Functional characteristics of the food web of artificial hard substrates of offshore wind farms along a depth gradient

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The establishment of man-made structures, such as offshore wind farms, provides hard substrates to naturally soft-bottom areas. Hard substrate fauna rapidly colonizes this new habitat, altering the natural biodiversity and thus affecting both ecosystem structure and functioning, e.g. food web interactions. The aim of the present study is to investigate the structural and functional food web characteristics along a depth gradient on a wind turbine in the Belgian part of the North Sea. For this purpose, macrofaunal organisms were collected at six different ecological zones along a depth gradient on a gravity-based wind turbine: (a) the intertidal zone, (b) the *Mytilus edulis* zone (~ 5 m water depth), (c) the *Jassa herdmani* zone (8-9 m water depth), (d) the *Metridium dianthus* zone (15-25 m water depth), (e) the erosion protection layer (EPL) and (f) the nearby soft substrate. All organisms were identified at the lowest possible taxonomic level and processed for stable isotope analysis (δ15N and δ13C). Based on stable isotope signals, the organisms form the seven zones were classified into eight functional groups. δ15N values showed that the variation in trophic position ranges was high between different ecological depth zones, with the EPL community showing the highest range (2.36 – 6.59), whereas the narrowest range was observed by the intertidal community (1.89 – 3.33). The high range for the EPL community suggests a possible relation between trophic position and mobility of the organisms. Overall, the structural difference in the fouling communities was partly reflected in other food-web characteristics (Layman indices) of the fouling communities: the intertidal food web is clearly different from the more homogeneous deeper parts which changed gradually with depth. This can be partly explained by the trophic plasticity of particular species, such as the anemone *Metridium dianthus* and the brittle star *Ophiothrix fragilis* which shift food sources and trophic positions depending on the zone they inhabit. This study corroborates the hypothesis that there is structural and isotopic variation of the food web along the depth gradient at a wind turbine; however, this is not reflected in the functional characteristics of the communities, indicating a more complex utilization of food sources and trophic level occupation.

Keywords: stable isotope analysis; artificial hard substrates; trophic interactions