



Fisheries benefits and ecological effects of offshore wind farms in the southern North Sea

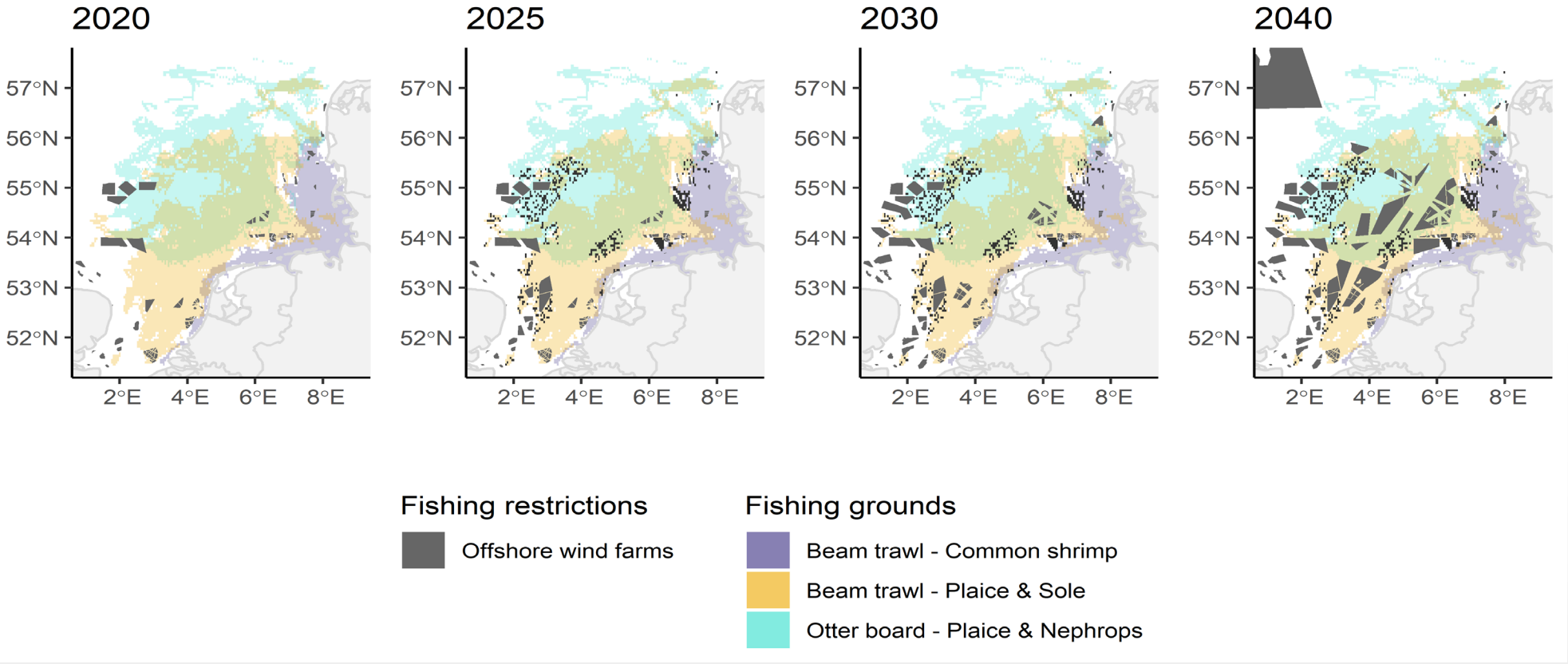
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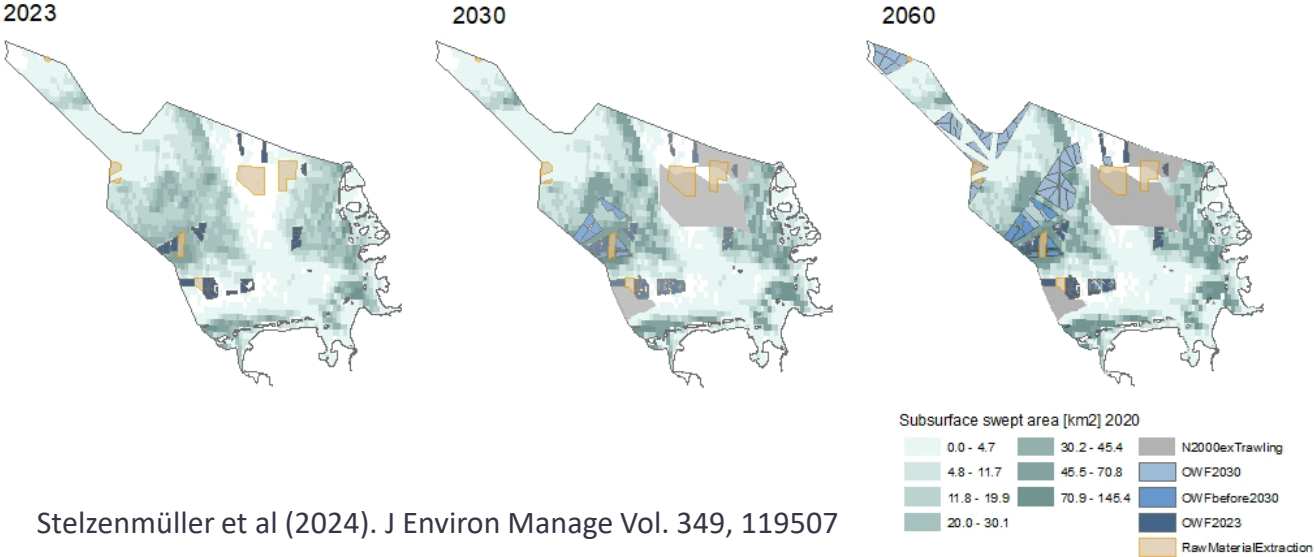


