

Impact of seagrass wrack accumulations of hydrogen sulfide emissions from sandy beaches

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The shallow waters of Geographe Bay, Western Australia, support extensive seagrass beds that contribute large amounts of wrack (detached leaves and stems) to the local beaches, predominantly during winter. Along most of the coast, the wrack collects on the beaches temporarily before it is removed by storm surges and transported along-shore; in this cycle its temporary accumulation and decomposition does not unduly affect the people that live close-by. However a proportion of the wrack moving onshore is permanently trapped by an extensive groyne development. These accumulations, and the management interventions to remove them, have become major environmental and social issues, impacting severely on the amenity of the area for local residents. Over a two-year period, we measured the physical, chemical and biological characteristics of the wrack piles, geochemical conditions in the underlying sand and gas fluxes out of the wrack. The wrack piles are hotspots for organic carbon degradation with the subsequent production of CO₂, CH₄ and, the last from the saturated sands underneath wrack piles. *In-situ* H₂S fluxes were comparable to those recorded in saltmarsh ecosystems, though these are highly variable in time and space. This variability appears to be related to the age and size of the wrack accumulations, which may affect the supply of DOC to sustain bacterial decomposition in the beach sand, and the porosity of the accumulations, which affects the diffusion of oxygen into, and H₂S out of, the sands. A laboratory experiment was conducted to elucidate the role of DOC supply and wrack porosity on H₂S production. These results suggested that the effect of seagrass wrack on gas diffusion was insufficient to generate redox conditions suitable for production of H₂S, suggesting that DOC loading is the primary mechanism through which wrack accumulations drive the production of H₂S. The results suggest that maintenance of oxic conditions or the re-distribution of wrack to unsaturated portions of the beach can manage H₂S emissions.