

NATURESCOT PhD RESEARCH TITLES FOR SUPER DTP – to start October 2022

Priority areas of marine and coastal research for NatureScot – general themes:

- Understanding connectivity of marine populations (particularly PMF species) to assist in developing measures to increase resilience to pressures, including climate change impacts
- Understanding the ecology and pressures on fish species and their supporting habitats in nearshore waters
- Investigating ecological change in relation to mobile fishery exclusions around offshore wind arrays
- Impacts on marine ecosystems of man-made structures and activities on the coast and in the sea
- Analysis of change in Scottish coastal habitats (e.g. investigating the value of mobility of sand dune systems in the context of adjacent habitats)
- Better understanding of the ecology of kelp species and habitats, especially in relation to the ability to recover ecosystem functions following harvesting activity
- Investigating seabird behaviour in tidal-stream environments
- Movements of diadromous fish (excl. salmon) in Scottish coastal and inshore waters
- Clarifying the linkages of marine and coastal habitats and/or species in relation to functionality and ecosystem services
- Exploring the potential of new technologies to assist in marine and coastal survey and monitoring work
- Assessing the use of voluntary versus statutory approaches to managing marine wildlife tourism
- Analysing Scottish Marine Animal Stranding scheme data to improve understanding of marine mammal behaviour and human impacts

Note that we would welcome further discussion on any of the above themes to explore the potential to develop a detailed proposal. Please contact Carol.Hume@nature.scot in the first instance.

Below are some more specific suggestions and relevant contact details associated with these.

Specific PhD proposals:		
Brief title	Specific Aims & Objectives	NatureScot contact for enquiries
The uses of artificial intelligence and digital imagery techniques for monitoring of Special Protection Area seabird colonies	The populations of breeding seabirds in Scotland are facing unprecedented pressures, including many associated with or exacerbated by rapid climate change. Robust monitoring of breeding numbers and productivity across representative colonies is essential to track and understand these impacts. SNH also have statutory obligations to assess the condition of SPA colonies and to provide robust advice with	Alex Robbins – Alex.Robbins@nature.scot

	<p>respect to marine developments that may affect these populations. However, traditional field monitoring methods are resource intensive and hence costly to sustain at the levels required to provide systematic and robust evidence of change and SNH are currently reviewing our Site Condition Monitoring programme.</p> <p>The main aim of this PhD would be to develop and evaluate novel and less resource intensive methods (i.e. automated image recognition and data extraction from digital imagery) to maintain our understanding of population numbers and explore monitoring of productivity. We also want to go through a process of calibrating the methods with current approaches, and to establish baseline standards. A second aim is that we would like to find methods that could enable widespread monitoring of colonies with connectivity to windfarms that could be undertaken by developers with clear methodologies and analyses that could be easily replicated.</p>	
<p><i>Development of methodological and analytical approaches to monitoring and tracking changes in populations and distributions of inshore wintering waterfowl (divers, grebes, seaduck) plus European shag across marine SPAs in Scotland to inform conservation management.</i></p>	<p>There are a range of specific topics that could fall within this research area, including:</p> <ul style="list-style-type: none"> • application and development of geospatial modelling and statistical methods to facilitate combination of data from a variety of sources and platforms (e.g. digital aerial surveys, Wetland Bird Survey (WeBS) counts and targeted vantage point counts), collected at varying spatial and temporal scales, to develop robust population indices for IWW at site and network level. • Investigation of limitations and sources of bias in IWW survey data and development and evaluation of practical methodological approaches to reducing or eliminating these <p>Work on these aspects would build on preliminary explorative analyses carried out under a short contract to compare 2019/20 digital aerial survey data, annual Wetland Birds Survey (WeBS),</p>	<p>Kate Thompson – Kate.Thompson@nature.scot</p>

	<p>and, historic and contemporary vantage point counts data for the Moray Firth SPA.</p> <ul style="list-style-type: none"> • Investigation of use of drones for image capture for survey of IWW and of automated image recognition and/or Citizen Scientists for data extraction. <p>Research on any of these topics would inform future approaches to surveying and monitoring wintering bird populations in marine sites. Highly topical and relevant to conservation management of (migratory) wintering waterbirds. Includes opportunities to apply GIS and modelling tools to a real world problem.</p>	
<p>Investigating effects of public pressure on common eider populations at Sands of Forvie SPA</p>	<p>Since monitoring began the number of eider breeding at Sands of Forvie has declined by 400%, to around 1000 birds. This is the largest colony in Scotland, but it is thought that public pressure is having a negative effect on the breeding success of the population. Eider declines are reported from many populations in North Western Europe, but the factors involved do not appear to have a common root. The productivity of birds at the Sands of Forvie will be investigated along with that of other Scottish populations using a combination of visual survey and remote monitoring techniques.</p> <p>Long-term count data exists for many areas and will be used to build population models. Nest site selection and hatching success will be investigated using timelapse and remote triggered cameras. Foraging areas for broods post hatching will be surveyed and habitat preferences assessed.</p> <p>The development of monitoring techniques on a sensitive species in sensitive sites would be required. While a lot of historic data exists the quality of that data is variable and would require innovative and advanced analytical techniques to provide useful information. Methods for measuring productivity of eider while minimising disturbance of breeding eider and other species breeding at the same location and time must be developed.</p>	<p>Glen Tyler Glen.Tyler@nature.scot</p>