Spread of offshore wind and the loss of fishing opportunities



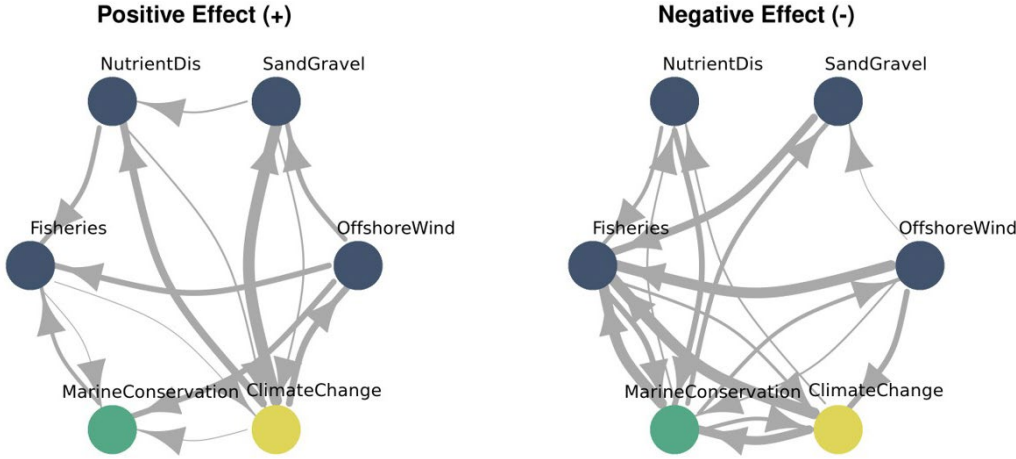
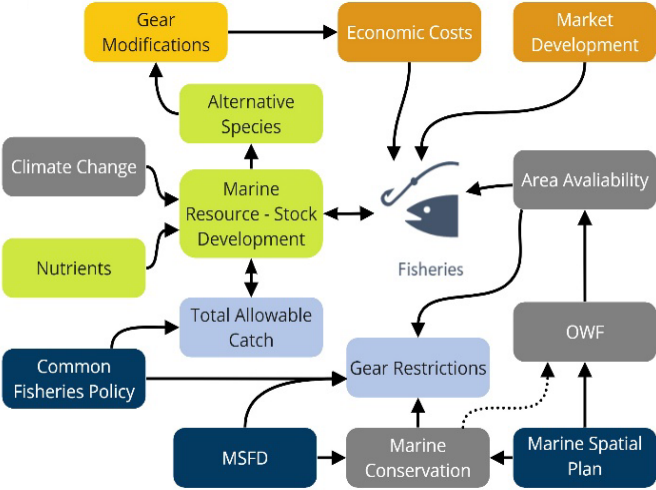
Letschert et al (in prep)

Future fishing activities in the German North Sea ?

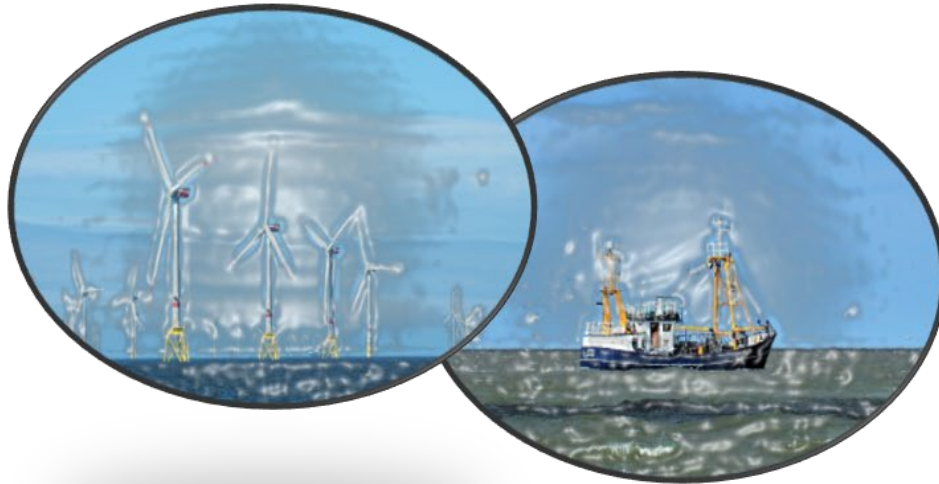


Stelzenmüller et al (2024). J Environ Manage Vol. 349, 119507

- Fisheries is exposed to multiple governance processes (EU, national, local) and external factors
- Area restrictions, climate change, and technological advances determine future fishing activities
- Socio-ecological impacts of OWF on fisheries



