Developing the knowledge base to guide renewable energy developments in Scotland and its seas

ROSS M. MCGREGOR,¹* ANDY DOUSE² & DES THOMPSON³

¹Scottish Natural Heritage, Inverdee House, Baxter Street, Torry, Aberdeen AB11 9OA, UK
²Scottish Natural Heritage, Great Glen House, Leachkin Road, Inverness IV3 8NW, UK
³Scottish Natural Heritage, Silvan House, 231 Corstorphine Street, Edinburgh EH12 7AT, UK

*Corresponding author.
Email: ross.mcgregor@snh.gov.uk

The Scottish Government has set some of the most ambitious targets for carbon dioxide output reductions in the world. It is intended that 50% of electricity generated in Scotland by 2020 will be from renewable sources. Approximately one-third of this target is expected to be met through marine renewable energy developments as Scotland is particularly rich in marine energy resources. The Scottish Executive estimated the potential resource in Scotland to be 25 GW from offshore wind developments, 14 GW from wave energy schemes and 7.5 GW from tidal stream energy (Garrad Hassan 2001).

Although it is widely recognized that climate change may be the largest human-induced threat to biodiversity, Scotland may be a particularly sensitive location for marine renewable energy development. The coasts of Scotland contain internationally important populations of breeding and non-breeding birds, especially breeding seabirds, and wintering sea ducks, divers, grebes, geese and swans. As the statutory nature conservation agency (SNCA) for Scotland, Scottish Natural Heritage (SNH) has a particular responsibility to advise government and industry on the location of these developments so that this rich energy source can be used without impacting upon these important bird populations. SNH has a statutory responsibility to assess the potential impacts to bird populations within 12 nautical miles of the Scottish coast. The spatial scale across which most seabirds exist exceeds this relatively local boundary so collaboration with the other SNCA and stakeholders is vital to provide context across the wider environment.

The Crown Estate has recently completed the first leasing round for wave and tidal energy developments in the waters of the Pentland Firth and Orkney (The Crown Estate, 2010a) with further areas of interest already being developed in the waters around Shetland, the Western Isles and west Scotland (The Crown Estate 2010b). Many of these proposed development areas are close to Special Protection Areas (SPAs), including those with extensions to the marine environment for the benefit of their marine qualifying species (such as cliff-nesting seabirds). In addition, the Joint Nature Conservation Committee (JNCC) is currently conducting searches for potential marine SPAs for offshore aggregations of breeding seabirds and for inshore aggregations of non-breeding birds (http://www.jncc.gov.uk/page-4184). Several of the areas of interest are close to areas proposed for wave and tidal energy development. However, the potential for these technologies to have adverse impacts on these bird populations remains largely unknown and further research is needed to understand these better. Although wind energy has the greatest potential for energy generation, the impacts, even in the marine environment, need to be better understood.

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There are currently nine proposed offshore wind sites within Scottish Territorial Waters (STW) and two large Round 3 (R3) zones off the Scottish Coast. In addition, there have been 25 potential offshore wind sites identified around Scotland which may be suitable for future development (Marine Scotland, 2010). Thus there is a strong need to consolidate existing knowledge and to develop the knowledge base further in order to better understand what the impacts of these new developments may be. SNH will be involved in The Crown Estate ornithological support services steering group which aims to identify the main ornithological issues facing current (R3 & STW) offshore wind developments and to coordinate research and direct action to address these issues.

SNH is currently funding research and cooperating with partners to develop the knowledge base required to properly understand the potential impacts of marine renewable developments. We have identified knowledge gaps in several critical areas:

- connectivity between breeding sites used by seabirds and proposed development sites;
- collision risk for diving birds with tidal current turbines;
- cumulative impacts on marine birds arising from multiple wave and tidal energy developments;
- patterns of seabird bird use of the marine environment around the west coast and Western Isles.

Connectivity between breeding sites and feeding areas at sea is poorly understood. It was recognized that the most expedient means for establishing connectivity would be through tracking individual birds from important breeding colonies and use these data to determine important foraging areas. Consequently, SNH has commissioned the production of methodologies for appropriate tagging studies to measure connectivity between SPAs and development sites, particularly for wave and tidal energy developments in the Pentland Firth and Orkney waters area.

That birds may be killed through collisions with wind turbine blades is well known and methods exist to determine the likelihood of this happening, and the potential effects of this increased mortality can be estimated. However, there is currently no empirical evidence that tidal stream turbines will result in any collision mortalities of diving seabirds. In order to address this, SNH has funded a study to determine the ability of real-time three-dimensional sonar tracking to follow diving birds. Initial results suggest that this technology has great potential to track diving birds within the limits of the technology. It is also important to understand what the impacts on bird populations might be if negative interactions with tidal turbines do occur. SNH is also developing a process to understand the impacts of collision risk with tidal turbines, in conjunction with key stakeholders. This will use known population dynamic processes to understand the potential level that collisions would have to make in order to negatively affect the population.

In addition it is important to understand whether diving birds are likely to use the water column in fast flowing tidal streams, how they dive in these flow regimes and which species make use of them. There has been little published data on birds using fast flowing tidal channels and further work is needed.

It is required that developers consider not only the impacts of their own proposed development, but also the impacts of all past, existing and reasonably foreseeable developments cumulatively on protected bird populations. Information on how to assess this was lacking for the wave and tidal energy industry. Consequently, SNH is currently funding the production of guidance on methods to estimate these cumulative impacts and how to assess when these impacts may have deleterious effects on protected bird populations. The assessment of cumulative impacts is particularly important in understanding population-level effects across broader areas. This
will be valuable for informing the process of growing these new industries without resulting in significant negative effects to protected species.

Individual developers need to complete baseline surveys to estimate the bird populations that may be using proposed development sites. However, there is also a need to understand the patterns of bird use across the wider strategic area. This will allow site level surveys to be placed in a wider context. Marine Scotland and The Crown Estate, with input from SNH, are conducting wider strategic level surveys in the Pentland Firth and Orkney waters from summer 2010. In order to facilitate surveys in the second round of wave and tidal development sites proposed for the west coast, SNH has commissioned the production of detailed survey methodologies.

Thus SNH has been engaging with developers, the academic community and non-governmental organizations in order to develop the knowledge base on the potential impacts of marine renewables development on birds in Scotland and further afield. It is hoped that this will allow the right developments to be brought forward in the right locations in order generate power without significant impacts on our natural heritage while mitigating the effects of climate change.

References

The Crown Estate. 2010a. World’s first wave and tidal energy leasing round to power up to three quarters of a million homes. http://www.thecrownestate.co.uk/newscontent/92-pentland-firth-developers.htm