Development and independent testing of a new biotic index of stream macroinvertebrate community response to deposited fine-grained sediment

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The susceptibility of freshwater biota to excessive fine-grained sediment inputs is not well understood. However, knowledge of their susceptibility could aid in identifying where excessive fine-grained sediment is impairing ecological condition. We collected biological and deposited fine-grained sediment data from streams across England and Wales, representative of a range of river types over a gradient of fine sediment pressure. Using objective statistical approaches (partial canonical correspondence analysis (pCCA)) we established relationships between the macroinvertebrate community and fine-grained sediment inputs to river channels, having already factored out that portion of the biological variation associated with natural environmental gradients. This analysis provided the basis for a new empirically-derived diagnostic index for fine-grained sediment stress in rivers. It was not possible to relate the invertebrate community response to a single descriptor of sediment stress, rather two sub-indices were derived to capture the community responses to both the gradient of organic sediment and the gradient of total fines. The two sub-indices were then combined to derive the new combined fine sediment index ($CoFSI_{sp}$). The index was tested on an independent test dataset and was found to provide a robust indication of benthic fine-grained sediment conditions. The strength of correlation with the total fine-grained sediment gradient was always greater than that for other routinely used indices, confirming that $CoFSI_{sp}$ offered additional explanatory power when assessing this stressor of aquatic environments.