



Thinking large - development of a methodology for improving quantification of tagged and traced intertidal boulders.

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The majority of coastal sediment transport studies focus on material finer than coarse gravels. Likewise, sediment fingerprinting as well as tag and trace technologies tend to focus on finer grained materials. In our paper, we present a methodology for tagging and tracing much larger materials – intertidal boulders weighing up to 0.75 tons.

Whilst the tagging technique – application of marine paint – is not novel, the field methodology is for a few reasons. First, there are few tagging methods that are suitable for an environment that is alternately wetted and dried, and subject to extreme wave forcing. Second, we initially tag intact intertidal rock on shore platforms, photograph them repeatedly, keep abreast of storms and then find the boulders shortly after detaching. These boulders are then traced, and re-surveyed on repeated visits using a differential or handheld GPS. Third, our field trial in Wales, UK, shows that boulders are repeatedly entrained, transported and deposited. During some of these events the boulders are broken. The use of marine paint as the ‘tag’ allows us to trace some of the boulder fragments. This would not be possible with other tagging methods which could be used in intertidal settings. We demonstrate these methods using data from south Wales, UK as a case study, illustrating that tag and trace methods can be used successfully to measure coastal erosion and subsequent transport over 10s to 100s of metres spatially, at the temporal scale of days to years.

The second methodological approach is more novel, and although we have applied it only to boulder-sized material in this paper, it could potentially be of value for tag and trace studies of finer sediments. It involves development of a method to calculate the measurement error associated with each observation, and cumulatively when creating transport pathways of individual ‘trace’ positions of boulders over time. A visual basic script has been developed which takes into consideration distance moved relative to a-axis of grain size (i.e. movement occurs where distance moved is $\geq 1/2$ the a-axis length of each clast monitored) and measurement error (which can vary with instrument type). It then uses trigonometry to calculate the longest and shortest possible routes that the boulder could have travelled between two or more time intervals, so that error estimates can be placed around the actual distance measured in the field. This script therefore enables us to place error bounds around our field measurements, which has not previously been possible. As such, this method has the potential to improve our ability to meaningfully and robustly report results from tag and trace studies in a range of settings.