Furness, R.W. et al. 2013. *BOU Proceedings – Marine Renewables and Birds*
http://www.bou.org.uk/bouproc-net/marine-renewables/furness-et-al.pdf

This paper forms part of the proceedings from the BOU conference ***Marine Renwables and Birds***
Other papers from these proceedings can be viewed at www.BOUPROC.net.

Potential population-level consequences of marine renewables

ROBERT W. FURNESS*[1], HELEN WADE[2], ALEXANDRA M. C. ROBBINS[3] & ELIZABETH A. MASDEN[3]

[1] MacArthur Green Ltd, 95 South Woodside Road, Glasgow G20 6NT, and College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow G12 8QQ, UK

[2] Environmental Research Institute, North Highland College, University of the Highlands and Islands, Thurso KW14 7EE, UK

[3] Scottish Natural Heritage, Battleby, Redgorton, Perth PH1 3EW, and College of Medical, Veterinary and Life Sciences, University of Glasgow, Glasgow G12 8QQ, UK

*Email: bob.furness@macarthurgreen.com

Offshore wind farms may affect seabird populations through collision mortality, barrier effects or displacement. Research so far, mostly carried out at Danish offshore wind farms Horns Rev and Nysted, suggests that marine birds are generally able to avoid collisions, barrier effects are trivial and few species are displaced (Petersen *et al.* 2006). However, given pressures to develop offshore wind and the rapid establishment of many offshore wind farms in European waters, there is an urgent need to assess population-level impacts on protected seabirds. We review an approach to assess the conservation importance of Scottish seabird species and aspects of their ecology that influence their vulnerability to wind farm impacts. Flight height appears to be a key factor influencing collision mortality risk but improved data on flight heights of seabirds are needed (Cook *et al.* 2012). Collision index calculations identify populations of gulls, White-tailed Eagles *Haliaeetus albicilla*, Gannets *Morus bassanus* and skuas as of particularly high concern at offshore wind farms in Scottish waters (Furness and Wade 2012). Displacement index calculations identify populations of divers and Common Scoters *Melanitta migra* as most vulnerable to population-level impacts of displacement (Furness and Wade 2012), but these effects are likely to be less evident than impacts of collision mortality. The collision and displacement indices developed for Scottish seabird populations could be applied to populations elsewhere, and this approach will help in identifying likely impacts of future offshore wind farms on seabirds.

Tidal turbines and wave energy devices may also affect seabird populations through collision mortality, or displacement from foraging habitat. With a lack of deployed tidal stream or wave devices to monitor in areas of importance for seabirds, we can only infer likely interactions with tidal and wave devices based on knowledge of seabird ecology. We outline aspects of ecology that are likely to influence seabird population vulnerability to tidal stream and wave device impacts in Scottish waters (Furness *et al.* 2012). Black Guillemot *Cephis grylle*, Razorbill *Alca torda*, Shag *Phalacrocorax aristotelis*, Guillemot *Uria aalge*, Cormorant *Phalacrocorax carbo*, divers and Puffin *Fraturcula artica* are the species that appear most vulnerable to adverse effects from tidal stream turbines in Scottish waters. Divers are the species that appear most vulnerable to adverse effects from wave energy devices in Scottish waters.

Wave energy devices seem likely to represent lower hazard to seabirds than tidal stream turbines, and both forms of energy capture seem likely to represent lower hazard to seabirds than offshore wind farms. The indices developed for Scottish seabird populations could be applied to populations elsewhere, and this approach will help in scoping likely impacts on seabirds of renewable energy developments.

This paper forms part of the proceedings from the BOU conference ***Marine Renwables and Birds***
Other papers from these proceedings can be viewed at www.BOUPROC.net.

References

Cook, A.S.C.P., Johnston, A., Wright, L.J. and Burton, N.H.K. 2012. *A review of flight heights and avoidance rates of birds in relation to offshore windfarms*. Crown Estate Strategic Ornithological Support Services. Project SOSS-02. http://www.bto.org/sites/default/files/u196/downloads/rr618.pdf

Furness, R.W., Wade, H.M., Robbins, A.M.C. and Masden, E.A. 2012. Assessing the sensitivity of seabird populations to adverse effects from tidal stream turbines and wave energy devices. *ICES Journal of Marine Science*, 69, 1466–1479.

Furness, R.W. and Wade, H. 2012. *Vulnerability of Scottish seabirds to offshore wind turbines*. The Scottish Government, Edinburgh. http://www.scotland.gov.uk/Resource/0040/00401641.pdf

Petersen, I.K., Christensen, T.K., Kahlert, J., Desholm, M. and Fox, A.D. 2006. *Final results of bird studies at the offshore wind farms at Nysted and Horns Rev, Denmark*. National Environmental Research Institute, Denmark.