THE CIRCLE OF LIFE OF ATLANTIC COD (*GADUS MORHUA*) AT A WIND FARM IN THE BELGIAN PART OF THE NORTH SEA: WHERE ECOLOGY MEETS ECONOMY

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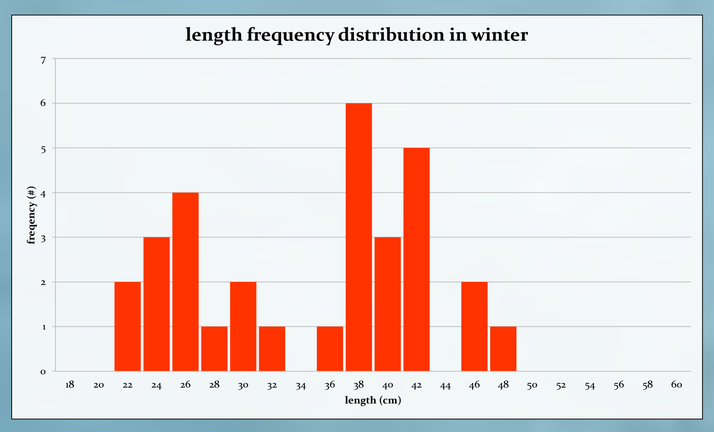
Cod at Windmill artificial reefs

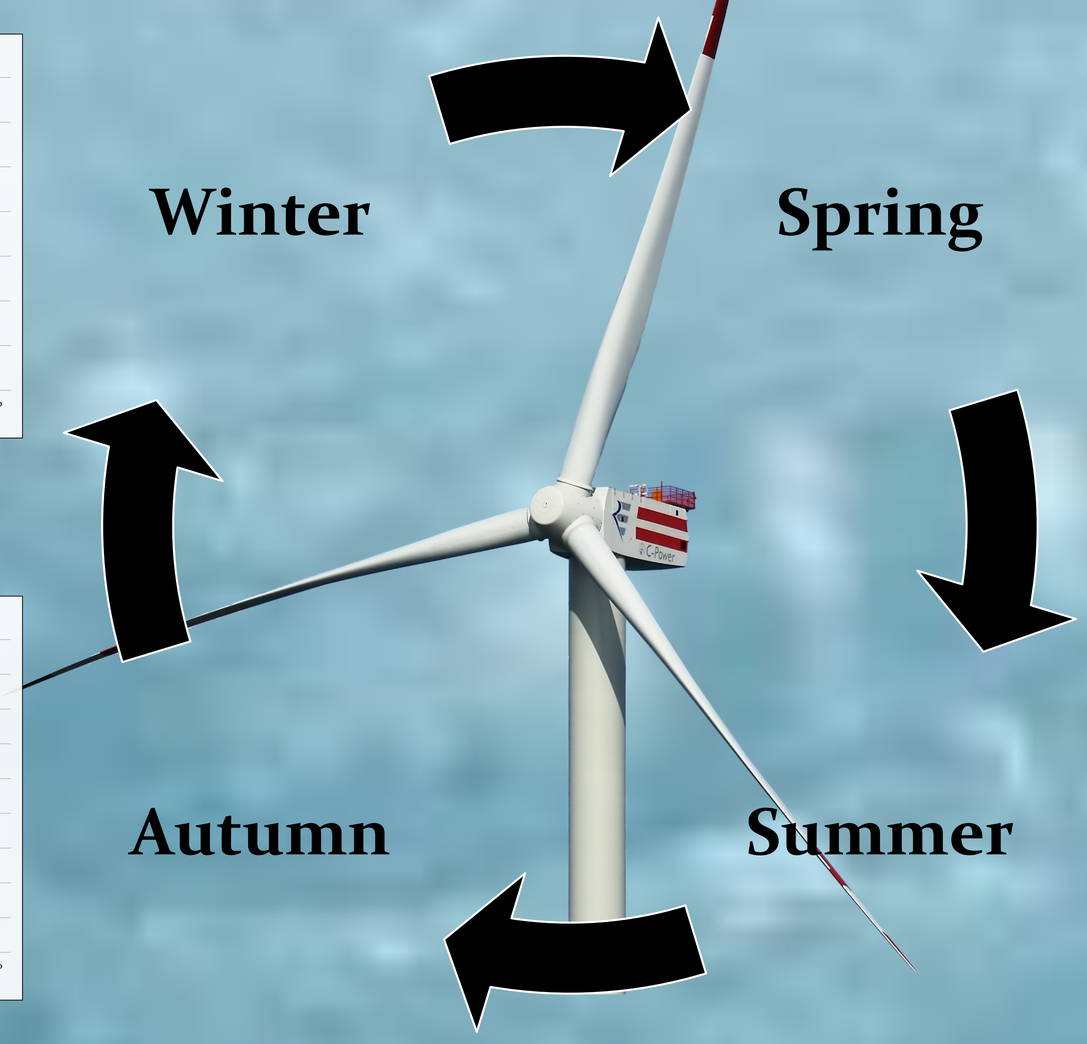
A substantial expansion of offshore wind farms in the North Sea has been planned, inducing a growing interest in the possible effects of these artificial habitats on the marine environment. Demersal fishes are likely to be affected by these changes in the environment. The offshore wind turbines may provide a suitable habitat for hard substrate dwelling fish since hard substrates, e.g. windmill artificial reefs (further referred to as WAR), have been reported to attract and concentrate fish and/or to enhance local fish stocks.
Since 2009 the trophic ecology and community structure of Atlantic cod has been investigated at WAR on the Thorntonbank. In this study, **the state of the art of ecological knowledge of Atlantic cod** (*Gadus morhua* L.) inhabiting WAR in the Belgian part of the North Sea after three years of environmental monitoring is given.

