

Seagrass Recovery and Restoration in a Bay of International Conservation Importance



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My PhD will address four research questions:

1. What is the **spatial extent** and biomass of **nuisance algae** within Budle Bay and does this change through space and time;
2. What are the **impacts of opportunistic macroalgae** on seagrass above and below-ground productivity and morphology (e.g. growth rates, shoot number);
3. What methods can be used to **remove nuisance macroalgae** without harming the seagrass and;
4. What methods are suitable for **restoring seagrass** in Budle Bay

The problem

Lindisfarne National Nature Reserve, Northumberland is of **significant conservation importance** (SAC, SPA, underpinned by a SSSI, adjacent an MCZ), but is increasingly subjected to **blooms of opportunistic algae** driven by diffuse **agricultural pollution**. The resulting eutrophication is having a negative impact on one of the main conservation features of this site, **intertidal Zostera seagrass** meadows. Budle Bay is an **important habitat** for many species, including **overwintering birds**. These large algal mats have been seen to **encroach onto the saltmarsh and seagrass**. In addition, the algal blooms have resulted in the bay being downgraded by the **Water Framework Directive**¹.



4. Seagrass restoration

Seeds will be harvested from Lindisfarne and **replanted in Budle Bay**. There is limited knowledge on the restoration potential of the intertidal seagrass *Zostera noltei*.

Two successful methods have been identified and trailed in the UK: **BOSSLINE**² and **DIS**³.

The BOSSLINE method uses **hessian bags** of seagrass seeds tied to a line and spread across the restoration site. The DIS method involves using a **modified caulking gun** to **inject seeds** directly into the ground. Both methods will be trialled in the study area to see which is most suitable for **intertidal restoration**

The solution

1. Spatial extent
2. Impacts of macroalgae

A **meta-analysis/systematic review** will be undertaken to look at the **known effects of macroalgae blooms on seagrass and saltmarshes**. This information will **inform removal methods and restoration actions**.

I will also monitor the spatial extent of **seagrass** and **macroalgae** & measure seagrass **shot density, leaf length and growth rate** monthly. This will determine the impacts of macroalgae on seagrass & also **create a baseline** to assess restoration success in Budle bay.

3. Macroalgal removal

Due to the sensitivity of the site, we **cannot use any chemical** methods to remove the algae and biological methods would not be effective at scale. The proposed method is to use a **shallow draft boat** to remove the **floating algal mats**. Which has been successfully used to remove algal mats in Wales. Trials of **hand raking** will also be undertaken.

Under the WADER project target **60 tons of macroalgae** need to be removed



References

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2. Unsworth, R.K. et al. 2019. *Frontiers in Ecology and Evolution*, doi: 10.3389/fevo.2019.00311.
3. Gräfnings, M.L. et al. 2023. *Restoration Ecology*, 31, p.e13851.



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