Geophysical Research Abstracts
Vol. 14, EGU2012-5963-2, 2012
EGU General Assembly 2012

Channel morphodynamics and habitat recovery in a river reach affected by gravel-mining (River Ésera, Ebro basin)

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Physical processes in rivers are the result of the interaction between flow regime and hydraulics, morphology, sedimentology and sediment transport. The frequency and magnitude of physical disturbance (i.e. bed stability) control habitat integrity and, consequently, ecological diversity of a particular fluvial system. Most rivers experience human-induced perturbations that alter such hydrosedimentary equilibrium, thus affecting the habitat of aquatic species. A dynamic balance may take long time to be newly attained. Within this context, gravel mining is well known to affect channel characteristics mostly at the local scale, but its effect may also propagate downstream and upstream. Sedimentary forms are modified during extraction and habitat features are reduced or even eliminated. Effects tend to be most acute in contrasted climatic environments, such as the Mediterranean areas, in which climatic and hydrological variability maximises effects of impacts and precludes short regeneration periods. Present research focuses on the evolution of a river reach, which has experienced an intense gravel extraction. The selected area is located in the River Ésera (Ebro basin), where interactions between morphodynamics and habitat recovery are examined. Emphasis is put on monitoring sedimentary, morphological and hydraulic variables to later compare pre (t_0) and post (t_1, $t_2 \ldots$ t_n) extraction situations. Methodology for all time monitoring steps (i.e. t_i) includes: i) characterization of grain size distribution at all of the different hydromorphological units within the reach; ii) description of channel morphology (together with changes before and after floods) by means of close-range aerial photographs, which are taken with a digital camera attached to a $1m^3$ helium balloon (i.e. BLIMP); and iii) determination of flow parameters from 2D hydraulic modelling that is based on detailed topographical data obtained from Leica® GNSS/GPS and robotic total station, and River Surveyor® ADCP M9. Finally, habitat suitability for selected fish species is simulated using hydraulics for the pre-extraction and the specified post-extraction time periods.