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Connectivity between seabird features of protected sites and offshore wind farms: Lesser Black-backed Gulls and Great Skuas through the breeding, migration and non-breeding seasons

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The UK Government has a commitment to obtain 15% of the country's electricity from renewable sources by 2020, of which wind energy is likely to form a major part. Many seabirds that are feature species of Special Protection Areas (SPAs) might potentially be affected by these developments, as their breeding season foraging ranges and migratory routes may overlap with proposed offshore wind farm sites. Offshore wind farms may potentially have an impact on these bird populations through four main effects: (1) displacement due to the disturbance associated with developments; (2) the barrier effect posed by developments to migrating birds and birds commuting between breeding sites and feeding areas; (3) collision mortality; and (4) indirect effects due to changes in habitat or prey availability. Assessing movements throughout the year (breeding, migration, non-breeding) is pivotal in the understanding of population-level impacts. We fitted 11 and 14 GPS tags to Lesser Black-backed Gulls *Larus fuscus* at Orford Ness, part of the Alde-Ore Estuary SPA, during 2010 and 2011, respectively. A further four and ten tags were fitted to Great Skuas *Stercorarius skua* at the Foula SPA in 2010 and 2011, respectively, and ten tags to Great Skuas at the Hoy SPA during 2011. During the breeding season, some gulls never ventured offshore, whilst others spent more than half their time away from the colony at sea. For Lesser Black-backed Gulls that spent substantial periods of time at sea, there was a degree of temporal (up to 12 and 7% of time budgets per bird) and spatial overlap (up to 48 and 33% of total area usage), in 2010 and 2011 respectively, with offshore wind farm areas. These areas included consented Round 1 and 2 wind farms (in this case, sites which are under construction), as well as proposed extensions and Round 3 development sites. The distances that birds foraged offshore and the amount of time spent offshore also differed between years (up to 159 km in 2010, 91 km in 2011). There was also temporal (up to 11 and 6% of time budgets) and spatial overlap (up to 31 and 31% of total area usage) between the ranges of Great Skuas from both Foula and Hoy and medium-term renewable development options in Scottish Territorial Waters. All of six gulls for which we obtained data for the 2010/11 non-breeding season wintered in southern Spain or Morocco. On their migrations, three birds crossed existing or proposed wind farms. This study shows the value of GPS data in assessing connectivity and potential interactions between SPA features and offshore wind farms.