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Ecological effects of flow disturbance on phytobenthos communities in natural and regulated alpine streams

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Phytobenthos is the dominant primary producer in streams and sustains, with the allochthonous organic matter inputs, the higher trophic levels. Among the different groups that constitute the phytobenthos community some, especially diatoms, have been studied deeply while others remain quite overlooked. Hence, a characterisation of the overall phytobenthos community is needed, considering all the main taxonomic groups (diatoms, green algae, cyanobacteria and red algae), as related to the environmental conditions characterizing different alpine streams. Moreover, despite the ecological role played by the phytobenthos the knowledge about the factors that control the variations of the community among streams and throughout the different seasons is still poor. Among the different drivers that regulate the phytobenthos component, a pivotal factor is the occurrence of high-flow events that, controlling the stability of riverbed substrates, influences both the phyto and the zoobenthos composition and distribution. Thus, the frequency and the magnitude of flow disturbances are determinant in regulating the phytobenthos density and the recolonization patterns. The aim of this work was to characterize and compare the phytobenthos communities in different streams highlighting the role of the flow regulation due to hydropower reservoirs accounting for the influence of the lithology and the seasonality. The presented phytobenthos data derive from a one-year sampling campaign in four alpine streams representative of different flow conditions (natural vs regulated flow discharge) and lithology (silicate vs carbonate). The riverbed coverage has been estimated monthly in each stream and the biomass has been quantified. In lab, phytobenthos samples have been analysed to measure the photosynthetic activity and define their composition. The main groups (cyanobacteria, green algae, diatoms and algae with phycoerythrin) have been determined both by phyto-PAM deconvolution and by the quantification of the photosynthetic pigments. In order to estimate the bed disturbance, painted stones of different size classes were located in regular arrays along three transversal transects and the distance travelled was measured during every sampling. The preliminary results indicate that regulated streams seem characterized by a greater algae biomass possibly due to a more stable environment. Concerning the community composition, the percentage of diatoms is significatively higher in silicate substrates. Despite the few hours of light, winter promotes phytobenthos colonisation especially for the low frequency of relevant high-flow events but also for the absence of the shadow due to tree canopy on the riverbed.