Integrating interactive stressors within marine spatial planning: A case study on the Chatham Rise

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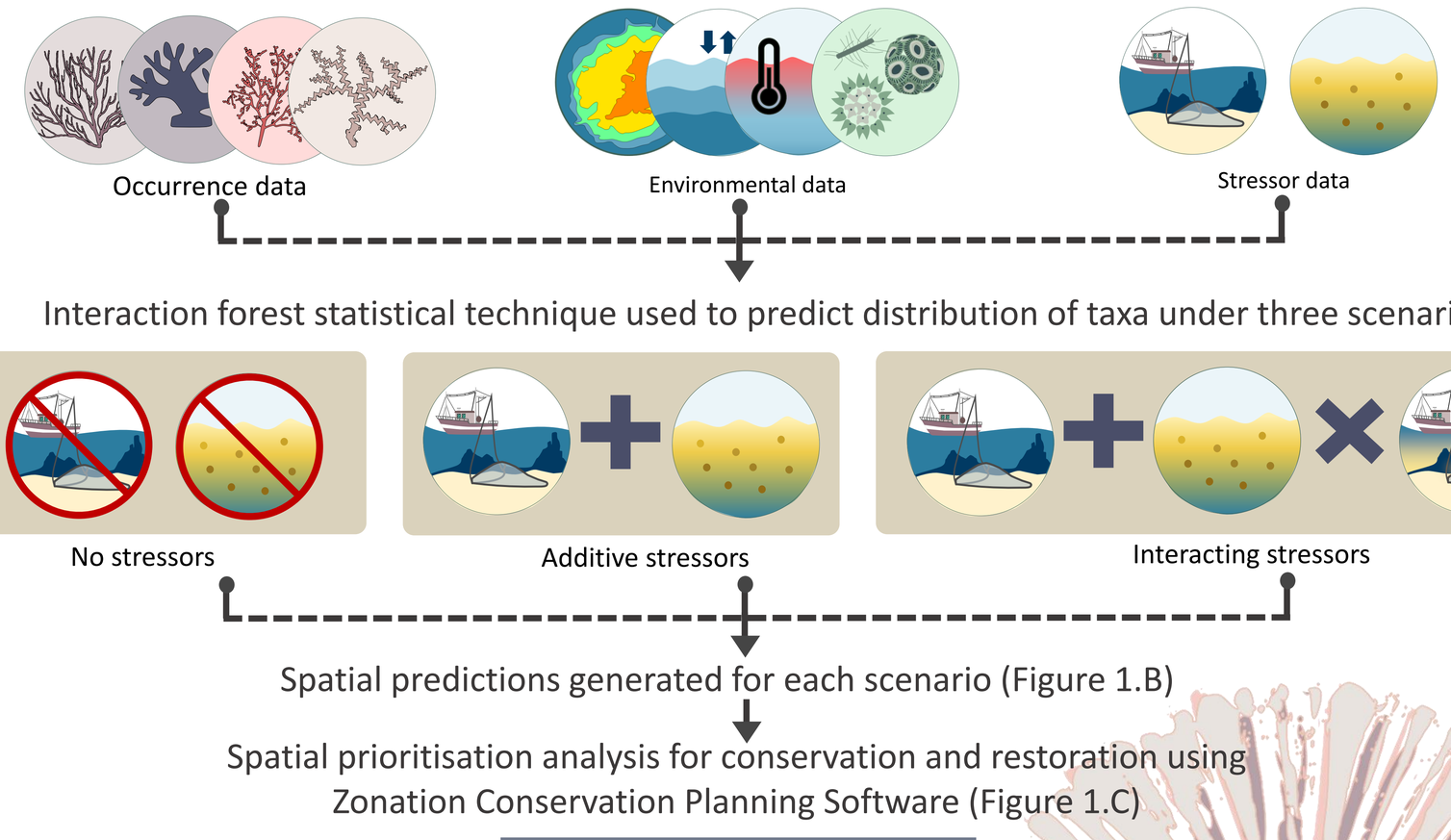
Overview

