PROJECT TITLE: AI reconstruction of coral growth and environmental responses in 4D

Project Science Theme: Science for Environmental Solutions
Project keywords: Eco-AI tools, Coral, Museum collections

Lead Institution: University Bristol
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Project Description:

Coral reefs are among the richest yet most pressurised marine habitats globally, but our understanding of how environmental factors drive loss and recovery remains coarse. Coral skeletons are time capsules linking corals' lives to their environment: hidden within them are features tied to time, growth, colony organisation, biotic interactions, and responses to external pressures like temperature extremes, flooding, or sedimentation. However, complex skeletal analyses at scale are currently impossible due to prohibitive manual labour.

Micrometre-scale X-ray micro-computed tomography (µCT) reconstructions can digitally capture this vital information key to quantifying carbonate budgets, morphological changes, and scarring from environmental events by localising polyp budding and mortality events, skeletal densities, calcification, and growth rates localised in 4D (i.e. 3D scan-space plus 1D time).

This Bristol-NHM project will deliver an eco-AI system for large-scale 4D coral skeleton analysis. It brings together the NHM's extensive collections and advanced scanning with Bristol's expertise in coral science and 'AI for nature' research. The PhD candidate will design, train, and evaluate AI models on real-world 3D scans to automate the 4D structural extraction of corals' life events. By integrating and fine-tuning recent D4RT and Segment Anything Model (SAM) architectures, the project will reliably track corallite segments through colony volumes, extract exact timestamps via banding recognition, and correlate sample-specific NHM environmental metadata directly to these structures. Discovering these events at scale will provide time-critical guidance for marine protected area design, re-seeding operations, and future change-monitoring strategies.

The student will work at the interdisciplinary vanguard of visual AI and historical ecology, pioneering eco-AI architectures and conservation tools. Supported by expert cross-disciplinary supervision, world-class Isambard-AI infrastructure, world-class Palaeobiology laboratories, including the XTM Imaging Facility for microCT scanning and imaging analysis, and access to the irreplaceable NHM data and coral collections, the student will break new ground in engineering-driven, AI-led reef conservation.

Useful recruitment links:

For information relating to the research project please contact the lead Supervisor via: e.hendy@bristol.ac.uk

Bristol NERC GW4+ DTP Prospectus:
https://www.bristol.ac.uk/study/postgraduate/research/great-western-four-doctoral-training-partnership-nerc/

How to apply to the University of Bristol:
http://www.bristol.ac.uk/study/postgraduate/apply/

The application deadline is Thursday 7 January 2027 at 2359 GMT