ONE Planet
Doctoral Training Partnership

Natural Environment Research Council

Project title:

Using eDNA and stable isotopes in lake sediment cores to inform wetland conservation by examining causes of decline of rare water bird species.

(Ref: OP20279)

One Planet Research Theme:

Climate & Climate Change ☐ | Earth System Processes ☐ | Anthropocene ☒ | Environmental Informatics ☒

Lead Supervisor: Dr Maarten van Hardenbroek

Key Research Gaps and Questions:

- *Can eDNA in water be used to identify current site use by elusive/hard to monitor species of water bird*
- *Can eDNA in sediment cores be used to establish historical wetland occupation?*
- *Can eDNA in sediment cores be used to track bird decline over time?*
  Can eDNA in sediment cores be combined with stable isotopes and traditional palaeolimnological approaches to examine the rate and causes of decline?

Project Description:

The UK was once home to a number of now locally extinct water bird species such as the white stork (*Ciconia ciconia*), Dalmatian pelican (*Pelecanus crispu*) and night heron (*Nycticorax nycticorax*). Almost nothing is known about the historic distribution of these birds or how important they may have been in structuring wetland communities. Other species of water bird such as the common scoter, have experienced worrying declines and have been afforded protection and conservation prioritisation in recent years, but again nothing is known about historic distributions and the reasons for decline and only just beginning to be understood.

This project aims to develop methods that will enable conservation practitioners to look back in time and establish historic distributions of now locally extinct water birds. It will explore how eDNA in sediment cores can be used track changes in water bird presence at key sites over several hundred years. With Dr Darren Evans (NCL) we will use specific primers to target DNA of bird and invertebrate species preserved in sediment samples. Stable carbon/nitrogen isotope analysis of sedimentary remains of invertebrates will be used to trace changes in resources and food web structure through time in collaboration with Dr Paul Mann (N'bria University).

CASE partner the Wildfowl and Wetland Trust (WWT), has a long history of working on water bird conservation in the UK and around the globe. At its UK sites WWT has a captive collection of water birds and ponds which could be used establish the pathways of DNA preservation and loss from bird to sediment under controlled conditions. In addition, WWT will provide robust and long term monitoring data for a number of priority waterfowl species and these data could be used to validate presence and abundance established using eDNA from sediment cores.

Skills training provided: (1) palaeo/limnological sampling/coring and creating chronologies using spheroidal carbonaceous particles (SCPs) of lake sediment records; (2) molecular techniques including extraction, PCR amplification, library preparation for sequencing or nanopore, bioinformatics; (3) multivariate statistics using Matlab/R.

Prerequisites: Candidates with experience performing PCR, sequencing, bioinformatics, stable isotope analysis, and (palaeo)limnological techniques are encouraged to apply.

For more information, please contact Dr Maarten van Hardenbroek (maarten.vanhardenbroek@ncl.ac.uk).

Newcastle University

Northumbria University NEWCASTLE