Living in multi-stressed sediments: behavioral consequences for the functioning and diversity in coastal habitats

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Shallow coastal habitats and estuaries provide a number of important ecosystem services and functions and are therefore considered to be of high ecological and socio-economic value. However, these crucial habitats are worldwide impacted by multiple stressors that alter the delivered critical ecosystem benefits or services. In the interest to assess how shallow coastal ecosystems respond to climatic and non-climatic stressors, it is essential to understand the dynamics and functioning of species populations within the ecosystem; specifically, how these processes and patterns are affected by various degrees of interactive stressors. Marine organisms carry out crucial behavioural activities, for example, foraging, avoiding predation and competing with others. Any stressor or environmental change that is able to induce disruption of behavioural processes has the potential to influence individual fitness and ultimately will affect community dynamics and coupled ecosystem functioning (Thrush et al., 2009). This project experimentally investigates the behavioural response of benthic key species to different degrees of multiple interactive stressors: hypoxia, warming and acidification of seawater; and how these responses affect the functioning and diversity of coastal ecosystems. Behaviour of benthic key species such as sediment reworking, siphon activity, sediment plume production and manoeuvring (Townsend et al., 2014) as well as predator avoidance (Maire et al., 2010) will be documented by using time lapse cameras and non-destructive pressure sensors to capture the hydraulic activities of the benthic organisms in pressure wave-forms within the sediment pore water (Woodin et al., 2010). Images and hydraulic pressure signals collected from both methods will be synchronised and analysed in order to identify activities carried out by the benthic species in surface and subsurface of sediment. Furthermore, the physiological responses of benthic macrofauna will be recorded. For example, respiration rate will be measured using Pyroscience sensor technology, feeding rate will be measured using a Coulter Multisizer to obtain the cell concentrations and the feeding rate will be derived from these cell concentrations using mathematical formula (Iglesias et al., 1996). Moreover, biodeposition rate, clearance rate and absorption efficiency will be calculated using mathematical formula (Iglesias et al., 1996; Norkko et al., 2005) and calcification rate will be measured with the alkalinity anomaly technique (Gazeau et al., 2007). In addition, ecosystem processes and properties mediated by of these benthic study species will be measured; for example fluxes of oxygen and nutrient across the sediment–water interface using closed corer incubations and benthic community composition using corers for sediment extraction (Thrush et al., 2006).

References