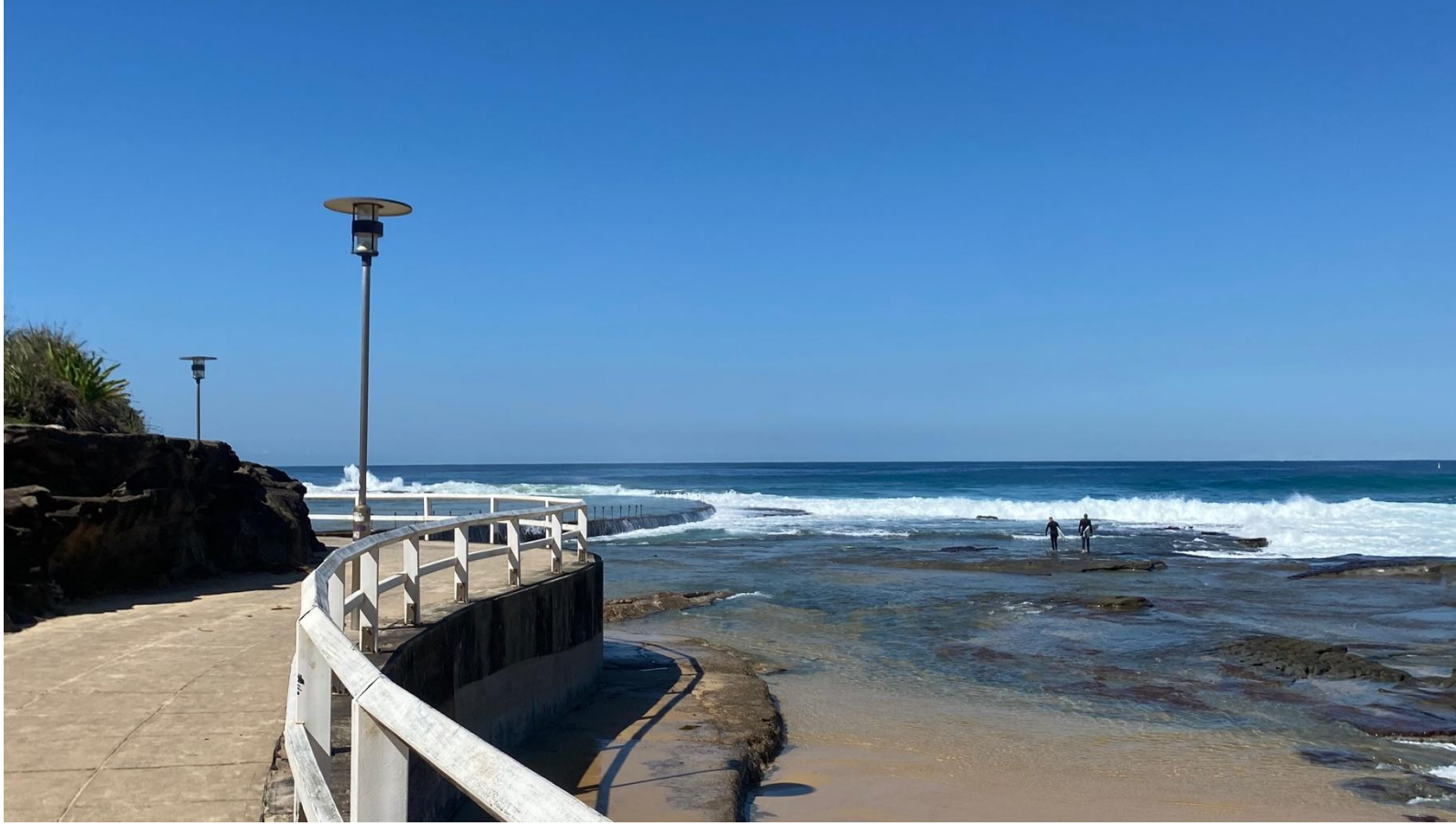


A Concrete Coastline: Can We Reclaim Biodiversity on Urban Seawalls?