Socio-ecological impacts of OWF on fisheries

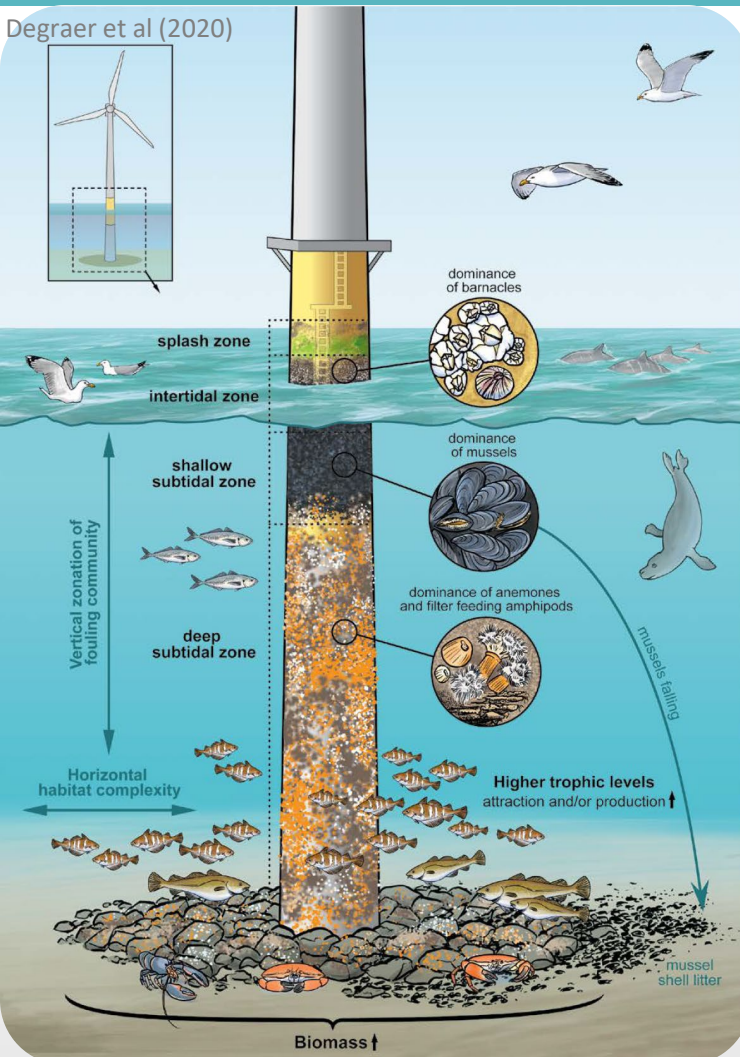


- Loss of fishing opportunities
- Economic losses
- Socio-cultural impacts on fishing communities



