Geophysical Research Abstracts
Vol. 12, EGU2010-3545, 2010
EGU General Assembly 2010

Contrasting effects of hydrological stability and flow extremes on benthic and hyporheic invertebrate communities

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In lotic ecosystems, the most common disturbance events occur at the extremes of the hydrological continuum, i.e. spates and streambed drying. During spates, high flow velocities can mobilise sediments and displace invertebrates, and during streambed drying, loss of free water can cause mass mortality of many aquatic taxa. In both cases, invertebrates inhabiting the surface sediments are subject to a greater frequency and magnitude of disturbance than those in the hyporheic zone, and this habitat may therefore act as a refugium. Between extreme events, stable hydrological conditions allow competitive species to thrive, which can cause biotic interactions to increase. We compared the effects of flow extremes and hydrological stability on benthic and hyporheic invertebrate communities. Hydrological conditions included spates, flow recession, and localised streambed drying. During flow recession, competitive benthic taxa, particularly Gammarus pulex (Amphipoda) increased in abundance in surface sediments, causing community diversity to decline. A concurrent increase in the hyporheic abundance of G. pulex indicated that the hyporheic zone may act as a refugium from increasing biotic pressures in the benthic sediments. In contrast, spate events caused severe reductions in both benthic and hyporheic invertebrate abundance, and declines in G. pulex abundance were particularly pronounced; spate events were therefore important in increasing both benthic and hyporheic community diversity.