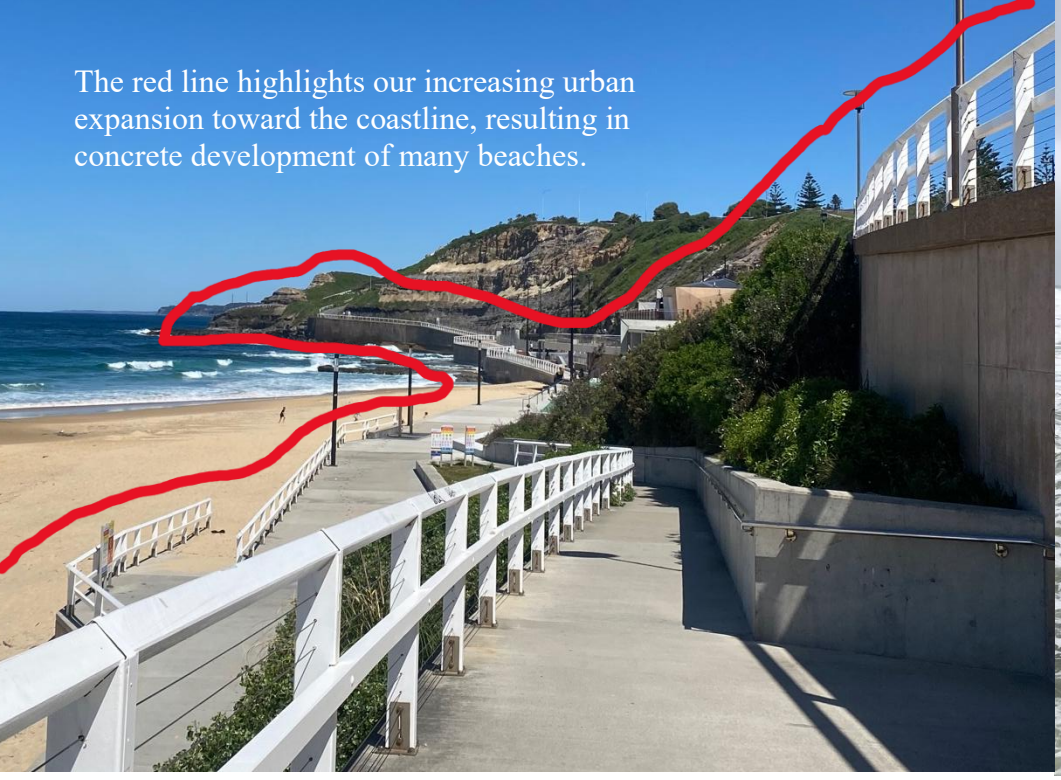
04 June 2025 | Written by Leonie Miskin-Brooks

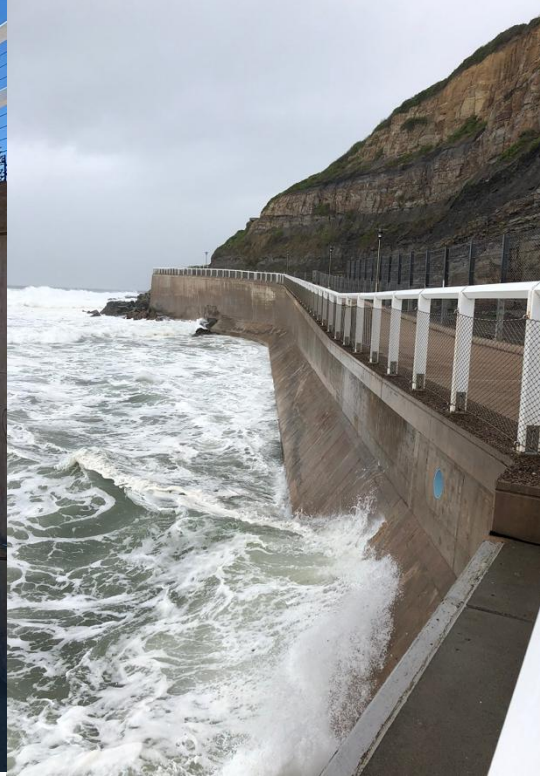
Concrete coastlines were built to endure, not to breathe. But what if these lifeless structures could be reshaped into catalysts for marine life? The innovative design of Living Seawalls may hold the key to rewilding our urban shorelines.

