PhD Studentship: Engineering Nature-Based Artificial Reefs for Coastal Protection and Biodiversity Enhancement

Supervisors:
- Dr Ioannis Karmpadakis – Department of Civil and Environmental Engineering
- Dr Yves Plancherel – Department of Earth Science and Engineering

Departments: Civil and Environmental Engineering & Earth Science and Engineering
Funding: We can support applicants interested in this project to seek funding via open scholarship schemes (see here: Scholarships | Faculty of Engineering | Imperial College London) .
Location: South Kensington Campus, London, UK
Start Date: October 2026

Project Overview

Coastal communities are increasingly exposed to sea-level rise, storm surges, and biodiversity decline. Traditional hard-engineering defenses such as seawalls and breakwaters can provide protection but often harm natural habitats and reduce long-term resilience.

This PhD project will investigate engineered artificial reefs as Nature-Based Solutions (NbS) for coastal protection and biodiversity enhancement, developing next-generation hybrid structures that harness natural processes for flood mitigation, habitat creation, habitat protection and carbon co-benefits.

The research will advance understanding of how reef geometry, materials, and configuration influence wave attenuation, sediment dynamics, and ecological functionality — informing design frameworks for sustainable, adaptive coastal defences.

Research Objectives

The project will aim to:
1. Quantify how artificial reefs modify nearshore hydrodynamics and reduce flooding risk.
2. Assess the ecological and habitat-forming potential as a function of reef structure, scale and deployment.
3. Develop coupled physical–ecological models linking wave processes, sediment transport, and biodiversity outcomes.
4. Produce engineering design guidelines for implementing reef-based NbS in the UK and beyond.

Research Approach

The student will conduct an integrated programme of physical experiments, numerical modelling, and environmental assessment, including:

- Laboratory experiments in the Imperial Hydrodynamics Laboratory – a world-leading facility for studying wave–structure interactions, turbulence, and sediment processes.
- Numerical simulations using advanced models (e.g. OpenFOAM, SWASH, XBeach) to generalise laboratory findings across scales and climates.
- Ecological integration, coupling hydrodynamic data with biodiversity and habitat indicators.
- Collaboration with researchers in the Grantham Institute – Climate Change and the Environment to embed outcomes within climate adaptation and sustainability frameworks.

Candidate Profile

We seek an outstanding and motivated candidate with:

- A strong background in civil/coastal engineering, fluid mechanics, oceanography, or environmental engineering.
- Strong analytical and quantitative skills.
- Experience in experimental or numerical modelling (e.g. MATLAB, Python, CFD) is desirable.
- A keen interest in climate adaptation, sustainable design, and interdisciplinary research.

Applicants should hold (or expect to obtain) a First Class or Upper Second Class degree (or equivalent) in civil engineering, mechanical engineering, physics, applied mathematics, or a related discipline.

Training and Environment

The successful student will join Imperial's Coastal and Ocean Engineering Group, working closely with the Earth Science and Engineering Department and the Grantham Institute. They will benefit from:

- Access to the Imperial Hydrodynamics Laboratory, one of the world's premier experimental facilities for coastal and offshore research.
- Advanced training in hydrodynamics, numerical simulation, and eco-engineering design.
- Collaboration opportunities across Imperial and with UK and European partners in Nature-Based Solutions and climate resilience.
- A supportive, interdisciplinary environment fostering impact-driven research at the interface of engineering and environmental science.

Application Process

Applications should include:

1. A CV (max 2 pages)
2. A cover letter outlining motivation and relevant experience
3. Academic transcripts

Informal enquiries are welcome and should be directed to:
Dr Ioannis Karmpadakis (i.karmpadakis@imperial.ac.uk) or Dr Yves Plancherel (y.plancherel@imperial.ac.uk)

Application deadline: Open until filled

Keywords

Nature-Based Solutions · Artificial Reefs · Coastal Protection · Biodiversity · Wave Dynamics · Ecohydraulics · Climate Adaptation · Sustainable Infrastructure