

Green Structures in Grey Environments

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Transportation Research Board of the National Academies
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Focus

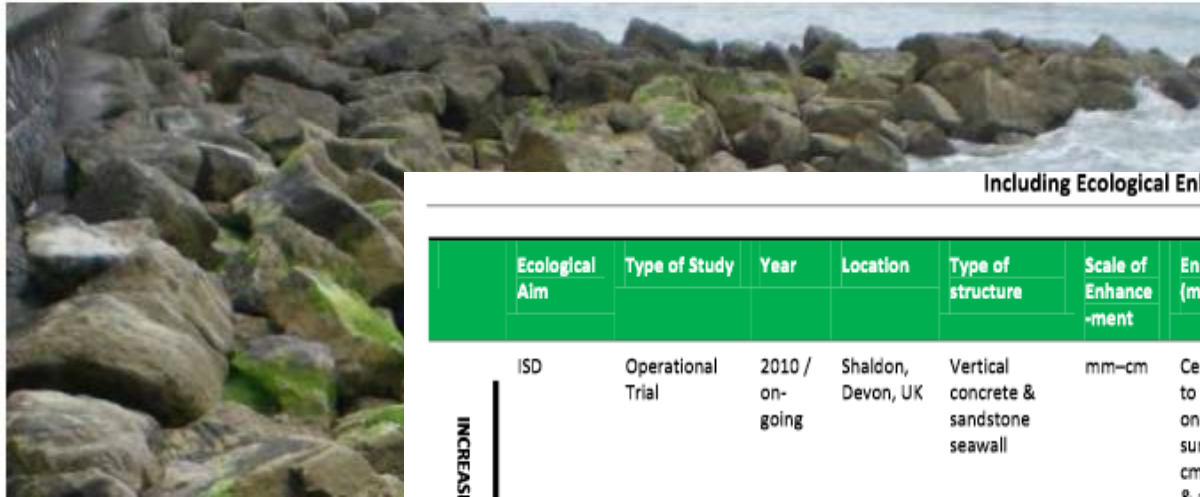


Incorporation of Ecological Principles in Urban Shorelines

- Roughness / texture
- Irregularity
- Material composition
- Slope
- Diversity



Including Ecological Enhancements in the Planning, Design and Construction of Hard Coastal Structures: A process guide



Including Ecological Enhancement in Coastal Structures

FINAL v3.0

	Ecological Aim	Type of Study	Year	Location	Type of structure	Scale of Enhancement	Enhancement Details (material & design)	Outcomes	Source
INCREASING SPATIAL SCALE OF ENHANCEMENT GOALS	ISD	Operational Trial	2010 / on-going	Shaldon, Devon, UK	Vertical concrete & sandstone seawall	mm–cm	Cement mortar textured to compare colonisation on smooth surfaces & surfaces with holes (1.5 cm dia.), grooves (mm), & artificial rock pools.	Preliminary results not yet available. Monitoring to commence in 2010.	Website: www.exeter.ac.uk/coastaldefencesbiodiversity
	ISD	Experimental	2008–2009	Ijmuiden, Netherlands	Concrete block rubble breakwater	mm–cm	Concrete slabs (75 cm x 25 cm) attached with different scales/types of texturing (Fine and coarse roughness, holes and grooves). Duration: after 15 months.	Rough surfaces and holes colonised by green algae quicker than smooth; mussels colonised grooves faster.	Borsje et al. 2011
	ISD	Experimental	2005	Elmer, Sussex, UK	Test panels (attached to rock rubble breakwater)	cm	Concrete panels exposed with smooth surfaces & with holes (1.5 & 3 cm dia. x 2 cm depth). Duration: after 1 yr.	Holes increased diversity of species two-fold compared to smooth panels.	Moschella et al. 2005 Website: www.dei.os.unibo.it/
	ISD	Experimental	2009	Lysekil, Sweden	Concrete foundations for wave energy	cm	Rectangular holes (12 x 15 x 30 cm) holes cast in subtidal concrete units. Duration: after 3	Fish & crab abundance was significantly higher on units with holes	Langhamer & Wilhelmsson, 2009



