

Investigating the combined effects of climate change on ecophysiological response of offshore wind farm fouling fauna

Voet Helena^{1,2}, Van Colen Carl², Van Den Bulcke Laure², Vanaverbeke Jan^{1,2}

¹ Royal Belgian Institute of Natural Sciences, OD Nature, Gulledele 100, 1200 Brussels – Belgium
E-mail: hvoet@naturalsciences.be

² Marine Biology Research Group, Biology Department. Ghent University, Krijgslaan 281 (S8), 9000 Ghent – Belgium

In the past decades, the Belgian part of the North Sea (BPNS) has been affected by a mixture of local and global pressures. Locally, an increasing trend to install offshore wind farms entails the introduction of artificial hard substrates and an increase in potentially non-indigenous fouling fauna. Plans to use these concession areas for aquacultural activities will further affect the food web structure and aggravate the emission of nitrous oxide (N₂O), a potent greenhouse gas. On a global scale, the International Panel for Climate Change (IPCC) 'business-as-usual' climate change scenario predicts a rise of ocean temperature by 3°C and a drop in oceanic pH of 0.3.

The overall objective of the PERSUADE project (Experimental approaches towards future sustainable use of North Sea artificial hard substrates) is to investigate the impact of these combined pressures on food web interactions and nutrient cycling of coastal ecosystems and integrate the dynamics of the water column and the sediment while doing so. As part of the doctoral research within PERSUADE, a series of fouling fauna experiments are being conducted. Blue mussel (*Mytilus edulis*), a tube-building amphipod (*Jassa herdmani*) and a colonial tunicate (*Diplosoma listerianum*) were selected as model species for fouling fauna communities that can be found at different depths on the artificial hard substrate of the Belgian offshore wind farms. To gain insight into the respiration, nutrient exchange and survival of these model species under current environmental conditions and the aforementioned future climate settings, fully crossed laboratory experiments are being set up at Ghent University. Incubations run for six weeks in four different environmental treatments: - CTRL: control settings (12°C and current pH), - pH: lowered pH (12°C and pH lowered by 0.3), - Temp: elevated temperature (15°C and current pH) and - CC: climate change scenario (15°C and pH lowered by 0.3). Under each of these environmental settings, different ecophysiological parameters are tested in the third and sixth week of incubation. The conditional and physiological response of the fouling fauna model species can be investigated in terms of survival, condition index, respiration, nutrient exchange, calcification rate and clearance rate. To this purpose, sealed cores are used in each environmental treatment for 150-minute experiments. Two cores are used per treatment, allowing for the correction of data and isolation of the organisms' effect. Different water samples are taken along the duration of each experiment to test the variation in different physiological parameters. Condition and survival are being monitored throughout the six-week incubations. The physiological and conditional response parameters will feed into the development of a 2-D ecological model, designed to predict the response of the fouling fauna communities to cumulative pressures and upscale this response to the offshore wind farm ecosystems.

Keywords: climate change; ocean acidification; fouling fauna; ecophysiology; *Mytilus edulis*; *Jassa herdmani*; *Diplosoma listerianum*