

“The underwater forests of nearshore ecosystems: kelp, environmental change, natural enemies and restoration”

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Kelp and related seaweeds are the dominant habitat forming organisms on temperate rocky shores. They provide a disproportional amount of the ocean's primary productivity, are the habitat for enormous associated biodiversity and have an economic value of many billions of dollars. These “ecosystem engineers” are in decline in Australia and elsewhere and this is associated with long term environmental change such as ocean warming and coastal urbanisation. However, the mechanisms by which these changes impact kelp are not well understood. I will explore the role of species interactions in these declines and how environmental change can modulate their impact, arguing that the impact of environmental change on interactions between kelp and their natural enemies (herbivores, microbial pathogens) can have greater impacts on these seaweeds and the communities they support than the direct physiological effects of a changing ocean. These studies span scales ranging from continental patterns of kelp-herbivore interactions to the molecular level of pathogen function and characterisation. In this later context, I will show how environmental sequencing of DNA or RNA – or ‘omics – has revolutionised our ability to understand disease as an ecological factor in the marine environment. As well as understanding the mechanisms leading to the decline of these habitat forming seaweeds, we should be trying to restore these systems wherever sensible. As an encouraging example, I will describe our restoration efforts with *Phyllospora comosa*, a previously dominant seaweed on Sydney shores which went locally extinct in the 1970's-80's, but which we have restored back into its original habitats where it is successfully reproducing and re-establishing.