secondary production were 7–14 times higher in sediment and on dead wood than on macrophytes and leaf litter. Significant seasonal patterns described the meiofaunal abundance in sediment and on leaf litter as well as the biomass in sediment, on macrophytes and leaf litter. Organisms in sediment and on dead wood contributed 48 and 43%, respectively, to secondary production m^{-2}, but in regard to the stream area covered by the microhabitats, sediment had the highest share (80%). Significant determinants of the density distribution were AFDM, protozoans, bacteria and Chl-a, which influenced all meiofaunal groups. Our study clearly indicates that meiofaunal organisms in sediment and on dead wood have a remarkable share on total secondary production of lotic systems which is especially relevant for forested low-order streams.

Keywords Sediment · Dead wood · Macrophytes · Leaf litter · Seasonal pattern

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H. Brüchner-Hüttemann (✉) · C. Ptatscheck · W. Traunspurger
Animal Ecology, Bielefeld University, Konsequenz 45, 33615 Bielefeld, Germany
e-mail: henrike.bruechner-huettemann@uni-bielefeld.de

Introduction

Headwater streams provide unique aquatic habitats not present elsewhere in a river network (Wohl 2017). Knowledge about the biological and ecological function of those first- and second-order streams (Strahler 1952) is important for the understanding of the whole stream system, because headwaters make up 70–80% of the total lengths of river networks (Downing et al. 2012; Wohl 2017).

Headwater streams are not static, but dynamic, constantly shifting mosaics of interconnected microhabitats. Those microhabitats are established by