

# LIVING SEAWALLS



ECOLOGICAL GUIDELINES

JANUARY 2024

ENHANCING THE ECOLOGICAL VALUE OF  
ARTIFICIAL MARINE STRUCTURES





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## Living Seawalls Solutions

Living Seawalls provides an evidence-based approach to mitigating ecological impacts of marine built structures, including seawalls, bulkheads and revetments. Though these structures provide vital human functions they often result in biodiversity loss, destroying natural habitat and replacing them with inferior, artificial habitat. In some instances, impacts from marine built structures can be avoided by using nature based solutions in their place. When this is not possible and construction is inevitable, built structures can be designed from the outset to be ecologically sustainable, support biodiversity, and provide multiple end-user benefits. We offer habitat modules that can be pre-fabricated and incorporated into new or existing structures to enhance their ecological value, making marine structures beneficial for both humans and nature.

Living Seawalls is based on over 20 years of marine ecological research and ongoing ecological monitoring and assessment by our team of university-based ecologists. Over 2500 Living Seawalls panels have been installed in over 20 sites worldwide, including Australia, Gibraltar, Singapore, UK, Europe and Peru. New Living Seawalls modules and panels are soon to be installed in South Korea, New Zealand and USA.



## How Living Seawalls Work

Living Seawalls habitat panels provide homes for marine life on otherwise largely flat and featureless surfaces. Built structures lack the complex 3D geometries of natural habitats such as holes, depressions and crevices. These features provide protection to inhabitants from predation and stressful environmental conditions. Living Seawalls habitat panels reintroduce these missing protective spaces and increase the area of hard surface to which marine life can colonise.

Living Seawalls products rely, in large part, on natural colonisation of marine life from the water. The protective spaces of the Living Seawalls panels provide a place in which marine life can live and thrive under otherwise stressful conditions. Depending on the environment in which panels are placed, these protective spaces can protect inhabitants from predators and environmental extremes such as high temperatures, and in intertidal zones drying out at low tide.

The designs of Living Seawalls panels are based on nature and mimic features such as rockpools, crevices and depressions. Each of the designs provide different sizes and shapes of protective spaces that support distinct ecological communities. Our scientific monitoring of Living Seawalls in Sydney Harbour have found that our habitat panels support up to 3 times the number of species than flat surfaces of a similar age.





OYSTER



CREVICE



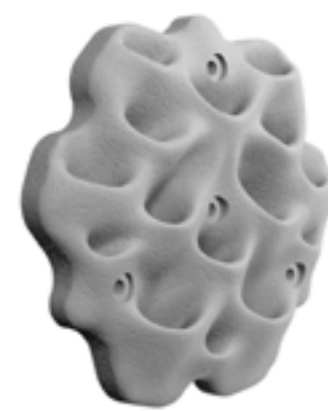
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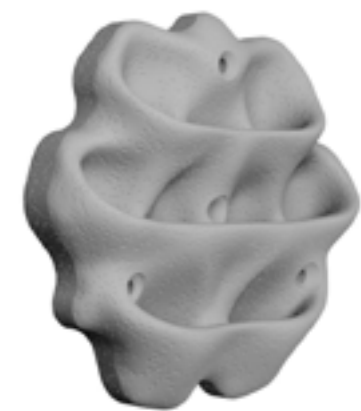
KELP HOLDFAST



SWIM-THROUGH



SMALL ROCKPOOL



LARGE ROCKPOOL

## Habitat Enhancement

Living Seawalls panels are designed using 3D printing technology. Each panel is 555 mm in diameter and weigh approximately 26 kg. They are fabricated with four 20 mm diameter holes (one central, three radial) which enable them to be bolted using stainless steel threaded rods or mounted on frames. Panels are roughly hexagonal and designed to interlock to give them stability.

Detailed information about habitat panel specifications, designs and installation options are available in our Living Seawalls Product Information and Installation Manual documents.

The modular nature of panels means that installations can be customised in scale and configuration. The design, size and shape of the overall installation can be tailored to the needs of specific sites. For larger developments please contact our team discuss.



## Where to Establish a Living Seawall

Living Seawalls habitat panels were developed by marine ecologists to boost biodiversity and increase the ecological value of artificial structures along urbanised shorelines. Comprehensive scientific monitoring has been conducted to ensure that Living Seawalls panels result in increased biodiversity when applied appropriately.

Living Seawalls panels are designed for harbours and estuaries that are sheltered from direct ocean swell. Sheltered sites with <2km fetch are ideal for Living Seawalls installations. Sites should be well flushed by tides or currents, with evidence of some marine life (assessed through inspection of structures or adjacent natural habitats). Environments that are so polluted that they are devoid of life are unsuitable.

The panels can be fitted directly to vertical or sloping seawalls made from concrete or stone, or mounted on frames for installation to wharves or piles. At sites with greater wave energy, Living Seawalls panels may be installed on the inner sheltered surfaces of breakwaters. To benefit marine life, the panels must be underwater for at least part of the tidal cycle. Structures that remain entirely above the water line for long periods of time are unsuitable.





When retrofitting to an existing concrete or stone seawall, the structure should be assessed by an engineer to ensure that it is structurally sound before installation. The surface of the wall should not be crumbling or damaged as this may not allow for secure anchoring of the steel rods.

Installation of Living Seawalls in sites outside of the above guidelines is not recommended, as panels will not perform as designed. The use of Living Seawalls habitat panels to make false or misleading claims of environmentally sustainable practices, or “greenwashing” is not condoned.