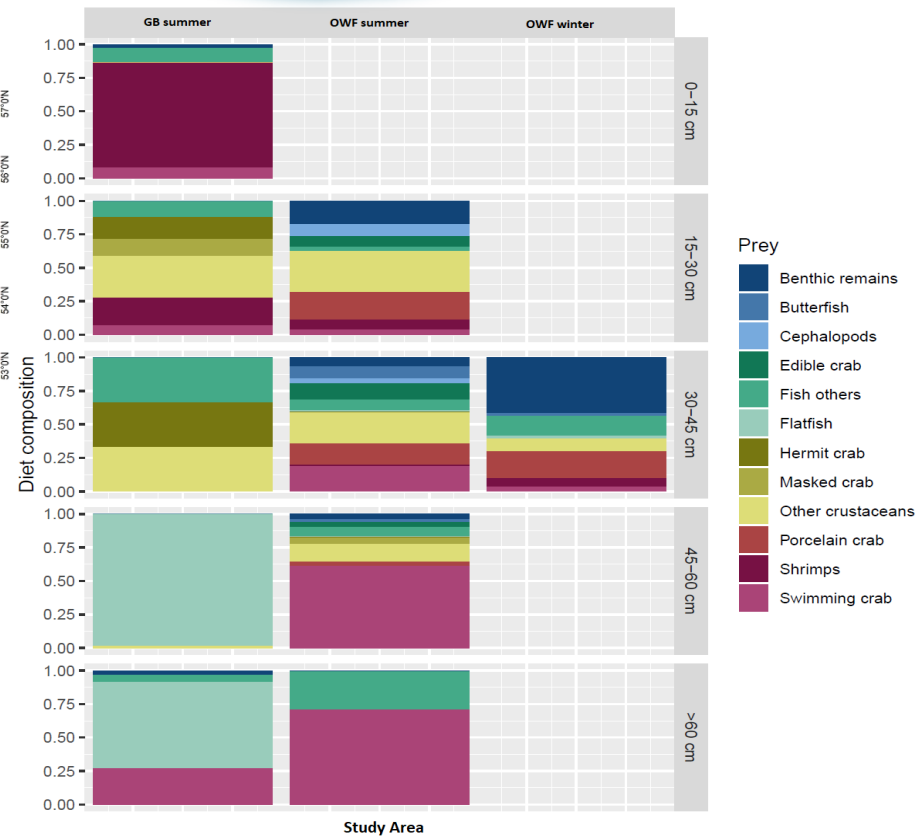
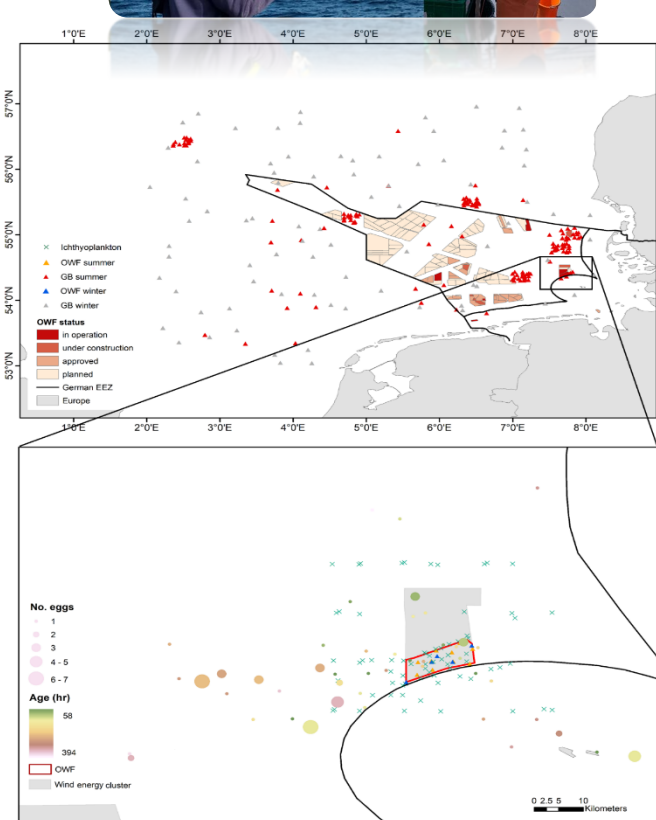
- Recovery of fisheries resources
- Fisheries benefits through restocking
- Availability of new resources
- Opportunities through synergies and/or co-location of sectors

OWF installations as artificial reefs



- Artificial reef structures can enhance benthic biomass production (Krone et al. 2017; Dannheim et al. 2020) and function as a refugia and nursery ground for fish (Glarou et al. 2020, Buyse et al. 2023)
- Local alteration of foodwebs (Raoux et al. 2016) – dominated by mussels (Pezzy et al. 2020, DeGraer et al. 2020)
- Attraction effect for marine mammals (Russel et al. 2014), fish and birds (Raoux et al. 2016)

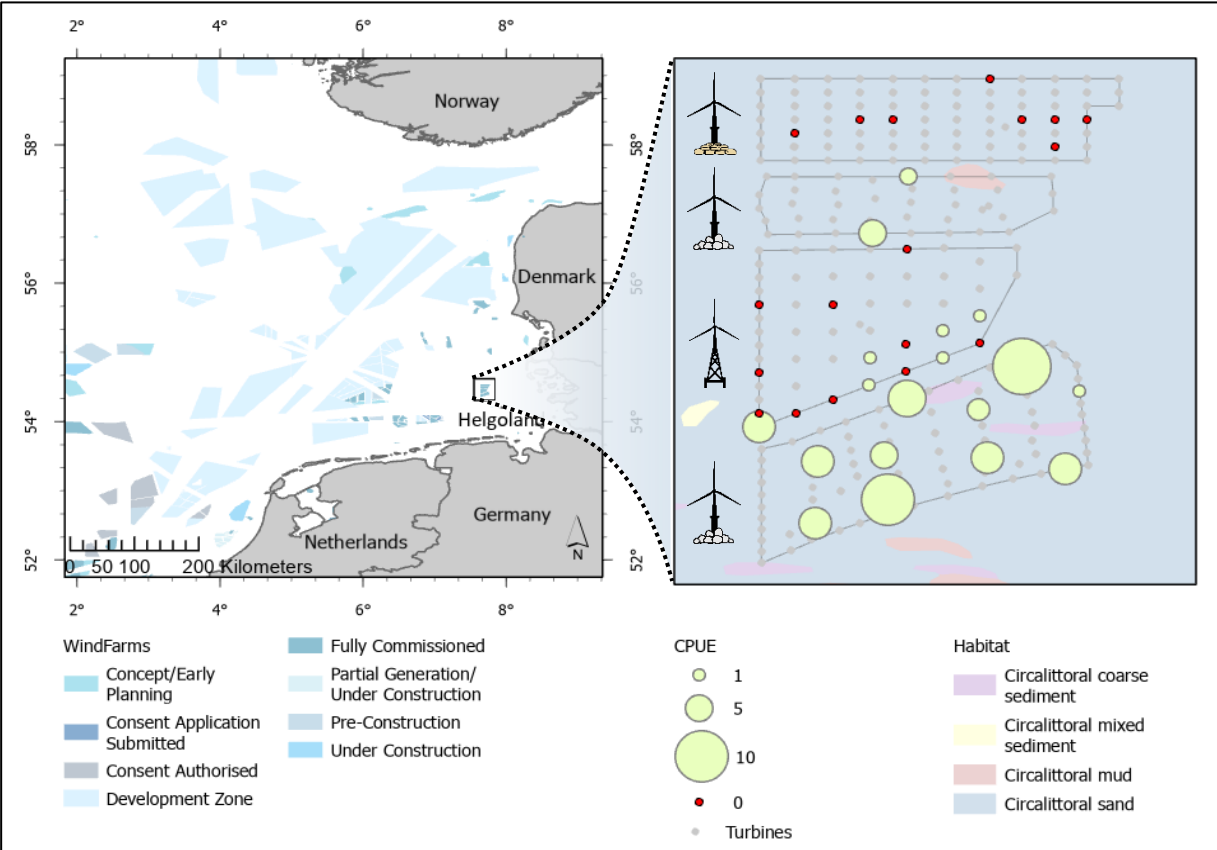
Ecological effects : Aggregation and reproduction of Atlantic cod in OWFs