- Most spatial planning approaches consider stressors in isolation – where management targets areas of high or low stressor footprints for restoration or protection respectively.
- Spatial modelling hold significant promise to incorporate the biological response of organisms to interacting stressors – enabling spatially explicit estimations of their cumulative impacts
- Here, we show a case study on the Chatham Rise – where bottom fishing and sedimentation are used to predict species distributions



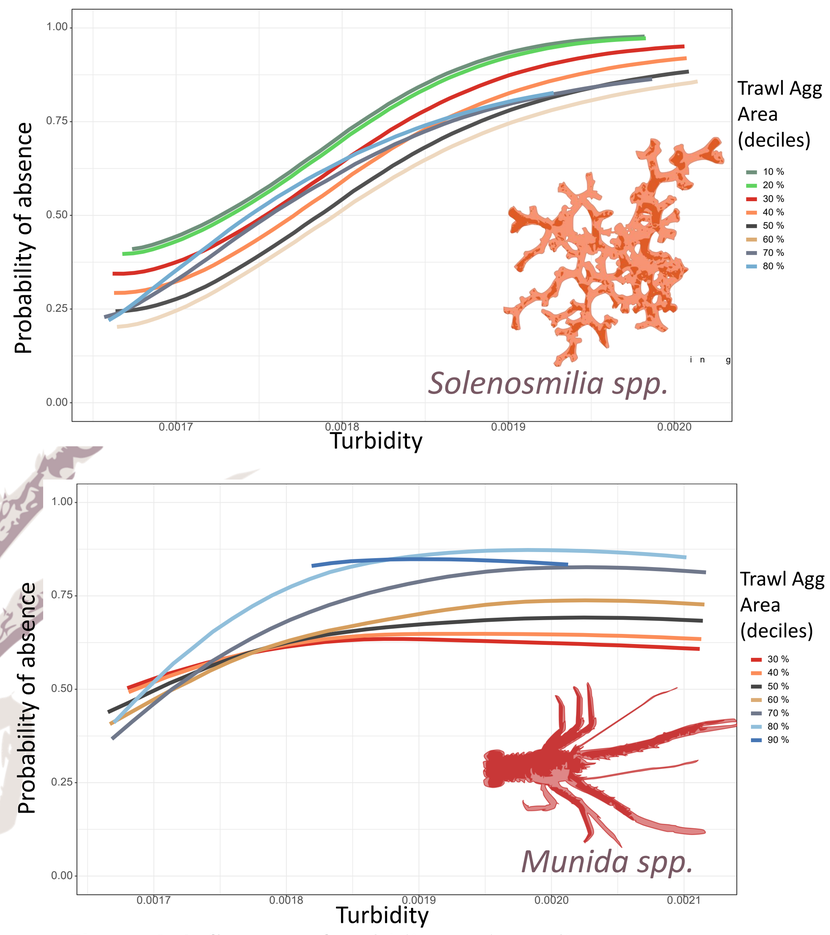


Figure 1: Influence of turbidity and trawling stressors on distributions, showcasing additive and interacting stressors.

Methods & Results

- Approximately 14,000 unique (1 km) locations on the Chatham Rise had observations of the presence of important invertebrate taxa (1990-2021).
- Robust models were fit for the majority of taxa using an **Interaction Forest framework**.
- Approximately 1/3 of taxa were best predicted with no stressors, 1/3 with additive stressors and 1/3 with interacting stressors
- Unique multi-variate responses across taxa
- High variability in predicted distribution with/without stressors among taxa
- Key differences in areas shown as high priority for protection of taxa with stressor impacts, and for areas with high restoration potential.

