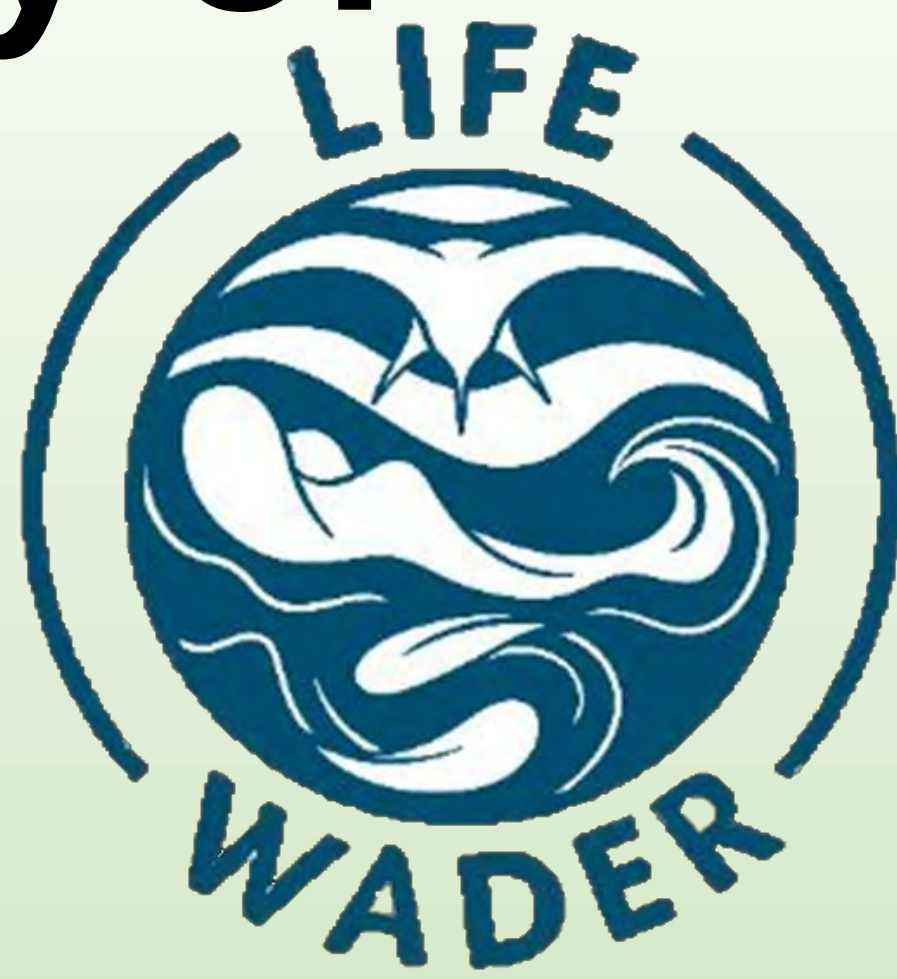
