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Bream (*Abramis brama* (L.)) as zoogeomorphic agents and ecosystem engineers: Implications for fine sediment transport in lowland rivers

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Despite increasing recognition that animals play important roles in geomorphological systems (zoogeomorphology), with important ecological implications for the animals and their ecosystems (ecosystem engineering), sediment transport continues to be regarded as an abiotic process. This research challenges that orthodoxy by investigating the biotic processes associated with bioturbation in rivers caused by feeding bream (*Abramis brama* (L.)) and quantifying their impact on fine sediment suspension and sediment yield. Experiments in lakes have demonstrated that bream negatively influence ecosystem dynamics through bottom up mechanisms as a result of physical bioturbation caused by benthivorous feeding. Although this level of bioturbation, and thus sediment entrainment, can alter the fundamental biogeochemical cycles and food web dynamics in lentic ecosystems, research is yet to assess this potential effect in riverine ecosystems or evaluate this bioturbation mechanism as a driver of fluvial sediment flux – even though they are common in rivers across mainland Europe.

A series of *ex-situ* mesocosm experiments have investigated the controls of fine sediment entrainment by bream, assessing the roles of both biomass (size and number) and food density on suspended sediment concentration and turbidity. Bream create large volumes of suspended sediment during feeding (highest recorded turbidity 1172 NTU) and there are significant ($p < 0.001$) increases in turbidity associated with each experimental parameter: number of fish, fish size and food density. Supplementary experiments have assessed bream as ecosystem engineers in the presence of the congener species, roach (*Rutilus rutilus* (L.)), which share the same ecological niche. In the presence of roach, the impact of bream on turbidity increased by an average of 120% (6.6 NTU to 15 NTU) and increased further at the 90th percentile by 240% (32 NTU to 110 NTU).

In light of these findings, the extensive geographical distribution of bream and the observation that shoals of bream commonly exceed one thousand individuals, it is plausible that bream are an important biological constituent of the fine sediment cascade within riverine systems. Complementary field work is underway to quantify the frequency-magnitude characteristics of the fine sediment plumes that feeding shoals of bream generate in lowland UK rivers.