- Trawl and angling data, ichthyoplankton sampling at different scales were combined with drift modelling
- Stomach contents and trophic level indicated that cod utilizes rocky scour protection as feeding ground
- Egg distributions indicate spawning activities in and around the OWF in winter
- Artificial reef structures can enhance the recruitment success of cod

Gimpel et al. (2023) Science of the Total Environment 878, 162902.

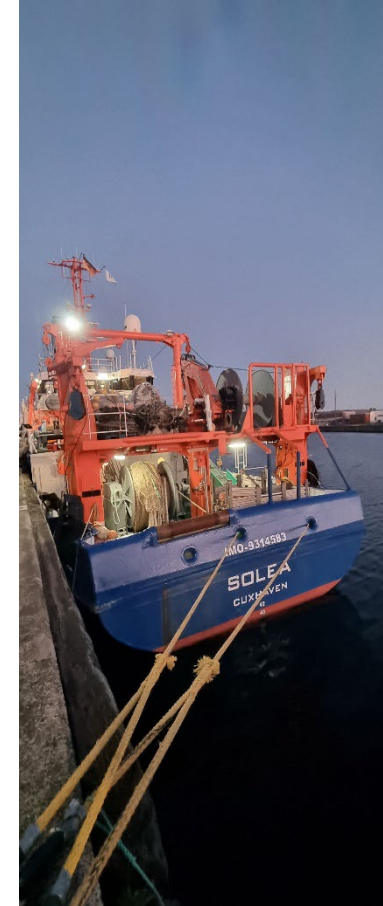
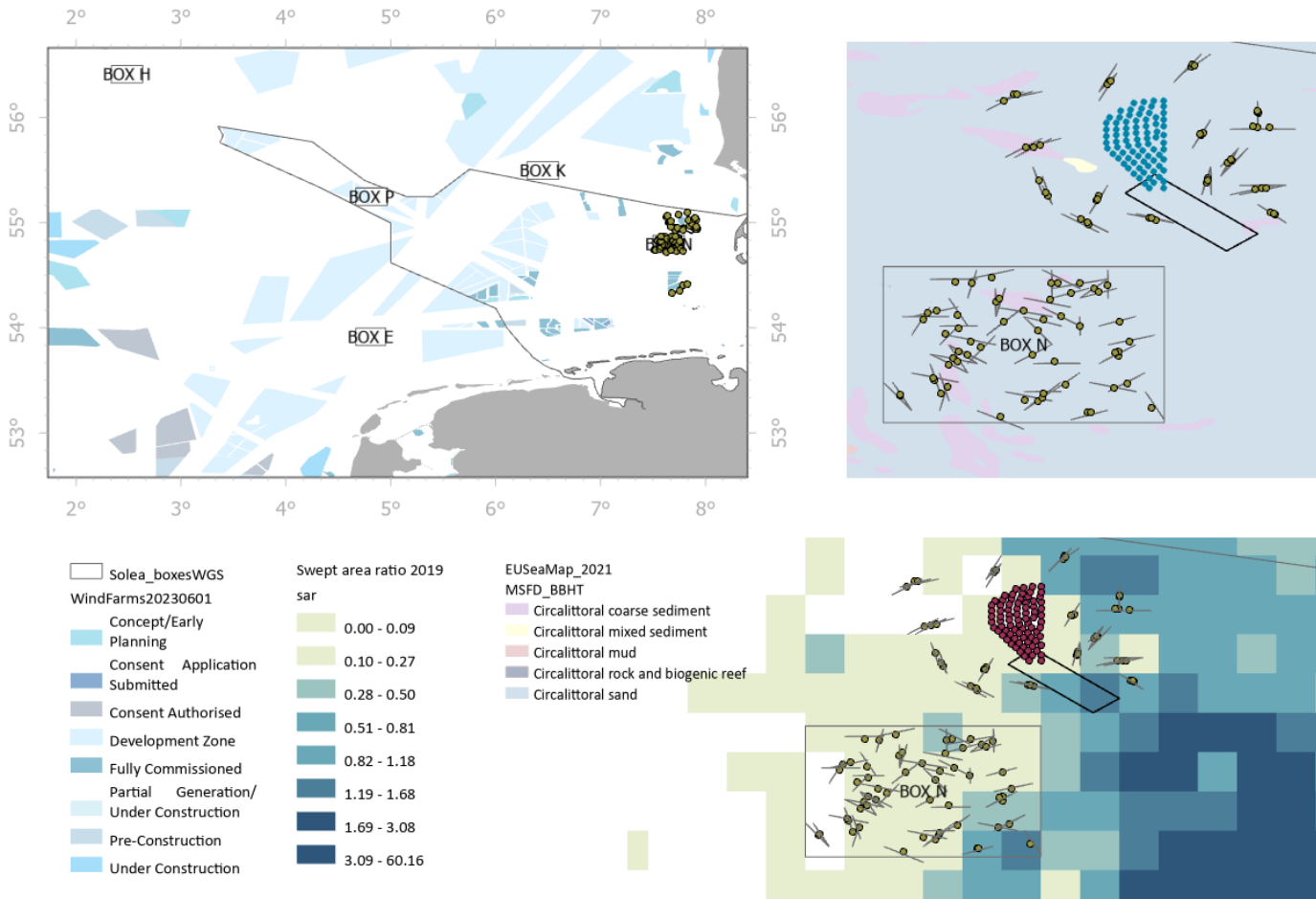
Ecological effects: OWF foundations and artificial reef potentials



