Biogeomorphology of coastal structures

UNDERSTANDING INTERACTIONS BETWEEN HARD SUBSTRATA AND COLONISING ORGANISMS AS A TOOL FOR ECOLOGICAL ENHANCEMENT

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Biogeomorphology is an integrated approach to understanding the environment, examining the two-way interaction between organisms and the physical landscape. Research funded by the Environment Agency and Great Western Research, based at the Universities of Exeter and Plymouth used this approach to improve understanding of how animals and plants respond to materials used in coastal engineering, and how structures might be enhanced for biodiversity gains.

The physical characteristics of materials used in coastal engineering influence which organisms colonise—and how quickly.

Hard coastal structures like sea-walls and breakwaters are essential for coastal erosion and flood risk management, and economically valuable port and harbour activities. While these structures act as new habitats in their own right—becoming colonised by animals and plants—the diversity of organisms that they support is typically lower than natural rocky shores.

Coastal engineering activities must minimise any adverse impacts on the environment and the Water Framework Directive requires that ecological potential is maximised wherever possible. Finding ways to enhance artificial structures so that they may better mimic natural shores (ecologically) is therefore a research and conservation priority.

SURFACE TEXTURE

Barnacles show strong responses to substratum surface texture. The species’ studied by researchers at the University of Exeter showed a positive response to fine scale (millimetre) textures when they were applied to common engineering materials. Making grooves in the surface of concrete whilst curing, for example, increased colonisation rates two fold compared to smooth concrete often used in coastal engineering. Encouraging early colonisers like barnacles could enable more species to establish, as succession continues.
Organisms change the properties of the materials they colonise.

Field and laboratory investigations showed that microorganisms can alter the roughness of rock and concrete through ‘bioerosion’. This created ecologically favourable textures that are often absent from artificial structures — but did not alter their durability, at least in the short term. The behaviour of materials at low tide also changed after they were colonised, which is important for weathering rates and landform development, and ecological stress.

Biogeomorphology provides an integrated framework within which physical and biological processes—and their influences on each other—can be studied. Understanding these feedbacks requires interdisciplinary knowledge and is inherently complicated, but is necessary for holistic management of the environment.

Further work is now needed to determine the sorts of features most important for different organisms, so that priority species can be targeted. Collaboration with engineers and coastal managers is needed to examine how these features can be incorporated in the planning, design and operation of coastal structures.

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