Examples of Textures



Sao Roque, Portugal

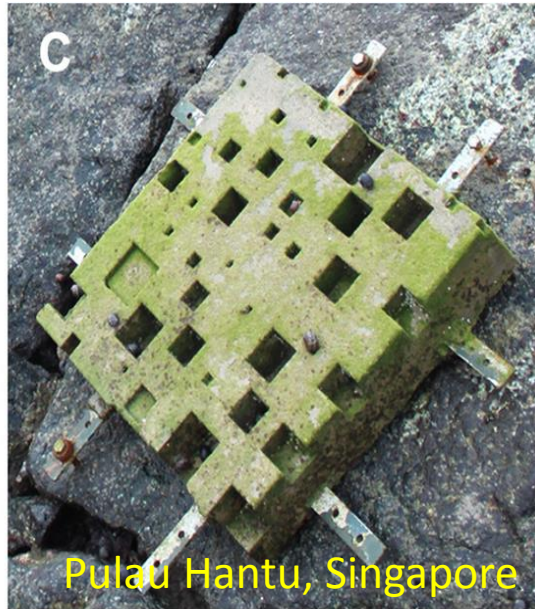
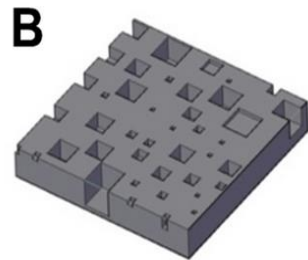
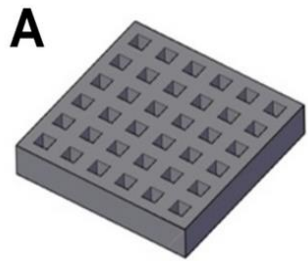
http://therrc.co.uk/MOT/References/EA_Ecological_Enhancements_Planning_Design_Construction_Hard_Coastal_Structures.pdf



Savannah, Georgia

<http://savannahnow.com/exchange/2012-03-09/savannah-port-skidaway-institute-team-ocean-exchange-project>

Examples of Textures



<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0087990#pone-0087990-g002>

<http://www.pulauhantu.sg/hantu-island-an-experimental-site-for-costal-protection-design/>

<http://www.biogeomorph.org/coastal/coastald efencesbiodiversity/index.html>



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Examples of Irregularities

McMahns Point, Sydney Harbor, Aus



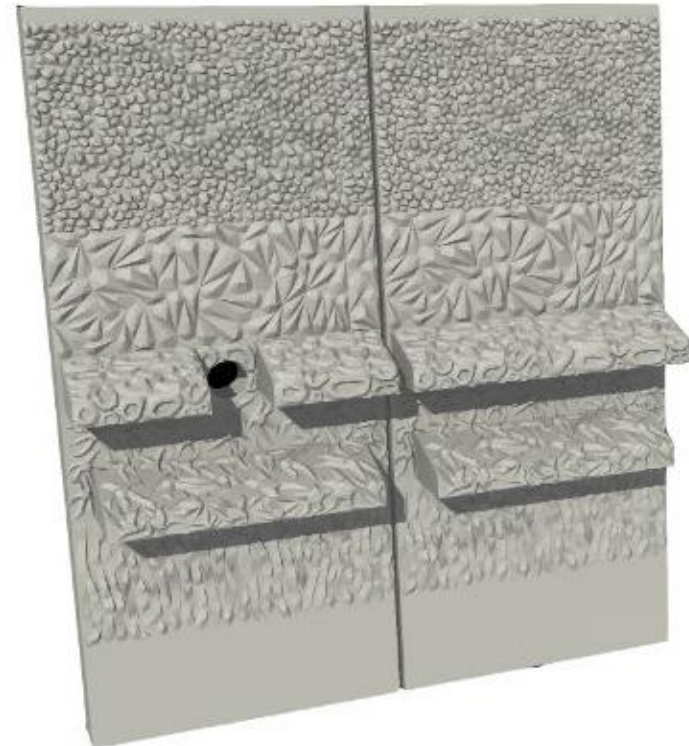
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Examples of Irregularities