- Different foundation types were sampled in 2019 and 2022
- Catch rates of Atlantic cod differed by foundation types
- Small-scale variability of catch rates imply local reef effects

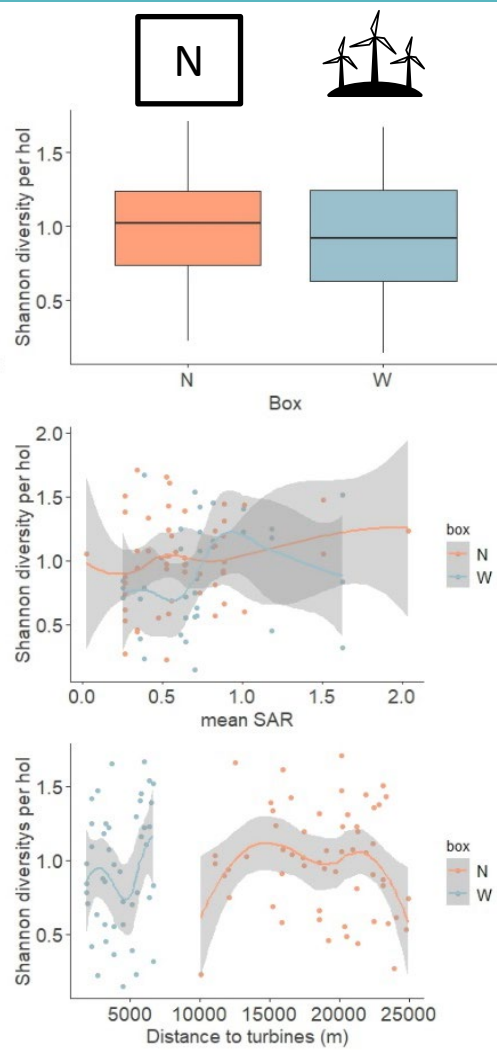
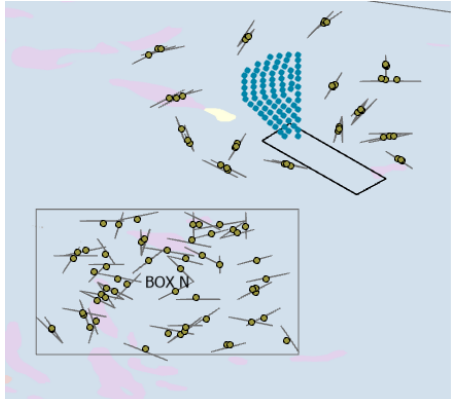
Werner, K.M. et al (2024) Fisheries Research 272.

