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The impact of feeding Cyprinids on river bed sediment structures and grain entrainment

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In gravel-bed rivers, between bed-mobilising flood events, surface sediment particles are rearranged by moderate flows, generally into more stable "water-worked" positions characterised by structures of various types, including imbrication and pebble clusters. This surface layer of structured, relatively coarse particles moderates the availability of finer sub-surface sediment and the transfer of mobile material from upstream. The work reported here is focused on understanding how benthic feeding fish (Cyprinids and Salmonids) dismantle surface structures, making particles less stable and potentially rendering vulnerable sub-surface material more mobile. An increase in available, transportable sediment has implications for sediment transport fluxes, reach-scale sediment loads, channel morphology and aquatic habitat. However, almost nothing is known about the impacts of feeding fish on bed sediment structures, entrainment and sediment fluxes. A series of flume experiments will quantify the effects of six different species of fish on sediment structure and grain entrainment. The experiments will consider 1) topographic variations between pre- and post-feeding substrates using DEMs interpolated from laser scans and 2) differences in sediment entrainment from water-worked substrates exposed to feeding fish and control substrates, without fish. Using interpolated DEMs, a variety of structural parameters will be extracted (e.g. imbrication indices) to quantify the impact of each species whilst feeding. Underwater videography techniques will be used to establish entrainment thresholds and transport rates under low critical shear stresses. A second set of flume experiments are planned using a large outdoor flume to investigate the effects of feeding Barbel Barbus barbus on surface structure, to assess how disturbance and sediment mobility vary as a function of species size and shoal density. A final set of field experiments will consider the large-scale, geomorphological implications of Cyprinid ecosystem engineering in the River Idle in Nottinghamshire. Here we report on the initial results of this work, highlighting the role of Cyprinid species in deconstructing and destabilising water-worked gravel-bed textures.