

# Ecologically Sensitive Design of Marine Infrastructure Improves Natural Habitats and Biodiversity

## RESEARCHERS

Dr Joe Ironside  
 Professor Pippa Moore  
 Dr Ally Evans

## THE OVERVIEW

Artificial structures, composed of concrete, wood, metal or granite blocks now proliferate marine environments, used in the construction of necessary coastal defences such as sea walls and breakwaters, for example. These structures can have negative impacts on the environment, and support different and less diverse communities of marine life compared to natural rocky shores.

Aberystwyth University's research on eco-engineering of artificial marine structures shows that relatively small and inexpensive interventions can lead to positive biodiversity outcomes and improved natural capital. Our research has impacted on Welsh marine planning policy, and our eco-engineered interventions have been incorporated into UK best practice guidelines. Consequent behavioural change has been encouraged globally, with policy makers, regulators and practitioners seeking to incorporate ecologically sensitive design within planned and existing structures.



## THE CHALLENGE

The coastline of Wales is highly urbanised. Artificial structures associated with coastal defence, ports, marinas and offshore renewable energy devices can have detrimental impacts on the environment. Due in part to their lower topographic complexity, they support different and less diverse communities of marine life compared to natural rocky reefs.

## THE SOLUTION

Research at Aberystwyth University has focused on improving the evidence base for eco-engineering of marine artificial structures, understanding the barriers to its widespread implementation in marine and coastal engineering projects, and working with policymakers, regulators and practitioners to increase awareness and uptake of eco-engineering solutions.

Ecological engineering of artificial structures provides opportunities to enhance biodiversity and natural capital by increasing habitat complexity. This beneficial effect has been tested at the micro scale (µm-mm) by creating textured surfaces, at the small-to-medium scale (mm-cm) by adding artificial pits, crevices and pools, and at the macro scale (cm-m) by incorporating pre-cast habitat units into structure designs. Alternative construction materials have also been tested to improve the habitat quality of structures and/or reduce their environmental footprint.

## THE IMPACT

### IMPACT ON INDUSTRY BEST PRACTICE GUIDELINES

Guides produced by the Construction Industry Research and Information Association (CIRIA) are often adopted as the industry standard for excellence. Our research has been incorporated into the Coastal and Marine Environmental Site Guide produced by CIRIA in the form of a case study.

Our drilled cored rockpools were named the Most Innovative Design and runner up for the Overall Prize in CIRIA's BIG Challenge annual awards. They were also included in the publication 'State of the possible' within Greening the Grey: a framework for integrated green-grey infrastructure, targeted at local authorities, national agencies, public bodies, asset managers and local community groups.

### IMPACT ON BEHAVIOURAL CHANGE

Natural Resources Wales has sought our advice and guidance on eco-engineering interventions and installation methods for the Welsh Government Capital Funds project Milford Haven Intertidal Restoration and Naturalisation, for casework on the Mumbles Promenade and Porthcawl Breakwater and to support an internal funding bid to purchase a stock of ecological enhancement units for future use. Our research has significantly influenced NRW's approach to enhancing biodiversity on coastal structures and in several cases, they have directed developers to us for advice.

## PRIZES, MEDIA AND OUTREACH

The Aberystwyth University led Ecostructure Project was presented with the Better World award by singer Sting at the 2020 .eu Web Awards, which celebrates websites that encourage green initiatives. The project brings together five leading universities in Wales and Ireland to raise awareness of eco-engineering solutions in response to the challenge of coastal adaptation to climate change. Our research has received media coverage appearing on BBC Radio 4 Today, BBC Countryfile Diaries, BBC Wales Today and the BBC News website and has also featured in the *Environmental Science Journal for Teens*.

## IMPACT ON POLICY MAKING

In 2015, Aberystwyth University researchers were invited to present their research findings to the Welsh Government's Marine Conservation and Biodiversity Branch. This led to the appointment of one of our researchers to the Welsh Government's Restoring and Enhancing Marine Biodiversity Task and Finish Group. Published in 2015, the draft Welsh National Marine Plan (WNMP) made clear reference to our experiments on drilled cored rockpools, pits and crevices. Since the WNMP was adopted, Natural Resources Wales has published the first Marine Area Statement for Wales. This includes as one of its three themes: 'Nature-based solutions and adaptation at the coast' specifically referencing the Ecostructure Project.

## GLOBAL IMPACT

Drill-cored rockpools based on designs developed and tested at Aberystwyth University have been used by a Malaysian research team to enhance the biodiversity on coastal defence structures in Penang, Malaysia. The pools supported more species than the surrounding unenhanced boulders, demonstrating that our drill-cored rock-pool method can be used successfully in the tropics.

