

CAN LIVING SEAWALLS BE DESIGNED TO IMPROVE BIOSECURITY?

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IMPACTS OF MARINE STRUCTURES

Artificial structures such as seawalls, typically support less biodiversity than the natural habitats they replace and can harbour invasive species. Marine life that can survive on these structures are responding to several design factors including the material used in construction and availability of micro/macro habitats as well as local environmental conditions such as light and wave energy. Our understanding of how these factors might influence the types of marine life found on artificial structures is increasingly being used to restore native biodiversity by creating “living seawalls” in a practice commonly referred to as “ecological engineering” (Chapman and Underwood 2011, Dafforn et al. 2015). Given that more structures will be built to protect our coastal assets from climate change, there is an urgent need to scale up eco-engineering efforts.

3D DESIGN AND PRINTING TO MIMIC NATURE

Advances in 3D design and printing are providing opportunities to incorporate complex mimics of natural rocky shore features, such as rock pools or crevices, into panels that can be retrofitted to seawalls. Previous testing at small-scales found that the addition of physical complexity (crevices) increased overall biodiversity and favoured native species (Strain et al. 2018b). Additionally, physical properties, such as quantifiable dimensions and the ability to retain water, were identified as some of the most important factors influencing the survival of marine life on retrofitted artificial structures (Strain et al. 2018a). Based on these encouraging results and data from a global review on how increases in the complexity of physical structures increased biodiversity (Strain et al. 2018a), the Living Seawalls team has been scaling up installations in Sydney Harbour.

LIVING SEAWALLS

Eco-engineering projects like Living Seawalls enhance biodiversity by adding complexity and surface area (Bishop et al. 2022). It is, however, unclear to what extent they might facilitate invasive species. In one of the largest attempts to eco-engineer seawalls through retrofitting, two 12m stretches were fitted with habitat enhancing concrete panels of six designs - five complex and one flat. Sampling of whole panels and the microhabitats within these were assessed as to - (1) whether colonisation of invasive species was enhanced on the complex panels when compared to the flat panel, (2) whether there were particular designs and microhabitats that promoted invasive species, and (3) whether colonisation patterns differed among tidal elevations. At high and mid intertidal elevations, the contribution of invasive species to total

abundance and richness was generally very small on both complex and flat panels. At the low intertidal elevation by contrast, invasive species contributed approximately 75% sessile cover, 50% richness and were in some instances 50% more abundant and diverse in growth on the complex rather than flat panels. Within the panels, invasive species were particularly abundant in moist, shaded microhabitats. Knowledge of the factors that supported invasive species colonisation will assist in designing future eco-engineering interventions that reduce biosecurity risk.



Figure 1 - Living seawalls add mimics of microhabitats like rockpools that are missing from built infrastructure

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