Seattle, WA

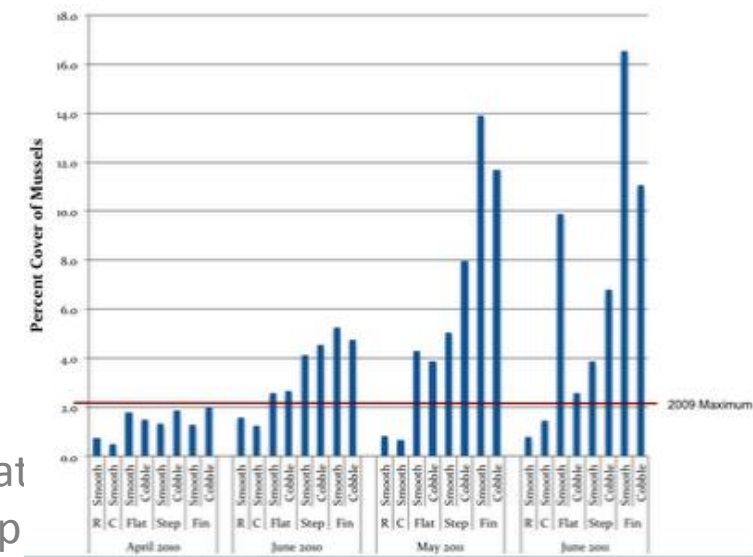
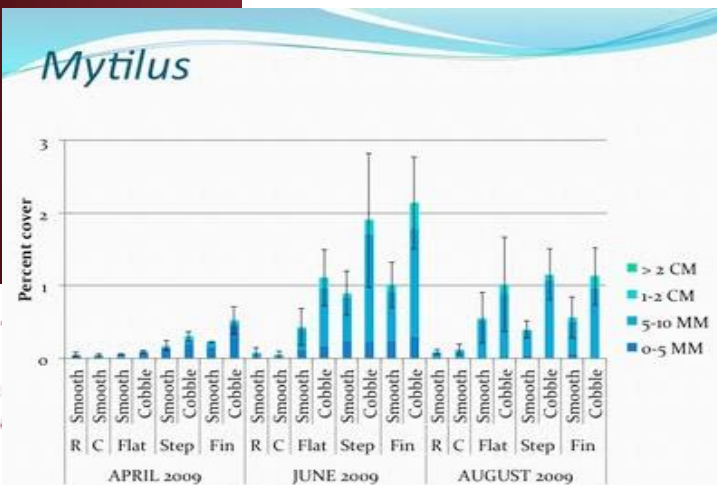
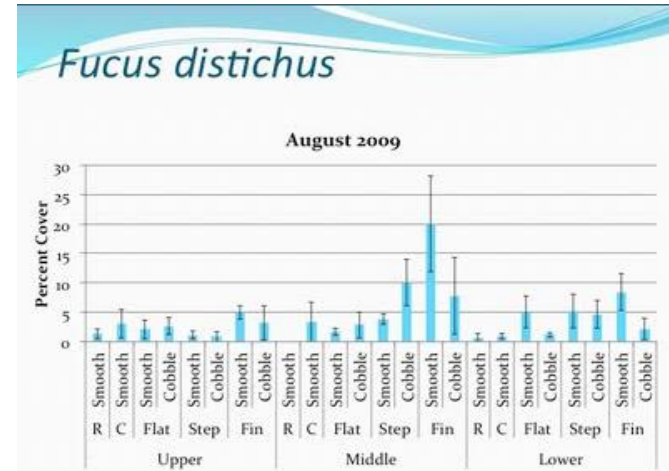
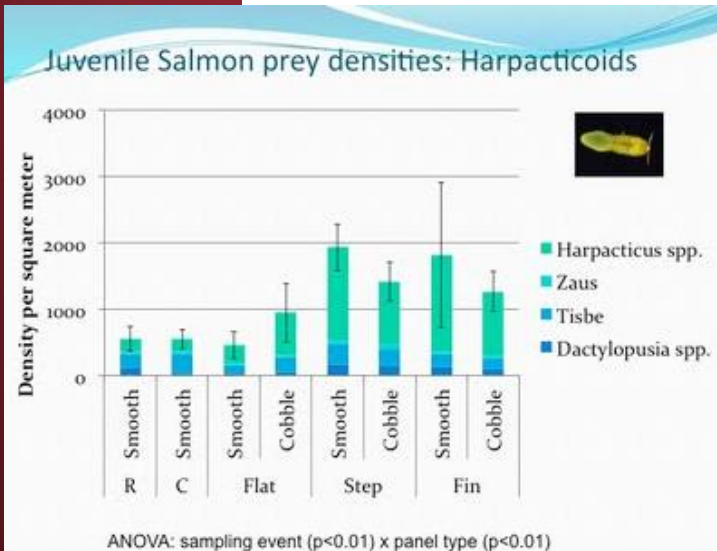
3 designs, each with 2 surface treatments;
plus Reference and Control



- <https://sites.google.com/a/uw.edu/seattle-seawall-project/home>

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Impact on fish, algae, & mussels