<p>Improving our understanding of the sensitivity of maerl bed habitats to pressures arising from aquaculture</p>	<p>Predicting impacts on maerl bed habitats, particularly in high energy sites, is very difficult due to a number of uncertainties around both the sensitivity of the habitat at various organic loads and modelling capabilities of waste deposition. Improving our understanding in these areas will provide the scientific basis on which to guide future policy and consenting decisions, helping to enable the sustainable growth of the industry. This work will be of value to both regulators, industry and statutory advisers by providing evidence to fill current knowledge gaps and enable more accurate science based decisions.</p> <p>There are a number of key areas this could cover</p> <p>a) Aim: To improve understanding of maerl bed sensitivity to various degrees of deposition and whether visual parameters can be used as a useful metric to measure impacts; Objective: establish the biological response of maerl beds to deposition; aim to define key sensitivity thresholds in relation to varying rates of solids deposition flux (as utilised in existing aquaculture depositional models).</p> <p>b) Aim: To improve understanding of the extent to which maerl habitats trap particles to help improve resuspension deposition modelling; Objectives: quantify the degree to which maerl bed habitat enhances sediment trapping, particularly in dispersive locations where modelling predicts that a high element of resuspension will occur; consider whether options exist to refine / adjust existing depositional models to factor in the presence of complex 3D structures created by maerl habitat.</p>	<p>Liam Wright Liam.Wright@nature.scot</p>
<p>Assessing the potential for water vole recovery in the face of a suppressed mink population</p>		<p>Rob Raynor Rob.Raynor@nature.scot</p>
<p>Scottish saline lagoons and climate change</p>	<p>Most Scottish saline lagoons (a Priority Annex I habitat) lie in areas of particularly high rates of Relative Sea Level Rise (RSLR). This study will use data loggers to investigate the relationship between RSLR, precipitation (actual and</p>	<p>Prof. Stewart Angus Stewart.Angus@nature.scot</p>

	anticipated) and stratification on lagoon function, and review the ecological consequences of this.	
Dynamism in structure and vegetation of Scottish dune habitats	Dune systems are usually dynamic, with the highest dynamism adjacent to the beach. This study will investigate the scale and nature of morphological and vegetational change across a range of dynamic situations and review results in the context of climate change. The consequences of increasing mobility near the beach and the contrast with relative stability inland will be investigated. A range of datasets will be employed, including the Aberdeen University (CCS) beach reports, the Sand Dune Vegetation Survey of Scotland, Dynamic Coast and (where available) LiDAR. Techniques developed by Dynamic Coast are likely to be of considerable value in this study.	Prof. Stewart Angus Stewart.angus@nature.scot

Title

Protecting wetlands biodiversity and ecosystem services from the impacts of extreme drought

Contact person: [Julia Stubbs Partridge](#)

Aims and objectives

Wetlands are highly sensitive to the impacts of climate change, which can affect their important role in catchments, providing a habitat for biodiversity, filtering nutrients, absorbing carbon and slowing the flow of flood waters. NatureScot [research](#) has shown that the risk to wetlands from extreme drought is likely to increase substantially in Scotland by 2040 as a result of climate change. This PhD will focus on designated (SAC, RAMSAR and SSSI) wetlands (not just peatlands) within the catchments that have been identified as being at greatest risk of extreme drought. The aim of the research is to investigate, and develop means of evaluating, the vulnerability of key wetland types within the most drought vulnerable catchments. This could be informed by factors including the plant communities associated with each wetland type, the water supply mechanisms of each site, and any historical or present management.

It is particularly important to understand what management actions will protect vulnerable wetlands against the impacts of extreme drought. This research project could examine wetlands where appropriate management regimes have already been implemented and assess their success by field comparison with sites where such actions have not taken place.

Within the research, based on designated wetlands wherever possible, the identification of management actions will also incorporate consideration of the potential for feedback loops caused by drought-related stressors, which could exacerbate the impacts of drought. For example, erosion is a key factor in degrading wetland systems; dry peatlands especially are prone to both wind and flood-driven erosion, which can break down the top vegetative layer of bog and expose the peat underneath, damaging the habitat and releasing the stored carbon. Fire is also a higher risk on dry wetlands, which can release massive amounts of carbon in addition to reducing habitat provision. Dry conditions can create cracks beneath the surface of a bog, weakening its internal structure such that heavy rain or floods can permeate rapidly and lead to bog bursts and slides. Dry conditions can make it harder for damaged habitats to recover from these events, potentially leading to longer-term impacts on the ecosystem services provided by a wetland.

This research will help to provide an evidence base to target future investment in sustainable management measures that will protect vulnerable wetlands and associated ecosystem services from the impacts of extreme drought. The presentation of the research will include site-specific case studies that will inspire and inform future wetland restoration outside of the study area.