Submitted Abstract

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Abstract

Water temperature is recognized as one of the most important drivers shaping both aquatic ecosystem structure and functioning. Indeed, temperature controls metabolic processes, primary production, growth rates, life cycle duration, and constitute a physiologic threshold for the different species. Despite the pivotal role of temperature on aquatic communities, a detailed investigation of the effects of different water thermal regimes on macroinvertebrates has been rarely carried out, especially in alpine streams. In the present study, we studied the response of macroinvertebrate communities to environmental conditions in alpine streams of the Serio River catchment (BG, Italy). Selected streams are characterized by different thermal regimes linked to the different water sources (snowmelt/stormwater and groundwater-fed streams) and human alterations (presence of reservoirs). At five stream sites, each month for one year, we sampled macroinvertebrates and organic matter (allochthonous and autochthonous) and measured water physical-chemical conditions and nutrient concentrations. Moreover, flood disturbance was quantified monthly using painted tracers while water temperature was measured continuously (every 10 min). We examined the ecological effect of environmental variables on the macroinvertebrate abundance, life cycle, and growth rate. Results showed a strong co-inertia between monitored environmental variables and macroinvertebrate assemblage with first floods and then temperature as the main driver structuring the communities. High annual thermal variability (range ~0-15 ˚C) promotes a high temporal turnover of macroinvertebrates compared to a stable thermal regime (range ~8.0-8.6 ˚C). In addition, we found a temporal mismatch in the life cycle of certain taxa (Amphinemurae sp., Ephemerella sp., Protonemura sp.,) between individuals captured in different thermal conditions. Finally, we observed significant temperature-abundance correlations for various genera such as Epeorus sp., and Leuctra sp. The study highlights that the thermal regime could be very different among alpine streams with strong ecological implications on macroinvertebrate communities. Although other variables as lithology and organic resources had a significant effect on the spatial macroinvertebrate assemblage, temperature mainly drove the temporal pattern. Under global warming, we thereby expect a significant change in taxa assemblage, with more temporal heterogeneity in community composition due to higher annual thermal variability and loss of cold stenothermal species where upper thermal limits will be exceeded.