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Coastal structures change marine ecosystems

The urbanisation of coastal areas and introduction of man-made structures, such as jetties and seawalls, are changing marine environments. A new analysis highlights the impacts of these changes on marine plants and animals and suggests options to manage the detrimental effects.

Many of the world's largest cities are in coastal zones and more than 75 per cent of people are expected to live within 100 km of a coast by 2025. These changes in population distribution have already had an impact on coastal landscapes. The EU's policy on Integrated Coastal Zone Management[1] aims to identify and promote measures to manage deteriorating coastal zones.

The study, supported by the EU's MarBEF project[2], summarises current knowledge on the impacts of urban infrastructure on marine habitats. Common examples of infrastructures include breakwaters to reduce the intensity of waves, jetties, floating docks and seawalls.

The different types of man-made infrastructure tend to provide more vertical habitats and are often made from artificial material, such as concrete or metal. This can change the physical properties of the habitat, with important consequences for both immobile and mobile species. For example, farmed mussels growing on artificial structures are larger than mussels growing on natural structures, but have weaker shells. This ultimately affects the feeding and distribution of sea ducks. Man-made infrastructures tend to lack "microhabitats", such as rock-pools and over-hangs, which often provide refuges against predators, particularly for larvae and young individuals.

Man-made structures on coastal areas that are exposed to waves often provide unnatural sheltered habitats. These can encourage species that might not normally flourish to take over the habitat and so reduce the diversity of species. The structures can also act as corridors or stepping-stones that connect populations. For example, the increase in man-made structures along the Belgian coast has enabled the spread of periwinkles across areas which naturally lack suitable habitat. There is also evidence that many exotic or alien species establish and spread more easily on artificial structures.

The study suggests a number of management options to address these impacts. Natural habitats, such as seagrasses and shellfish reefs, can be incorporated into hard man-made structures to produce "hybrid" designs. Similarly, habitat features, such as rock-pools, can be added. Coastal defence structures, such as seawalls, could be moved inland, in managed retreat or realignment strategies.

Finally, impacts could be minimised by restoring degraded habitats, such as dunes. More collaboration is needed between engineers, managers and ecologists to research and produce ecological engineering solutions. For example, the EU project DELOS[3] has suggested that the negative impact of coastal defence structures on sediment-living organisms could be reduced by using low-crested barriers which allow waves to pass over the top. Further ecological engineering research could eventually produce a "recipe book" of structures that satisfy the needs of a growing human population without sacrificing the marine environment.

1. See http://ec.europa.eu/environment/iczm/home.htm
2. MarBEF (Marine Biodiversity and Ecosystem Functioning) was supported by the European Commission under the Sixth Framework Programme within the Sustainable Development, Global Change and Ecosystems programme. See www.marbef.org
3. DELOS (Environmental Design of Low Crested Coastal Defence Structures) was supported by the European Commission under the Fifth Framework Programme within the Energy, Environment and Sustainable Development programme. See www.delos.unibo.it

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