Imperial College London

Natural Environment Research Council

2023_36_ESE_Sutton: Leveraging emerging numerical models from engineering to support coral reef conservation

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Department: Department of Earth Science and Engineering

Coral reefs are hot spots of biodiversity, provide important ecosystem services (e.g. protection from coastal erosion), and underpin fisheries. However, they are also under unprecedented stress. Current work in coral restoration aims to conserve existing populations through assisted migration and evolution. However, in the case of assisted migration, there are no well-grounded metrics for selecting the areas for migration and the mechanisms of propagation in a dynamic fluid environment are largely unknown, and likely bespoke to each site. Little is known about how coral nurseries affect the survivorship of propagated corals downstream. Does the shape of nurseries impact shear stress? How does that influences individual corals? How do human activities upstream, such as land reclamation, affect currents and associated feeding mechanisms, or smothering via sedimentation?

While temperature is a primary stressor and temperature data have been used to guide mitigation efforts, other stressors also affect corals, such as changes in precipitation, pH, salinity, and sedimentation. To understand the sensitivity of coral reefs to change, many factors must be incorporated, at scales from global climate change to local. Suitable data and new modelling frameworks, capable of working across scales from centimetres to hundreds of kilometres, are required.

In joining this project, you will aim to deliver a step change in quantitative and modelling tools geared towards coral reef conservation. Extensive fieldwork will be essential to the project to provide imaging at varying scales, to develop high-fidelity 3D models of nurseries and study areas, and to measure local conditions to constrain numerical models.

You will combine new observations with state of the art 3D photogrammetric techniques and novel hydrodynamic modelling capabilities developed and used in Earth Sciences and Engineering, Imperial College (e.g. https://fluidityproject.github.io/, https://solidityproject.com/applications/, https://thetisproject.org/). You will leverage tools developed for engineering applications to develop a suite of numerical and modelling applications geared towards coral reef protection and management.

The ideal candidate will have experience in: numerical modelling; computational fluid dynamics; remote sensing; and marine conservation biology; SCUBA experience and qualifications of PADI Rescue Diver or above. Candidates who can demonstrate a track record of academic excellence (e.g. first class degrees, prizes), potential for research (e.g. publications), leadership and proactive involvement in impactful outreach activities will have a high chance of success. Please consider these criteria when preparing your CV.

Note that due to the way scholarships applications are managed, applications deadlines for projects hosted in the Department of Earth Sciences and Engineering will be a few weeks before the deadline published by the SSCP DTP programme. Apply early!