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Weirs effects on the sediment continuity of two lowland rivers (Orne et Vire rivers, France) : implications for river restoration.

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In the search for good ecological status of watercourses, the restoration of sediment transport is today the subject of particular attention. The removal of transverse structures (weirs, dams) is often advocated, even though the real effect of small weirs on the transport of the bed load has not been demonstrated in all types of context (particularly medium and low energy rivers). This paper will present the results of a study on two highly anthropised rivers in Normandy (Vire and Orne Rivers, N-W France) to (I) document the real effect of weirs on the dynamics of coarse sediment transfers (> coarse gravel), (II) quantify the morphological effect of this interruption on the morphology/granularity of the channel, and (III) discuss the relevance of the removal of these structures for the restoration of sediment continuity in these systems. To this end, an annual sediment tracing system (848 RFID tracers) was set up in 2017 upstream of 6 structures of different types (micro-power stations, weirs, breached weirs) as well as on two recently restored sites in order to test different configurations. These tracers were placed in transects perpendicular to the flow, at different levels in the reservoirs in order to understand in detail the contribution of the water bodies and the structures as such in the modification of the mobility of coarse sediments. This monitoring was completed by measurements of morphological parameters (granulometry and geometry) upstream and downstream of these structures as well as by bathymetric measurements in the reservoirs in order to determine their filling levels. We were thus able to highlight the existence of coarse sediment mobility between structures despite modest powers (< 30 W.m²) as well as the significant effect of the hydraulic slowing of the reservoirs on the mobility of coarse sediments, regardless of the size of the structure considered. Since 2017, no tracer has been able to pass unrestored structures, which leads us to believe that these structures really affect sediment dynamics. Nevertheless, this sediment load interruption does not seem to induce any morphological adjustment downstream. These results thus question the interest of structure removal operations for the physical restoration of rivers in which the importance of solid flow seems to be a secondary control factor.