

Session A2: Environmental Science and Environmental Studies.

Session Chair, Professor Keith Davidson

Room: 959/960

Presentation 1 - Individual foraging niches of black guillemots in relation to tidal stream turbines	
Daniel Johnston ¹ , Environmental Research Institute, North Highland College UHI Supervisors: Robert W. Furness ² , Alexandra Robbins ³ , Glen Tyler ³ , Mark Taggart ¹ , Elizabeth Masden ¹ , 1. Environmental Research Institute, North Highland College, UHI 2. MacArthur Green Ltd 3. Scottish Natural Heritage	
Abstract	<p>Tidal streams provide important foraging habitat for marine top predators, including the benthic foraging black guillemot <i>Cepphus grylle</i>. This habitat may be altered by the addition of renewable energy devices i.e. tidal stream turbines. These devices may affect inshore habitat or species distributions by shifting tidal flow patterns, altering benthic composition and forming reefs. However, species will be affected to varying extents based upon their foraging requirements. A variety of foraging niches may also exist within a species' population, varying the extent of impacts between individuals. This study investigates the individual foraging niches of chick-rearing black guillemots, and how these relate to diet, nest success, and vulnerability to tidal turbines.</p> <p>Adult black guillemots were tracked using GPS during the summer breeding seasons on the Scottish islands of Stroma and North Ronaldsay. Concurrently, breeding success and chick diet were monitored using camera traps and visual observations. Both islands are associated with tidal streams, and Stroma is in close proximity to ongoing turbine installations within the Inner Sound of the Pentland Firth. The GPS tracks revealed individual specific foraging locations, with individuals foraging exclusively within or outwith tidal streams. Using predictive biotope data and tidal models, we identified the partitioning of habitats between individuals. Nest monitoring and chick weighing provided a measurement of breeding success in relation to diet and the related habitat of origin. Knowledge of black guillemot individualistic foraging behaviour will allow for population and individual level impacts of environmental alteration by tidal turbines to be assessed and potentially quantified.</p>
References	<p>Bolnick, D. I., Svanbäck, R., Fordyce, J. A., Yang, L. H., Davis, J. M., Hulse, C. D., & Forister, M. L. (2002). The ecology of individuals: incidence and implications of individual specialization. <i>The American Naturalist</i>, 161(1), 1-28.</p> <p>Furness, R. W., Wade, H. M., Robbins, A. M., & Masden, E. A. (2012). Assessing the sensitivity of seabird populations to adverse effects from tidal stream turbines and wave energy devices. <i>ICES Journal of Marine Science: Journal du Conseil</i>, 69(8), 1466-1479.</p> <p>Masden, E. A., Foster, S., & Jackson, A. C. (2013). Diving behaviour of Black Guillemots <i>Cepphus grylle</i> in the Pentland Firth, UK: potential for interactions with tidal stream energy developments. <i>Bird Study</i>, 60(4), 547-549.</p> <p>Wade, H.(2015) Investigating the potential effects of marine renewable energy developments on seabirds. PhD Thesis</p>
Presentation 2 - Cairngorms Reindeer Research Partnership	
Louise de Raad, Inverness College UHI; Eilidh Smith, Inverness College UHI	

Abstract	<p>Reindeer were introduced to the Cairngorms National Park (CNP) in 1952. The reindeer herd is managed by the Reindeer Company and counts approximately 150 reindeer, attracting over 40,000 visitors a year and resulting in direct income and employment to the area. The CNP is managed primarily for landscape value, including a vision to create a “super forest” through woodland expansion and mountain shrub restoration, which may lead to potential conflict with the free-ranging reindeer. Reindeer are a notable part of the CNP, but despite being present in the landscape for over sixty years, there is a very limited understanding of the ecological and socio-cultural role they play in the CNP, which is essential to assess their impact on the local area.</p> <p>The Cairngorms Reindeer Research Partnership brings together all reindeer stakeholders with the aim to gain a better understanding of reindeer seasonal ranging and reindeer behaviour, using state-of-the-art tracking technology. We are specifically interested in reindeer feeding behaviour and aim to determine the main parts of their seasonal diets using genetic meta-barcoding techniques and video-footage captured by the tracking equipment. Alongside this ecological project sits a social science project in which we explore people’s attitudes and perception towards the reindeer and assess people’s acceptability of potential management interventions. We present the results of the first phase of the project during which we have piloted tracking equipment, developed an automated reindeer behavioural classification system, carried out a proof-of-concept meta-barcoding test of recoverability of diet and carried out a pilot of the social science project. We will also present our future plans for the second phase of the partnership.</p> <p><i>Project partners include: Cairngorms National Park Authority (CNPA), Reindeer Company Ltd., Forest Enterprise Scotland (FES), Royal Botanic Garden Edinburgh (RBGE), Highlands and Islands Enterprise (HIENT), The Royal Society for the Protection of Birds (RSPB), Scottish Natural Heritage (SNH) and (lead partner) Inverness College University of the Highlands and Islands (IC UHI).</i></p> <p><i>The project will feature on Landward and Countryfile in December 2018.</i></p>
----------	---

Presentation 3 - Is biodiversity important?

Agata Drywa and Eric Verspoor, Rivers and Lochs Institute, Inverness College, UHI

Abstract	<p>Biodiversity describes the richness of plant and animal life in the earth’s ecosystems. It exists from single genes, to populations, species and ecosystems. It arises from genetic mutation and evolutionary processes and is lost through environmental change and interactions among populations and species.</p> <p>In the Rivers and Lochs Institute (RLI), our work focuses on freshwater biodiversity. We specialise in research and knowledge exchange in molecular, population and ecological genomics towards the scientific support of the conservation and sustainable exploitation of freshwater biodiversity. Focussing on the delineation and characterisation of biodiversity units in Scotland’s rivers and lochs, we aim to augment conservation through better understanding of human impacts.</p> <p>Much freshwater diversity exists within species like Brown trout or Arctic char. By analysing DNA, we are able to identify biodiversity at the population level within “species”, understand how they are biologically different and locally adapted, have evolved, and establish their roles in local ecosystems. Such populations are fundamental units of biodiversity and their protection at the heart of sustainable ecosystem management. Using genetics, we can also assess the health of stocks through metrics that estimate the numbers of breeders in a population.</p>
----------	---

	<p>The human population continues to increase; its impacts on the environment grow, with expanding demand for food, new medicines, clean air and water. To protect the earth's threatened ecosystems, we need a better understanding of biodiversity and its essential components. Our talk will describe the exciting new work being carried out by the RLI in this important area of science.</p>
<p>Presentation 4 - Population and landscape genomics in the Sugar Kelp <i>Saccharina latissima</i>.</p>	
<p>Alexander Innes Thomson, SAMS UHI</p>	
<p>Abstract</p>	<p>As interest in the cultivation and harvesting of macroalgae increases, the need for a greater understanding of the underlying population genetics and adaptive capabilities of natural kelp forests becomes apparent. Landscape genomics utilise high depth next generation sequencing approaches to investigate the relationships between genomic variation across population distributions, and the varying environmental gradients constraining them. Here I present how the application of a reduced-representation sequencing approach (ddRAD-Seq) on kelp populations from around Scotland can give insights into the diversity, structure and connectivity of wild kelp populations, as well as highlighting potential signatures of selection and adaptation in <i>S. latissima</i>. The information gained can offer evidence on how kelp adapt to temperature, salinity and hydrodynamic regimes through the identification of genes under selection and adaptation, and can further inform the management and conservation of both wild and cultivated kelp resources.</p>