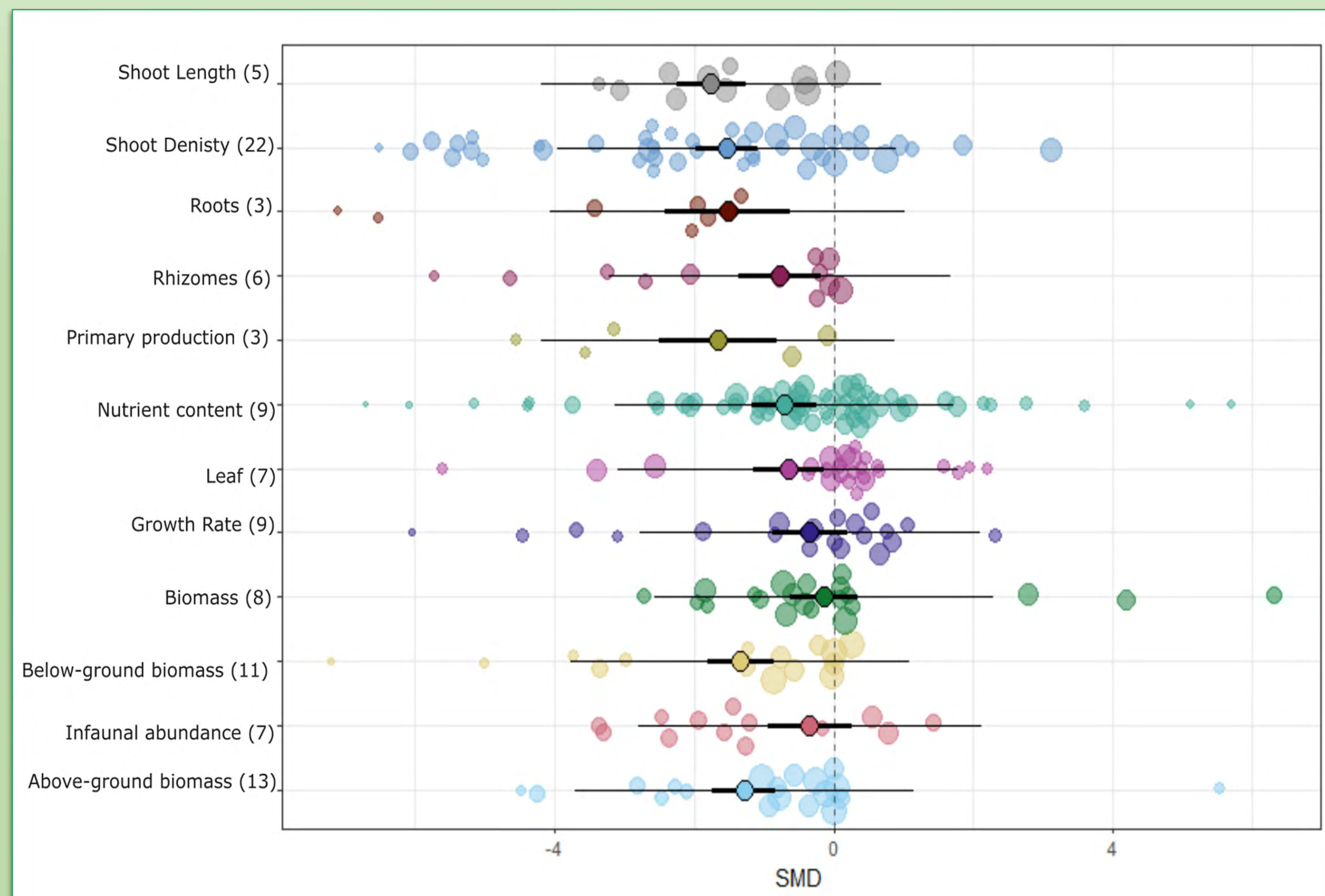


