

NERC-funded Research Experience Placement (REPs) Summer 2025

Project title

Patterns in the plankton: harnessing in-situ imaging and machine learning for zooplankton monitoring

Lead supervisor

Cecilia Liszka

Project description

Zooplankton play a vital role in the pelagic ecosystem, transferring energy and nutrients from primary producers to higher trophic levels; supporting commercially important fish stocks; contributing to ocean carbon storage via the biological carbon pump; and serving as indicators of environmental change. Understanding the structure and variability of plankton communities is essential if we are to detect signs of change and assess the implications of changes for the health of the pelagic system or the provision of ecosystem services. This also requires identifying appropriate indicators against which status and change can be assessed.

Traditionally, zooplankton samples are collected from ships using nets and analysed using microscopy, a process that requires specialist expertise, and that can be time-intensive and costly - both financially and in terms of carbon footprint - especially at the resolution required for comprehensive monitoring. Over recent years there have been developments in the application of in-situ imaging technologies and machine-learning methods. These offer the potential to increase the temporal and spatial resolution of data collection and analysis, and to harness this for rapid, or even real-time, monitoring.

This project will make use of a novel type of image data collected during a recent trial of an in-situ plankton imager on board the RRS Sir David Attenborough. It will use machine learning techniques with statistical methods to analyse these data with the goal of enhancing the accuracy of species identification and improving ecological monitoring.

Images will initially be classified using a machine learning classifier with an existing training dataset. There will be opportunities to improve the training dataset by manual review of the resulting classes, developing expertise in plankton identification, followed by repeat classification using the improved training dataset. Analysis of the final data will include metrics such as community abundance, diversity and size spectra, which will be placed in its environmental context using ancillary data on, for example, temperature, salinity, chlorophyll and dissolved oxygen obtained from in situ (ship) measurement or remotely-sensed sources.

The lead supervisor will be Dr Cecilia Liszka (BAS) and the project will be co-supervised by Dr James Scott (Cefas) who will provide input on the machine learning component of the project. This will provide opportunities to visit Cefas and experience the variety of work carried out there. The project would be principally based at BAS with the potential to work from home where possible.

Project restrictions

This project would suit students studying for a quantitative environmental/ marine sciences degree (or equivalent) with good analytical and numerical skills. Some experience of programming (R or Python) or experience with zooplankton identification would be an advantage but is not essential.

Working arrangements

This project is largely computer-based so there is potential for much of the project to be carried out remotely, although regular communication with project supervisors would be expected. An initial period of work at BAS Cambridge is anticipated at the start of the project, although the student is welcome to work on-site as much as they wish. The student will be integrated into the Ecosystems team at BAS where the lead supervisor is based. There are approximately monthly full team meetings, and additional sub-group meetings, which the student will be invited to. These are all held in person with an option to join remotely. There is also a thriving early career community at BAS which the student will be integrated into. A visit to Cefas in Lowestoft, where the co-supervisor is based, is also planned in the early part of the project so the student can gain experience of the work carried out there.