

Feel the vibrations – seismic sensing of salmonid nest building and associated river sediment mobilisation

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The role of spawning salmonids in altering river bed morphology and sediment transport is significant yet poorly understood. This is due, in large part, to limitations in monitoring the redd-building process in a continuous and spatially extended way. A complementary approach may be provided through the use of a small seismic sensor network analysing the ground motion signals generated by the agitation of sediment during the redd-building process. We successfully tested the viability of this approach by detecting and locating artificially-generated redd signals in a reach of the Mashel River, Washington State, USA. We then utilize records of 17 seismic stations, in which we automatically detected seismic events that were subsequently manually checked, yielding a catalogue of 45 potential redd-building events. Such redd-building events typically lasted between one and twenty minutes and were comprised of a series of clusters of 50–100 short energetic pulses in the 20–60 Hz frequency range. The majority (> 90 %) of these redd-building events occurred within eleven days, predominantly during the early morning and late afternoon. The seismically derived locations of the signals were in agreement with independently mapped redds. Improved network geometry and installation conditions are required for more efficient detection, robust location and improved energetic insights to redd-building processes in larger reaches. The passive and continuous nature of the seismic approach in detecting redds and describing fish behaviour provides a novel tool for fish biologists and fisheries managers, but also for fluvial geomorphologists, interested in quantifying the amount of sediment mobilised by this ecosystem engineer. When complemented with classic approaches, it could allow for a more holistic picture of the kinetics and temporal patterns (at scales from seconds to multiple seasons) of a key phase of salmonid life cycles.

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