Ecological effects : Impact of OWF on demersal fish communities



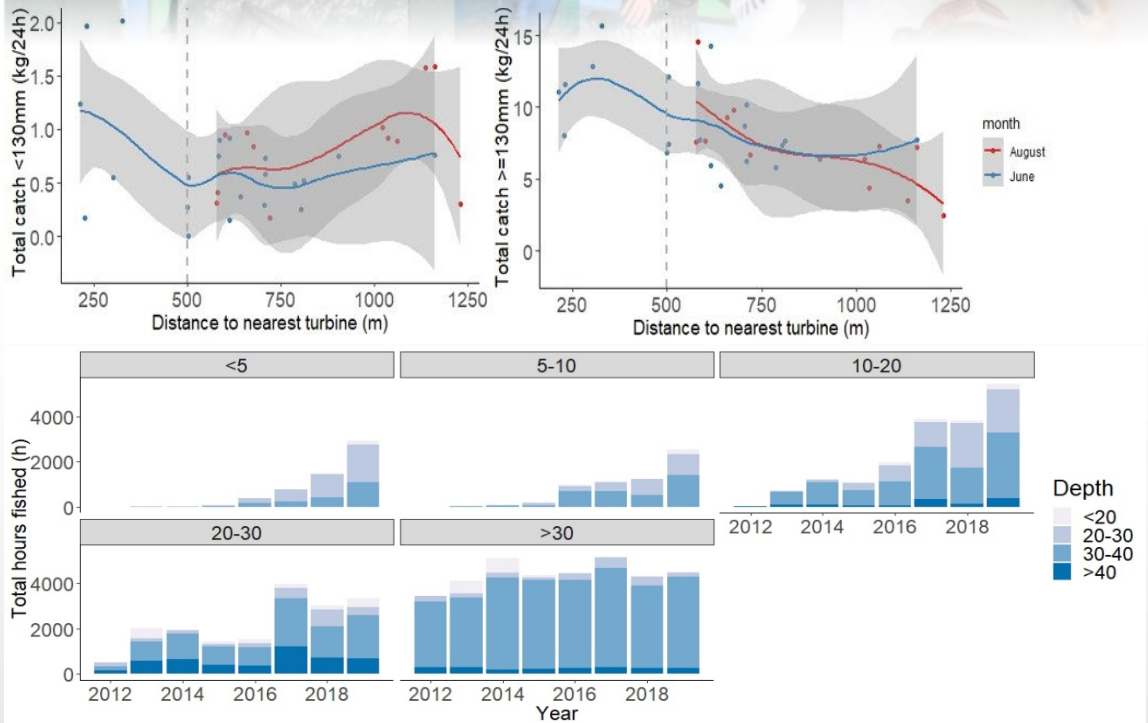
- German small-scale bottom trawl survey (GSBTS) high frequent sampling within in 10x10 sm areas (>30 years)
- Experimental demersal fisheries around OWF Butendiek (2017-2019)
- OWF since 2015 in operation
- Comparable habitats and fishing pressure

Ecological effects : Impact of OWF on demersal fish communities



- No sig. differences between numbers of species and demersal fish diversity
- No effects of depth, distance to turbines, distance to boulders or mean swept area ratio on community compositions
- Future analysis of length based indicators
- Artificial reef effects at scales < 1000 m

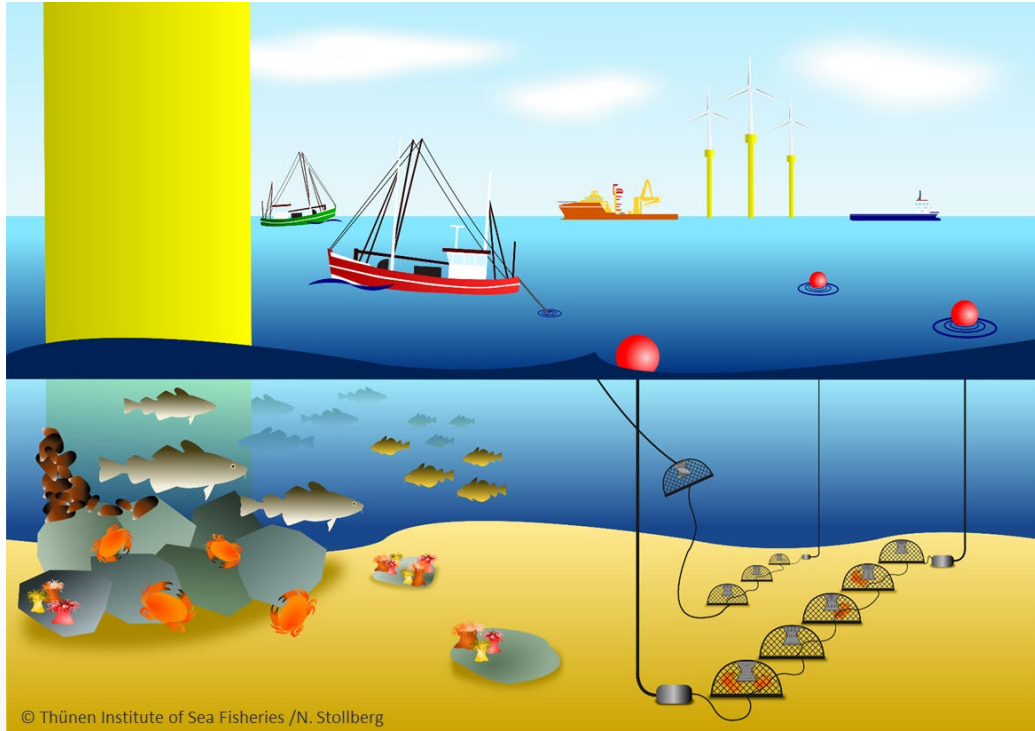
Fisheries benefits: Local spill-over of brown crab (*Cancer pagurus*)



- Experimental pot fisheries in and around OWF (2019) with favorable habitat
- Decrease in catches of brown crab with increasing distance to monopiles
- Small and large crabs seem to aggregate around monopiles -> function as nursery area
- Increasing int. pot fisheries around established OWFs
- Engaging in this passive gear fishery can be economically viable for German vessels

Stelzenmüller et al. (2021). Science of the Total Environment 776, 145918.