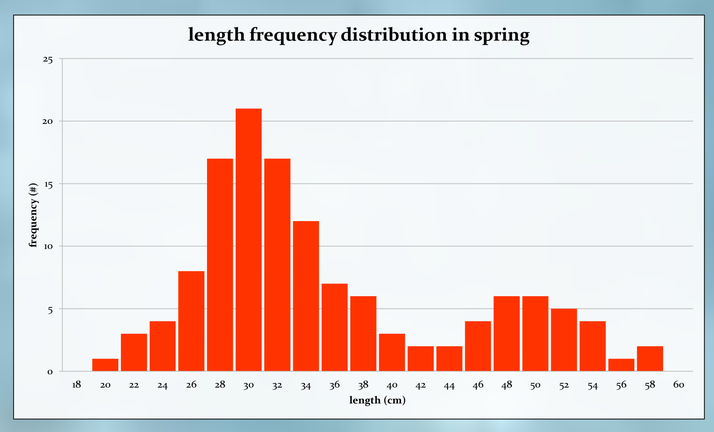

Atlantic cod (*Gadus morhua* L.)

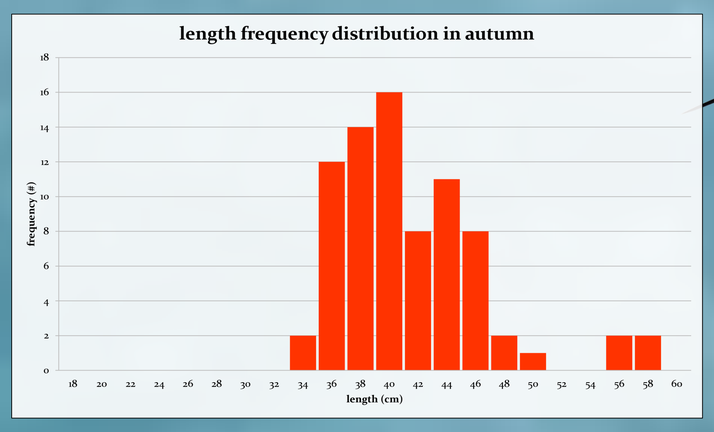
Study area & sampling design

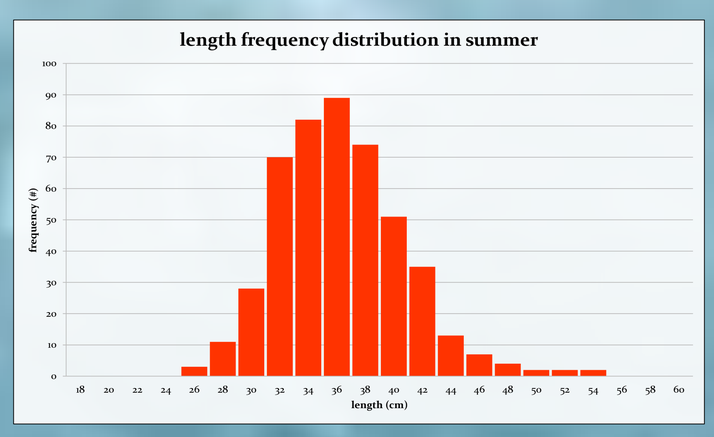
The wind farm under consideration is located at a sandbank 27 km offshore the Belgian coast. The turbines in combination with the buffer (i.e. erosion protection layer) form the WAR, which has a diameter of 50 m. Several techniques were used to investigate the trophic ecology and community structure:
(1) Standardized line fishing (hooks: Arca, size four; bait: *Arenicola marina*) was performed to **quantify the catch rates** of Atlantic cod.
(2)All fish caught were measured to investigate the **length frequency distribution.**
(3) An acoustic telemetry study was set up to investigate **residency and seasonal migration** of Atlantic cod. 19 specimens were tagged and tracked with Vemco VR2W receivers from may 2011 onwards .