Examples of Material Composition

Rotterdam, Netherlands



<http://www.deltares.nl/en/news/news-item/item/16526/collection-of-practical-examples-of-eco-engineering>

www.deltares.nl/xmlpages/tan/files?p_file_id=13032

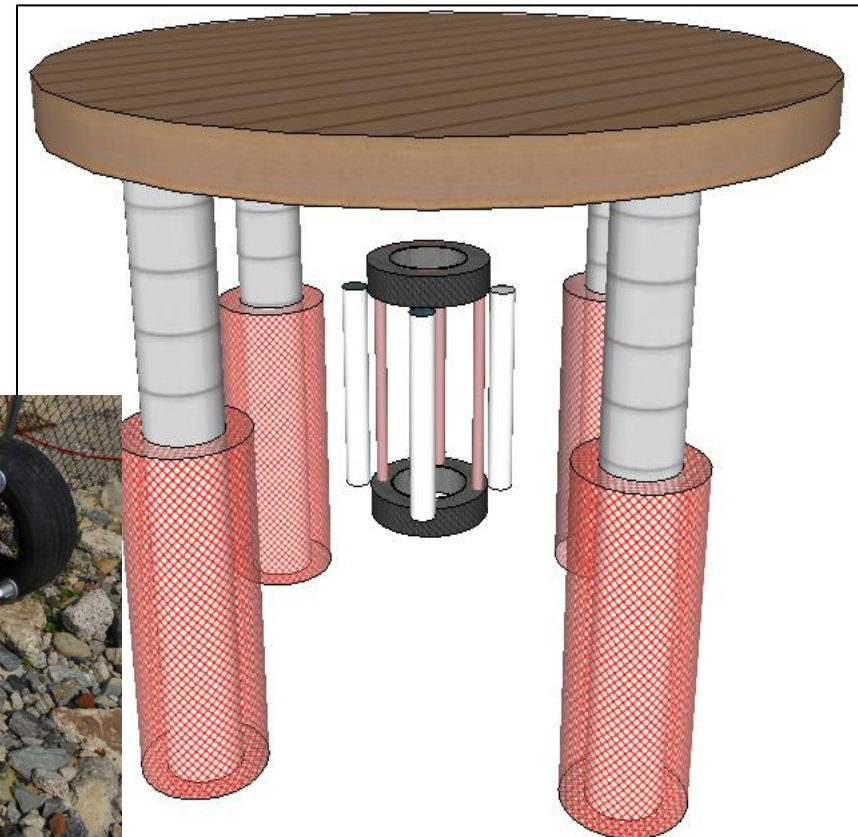
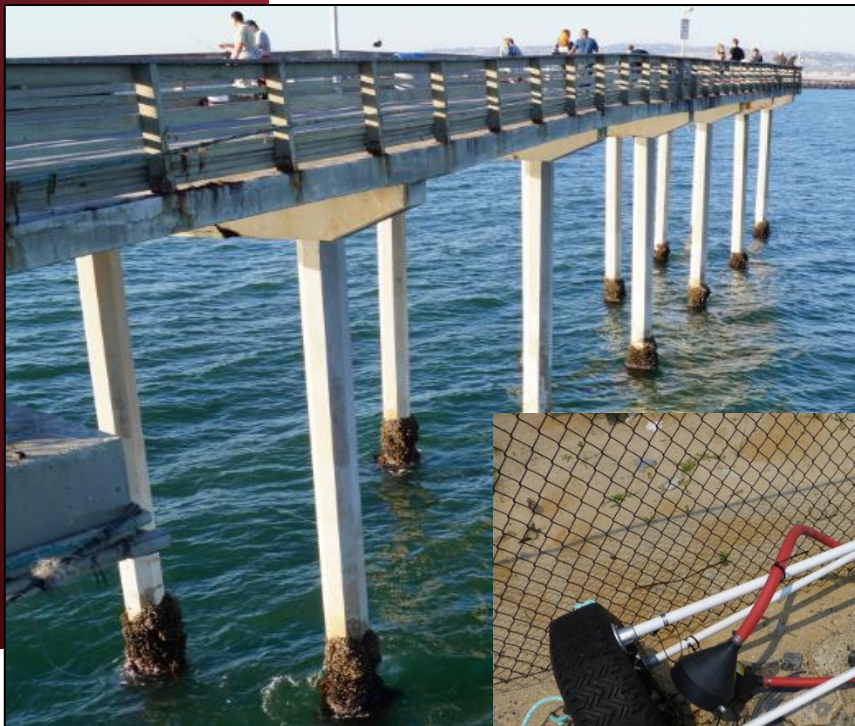
Examples of Material Composition

Ijmuiden, Netherlands



Examples of Material Composition

Andrew Rella Dissertation Research & NYC EDC “Changing the Course..” 2nd Place: Oyster Encasements for Pile Enhancement
(<http://www.nycedc.com/WaterfrontCompetition>)



