

# Sediment deposition affects biodiversity and ecosystem functioning in soft-sediment communities

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Estuaries are worldwide affected by human activities such as pollution, fisheries, and the development of coastal infrastructure. A number of human activities, such as dredging or land use change in river basins, alter estuarine sediment transport processes and sediment loads. Changes in such sediment dynamics can have an impact on the biodiversity and functioning of the sediment bed community. For example, benthic macrofaunal organisms influence sediment chemistry and functioning through behavioural activities that affect the fluxes of energy and matter between the sediment and water column, i.e. benthic-pelagic coupling. Changes in macrobenthic community composition related to sediment change can therefore affect ecosystem-wide functioning.

To investigate the effects of sediment deposition on biodiversity and ecosystem functioning in estuarine sediment communities, a laboratory experiment was conducted with sediment samples collected from the Paulina mudflat, Westerschelde estuary (SW Netherlands). Sediment communities were incubated in the laboratory, where a layer of sediment was applied. Four different treatments were used, each of which corresponding to a different thickness of the added layer (0, 1, 2 or 5cm). During incubation at ambient temperature, water samples were taken for measurements of sediment community oxygen consumption, i.e. benthic mineralisation (SCOC). Additionally, bromide was used as a tracer for benthic bioirrigation activities, while luminophores were used to measure benthic bioturbation rates. After incubation, the macrofauna was extracted, identified and counted. Linear regressions were applied to assess the relationships between benthic processes, SCOC, and structural community attributes, e.g. population densities and diversity.

We found a significant decrease in community diversity and population densities of most species with increasing thickness of the deposited sediment. Furthermore, bioturbation and SCOC were negatively affected by the sediment deposition. Linear regression was used to assess relationships between functional parameters and community composition and diversity. Changes in community-wide processes and functioning were correlated with the deposition-induced change in density of some or just one single species. We conclude that sediment deposition can greatly influence the coupled biodiversity and functioning of the estuarine soft-sediment ecosystem.

Keywords: estuaries; bioturbation; bioirrigation; SCOC; macrobenthos; benthic-pelagic coupling