## Unsuitable Installation sites

- Where boat-strikes are likely to occur (e.g. near ladders or on the edge of wharves)
- Above the high tide line
- With stagnant water or severely degraded ecosystems
- Where the existing seawall is structurally unsound

People should be discouraged from standing or climbing on Living Seawalls habitat panels.





## Shore Height Placement

The panels can be placed anywhere below the high tide mark - within the intertidal zone or completely underwater.

The shore height or depth of the panel will influence the types of marine life inhabiting the panels. For example, panels installed high on the intertidal shore will generally support less growth but more snails and limpets; panels installed low on the intertidal shore or subtidally generally support more growth, often of seaweeds. Below the water line, seaweed growth will decline and invertebrate growth will increase as light availability diminishes.

Placing panels in well-lit locations may reduce the risk of non-native species colonisation. Combining different panel designs at different shore heights will result in increased habitat availability for a wide range of organisms.



## What Help is Available?

### PANEL INSTALLATION MANUAL

Living Seawalls provides a comprehensive manual outlining the steps to retrofit Living Seawalls panels to an existing seawall. When mounting to frames or integrating panels into a new structure, installation methods should be developed in consultation with qualified marine builders.

### ECOLOGICAL ADVICE

A 1-hour consultation with a Living Seawalls ecologist is included for purchases of over 50 panels. Our ecologists can advise on the number and design of panels for your area based on site details and images of local marine life.

More detailed ecological advice can be provided at additional cost and can range from systematic reviews of local marine life to be targeted by installations, to comprehensive ecological surveys of your site, before and after panel installation.

## FAQs

### How many panels are required?

There is no minimum number of panels required for a single site, however, the panels have been designed to be attached in continuous or grouped mosaic patterns along a stretch of seawall. As an example, approximately 70 panels are required to provide continuous intertidal zone coverage along a 2m x 10m section of seawall.

### What are panels made from?

The panels are cast from Glassfibre Reinforced Concrete that is otherwise wasted during the manufacture of marina pontoons. Panels are made of concrete as it can be readily moulded into the complex 3D geometries needed to provide protective spaces for marine life. The chemical signature of concrete is attractive to the colonisation of many marine species, including oysters and other shellfish. As concrete is the mainstay of marine construction its material and structural properties are well understood.

### Which panel designs?

Living Seawalls panels come in six different complex designs, each mimicking different features of nature. Our ecological monitoring and evaluation revealed that each panel design supports a unique ecological community. Consequently, if the overall goal of the Living Seawall is biodiversity enhancement we recommend using a mix of designs. Where the Living Seawall is targeted at particular species or service (clean water) our ecological team is able to advise on the most suited configuration. It may also be possible to develop new designs based on budget and goals.

### What are panels made from?

The most commonly used method of installation is to fit panels onto marine-grade stainless steel rods that are anchored into the seawall. The panels can be mounted onto rods such that they are flush to the wall or offset by up to 10 cm. This offset reduces the need to remove existing marine growth and allows panels to be fitted to an uneven surface. Alternatively, panels can be epoxied/grouted onto the surface of a new/refurbished structure or attached to frames. See our comprehensive installation manual for further details.

### What are the risks of panel installation?

Our previous research has shown that when installed in the intertidal zone few non-native species colonise, and the panels are effective at bolstering native biodiversity. Further, the panels sit relatively flush (100 mm away) to the seawall and will not cause a navigational hazard. Hence, risks are negligible.

### How long does it take for panels to be colonised?

This will depend on site conditions, geographic location and the time of year at which the panels are deployed. However, in Sydney Harbour we have observed snails and limpets colonise habitat panels within hours of installation, with seaweeds, barnacles and shellfish following within 2 months. Some species take longer to colonise so biodiversity is likely to continue to increase over 2-5 years following installation.

### How long do panels last?

The panels have been engineered for a design life of at least 20 years in a sheltered harbour environment. This design life is based on bare panels and we expect that marine growth will further reinforce and increase the life-span of the panels. Over time, panels can become completely overgrown with life, such that the material is in fact embedded within the matrix of species. Panels can be removed at any time to facilitate structure maintenance, or if panels are damaged or require relocation. If relocation is required, panels may be used in artificial reefs.

### What are the maintenance requirements?

The panels are designed to be maintenance-free. However, particularly in environments with high vessel traffic, we recommend regular (6-month to annual) visual inspections to check for damage from boat strike or other external forces. The modular nature of panels means that individual damaged panels can easily be removed and/or replaced.

### How are the habitat panels removed?

Panels can be unbolted and removed from rods individually. If removing a panel permanently, the rods can be removed or cut flush with the seawall. The cleared areas left by the steel rods are grown over by species such as shellfish and seaweed, leaving no evidence of the panels.

### How can I assess the ecological benefits of my Living Seawall?

Living Seawalls can provide guidance on appropriate monitoring and evaluation protocols for assessing biodiversity enhancement by Living Seawalls. If your organisation does not have in-house capacity to conduct impact assessment, our team can provide ecological consulting services, or put you in touch with local organisations with expertise in this space.



# LIVING SEAWALLS



## Contact

For more information, please contact  
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[www.livingseawalls.com.au](http://www.livingseawalls.com.au)

Living Seawalls works in collaboration with Reef Design Lab

**REEF DESIGN LAB**

[www.reefdesignlab.com](http://www.reefdesignlab.com)