Sensitivity maps for interactions between seabirds and marine renewable energy developments

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The development of large scale marine renewables power industries is a key element of the Scottish Government economic strategy. Recent assessments of the vulnerability of Scottish seabirds to marine renewable developments have been combined with existing seabird abundance to produce sensitivity maps. These sensitivity maps may provide an initial indication of areas where a high level of interaction between seabirds and developments may be expected.

Introduction

The successful establishment of marine wind, wave and tidal energy needs to encompass environmental sustainability. A wealth of existing information of sea bird distribution and abundance is available and needs to feed into the selection of potential development sites, or highlight areas where negative interactions with developments may occur e.g. through collision of birds with rotating blades or static elements of the energy capture devices, or through disturbance of natural use of the sea by seabirds in and around the farms. Reviews of potential interactions between sea birds and marine renewable developments (REFS) provide the opportunity to map potentially sensitive areas by combining a sensitivity score with existing JNCC seabird data.

Figure 1. Examples of Scottish population proportional distributions using ESAS data.

Methods

Data from the breeding season were extracted from the ESAS (European Seabirds at Sea) data to generate a 36 km² grid layer of Scottish seabird distribution. The list of seabird species for which vulnerability factors were calculated were collated by Scottish Natural Heritage (SNH) based on seabirds that were deemed likely to interact with offshore devices, see *Furness and Wade* (2012).

For each species the proportion of the total Scottish population in each grid cell was calculated by dividing the number of seabirds of each species per cell by the total Scottish population of that species.

The vulnerability factors from *Furness and Wade* (2012) were applied to the calculated proportion of individual species within each grid cell, and these were summed to provide a single weighted sensitivity score. The applied vulnerability indices incorporate a range of factors that encompass behaviour, ecology and conservation status of the seabirds studied.

The maps produced allow areas supporting populations of Scottish seabird species that may be sensitive to offshore wind, wave or tidal developments to be identified.

Data limitations

The ESAS densities used for these calculations were determined using a poisson kriging interpolation method. However, some species have not been surveyed in sufficient numbers to allow this type of analysis, principally inshore species. For a list of species for which the poisson kriging interpolation was performed see Kober, et al (2010).

The *Furness and Wade* (2012) vulnerability factors have been applied to data on these species separately on a finer grid scale (~7 km²).

Figure 2. Methodology work flow. Data represented shows sensitivities to collision with offshore wind devices.

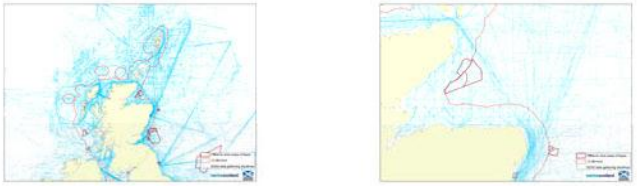

Figure 3. Track lines in Scottish waters where ESAS data has been gathered and close up on Moray Firth area.

Results

The resulting spatial representations offer a relative sensitivity level based on the proportion of Scottish seabird species and the calculated sensitivity factor per species for each technology.

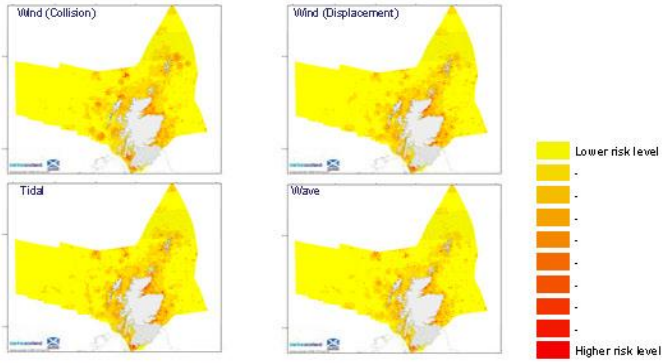

Figure 4. Sensitivities for Scottish seabird populations for wind, tidal and wave devices.

Not all ESAS seabird data collected was processed using the poisson kriging method (mostly inshore seabirds). These species tend to be susceptible to displacement effects. Fig 5. shows mean abundance per year/grid cell and displacement sensitivity of these inshore species.

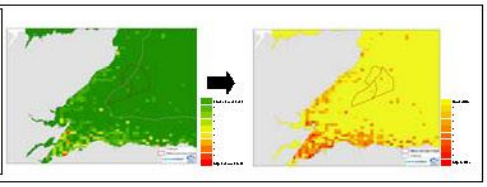

Figure 5. Moray Firth, representation of non poisson kriged data by mean abundance and calculated sensitivity to displacement effects from wind devices.

This additional ESAS dataset was provided by The Joint Nature Conservation Committee support Unit (JNCC)

Figure 6. Sensitivity by regions of interest for each energy type. From Left: displacement by wind devices in the east coast of Scotland, collision risk for wave devices in north-west Scotland, collision risk for tidal devices in the Pentland Firth.

Conclusion

Combining estimates of density with sensitivity scores for key marine species of bird has the potential to inform the strategic assessment of areas for potential development, or flag up where potential conflicts between marine developments and seabird interest may occur. As additional data, and data analysis procedures on bird abundance and how they interact with marine renewables become available, such tools can be revised and updated.

References:

Furness, RW., Wade, H. 2012. Vulnerability of Scottish Seabirds to Offshore Wind Turbines. Report to Scottish Government by MacArthur Green Ltd.

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Kober, K., Webb, A., Win, I., Lewis, M., O'Brien, S., Wilson, LJ., Reid, JB., 2010. JNCC Seabird density surface maps: A summary of how seabird density surfaces were generated from European Seabird at Sea (ESAS) data. Unpublished information paper by JNCC, Peterborough.