Seagrass Recovery and Restoration in a Bay of International Conservation Importance

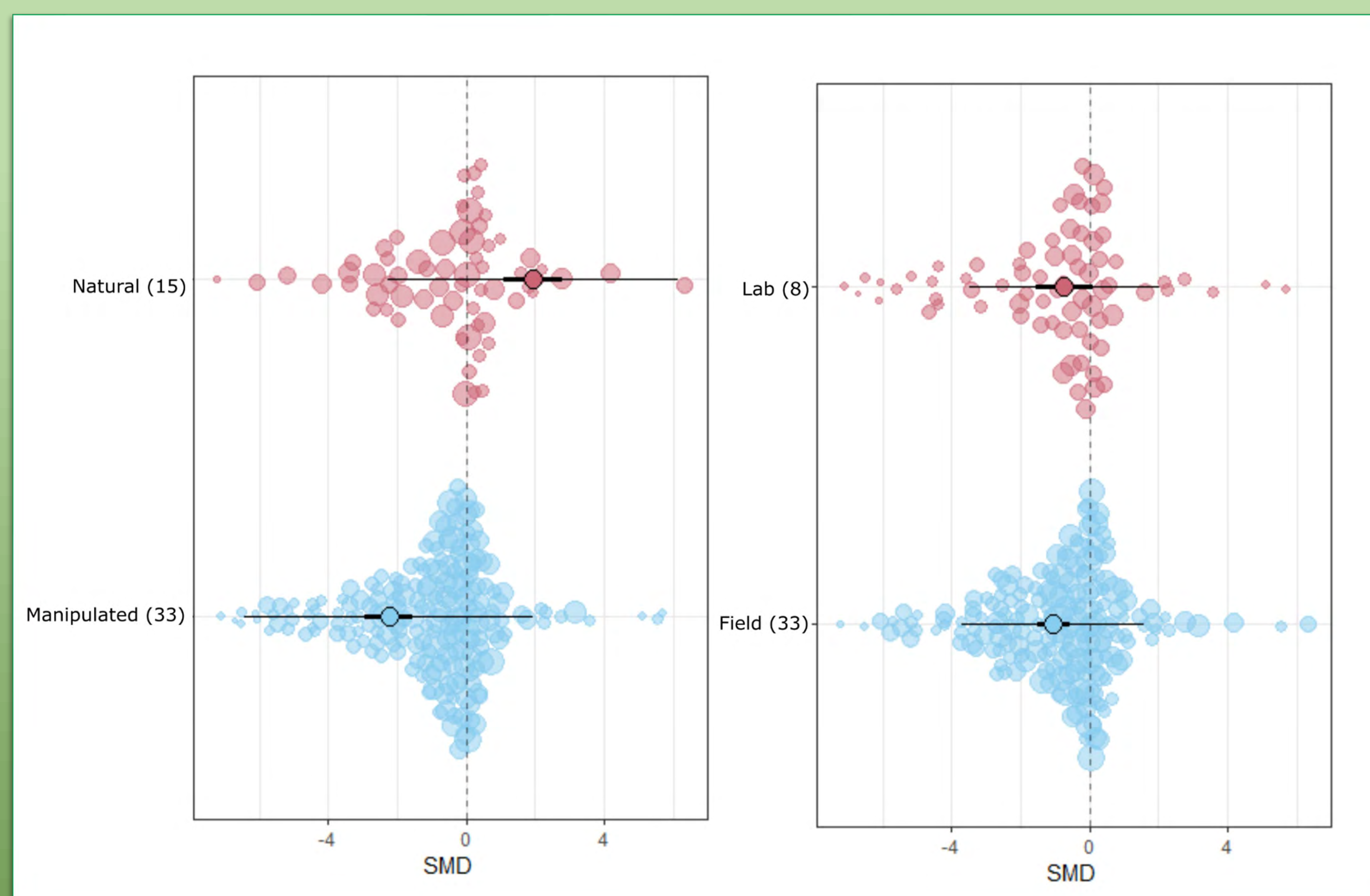
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¹Dove Marine Laboratory, School of Natural and Environmental Sciences,
 Newcastle University, Newcastle-upon-Tyne NE1 7RU
²Natural England



Meta analysis key results



3 How to read an Orchard plot. Points show the **Standard Mean Difference**, error bars are 95% Confidence interval and thin black lines are the 95% prediction intervals.. If the **error bar crosses the dotted line at 0** this means the result is not significant. If a point and its error bars are **below 0** it shows the test performed worse than the control.