A construction boom in our seas

Our oceans coastline, once alive with colour and biodiversity, is now one of the greatest causalities of rapid urbanisation. Rising sea levels and expanding coastal cities, have led us fighting back for control over our oceans, leading us to respond with a wave of concrete construction. Seawalls, marinas, and pontoons now dominate our once-thriving shorelines, replacing dynamic ecosystems with flat, lifeless concrete barriers.

The statics paint a stark portrait of this transformation. According to SIMS (Sydney Institute of Marine Science), artificial infrastructure has consumed 50% of Sydney's natural shorelines through a process called shoreline hardening. These sterile structures serve human needs, but at what point does protection tip into irreversible destruction?





The biodiversity dilemma

We can't stop industrial development, neither can we tear down the seawalls we've relied upon since the early 20th century. Their presence isn't negotiable, but their design is, and that's where opportunity lies. Traditional seawalls and marine infrastructure, lack the structural complexity that marine life requires to colonise, shelter, and thrive. Unlike weathered natural coastlines, these sterile surfaces offer no depression for oysters to anchor, no shelter for fish to hide within and no texture for seaweed to grow. This results in a collapse of local biodiversity and a drastic shift in the marine community structure. Without these critical organisms, the ocean loses its natural ability to filter water, support fisheries and regulate entire ecosystems. What may seem like a simple wall becomes a silent disrupter of an intricate underwater food web dependent on primary producers like seaweed.

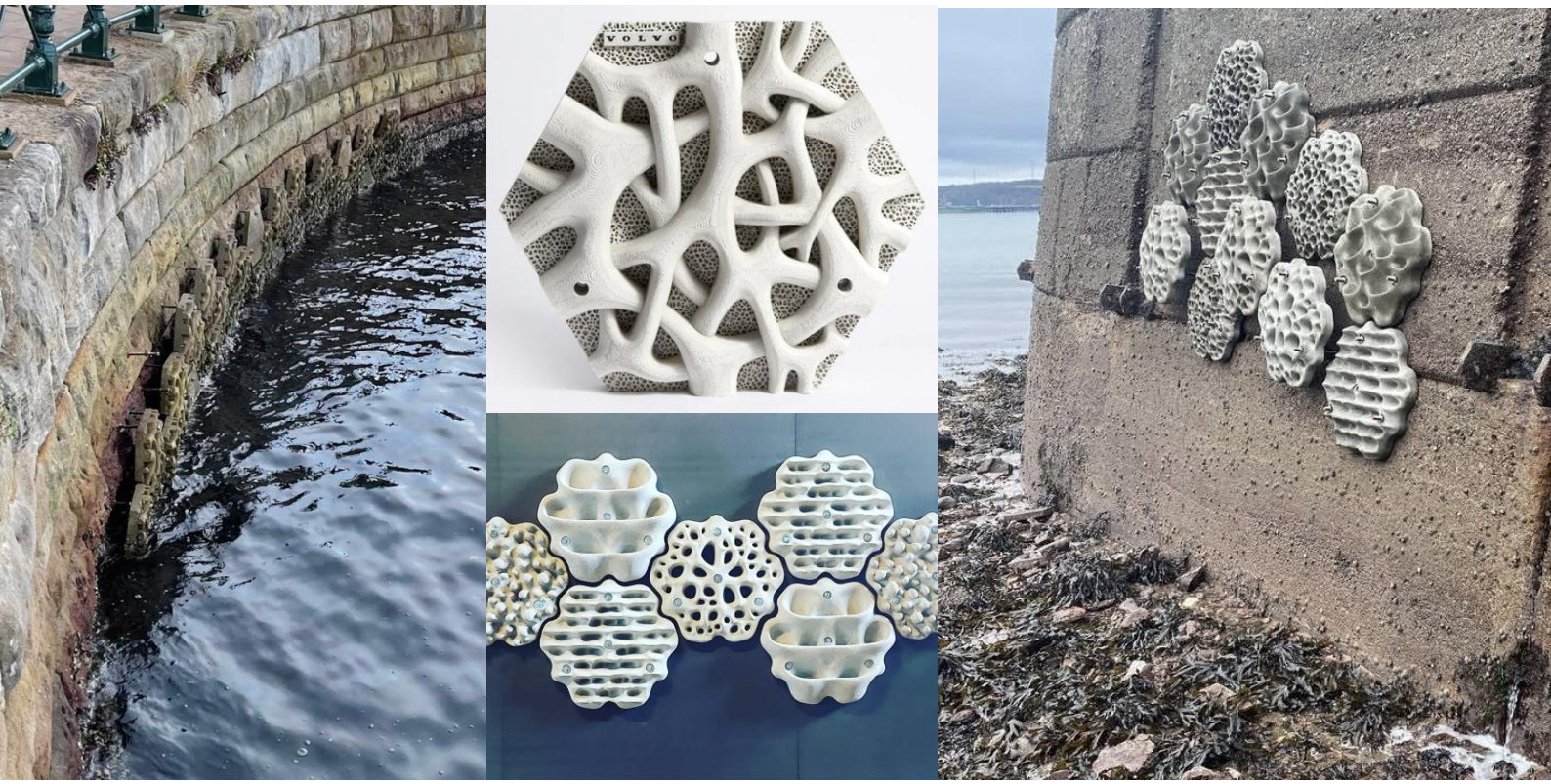
" The ocean's power of regeneration is remarkable – if we just offer it the chance." – David Attenborough