How to regulate the co-location of fisheries around OWFs?

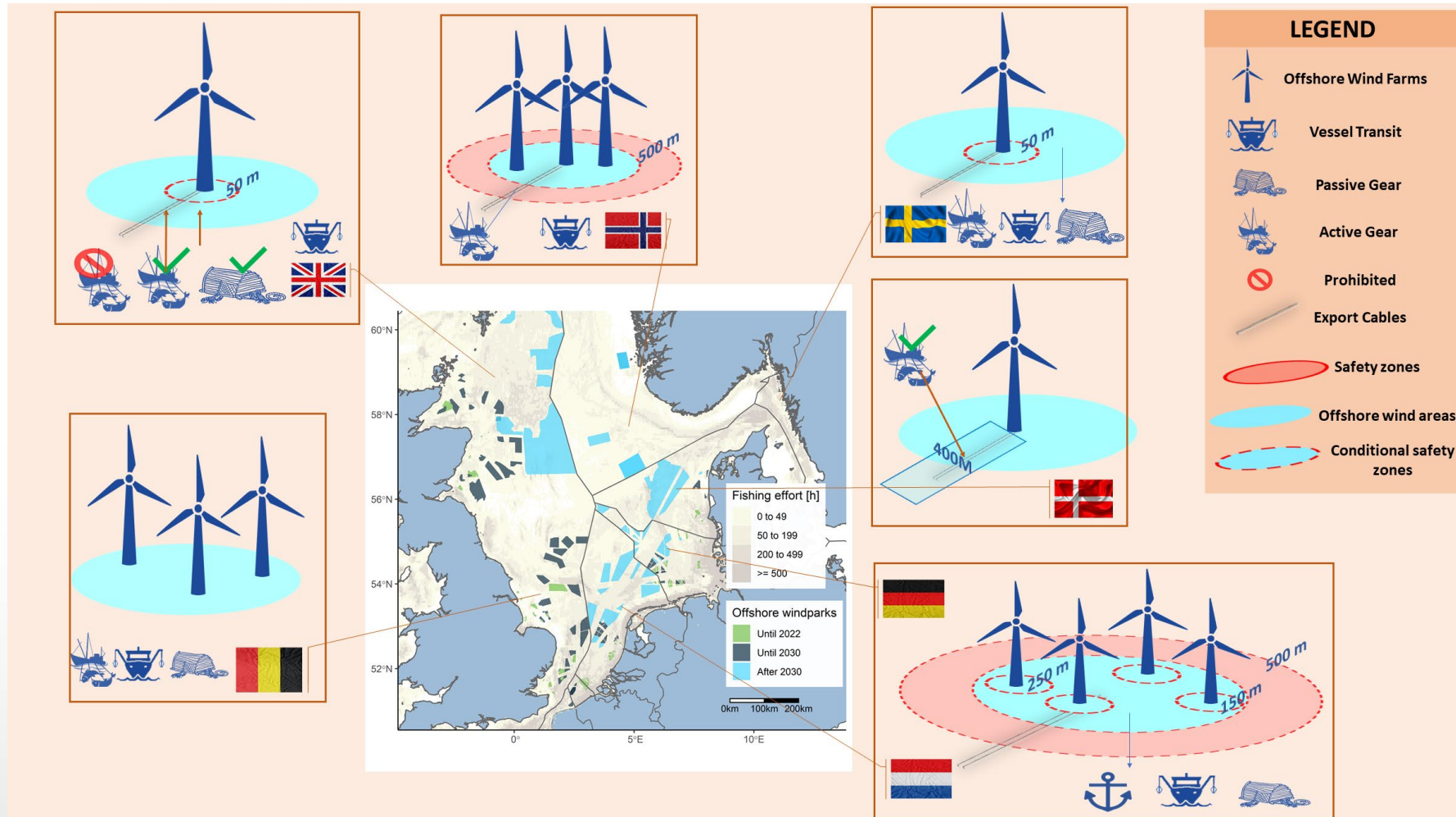


Stelzenmüller et al. (2021)

What can be regulated?



Permissions and restrictions vary across the North Sea region



Bonsu et al. (2024) Marine Policy 2024 Vol. 159

Summary

- Atlantic cod aggregates and reproduces in OWFs
- Artificial reef effects depend on OWF design and are local (< 100m)
- Standard trawl survey does not reveal differences in fish communities between OWF and nearby areas - artificial reef effects expected at scales < 1000 m
- Passive gear fisheries targeting brown crab benefits from artificial reef structures in OWFs (spill-over ≤ 1000 m)
- Regulations for co-locating fisheries and OWF vary significantly in the North Sea region



Conclusions

- Transboundary OWF impact monitoring is needed to advice on sustainable co-location solutions
- Transdisciplinary research is needed to upscale local observations of OWF impacts to appropriate ecosystem scales
- Scenario based analyses to inform marine spatial planning (MSP) processes
- MSP to facilitate the co-development of area-specific advice for fisheries operations around OWFs – need of success stories !





Thank you!

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