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## 25 Years of Occupational Scientific Diving at RBINS

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### **OUTFLOW: Quantifying the contribution of fouling fauna to the local carbon budget of an offshore windfarm**

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The OUTFLOW project (Belgian Science Policy Office – funded research project 2021 – 2025) aimed at increasing the understanding of carbon cycling within and beyond the scale of an offshore wind farm. The interdisciplinary research consortium adopted an approach that integrated field-validated and model-supported assessments of how fouling fauna on offshore wind turbines alter carbon dynamics in and around offshore wind farms (OWFs) in the Belgian Part of the North Sea. The field work around the foundations and scour protection layers of offshore wind turbines was conducted with skillful help of the Belgian Occupational Scientific Diving Team and the VLIZ Scientific Diving Team which operate as services provided by EMBRC Belgium. This allowed detailed observations of the local alterations to carbon dynamics in an OWF. Our results reveal that fouling communities create novel trophic pathways that channel water-column production to the seafloor, leading to localised and temporal increases in benthic organic matter and measurable changes in processing of carbon in the benthic food-web. However, biogeochemical modelling of the observed patterns in the sediment porewater nutrients indicated that the fast mineralisation processes in permeable sediments and the dynamic hydrodynamic environment strongly limit long-term carbon storage. While OWFs induce clear ecological and biogeochemical effects at the scale of individual turbines and wind farms, our upscaling efforts suggest a relatively modest broader regional effect on carbon cycling. The findings highlight the importance of considering both physical sediment properties and hydrodynamic processes when assessing the potential of OWFs to influence carbon cycling or contribute to carbon storage.