

## AN APPARATUS FOR BED MATERIAL SEDIMENT EXTRACTION FROM COARSE RIVER BEDS IN LARGE ALLUVIAL RIVERS

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**Abstract:** Grain size distributions of bed material sediment in large alluvial rivers are required in applications ranging from habitat mapping, calibration of sediment transport models, high resolution sediment routing, and testing of existing theories of longitudinal and cross stream sediment sorting. However, characterizing bed material sediment from coarse river beds is hampered by difficulties in sediment extraction, a challenge that is generally circumvented via pebble counts on point bars, even though it is unclear whether the bulk grain size distribution of bed sediments is well represented by pebble counts on bars.

We have developed and tested a boat-based sampling apparatus and methodology for extracting bulk sediment from a wide range of riverbed materials. It involves the use of a ~36 x 23 x 28 cm stainless steel toothed sampler, called the Cooper Scooper, which is deployed from and dragged downstream by the weight of a jet boat. The design is based on that of a river anchor such that a rotating center bar connected to a rope line in the boat aligns the sampler in the downstream direction, the teeth penetrate the bed surface, and the sampler digs into the bed. The sampler is fitted with lead weights to keep it from tipping over. The force of the sampler 'biting' into the bed can be felt on the rope line held by a person in the boat at which point they let out slack. The boat then motors to the spot above the embedded sampler, which is hoisted to the water surface via a system of pulleys. The Cooper Scooper is then clipped into a winch and boom assembly by which it is brought aboard.

This apparatus improves upon commonly used clamshell dredge samplers, which are unable to penetrate coarse or mixed bed surfaces. The Cooper Scooper, by contrast, extracts statistically representative bed material sediment samples of up to 16 kg (dry weight) with an average sample size of ~6 kg. Not surprisingly, the sampler does not perform well in very coarse or armored beds (e.g. where surface material size is on the same scale as the sampler). The Cooper Scooper has been tested in mixed and coarse beds at ~60 cross sections of the Middle and Upper Sacramento River (usually 3 samples across each section) spanning ~160 river kilometers. The sampler and method have allowed us to characterize the grain size distribution for large portions of the river for which bed material data were previously unavailable. The data will enable assessment of habitat for anadromous and benthic species, computations of sediment transport and routing, and the testing of current theories of downstream fining.