Disentangling the effects of climate change on the offshore wind farm hard substrate fouling community

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In the Belgian Part of the North Sea (BPNS), the area used for or allocated to the construction of offshore wind farms (OWFs) is increasing. The installation of these artificial hard substrates, as well as their potential as a multi-purpose platform for combined aquaculture activities, introduce a completely novel ecosystem to these otherwise sandy environments. On top of these local anthropogenic stressors, a combination of global changes continues to affect the marine ecosystem. The International Panel for Climate Change (IPCC) predicts a global rise in ocean temperature of 3°C and a drop in oceanic pH of 0.3 by the end of this century, according to its 'business-as-usual' climate scenario.

To investigate how this combination of local and global changes is affecting our coastal ecosystems, the hard substrate fouling community found on the OWF turbines has been characterised by three model species: the blue mussel (*Mytilus edulis*), the amphipod Jassa herdmani and the plumose anemone (*Metridium senile*). These three model species were subjected to long-term ecophysiological experiments at Ghent University and Marine Station Ostend between 2017 and 2020. All experiments had four environmental treatments in common: CTRL (control setting with ambient sea water temperature and current pH), OA (ocean acidification setting with ambient temperature and pH lowered by 0.3), OW (ocean warming scenario with elevated temperature and current pH) and CC (climate change scenario with combination of elevated temperature and lowered pH).

This presentation reports on the different, species-specific effects of temperature and pH on the ecophysiology of our three model species. Survival and volumetric growth are heavily impacted, with an overall negative effect of environmental manipulations on survival and a varying effect of elevated temperature and lowered pH on the shell-size and biovolume of *M. edulis* and *M. senile*, respectively. Metabolic stress was quantified by changes in individual respiration rate under different environmental stressors, resulting in a species-specific reaction in oxygen consumption. Production of the potent greenhouse gas nitrous oxide (N2O) by the model species or their microbial biofilm was quantified as well, with emission rates varying across species and climate settings. The presence of this hard substrate fouling fauna, as well as extensive aquaculture plans in these areas, undoubtedly affect the local food web structure and biogeochemistry of the surrounding environment. Therefore, ecophysiological parameters and their behaviour in future climate settings can be an important tool to characterise and validate ecological models that can be used to run different application and upscaling scenarios.

Keywords: Climate Change; Ocean acidification; Offshore wind farm; Fouling fauna; Ecosystem functioning; Aquaculture; Nitrous oxide (N2O)

POSTER PRESENTATIONS