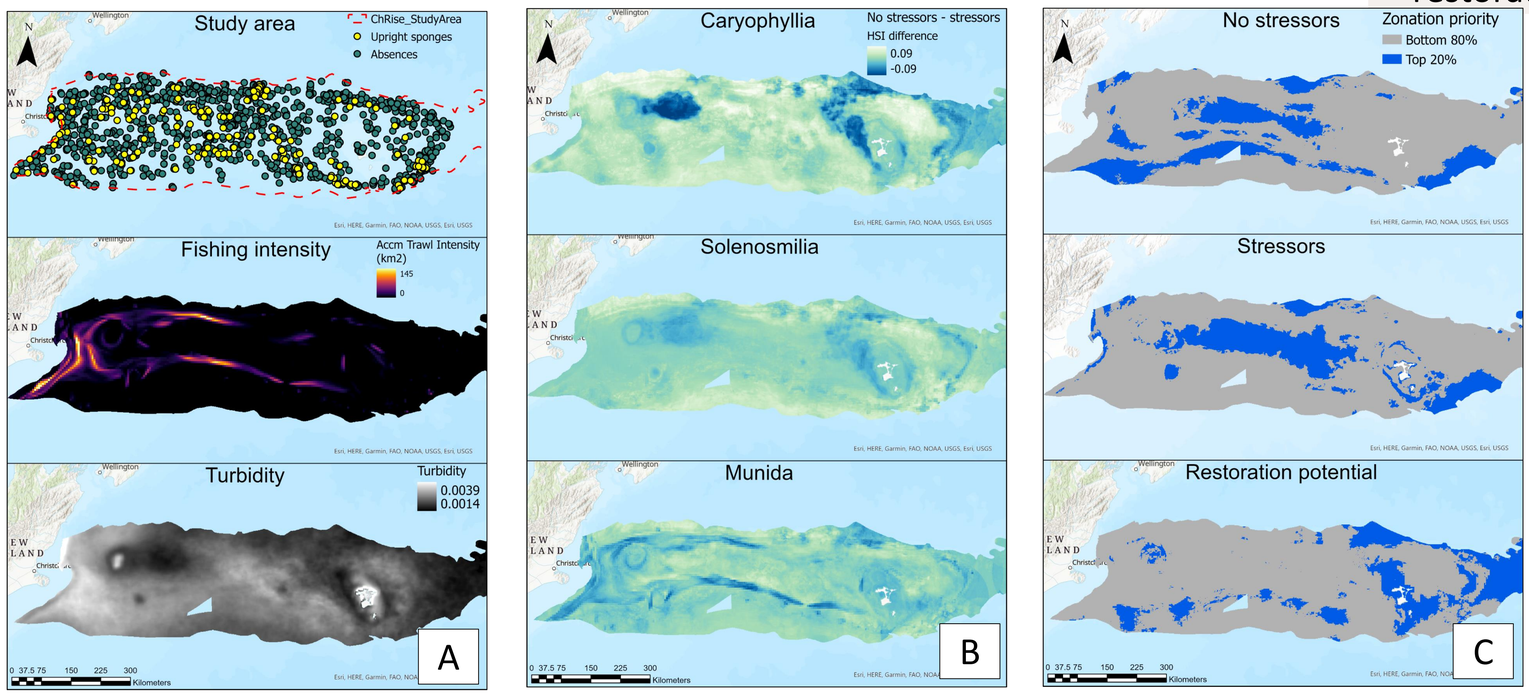


Figure 2: A) Stressor maps, B) Difference in Habitat Suitability between no stressor and stressor scenarios, C) Top 20% areas for conservation with and without stressors and priority areas for restoration potential.

Discussion

- Interaction Forest framework provides some unique opportunities for incorporating interacting stressors within marine spatial planning.
- Requires high-quality data – ideally from systematic surveys with matched stressor footprints
- Historical impacts (trawling pre-1990, variability in sediment deposition over time) are not accounted for, and are probably significant drivers of current distributions.

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March 2023

Graphic design by Nidhi Yogesh (NIWA)