Geophysical Research Abstracts,
Vol. 10, EGU2008-A-00618, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-00618
EGU General Assembly 2008

Physico-chemical controls on hyporheic community structure

J. Grant (1), C. Soulsby (1), I.A. Malcolm (2)

(1) Environmental Hydrology Research Group, School of Geosciences, University of Aberdeen, Aberdeen, Scotland, UK (j.grant@abdn.ac.uk / Phone: 01224 273696)
(2) Fisheries Research Services, Freshwater Laboratory, Faskally, Pitlochry, Perthshire, UK (I.A.Malcolm@marlab.ac.uk / Fax: +44 (0)1796 473523 / Phone: +44 01224 294419)

This study applied novel experimental methods to investigate the physico-chemical and ecological characteristics of the hyporheic zone of a Scottish mountain stream. The project aimed to investigate the influence of hyporheic physico-chemistry on hyporheic invertebrate community structure in two stream reaches with contrasting stream-aquifer interactions. The streambed at S5 was characterised by spatially variable groundwater upwelling, while at S16 surface water dominated. In winter 2005, 56 hyporheic invertebrate colonisation chambers, with built in water-quality sampling tubes, were deployed in two reaches of the Girnock burn. From Nov 2005 to June 2006, water-quality samples were taken at fortnightly intervals from the channel and at depths of 150mm, 300mm and 450mm below the streambed. Water samples (100ml) were analysed for dissolved oxygen, alkalinity, chloride and temperature as tracers of groundwater-surface water exchange. Each season winter, spring and summer eighteen chambers were removed and invertebrates were identified (as far as possible) to species level. Canonical Correspondence Analysis (CCA) was used to investigate the relationship between the collected physico-chemical variables and observed invertebrate community structure.

Results revealed large inter- and intra-reach differences in hyporheic water quality, linked to high levels of spatio-temporal variability in groundwater – surface water exchange. This was found to vary seasonally in relation to groundwater recharge at

the catchment scale.

A total of 55 invertebrate taxa were found within the hyporheic zone at the two sites. CCA results showed the measured physico-chemical variables together helped explain 25% of the observed variability in invertebrate community structure in winter, and 20.6% in spring. Hyporheic communities contained large number of taxa commonly associated with the benthos of mountain streams and riparian zones, indicating an important exchange of fauna into shallow subsurface layers of the streambed. In winter, the hyporheic zone of the groundwater dominated reach (S5) contained a more diverse range of invertebrate assemblages than the surface water dominated reach (S16), differences which narrowed in spring and summer. This research provides a valuable insight into the nature of macro-invertebrate communities within the hyporheic zone, of upland Scottish streams, and which until recently has largely been overlooked. The work may have wider implications for understanding the significance of groundwater – surface water interactions to the ecological status of streams, as required by the Water Framework Directive.