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Biogeosciences
Discussions

Interactive comment on "The effects of five different defaunation methods on biogeochemical properties of intertidal sediment" *by* T. J. Tolhurst et al.

Anonymous Referee #1

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This paper describes a series of trials to investigate different kinds of defaunation methods on sediment properties. The authors make the important point that benthic infauna and sediment biogeochemical properties are intimately linked and should be considered in defaunation experiments. The methods used in the experiments included either (a) removing, homogenizing and either freezing or drying the sediments in the lab, or (b) attempting to defaunate in situ using formalin, liquid nitrogen or hydrogen peroxide.

While the removal of sediments, not surprisingly, defaunated the sediments, the in situ manipulations were only transient and resulted in partial defaunation. Responses in terms of biogeochemical properties did not reveal any major effects except for parame-

ters related to microphytobenthos. But also here effects were transient due to the small scale of disturbance and the rapid colonization of diatoms.

While the methods used represent some, at least historically, used methods, none of the methods used for conducting larger scale experiments, such as those that use different plastics for defaunation (some of which are cited in Table 1) are tested. The authors argue that recovery experiments are confounded in their methods, as they do not explicitly test recovery to undisturbed sediments. However, they do show that these confounding effects are surprisingly minor and transient! Most ecologists working on disturbance and recovery recognize the potential problem, but as highlighted by the authors, the methods chosen need to be gauged against the question asked.

The relevance of this work to those conducting larger scale experiments is unclear. A potentially much more serious problem than the method of defaunation is the small scale (or location-dependence) of the experiments that have traditionally been conducted. Perhaps most importantly though, I do not think there is any kind of disturbance (natural or anthropogenic, experimental or not) that would selectively defaunate the sediments without also affecting sediment structure and microphytobenthic community structure in some way. Also naturally disturbed areas will usually need conditioning of the sediment characteristics to be suitable for colonists.

In experiments that seek to understand recovery after disturbance, the scale of defaunation, the hydrodynamic regime and the long-term successional sequence is usually of main interest – especially considering recovery dynamics that may take months to years. Priority effects are not as prominent in soft-sediments as in hardsubstrate communities. The authors cite Beukema et al's. (1999) observation on transient overshoots in abundance early in the colonization processes and highlight that their conclusions that relate to biotic interactions and resource supply may be construed because they did not measure sediment characteristics; in this case it is a mute point as their first sampling was done after half a year and the timescales considered are contrasting. Another point is that several more recent defaunation papers have actually addressed, for

example, sediment characteristics more explicitly (see the Dutch papers by Montserrat, Van Colen, Rossi et al.) and defaunation that test scale- and location dependence (Norkko et al.; Thrush et al.). Most more recent work has also used different types of plastic sheeting to induce hypoxia to the seafloor – it is a shame that their potential artefacts was not tested in this paper. In this context the questions and conclusions of this paper seem somewhat academic.

The authors make an important point that defaunation may affect sediment characteristics and potential early stage colonisation, however, the actual question asked in combination with the transience of the artefacts is central. While the paper provides some insights into how different kind of defaunations affect sediment properties its contribution to advancing the field is somewhat unclear. I think the paper either needs to (a) be cut down to either report the mere experiments (which were robust in their design), or (b) be expanded considerably to more generally discuss the importance of the methods used in relation to the questions asked.

Some minor points:

Perhaps not surprisingly the major effects on sediment properties were those that affected microphytobenthos, measured both as chl biomass and as reduced photosynthetic yield. But why not measure pheophytin to get a quantitative measure of chl degradation products?

Interactive comment on Biogeosciences Discuss., 9, 1377, 2012.