A living solution:

Traditional seawalls were built to last, but they don't have to remain lifeless. Marine habitats can be restored, and ecological damage repaired by designing with nature in mind. By blending ecological insight with engineering innovation, the Living Seawalls project is transforming our shoreline infrastructure.

Pioneered by the Sydney Institute of Marine Science, Living Seawalls adorns existing concrete barriers with modular panels designed to resurrect marine communities. Inspired by the root system of native mangrove trees, the panels add texture, complexity, and shelter to otherwise sterile surfaces. Designed through 3D modelling and crafted from 100% recycled marine plastic, these habitats merge durability with ecological sensitivity.

Installed like an underwater mosaic, the panels function as ecological stepping stones, creating specialized niches where intertidal species can anchor and flourish. What begins as a concentre wall now can be a catalyst for marine life. Over time, these engineered habitats attract a wide range of marine organisms, from Green Leaf Seaweed to Gnome Hat Limpets and Rose Barnacles.



Two middle images taken from the VOLVO's living sea wall project and used to show the up-close 3D geometry of each tile, which mimics the structural complexity of native mangrove roots.

These intricate structures provide a myriad of ecological benefits that go far beyond an increase in biodiversity. Filter-feeding organisms, such as oysters and mussels filter our water, whilst the new microhabitats increase ecological resilience along urban coastlines. New generations of Living Seawalls tiles are continually being developed, each engineered for a specific ecological purpose. Some are designed to retain tidal pools when the water recedes, while others encourage oyster aggregation, helping to filter thousands of litters of seawater each day.