Examples of Slope

Vancouver Convention Centre



<http://buildipedia.com/aec-pros/from-the-job-site/construction-of-the-vancouver-convention-centres-habitat-skirt>

http://www.greenbuildingaudiotours.com/buildings/vancouver_convention_exhibition_centre_expansion_project#

Examples of Diversity

Lower Cuyahoga River, Ohio

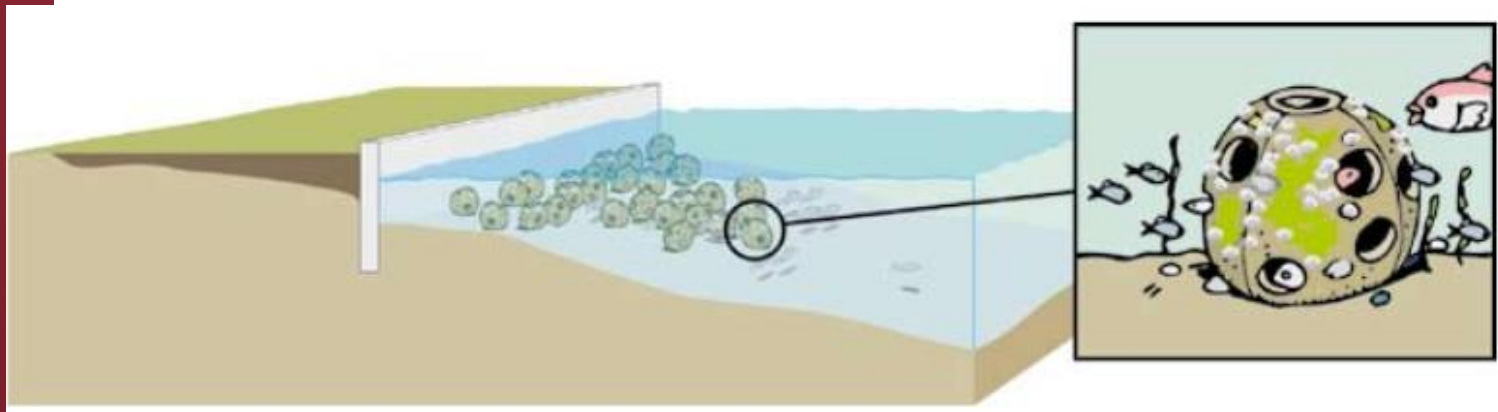


crcpo.org/GREENBULKHEAD.html

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Examples of Diversity

Mandurah, Aus



Examples of Diversity

Michmoret, Israel



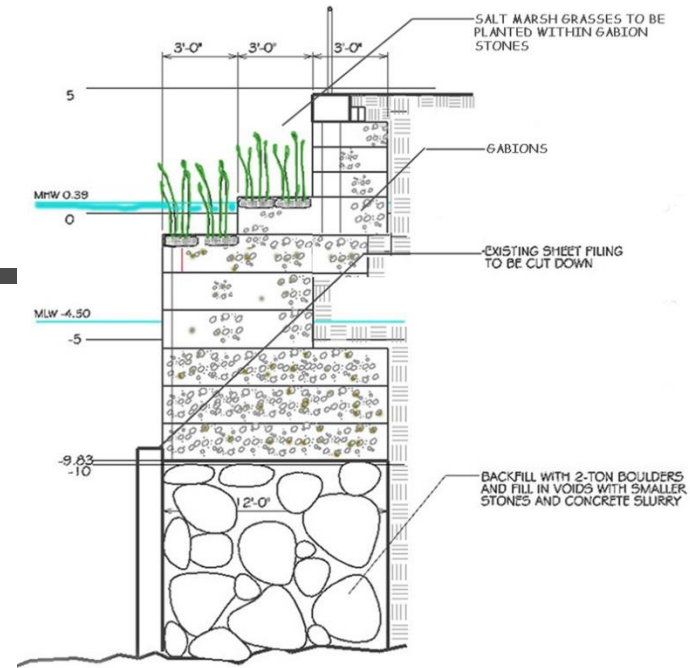
Examples of Diversity

Brooklyn Bridge Park



- <http://www.theepochtimes.com/n3/613250-nyc-marine-life-bolstered-by-israeli-technology/?photo=3>

Designing the Edge Harlem River Park



Harlem River Park - Gabion Shoreline

Reza Mashayekhi, Structural Design
Ricardo Hinkle and Marcha Johnson - Landscape Architects



A few final thoughts

- It is possible to be green in an urban environment
- Little things can have a big impact
- Its been done before
- Metrics and assessment procedures need work
- There is no one-size fits all solution





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