Living Seawall
Sawmillers Reserve, McMahons Point, Sydney, Australia
Clients: North Sydney Council and NSW Environmental Trust

Habitat Creation: Project of the Year Award (Small scale biodiversity enhancement of up to 0.5ha)

Project overview

This project enhanced marine life along 12-m of Sydney Harbour seawall. Modular Living Seawalls panels, designed by the Sydney Institute of Marine Sciences and Reef Design Lab, were retro-fitted to the seawall to recreate the crevices and pools of natural shorelines.

Installation: November 2018. Ecological assessment: completed November 2021.

What were the biodiversity conditions on site, prior to the enhancement?

Sawmillers Reserve is a public parkland on the northern shore of Sydney Harbour and features a sandstone seawall supporting reclaimed land. As compared to the natural shoreline ecosystems it has replaced, the vertical seawall is flat and featureless providing limited protective habitat to biodiversity from predators and environmental stress. Additionally, the seawall's vertical orientation provides reduced intertidal area as compared to gently sloping natural shorelines. Prior to installation of the Living Seawall, the Sawmiller's Reserve seawall supported ~20% less biodiversity than adjacent rocky reefs. The project was conducted as a retrofit of the existing seawall and classified as maintenance works.

What were the reasons behind this project ?

The project aimed to develop and showcase a solution for enhancing marine life on marine built structures, such as seawalls. Most marine built structures are designed with only their primary, human, purpose in mind. There is massive, untapped potential to co-design these for marine life too. To benefit biodiversity, our solution needed to be lasting, scalable and adaptable to a range of structures and environments. The solution also needed to be visually appealing to build public connection to blue spaces. Our solution targeted existing seawalls, which cover >50% of the shoreline of many coastal cities.

The Living Seawall, 6 months after installation at Sawmillers Reserve, McMahons Point, Sydney, Australia

Living Seawalls panels are designed to mimic features of nature

What were the biodiversity measures taken?

The Living Seawall comprises panels, mimicking the habitat features of natural shorelines (e.g. rock pools, crevices), that have been retrofitted to the seawall in a scalable mosaic. The complex panel surfaces increase the habitat area for growth of seaweeds, shellfish and other marine life. They also provide protection to marine life from high temperatures and predators. The panels are modular, can be fitted to built structures of varying size, can be planted with native species, and are fabricated from eco-blend cement including fly-ash and blast furnace slag.

The approach builds on small-scale experiments, conducted in Sydney and then globally across 27 sites. These identified the inclusion of complex surfaces into marine built structures as a simple and cost-effective way to enhance native biodiversity, decrease pest species and bolster water filtration. An accompanying global synthesis revealed that different types of complexity encourage different species. Consequently, Living Seawalls panels come in multiple designs, which when used together, benefit a wide range of species.

The accompanying monitoring and evaluation program censused biodiversity at the installation site, control sites (unmodified seawalls) and reference sites (natural rocky shores whose biodiversity we were seeking to emulate), both before and up to three years after panel installation. This monitoring revealed 115 different species of invertebrates and seaweeds colonising the Living Seawall, and 37 species of fish utilising the Living Seawallsfor food and habitat. Up to 264% more species were observed on Living Seawalls panels than flat, control, surfaces of similar age. Furthermore, after just three years the Living Seawalls supported 20% more species than adjacent unmodified seawalls with years of marine growth, and a similar biodiversity to natural rocky reef. The species enhanced by the Living Seawalls included oysters, that improve water quality through filtration, and kelp, that provides nursery habitat to fish.

Over 115 species of seaweed and invertebrate colonised the Living Seawall

Our team of ecologists from the Sydney Institute of Marine Sciences conducted biodiversity monitoring at site, panel and microhabitat scales, before and up to 3 years following installation

Further information

Bare Living Seawalls panels are engineered to last at least 20 years. Once covered in marine life, this life-span increases due to wave dissipation by the 3D structure of species, and calcification of panels. The panels were installed on stainless steel rods, to sit 10 cm off the surface of the existing seawall, removing need to clear the seawall of existing marine life and enabling the panels to be fitted to an uneven surface. This installation method more than tripled the surface for marine growth.

A key challenge for the project was unsupportive policy and legislation. We worked closely with local and state government to have Living Seawalls classified as restoration works. Additionally, we developed guiding principles and step-by-step guidelines for planning and constructing eco-friendly foreshore developments.

An important component of the project was education and outreach activities aimed at increasing awareness of biodiversity loss due to marine construction and raising awareness for solutions for co-designing structures for marine life. With North Sydney Council we co-created nationally recognised interpretive signage for the site. The project was showcased in the High Level Panel for a Sustainable Ocean economy Blue Paper (2020), the 2021 Australian State of the Environment Report, and featured at local Ocean Lovers and Seaweed Forests festivals. Additionally, Living Seawalls panels were displayed at over 7 galleries nationally and internationally, including the Australian National Maritime Museum and Design Museum London. The project's success has resulted in an additional twenty Living Seawalls being established globally.

Project Team

- North Sydney Council
- NSW Environmental Trust
- Sydney Institute of Marine Science
- Reef Design Lab

What was the motivation for carrying out the enhancement?

Our motivation was (1) to develop an adaptable and affordable mechanism for greening marine built structures at scale, and (2) establish a pathway and evidence base for its implementation. Living Seawalls provides a solution to ensure marine structures are created, repaired or rebuilt to benefit both humans and nature.

Outreach and education have been an important aspect of the Sawmillers Reserve Living Seawall

Living Seawalls panels on display in the Sydney Harbour gallery of the Australian National Maritime Museum

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