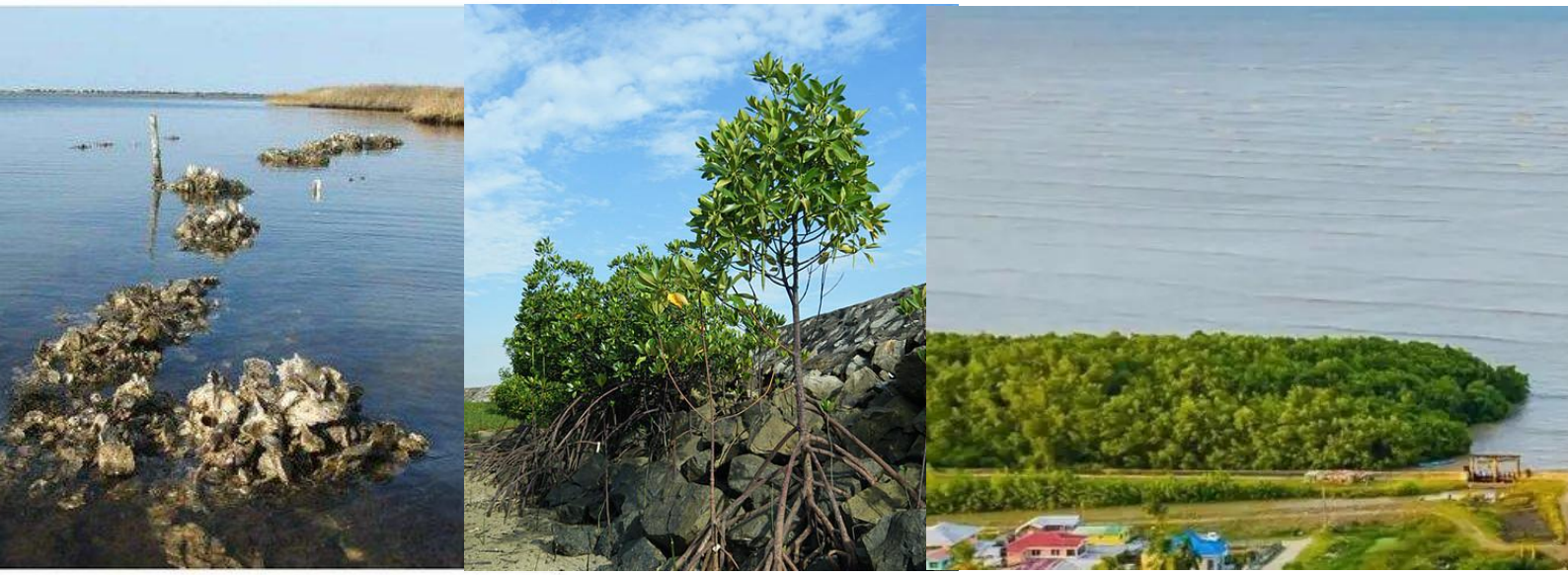
"In areas with Living Seawalls, we have seen an increase of up to 36% in the number of fish, seaweeds, and invertebrates…. In pilot study's, within the nooks and crevices of the tiles, we have seen temperature 10°C cooler which could mean the difference between life and death for some species." – Australian Geographic

The prospect of a time travel machine:

Rewriting the Past
Travelling to the past would reveal humanity's greatest missed opportunity – the chance to preserve nature's own coastal defence before concrete became our default solution. Mangrove forests, oyster reefs, salt marshes and sea grass meadows formed complex, layered ecosystems that buffered erosion, filtered water, captured carbon, and sustained biodiversity. Shaped by a millennium of evolution, these systems were not only effective but regenerative.

Yet in the urgency to protect coastal infrastructure, chemically inert concrete become the default. Hailed as cheap, durable, and fast, it was deployed without regard for its ecological cost, one that is now only being fully understood.

The chance to revisit the past would present a powerful opportunity to steer humanity towards natural based solutions. Strategic intervention through education and policy could have prioritised preservation, urging engineers and planners to design with the environment in mind. Green-engineering solutions, such as using textured stone, embedded ecological tiles or biological compatible material, could have supported both human needs and marine life from the very beginning.



Three examples on natural coastal defence, taken from Google. From left to right: an oyster reef, a mangrove tree growing from a seawall, and a mangrove forest creating a naturally formed seawall structure/

Revealing the future:
Though we are past the point to reverse man-made changes we have made along our coastline, our future holds power. A glimpse into our future world could allow us to answer critical questions that researchers could only speculate about today. Will marine life that colonises the living seawall begin to reinforce the Living Seawalls panels themselves, creating self-strengthen structures that exceed the projected 20-year life span of each

tile? Can transplanting established seaweed communities accelerate ecosystems recovery on these artificial substrates? A look into our future timeline would reveal whether offshore industries, form wind farms to oil platforms will successfully integrate living tiles from the outset, transforming industrial infrastructure into ecological stepping stones.

"We need to work together to create a new balance with the ocean that no longer depletes its bounty but instead restores its vibrancy and brings it new life." – United Nations

In conclusion, nature and engineering no longer need to stand at odds. Science-led designs, built with nature in mind, are beginning to reshape the future of our coastlines. From Australia's harbours to the docks of the UK, early deployments of the Living Seawall are proving that we can reclaim biodiversity on our urban seawalls. We've discovered how with community, collaboration, and time we can create real and substantial change.

"By allowing our coastal and marine environment to thrive we will be bringing opportunities for learning, green jobs, wellbeing and nature-related economic development to our communities" - Gail MacGregor
leader of The Solway Coast and Marine landscape Connections Project in Scotland.

**Two examples of flourishing living seawalls, shown two years after installation. Images taken from VOLVO Living seawall project.*