Tracking labelled faecal pellets and their effect on carbon dynamics in offshore wind farms sediments

Cepeda Gamella Esther[1], Boeckx Pascal[2], Bodé Samuel[2], De Borger Emil[3], Vanaverbeke Jan[1] and Braeckman Ulrike[3]

[1] Marine ecology and management, Institute of Natural Sciences, Vautierstraat 29, 1000 Brussels, Belgium
E-mail: ecepedagamella@naturalsciences.be
[2] Isotope Bioscience Laboratory, Ghent University, Coupure Links 653, 9000 Gent, Belgium
[3] Marine Biology Research Group, Ghent University, Krijgslaan 281/S8, 9000 Gent, Belgium

Offshore Wind Farms (OWF) have become a constant presence in the marine environments of the North Sea. Their existence contributes to the imperative transition toward more sustainable energy production, a necessary step to achieve the European Union's carbon neutrality objective by 2030. By then, at least 32% of the energy consumed in Europe should be derived from renewable sources. In this regard, the North Sea already stands as a world-leading area.

In addition to energy production, the presence of these turbines in marine environments means an increased availability of artificial hard substrates for fouling organisms, such as blue mussels (*Mytilus edulis*). This species is a dominant colonizer of wind turbines, feeding by removing particles from the water column. However, they also produce considerable amounts of faecal pellets, likely serving as an additional carbon source to the environment and impacting benthic communities near the turbines. Given that the number of blue mussels per turbine is approximately hundreds per square meter, understanding how this carbon is processed in the environment and partly assimilated by fauna is crucial.

In an experiment, we investigated the fate of these faecal pellets in the benthic environment. We collected cores with sediment impacted by the OWF and sediment from outside the influence of the OWF. We added 180 mg of ^{13}C-labeled mussel faecal pellets per core, corresponding to an estimated weekly carbon deposition in the OWF area. We tracked these labeled faecal pellets in different carbon pools, including dissolved (in)organic carbon resulting from respiration, bacterial pool, faunal biomass, and the remaining faecal pellets in the sediment. This comprehensive approach will enable us to close the carbon budget.

We present the experimental setup and initial results on carbon respiration. Preliminary results regarding oxygen consumption during closed- core incubations indicate different responses from both sediment types. Non-impacted sediments from outside the OWF showed a faster respiration rate during the incubations, implying more rapid degradation processes compared to impacted sediment. Upcoming results should further elucidate whether bacterial and faunal communities from non-impacted sediments respond faster response to the organic input from the faecal pellet rain than OWF sediments that are already used to continual organic input from faecal pellets.

Keywords
Mytilus Edulis, Faecal Pellets, Stable Isotopes, Fouling Fauna, Organic Matter Dynamics, Carbon Flows, Offshore Wind Farm