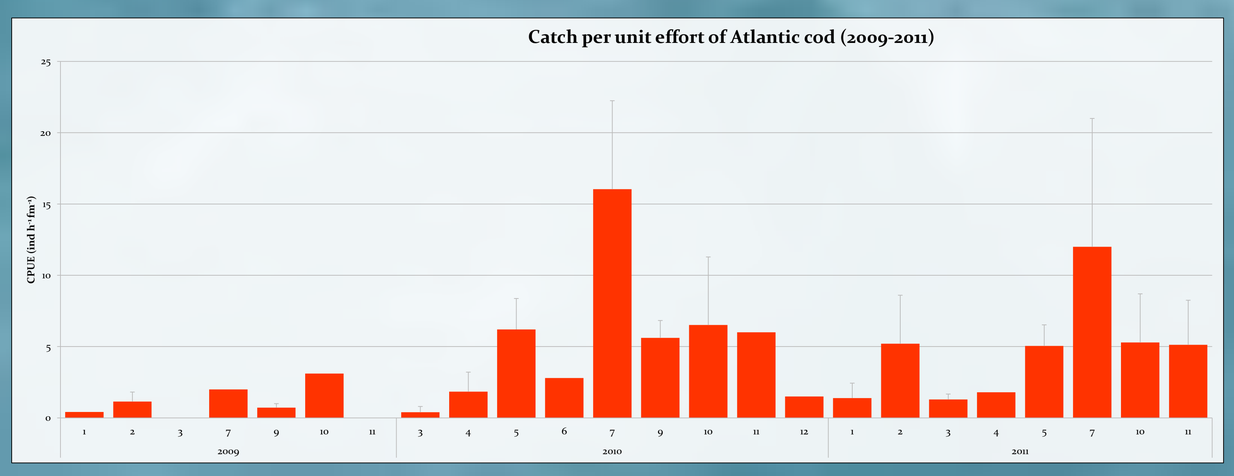


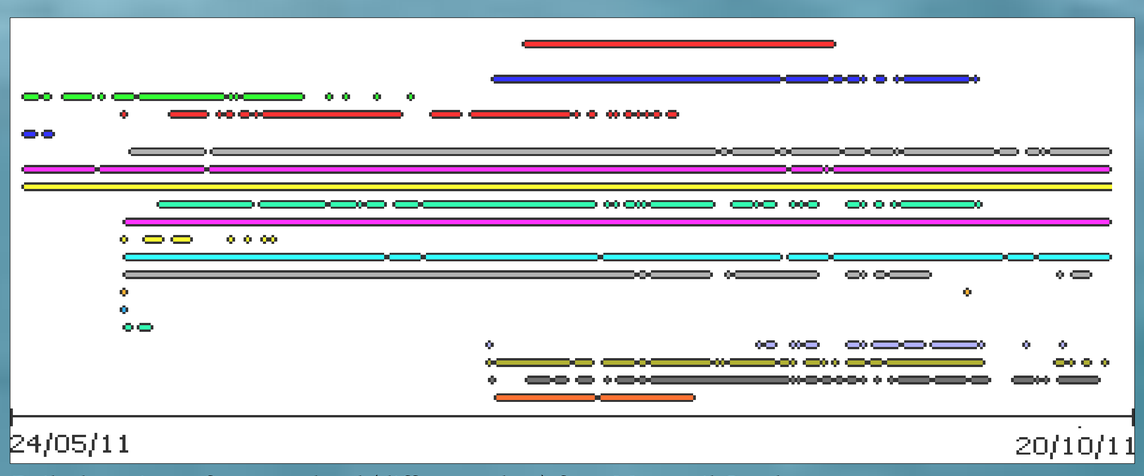












Daily detections of 20 tagged cod (different colors) from May until October 2011

This study disclosed the importance of the WAR in the life history of Atlantic cod in the BPNS.
Every year, large aggregations of Atlantic cod (aged 2 to 3 years) arrive at the WAR in spring, stay throughout summer and autumn (which is the growing season) and leave the area in winter time. The (ongoing) acoustic telemetry study (Reubens et al. 2011) revealed high site fidelity and residency near the WAR.
Currently the WARs in the BPNS actually are *de facto* marine protected areas. However, a study has been performed to investigate the possibility of small-scale passive fisheries inside these concession areas (Verhaeghe et al., 2011). Fish aggregations, as e.g. found at the WARs for Atlantic cod, are particularly vulnerable to fishing pressure and overexploitation (Rose and Kulka, 1999). Therefore it is important to carefully monitor the aggregations of Atlantic cod in the long term.

Ref: Reubens, J., Degraer, S., Vincx, M., 2011. Spatial and temporal movements of cod (Gadus morhua) in a wind farm in the Belgian part of the North Sea using acoustic telemetry, a VPS study. In: Degraer, S., Brabant, R., Rumes, B.s (Eds.), Offshore wind farms in the Belgian part of the North Sea - Selected findings from the baseline and targeted monitoring;Rose, G.A., Kulka, D.W., 1999. Hyperaggregation of fish and fisheries: how catch-per-unit-effort increased as the northern cod (Gadus morhua) declined. Can. J. Fish. Aquat. Sci. 56, 118-127;Verhaeghe, D., Delbare, D., Polet, H., 2011. Haalbaarheidsstudie: Passieve visserij en maricultuur binnen de Vlaamse windmolenparken? Eindrapport MARIPAS. ILVO-Mededeling 99.

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