



# ECOSTRUCTURE

*Climate Change Adaptation through  
Ecologically Sensitive Coastal Infrastructure*

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# Coastal sprawl

- Coastlines of Ireland and Wales
  - Highly urbanised
- Proliferation of artificial structures in the coastal zone
  - Defence against floods and storms
  - Renewable energy
  - Aquaculture
  - Transport and leisure








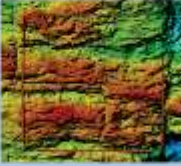
# Artificial structures

- Usually provide poor habitat for native species
  - Can be preferentially colonised by invasive species
- Can prevent natural retreat of shoreline
  - Coastal squeeze
- Create patches of hard substrate
  - Often in areas of soft sediment
- Can act as corridors or stepping stones for natural dispersal of invasive species and climate migrants



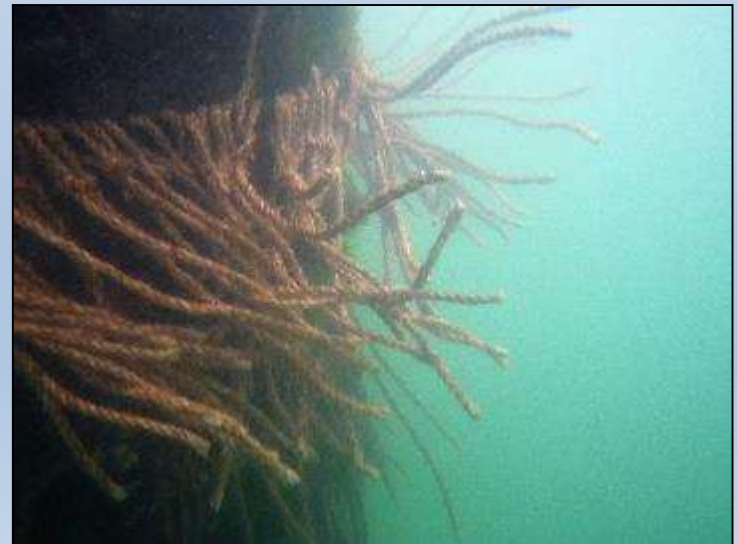
# Mapping, imaging and surveys

- Compare physical features with living communities
  - On natural shores and artificial structures

<p><b>Spatial scale</b></p>	<p><b>Regional</b></p> 	<p><b>Local</b></p> 	<p><b>Micro</b></p> 
<p><b>Methods</b></p>	<p><b>GIS and Satellites</b></p>  <p>Broad-scale drivers in species distributions. Characterising wave exposure, salinity, connectivity potential from surrounding habitats and human activity.</p>	<p><b>Drone imaging and laser scanners</b></p>  <p>3D mapping, high resolution, geo-referenced data products. Characterising medium-scale variables such as: exposure, aspect, rugosity, extent of species.</p>	<p><b>Hi-res photogrammetry</b></p> <p>Sub-cm scale structure from motion models of &lt; 50cm x 50 cm areas using digital camera technology. Characterising small scale variables such as species coverage, abundance, richness, microtopography.</p> 

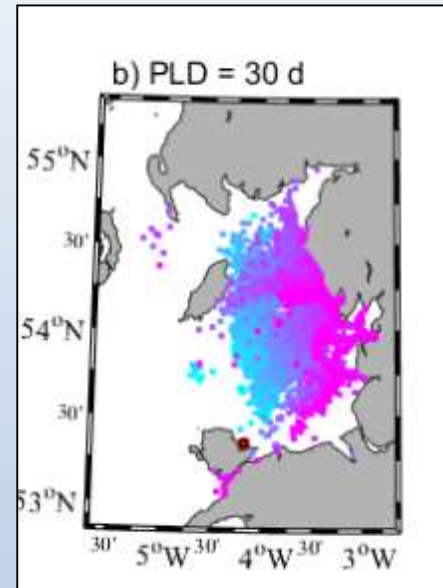
# Ecological engineering of coastal structures

- Testing interventions
  - For impacts on biodiversity and ecosystem function
    - Concrete habitat units
    - Drill-cored rock pools
    - Hulas
- Testing different concrete mixes
  - For performance
  - For biodiversity and community composition



# Dispersal and biosecurity

- Hydrodynamic model of Irish Sea
  - Predicts impacts of artificial structures on dispersal of native and non-native species
- Population genetics
  - Tests predicted impacts of artificial structures
    - On dispersal of invasive species
    - On climate migration
- Environmental DNA
  - Detects non-native species in water samples
    - Provides early warning and rapid identification
- Biosecurity measures
  - Provide methods for stakeholders (e.g. marina owners) to reduce colonisation of artificial structures by non-native species



### Operations: promoting biosecurity awareness

**Why:**  
Vessel owners may not be aware of non-native species. Promoting biosecurity awareness may increase understanding and encourage action, such as hull cleaning.

**Where:**  
Many marinas already promote "Check, Clean, Dry" protocols, even if not actively promoting for vigilance of non-native species.

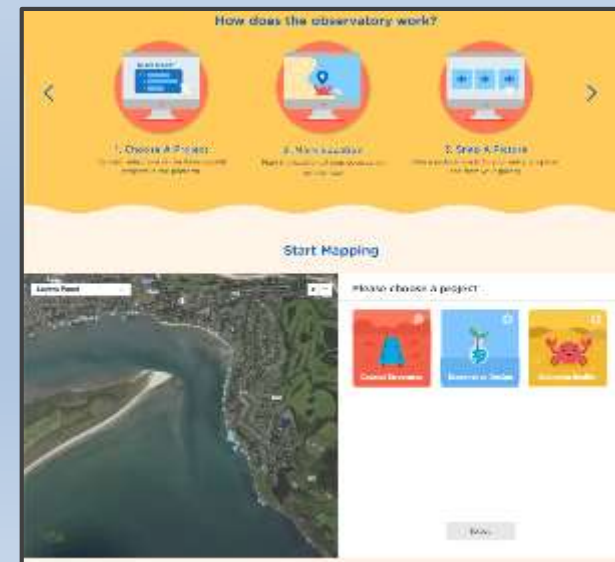
**What:**  
Marina staff promote biosecurity awareness through materials such as "Check, Clean, Dry" posters and materials, berth holders, communications, etc.

**Marina responsibilities:**  
Marina staff would be responsible for ensuring risk assessment takes place and biosecurity risks are removed.



# Engagement with coastal communities

- Awareness-raising workshops
  - Semi-structured focus groups (e.g. Marina owners)
    - On specific topics (e.g. biosecurity)
- Community needs assessment
- Perceptions study
- Ecostructure Observatory
  - Citizen engagement through participatory mapping



# Planned Outputs

- Maps and characteristics of artificial structures
  - Including intrinsic (e.g. material, design, topographic complexity) and extrinsic (e.g. exposure, salinity) features.
- Modelling tools to predict
  - biodiversity and ecosystem services supported by different structures in different contexts
  - Effects of artificial structures on dispersal of native and non-native species
- eDNA techniques for early-warning of non-natives
- Biosecurity tools and protocols
- New eco-engineering solutions
  - And tests of pre-existing solutions in an Irish Sea context
- Evidence-based catalogue of eco-engineering options
  - for “Enhancing Biodiversity on Marine Artificial Structures”



# Project Partners

