

NATURESCOT PhD RESEARCH TITLES FOR SUPER DTP

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
- Developing marine natural capital approaches to underpin decision-making in the marine environment
- 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.

The following specific proposals are of particular interest for further discussion. These will also be subject to final decisions on NatureScot capacity to provide supervisory input and funding.

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. NatureScot also have statutory obligations to assess	Alex Robbins Alex.Robbins@nature.scot

	<p>the condition of SPA colonies and to provide robust advice with 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 NatureScot 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>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.</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 Inshore Wintering Waterfowl (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>Kate Thompson Kate.Thompson@nature.scot</p>

	<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), and, historic and contemporary vantage point counts data for the Moray Firth SPA.</p> <ul style="list-style-type: none"> Investigation 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</p>	<p>Glen Tyler Glen.Tyler@nature.scot</p>

	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.	
Improving our understanding of the sensitivity of maerl bed habitats to pressures arising from aquaculture	<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>	Liam Wright Liam.Wright@nature.scot
Scottish saline lagoons and climate change	Most Scottish saline lagoons (a Priority Annex I habitat) lie in areas of particularly high rates of Relative Sea Level Rise	Prof. Stewart Angus Stewart.Angus@nature.scot

	(RSLR). This study will use data loggers to investigate the relationship between RSLR, precipitation (actual and 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
Investigating the role of seaweed and shellfish cultivation in wave attenuation and the provision of other ecosystem services.	<p>There is currently a lack of understanding of whether seaweed and shellfish cultivation may help protect vulnerable Scottish shores by attenuating marine energies, as well as what other ecosystem services and benefits may be provided, such as carbon sequestration and essential fish habitats. Improving our understanding of these possibilities can help to inform whether these activities can be spatially planned and operationalised to maximise benefits. The energy-attenuation potential is particularly under-researched, but the multiple- benefits context is important for a more rounded consideration of future approaches to spatial planning, development licensing, ecosystem enhancement opportunities and protected area management.</p> <p>This study would begin with an international literature review, combined with discussion with key stakeholders, to examine any relevant existing studies, on attenuation of marine energies, and other benefits provided by these activities. This would refine the</p>	Sinead Sheridan Sinead.sheridan@nature.scot

	<p>objectives and details of the research, with potential to include field-trials with wave recorders, hydrodynamic modelling and ecological surveys/sampling. If progressing, proposal development would seek industry partnership.</p> <p>Final outputs may include an opportunity mapping exercise to illustrate areas of coast where aligning seaweed cultivation activity with areas of vulnerable coastline might be appropriate, alongside opportunities for other ecosystem services.</p> <p>Ideally, this study would also liaise with other relevant partners – Marine Scotland and Crown Estate Scotland, so as to ensure the findings and outcomes are effectively used to inform the development of marine planning policy and other coastal management mechanisms.</p>	
<p>Ocean literacy and informed public participation in marine governance interactions</p>	<p>Stakeholder engagement and public participation are key components of any marine planning or management process. These often involve face-to-face meetings, whether individually, in small groups, or in a ‘town hall’ format, with a lot of time spent on information provision, or misinformation correction. Covid-19 has forced the majority of meetings into the online sphere and it is likely that this prevalent way of communicating will continue into the future. This project will identify if, and how, stakeholder engagement and public participation can be conducted effectively within an online environment, in ways that improve ocean literacy, whilst also being equitable and just.</p> <p>To date efforts to understand and improve the extent of ocean literacy have tended to focus on environmental issues (e.g. climate change, micro plastics, ocean noise etc). This is widely accepted as an important step in increasing public engagement in marine issues and driving behavioural change. This project would go a step further to understand existing levels of citizen knowledge about how the sea and these environmental issues</p>	<p>Chris Leakey chris.leakey@nature.scot</p>

	<p>are governed and regulated, and the opportunities for greater and more equitable engagement in marine decision-making.</p>	
<p>How can the 'youth voice' be heard and considered in regional marine planning?</p>	<p>Securing public engagement in consultation processes, and the wider management of our seas is generally acknowledged as a significant challenge. These processes tend to be dominated by well-established (often older) voices; generally representing vested interests. Despite the environment (particularly climate change) being regularly cited as one of the major concerns the younger people, youth voices do not feature regularly in marine planning decisions and processes. This project will explore legal frameworks and or governance structures that might be used to increase youth voices, and test softer measures and potential good practice.</p>	<p>Chris Leakey chris.leakey@nature.scot</p>
<p>Understanding the impacts of demersal mobile fishing gear on sandeels in Scottish waters</p>	<p>Sandeels are a Priority Marine Feature and a protected feature of some MPAs within Scotland. The current focus of managing pressures from commercial fisheries on sandeel populations in Scottish waters is on avoiding removal of sandeels by species specific fisheries and also on human activities that have the ability to remove or change the structure of the gravelly sands that they inhabit. There is a formal closure of sandeel fisheries along the east coast of Scotland and no targeted fishery in on the west of Scotland. For other fishing gears, consideration has been around how they affect the structure of the sandeel habitat. Demersal hydraulic fishing gears (those that hydrolyse the sediment by blowing or sucking water/sediment) have the ability to change the sediment structure but there is uncertainty around other forms of demersal mobile fishing e.g. dredging, and their ability to affect the structure to the degree that it is no longer suitable for sandeels. Sandeels are reactive to disturbance near the seabed and will emerge from the sediment with the passing of fishing gear. It is not clear what the energetic costs of repeated disturbance are for sandeels and the effects of this on their survivability (predation, foraging, reproductive success etc). This PhD would look to explore these unknowns and possibly others by undertaking a review of the evidence and developing experimental methods to help improve the evidence base so that we can provide better management advice for these species.</p>	<p>Sarah Cunningham Sarah.Cunningham@nature.scot</p>