PROJECT TITLE: Diurnal vertical migration in the Southern Ocean: Importance to carbon sequestration and impacts from future oceanic warming

DTP Research Theme(s): Living World, Changing Planet

Lead Institution: University of Bristol

Lead Supervisor: Prof. Martin Genner, University of Bristol, School of Biological Sciences

Co-Supervisor: Prof. Geraint Tarling, British Antarctic Survey, Ecosystems Team

Co-Supervisor: Dr Sophie Fielding, British Antarctic Survey, Ecosystems Team

Co-Supervisor: Dr Ryan Saunders, British Antarctic Survey, Ecosystems Team

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Project keywords: global warming, mesopelagic, marine ecosystem, Antarctica

Lanternfishes, named because of their bioluminescent photophores, are a key component mesopelagic fish communities of the Southern Ocean. Image credit: British Antarctic Survey

Water samples are collected from known depths, and environmental DNA within the sample can be used to determine the species composition of the mesopelagic community. Image credit: British Antarctic Survey

Project Background
The daily migration of mesopelagic species from deeper waters they occupy during the day, to the surface waters during the night, is the most important mass movement event that takes place on Earth. The migration transports a vast biomass of carbon from the surface waters to the ocean depths and is a key component of marine biological carbon pump (the migration is responsible for an estimated ~32% of total oceanic carbon sequestration). Despite this importance, there is considerable uncertainty regarding the species involved in the daily migration, the factors that determine the extent of migration, and the vulnerability of this pathway of carbon sequestration to climate warming. This project aims to resolve the extent of carbon transport by mesopelagic species of the Southern Ocean and how this critical process will be affected by future climatic warming.

Project Aims and Methods
Key aims of the project will be to: 1) Establish the migratory behaviour of key mesopelagic species in the Southern Ocean, and how this varies in relation to environmental variables. 2) Evaluate the extent and spatial distribution of carbon sequestration driven by mesopelagic species across the Southern Ocean. 3) Determine how past and future climate change will affect the distribution of key species and the extent of carbon sequestration. The project will utilise and combine evidence from multiple different sources, including species distribution models, experimental trawl data, active acoustic data, environmental DNA and modelling of oceanographic processes. There will be opportunities for the student to contribute to the design of the research programme.

Candidate requirements
The project would suit well-rounded candidates with strong quantitative skills, an interest in fieldwork and experience of molecular laboratory work. We welcome and encourage student applications from under-represented groups. We value a diverse research environment.

**Project partners**
The project will be a collaboration between the British Antarctic Survey (Dr Sophie Fielding; Prof. Geraint Tarling, Dr Ryan Saunders) and the University of Bristol (Prof. Martin Genner). Collectively, the team bring relevant skills in marine ecology, active acoustics, environmental DNA, species distribution modelling, ecosystem modelling and marine climate change.

**Training**
Training will be provided in key aspects of the work, including species distribution modelling, laboratory analyses of environmental DNA, bioinformatic analyses of environmental DNA data, analyses of ecological and active acoustic data, and modelling of oceanographic processes. There is the possibility of fieldwork in the Scotia Sea depending on a number of factors, although the success of the project will not be dependent on this aspect.

**Background reading and references**


**Useful links**
http://www.bristol.ac.uk/biology/courses/postgraduate/

**NERC GW4+ DTP Website:**
For more information about the NERC GW4+ Doctoral Training Partnership please visit
https://www.nercgw4plus.ac.uk.

**Bristol NERC GW4+ DTP Prospectus:**
http://www.bristol.ac.uk/study/postgraduate/2022/doctoral/phd-great-western-four-dtp/

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

The application deadline is Monday 10 January at 2359 GMT. Interviews will take place during the period 23 February – 9 March 2022.

**General Enquiries:**
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