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The ecological enhancement of coastal and marine structures by implementing bio-enhanced concrete elements into design

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Abstract

Coastal hardening replaces natural habitats with urban and industrial waterfronts that cannot provide ecosystem services similar to those offered by undisturbed coastlines. As a result, concrete based coastal and marine infrastructure are often considered as sacrificed zones ecologically with no environmental value.

The ecological engineering of shoreline schemes is an evolving discipline with the aim of building more inclusive, resilient, and safe coastal and marine structures for both people and nature that maximize benefits for ecosystems, society, and economies.

ECOncrete® offers sustainable solutions for coastal and marine infrastructure that provides fully constructive, cost-effective concrete products, with significant structural, biological, and environmental advantages. ECOncrete's technologies bridge the gap between sustainability and development with high-performance bio-enhancing concrete elements that significantly enhance the biodiversity, species richness, and live cover compared to standard "gray" concrete elements, without affecting the operational needs of the infrastructure.

Bio-enhancing concrete elements induce the growth of ecosystem engineers that have profound impacts on how communities develop; increasing species abundance and biodiversity. Species such as oysters, corals, and the like secrete CaCo3 skeletons onto the substrate serving multiple benefits. This "biological crust" serves as an active carbon sink as carbon is assimilated into the skeletons of these organisms. This form of bioprotection reduces the magnitude and frequency of structural maintenance, which translates into improved ecological stability (reduced anthropogenic intervention), and a higher ROI (reduced maintenance costs).

In an era of accelerated coastal development, we must promote innovative ways for developing more ecologically productive urban coastlines. Bio-enhancing concrete elements that are eco-engineered to support rich sessile communities serve multiple ecological, environmental, and operational goals. To achieve a significant ecological uplift in urban waterfronts, ports, and coastal protection there is a need for large-scale implementation, calling for practical solutions that can be simply and cost-effectively implemented into the conservative construction industry.

Keywords

ecological engineering, bioenhancement, coastal and marine infrastructure, carbon reduction