

2024_54_DoLS_ER: Enhancing seagrass growth and resilience for restoration purposes with microbial manipulations

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Globally, seagrass meadows are being lost at an alarming rate, with the UK having lost as much as 40% of its seagrass coverage over the last 30 years. Seagrasses provide a variety of ecosystem services, and thus there are several efforts aiming to restore these lost meadows in the UK. To date, there have been three central approaches to seagrass restoration: transplanting naturally occurring seagrass into new locations, planting seeds directly onto the seabed, and planting seagrass cultivated ex situ into the marine environment. These methods have had varying success for UK seagrass species *Zostera mariana* and *Z. noltei*. The Ocean Conservation Trust (OCT) is developing a restoration pipeline which grows seeds in an indoor aquaculture facility and transplants the established plants into the environment. Nursery-grown seeds can reach high germination success rates, but this success is currently highly variable, as is plant health in indoor facilities.

A commonly used approach for improving plant health in terrestrial plants, particularly within agriculture, is the use of probiotics, or live microorganisms that confer a health benefit to the host. The growth and survival of plants are reliant on the bacteria, archaea, fungi, and viruses that they share the soil with. In seagrass sediments, microbial communities are involved in carbon-, nitrogen-, and sulphur- cycling, thereby aiding plants with nutrient uptake and toxin removal. Attempts to manipulate this microbiome for the purposes of enhancing restoration success in seagrass are however nascent.

OCT and Zoological Society of London (ZSL) are actively working on subtidal and intertidal seagrass restoration respectively. Both have readily accessible field sites with ongoing restoration trials and monitoring suitable for this project: Plymouth Sound and Torbay (OCT) and the Medway and Swale estuaries of Kent (ZSL).

The goal of this studentship is to carry out manipulations of the seagrass microbiome to enhance seagrass restoration. The student will do this by a) determining the natural variation of microbial communities inhabiting UK seagrass rhizospheres and surrounding sediments, and comparing this variability with environmental factors such as microtopography (from drone and ROV surveys), temperature and turbidity (from in-situ sensors), b) using a range of novel isolation techniques to curate a library of metabolically diverse microbes to trial in experiments, c) developing a high-throughput experimental pipeline to test combinations of microbes for enhancing seagrass germination, growth and resilience to perturbations (e.g. warming).

This student will work with a multi-disciplinary team of experts in the fields of microbial ecology (Ransome, ICL), metagenomics (Sweet, UoD), habitat monitoring (Yesson, ZSL; Cameron, OCT), and seagrass restoration (Parry, OCT). The student will gain skills in experimental manipulation, sequencing, bioinformatics, and marine monitoring and field work.

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