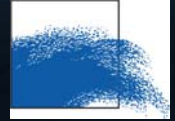


# Offshore Intertidal Hard Substrata: a new habitat promoting non-indigenous species in the Southern North Sea



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## Introduction

Windmills in the Belgian part of the North Sea (BPNS) create a new habitat of artificial hard substrata in a region mostly characterized by sandy sediments. Given the consequent increase in habitat heterogeneity, the effect of the introduction of these hard substrata is widely regarded the most important impact of wind farms. This study investigates the colonisation of the macrofouling communities on these newly introduced hard substrata, with special attention to non-indigenous species on the offshore intertidal hard substrata.

## Material and methods

Seasonal semi-quantitative sampling of epibiota from autumn of 2008 up to the spring of 2012 at types of two foundations: steel monopile (Belwind - a) and concrete gravity based foundations (C-Power - b). Visual inspection and video transects allowed for the detection of rare, though conspicuous species.

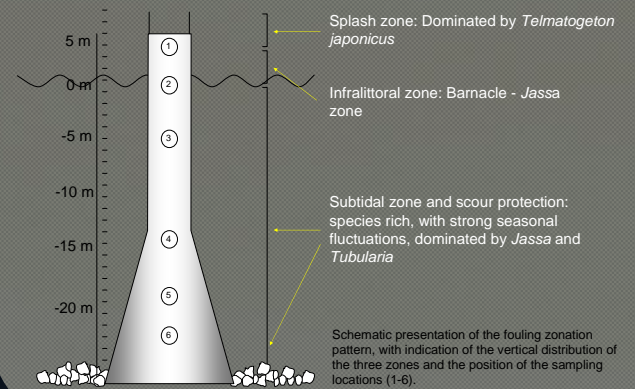


## Dominance of non-indigenous species

	C-POWER				BELWIND	
	Year One	Year Two	Year Three	Year Four	Year One	Year Two
<i>Megabalanus coccopoma</i> (Darwin, 1854)	<b>C</b>				<b>F</b>	
<i>Balanus perforatus</i> Bruguière, 1789	<b>S</b>	<b>A</b>	<b>A</b>	<b>C</b>		<b>C</b>
<i>Telmatogeton japonicus</i> Tokunaga, 1933	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>		<b>S</b>
<i>Elminius modestus</i> Darwin, 1854	<b>A</b>	<b>A</b>	<b>A</b>	<b>A</b>	<b>C</b>	<b>C</b>
<i>Jassa marmorata</i> (Holmes, 1903)	<b>C</b>	<b>C</b>	<b>C</b>	<b>C</b>	<b>C</b>	<b>S</b>
<i>Mytilus edulis</i> (Linnaeus, 1758)	<b>F</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>C</b>	<b>C</b>
<i>Semibalanus balanoides</i> (Linnaeus, 1758)			<b>S</b>	<b>S</b>	<b>C</b>	<b>C</b>
<i>Balanus crenatus</i> Bruguière, 1789		<b>F</b>			<b>C</b>	<b>R</b>
<i>Patella vulgata</i> Linnaeus, 1758			<b>F</b>	<b>F</b>		
<i>Hemigrapsus sanguineus</i> (De Haan, 1835)			<b>F</b>	<b>F</b>		
<i>Crassostrea gigas</i> (Thunberg, 1793)			<b>O</b>	<b>O</b>		
<i>Littorina littorea</i> (Linnaeus, 1758)			<b>F</b>	<b>F</b>		
<i>Balanus improvisus</i> Darwin, 1854			<b>O</b>		<b>O</b>	<b>R</b>
<i>Emplectonema gracile</i> (Johnston, 1873)			<b>O</b>			
<i>Emplectonema neesii</i> (Ørsted, 1843)			<b>O</b>			
<i>Pleioplana atomata</i> (OF Müller, 1776)			<b>O</b>			
<i>Eulalia viridis</i> (Johnston, 1829)				<b>O</b>		

Overview of recorded intertidal species at the C-Power and Belwind site with indication of their abundance as indicated by the SACFOR scale. S, superabundant; A, abundant; C, common; F, frequent; O, occasional; R, rare. Non-indigenous species are indicated in bold.

## A clear depth zonation pattern



## Eight non-indigenous species present!



### Six human introduced species

### Two range expanding species

All species were already known from the BPNS. Most are opportunistic and early colonisers of man-made structures

## Conclusions

Increased availability of artificial hard substrata promotes:

- the spreading of southern species (in conjunction with the effect of climate change)
- the establishment of introduced species
- strengthening of the position of populations of non-indigenous species in the Southern North Sea
- the stepping stone effect, which is highly relevant for the dispersal of species, that lack planktonic larval stages (e.g. *Jassa* spp.).
- the follow up of response variables such as species richness, species-specific densities and biomass, will allow to investigate and document the successional transitions in detail.

➡ Attention needs to be given to the taxonomic resolution to be able to observe the shifts in species.