



Seaweed cultivation monitoring in the Dutch North Sea



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Background

This decade, humanity will reach 8.5 billion people, increasing the demand for food and goods (FAO report, 2009; United Nations, 2022). Seaweed is an innovative resource (Beaumont et al., 2008; Buschmann et al., 2017; García-Poza et al. 2020). The marine aquaculture sector, particularly in the West, is rapidly expanding with sugar kelp (*Saccharina latissima*) being the most cultivated species (García-Poza et al., 2020; Heidkamp et al., 2022). Typically, early-stage gametophytes and young sporophytes are directly glued or indirectly twine-seeded onto ropes in autumn. By late spring, late-stage adult sporophytes are harvested for downstream processing (Dussan et al., 2023). Industrial partners report, first, a >90 % seeding material loss and, second, late-stage sugar kelp seems more likely to detach with prolonged cultivation (e. g., storms or harvest leftovers; pers. communication). The ecological impacts of these two detachment-prone cultivation stages are understudied (Grebe et al., 2019; Van der Loos et al., 2021). We aim to address this gap by focusing on the associated microbiome, known to include Planctomycetes, Gammaproteobacteria, Alphaproteobacteria and Bacteroidiaphylae (Tourneroche et al., 2020; King et al., 2022; Burgunter-Delamare et al., 2023). Our study will investigate changes in the microbiome post-detachment throughout cultivation and beyond. Results shall help assess the potential for disease spread or pathogenicity in marine environments, supporting sustainable marine resource policies.

Materials & Methods

Starting in November 2023 until September 2024, we monthly investigated sugar kelp development (A) at the Oosterschelde site, NL, owned by The Seaweed Company (B). This small-scale, close-shore site enabled sampling (C) including swabbing the rope sections closest to sugar kelp holdfasts, sugar kelp individuals, and surrounding seawater. Seawater was filtered over 0.22 μm MCE filters. All samples were stored at $-80\text{ }^{\circ}\text{C}$ until laboratory processing. At the cultivation peak, adult sporophytes were harvested, placed in fresh seawater filled tanks, and individuals were monitored for full and fragmented decay (D).



Outcome & Outlook

Upcoming research will assess bacteria and fungi associated with all Oosterschelde site samples. We expect to examine therewith the ecological impact of the detachment-prone cultivation stages. In the future, we will collect similar samples at the North Sea Farm 1, owned by North Sea Farmers, NL. As implemented in 2024 for the first time, this site offers the unique opportunity to expand our results to large-scale offshore cultivation in the Dutch North Sea. Our goal is to provide suggestions to limit potential ecological impacts, supporting sustainable policy making.

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