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The hyporheic zone as a refugium in reaches with contrasting antecedent flow permanence

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One of the key ecological functions of the hyporheic zone is as a potential refugium for benthic invertebrates during hydrological disturbances. However, during flow recession, conditions within benthic sediments are relatively stable and no study to date has reported use of the hyporheic zone as a refugium during a gradual decline in discharge. This may be due to conditions remaining favourable in the benthic sediments. We investigated hyporheic zone usage by benthic invertebrates during a four-month period of flow recession. As flow declined, the area of submerged habitat contracted and the population density of the dominant benthic species, Gammarus pulex (Amphipoda), increased threefold in the surface sediments; this may have caused an increase in biotic pressures including predation and cannibalism. Concurrently, both the hyporheic abundance of G. pulex and the proportion of the total (benthic + hyporheic) G. pulex population inhabiting the hyporheic zone increased. This indicated that the hyporheic zone may have acted as a refugium following the proposed increase in biotic pressures. The refugial capacity of the hyporheic zone varied at sites with contrasting antecedent flow permanence, which could be related to the dominant direction of hydrologic exchange. A conceptual model is presented illustrating the spatial variability in the refugial capacity of the hyporheic zone during flow recession.