LINKAGES BETWEEN HYPORHEIC AND BENTHIC INVERTEBRATE COMMUNITIES IN NEW ZEALAND GRAVEL BED RIVERS

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ABSTRACT

Surber samples from the benthos and T-bar samples (14 mm PVC pipe diameter) from the hyporheos were collected from 8 Southern Hawkes Bay rivers, differing in environmental conditions and geological age, and 8 rivers of the Cass/Craigieburn region of Canterbury that had differing physical stability and hyporheic physicochemical characteristics. Gravel bedded rivers of the Southern Hawkes Bay (North Island) and Cass/Craigieburn region (South Island) were sampled to examine the spatial distribution of the hyporheos in relation to physicochemical factors, bed stability and the significance of the hyporheic zone as a refuge and/or source of invertebrate colonists to the benthos. Physical bed movement, the duration of channel dewatering and flow variance were used to measure disturbance to the hyporheos and benthos, respectively. Benthic invertebrate communities of many streams are subject to constant disturbance from fluctuations in flow, temperature, and bed movement. In contrast, the hyporheos residing in the hyporheic zone may not experience the same disturbance regimes because bed movement occurs less often in the hyporheic zone and there is less diel temperature, dissolved oxygen and flow fluctuations.

In the rivers investigated, broad (between river) and finer (within river) scale environmental factors influenced the composition of the hyporheos. Local geomorphology appeared to have a significant effect on the hyporheos by markedly increasing the proportion of epigean animals (benthic animals resident in the hyporheos) at sites of young geomorphology (less that 0.05 mya). In contrast, hypogean animals (animals seldom encountered from the benthos) dominated geologically older sites (greater than 0.4 mya). Species diversity in the hyporheic zone was highest with intermediate levels of bed movement where both hypogean and epigean animals were present. The greater abundance of epigean fauna with increasing bed movement may reflect differences in disturbance regime between sites and in turn interstitial flow rates. However, it is unlikely that the geological age and stability of bed substrates determined community composition alone. Water chemistry was also an important factor determining community composition; epigean animals were more abundant in the hyporheic zone when hyporheic water chemistry was similar to the surface river water (e.g., higher dissolved oxygen and lower conductivity). In contrast, hypogean animals dominated the hyporheos when water chemistry was least like the surface water (e.g., lower dissolved oxygen and higher conductivity).

Dewatering and bed movement may disturb the hyporheos by desiccating or physically disturbing the hyporheic zone, respectively. If the potential colonists of the hyporheic zone are removed by desiccation or physical abrasion, the types of invertebrate taxa colonising will change because some invertebrates may be less capable of colonising from this region. The proportion of epigean animals may increase in the hyporheic zone with greater bed movement, but decline during stable conditions or at stable sites because the interstitial environment becomes less like the surface. Thus, the hyporheic zone may harbour benthic invertebrates during disturbance events and may be an important source of colonists for the benthos in frequently disturbed sites. In contrast, during stable conditions, or at stable sites, factors other than disturbance (e.g., substrate compactness, organic matter supply, competition or surface/groundwater interactions) may be more important in determining community composition. The diverse hyporheos identified in New Zealand rivers may be influenced by substrate composition, which may in turn alter interstitial flow patterns, discharge variance and the probability of bed movement.

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