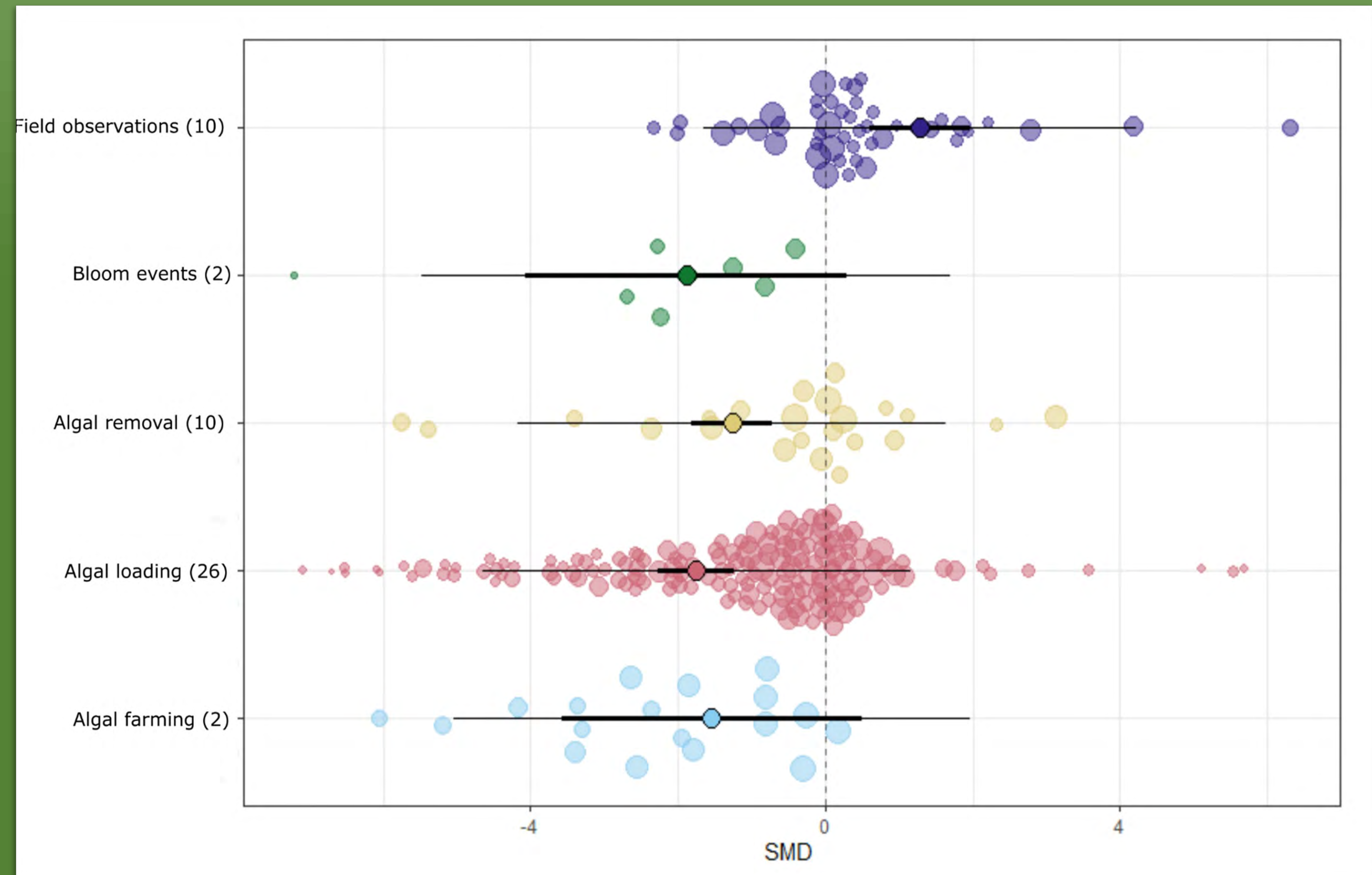
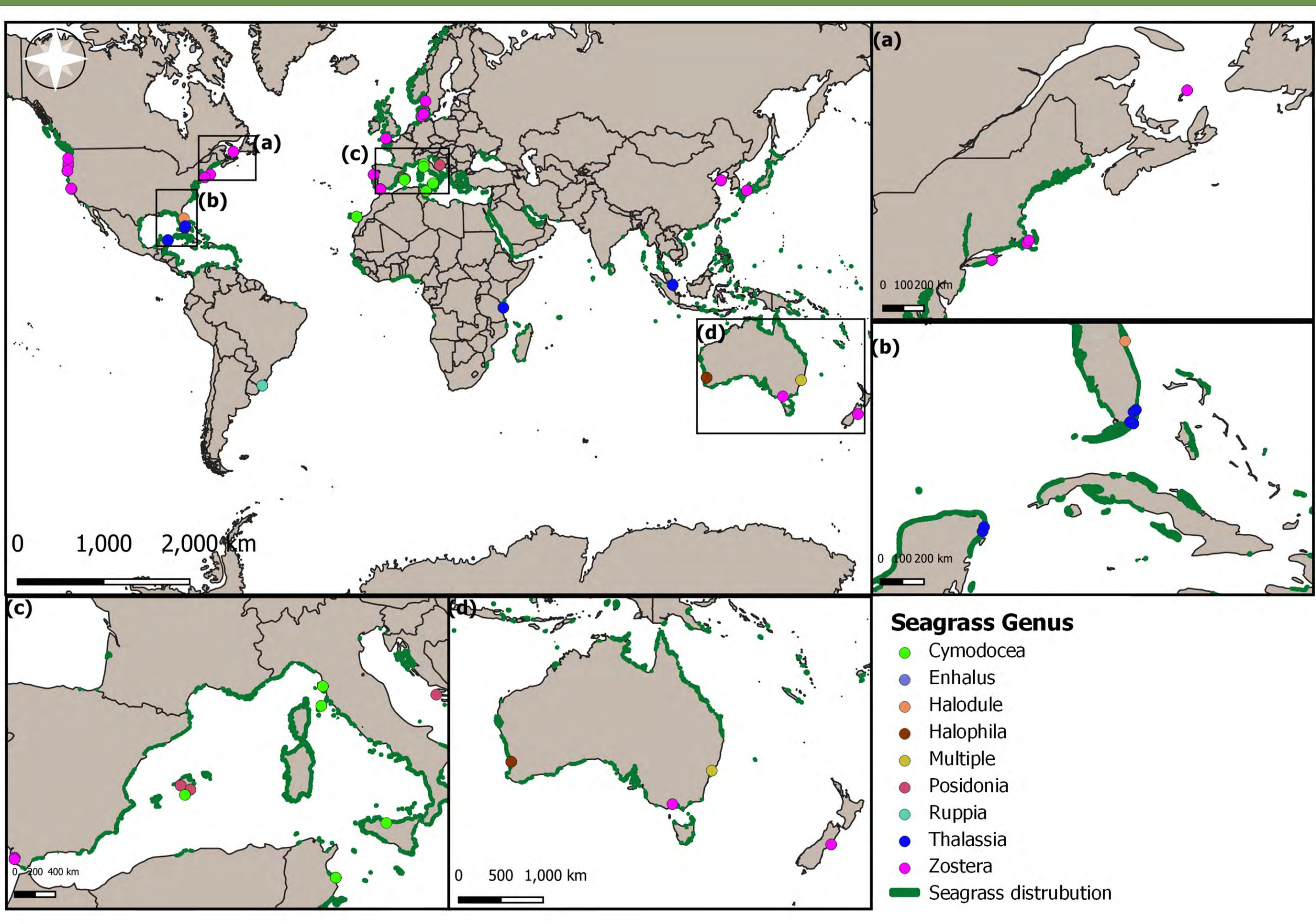
4 A **meta-analysis** has been undertaken to look at the **known effects** of **macroalgae blooms on seagrass**.. All studies were **grouped by measured variable**, Shoot length, shoot density, effect to roots, effects to rhizomes, primary production, nutrient content, above ground and below ground biomass **all showed negative values**, which shows under algal cover they **perform worse than the control**. Meaning seagrass grew slower, fewer shoots, had a reduced overall biomass, we can conclude that this **results in the degradation of seagrass**

When studies were split by type It has been found that **field studies have a more negative effect** than lab studies, and when we look at the difference between manipulated studies vs natural density, we find that there is, a **positive result in natural density studies**

1 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

2 Lindisfarne National Nature Reserve in 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, for example, diffuse **agricultural pollution**. The resulting eutrophication is having a negative impact on the, **intertidal Zostera seagrass** meadows. Budle Bay is an **important habitat** for many species, including a large population of **overwintering birds**. These large algal mats have been seen to **encroach onto the saltmarsh**.



5 Map showing where studies used in the meta-analysis were undertaken. Different coloured points indicate **different seagrass genus** tested. The green layer indicates global seagrass distribution. The majority of studies were in **Europe** and **North America**

6 When looking at experimental method, it was shown that studies under **algal loading**, showed **poorer seagrass health**. Even studies under algal removal scenarios, still showed poor seagrass health, this shows that even when algal blooms have been removed **seagrass may not recover to prior healthy condition**. Field observations showed a **positive result** indicating in these studies

