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Quantifying and propagating uncertainty when assessing impacts of proposed offshore renewables developments on seabirds

Offshore renewable energy production is growing rapidly, and is a central element in meeting ambitious global and national targets to reduce greenhouse gas emissions. However, offshore renewable developments themselves have the potential to impact biodiversity when many species, including seabirds, are already declining because of climate change and other drivers. Impacts may occur either through direct mortality (e.g. collision) or through indirect mortality (e.g. displacement or barrier effects), so it is therefore important that developments are designed and located to prevent or minimize these. This objective requires the likely impacts of proposed developments on specific populations to be quantified, along with their associated uncertainties. A series of quantitative tools based on statistical or mathematical models can be used to estimate population-level effects under various impact scenarios. This is done by estimating in stages (a) the current, baseline, spatial interaction between individuals from the population and the footprint of the proposed development, (b) the likely effects of this development upon these individuals, in relation to both direct and indirect mortality, at an annual level, and (c) the consequences of these levels of annual mortality for the long-term viability of the population. Statistics is key to this process, with statistical models of aerial at sea survey data and/or GPS tracking data informing the first step, stochastic mechanistic models of collision and/displacement informing the second, and matrix population models informing the final step. Importantly, key sources of uncertainty and variability are captured within, and propagated between, stages to be incorporated in the final outputs of an assessment.

In this talk we illustrate the general statistical issues associated with addressing this problem, and outline current work to try and address these issues in the United Kingdom. In particular, we will describe the statistical approach taken within a project, funded through the European Maritime and Fisheries Fund and commissioned through the Scottish Government, to develop a “Cumulative Effects Framework”, which is designed to provide a user-friendly tool for quantifying the impacts of the in-combination impacts of multiple developments.