Properties of netting attached to bedload samplers affect hydraulic and sampling efficiency

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Abstract. Bedload transport comprises a wide range of particle sizes from sand to cobbles. Projects that collect bedload using handheld (or cable-suspended) samplers may focus either on sand and fine gravel or on coarse gravel and cobble sizes. To this end, a large variety of bags with different mesh sizes, volumes, and shapes are typically attached to bedload samplers. A problem encountered in bedload sampling projects is that fine particulates and organic debris may clog the net, and this quickly diminishes hydraulic efficiency, creates a backwater upstream of the sampler, and decreases hydraulic efficiency. Fine meshes—needed to collect small and large bedload are most affected by clogging. Besides mesh size, flexibility of the netting material can have a large effect on hydraulic efficiency. We conducted a field experiment during moderate high flows in which two different nets were attached to a non-flared, 0.3 by 0.2 m opening sampler (=bedload traps). One was an unstretchable 1.18 mm woven precision net, the other was a flexible, knitted, non-precision netting with 3.6 mm mesh opening size. We compared sampled bedload transport rates and particle sizes as well as mean flow velocities and depths measured at various distances from the sampler entrance between the two nets. The 1.18 mm mesh created slightly more backwater upstream of the sampler flow than the 3.6 mm nets. The difference in back-water effects became very pronounced when 10 liters of organic debris was inserted into the net (a volume typical of a 1-hr sample). In the non-stretchable 1.18 mm net, the debris pressed against the net end where it blocked the exit of water flow. This blockage forced waterflow to exit elsewhere which retarded flow velocity and created a backwater. By contrast, the stretchable 3.6 mm mesh width netting took an elongated, slender shape as bedload and organics traveled along the bottom and accumulated in the net end whereas water exited shortly behind the sampler opening. Flexibility of the netting material and its ability to stretch are other important properties affecting hydraulic and sampling efficiency. Ideally, netting material is fine-meshed and has thin yet sturdy thread in order to not impede throughflow. As soon as net clogging plays a role, being flexible and stretchable become important net properties. Netting material with that combination of properties does not exist. A user needs to select netting properties depending on the sampling situation and be aware of how those choices might affect the study outcome.