Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index


Summary

1. Marine wind farms have aroused substantial public interest. The erection of wind facilities offshore may become Europe’s most extensive technical development ever in marine habitats. Due to political pressure to complete construction soon, assessments of possible wind farm locations have to be based on current knowledge, for example in the German sectors of the North Sea and Baltic Sea.

2. In this paper, we develop a "wind farm sensitivity index" (WSI) for seabirds. We apply this index to the Exclusive Economic Zone and the national waters of Germany in the North Sea. We chose nine factors, derived from species’ attributes, to be included in the WSI: flight manoeuvrability, flight altitude, percentage of time flying, nocturnal flight activity, sensitivity towards disturbance by ship and helicopter traffic, flexibility in habitat use, biogeographic population size, adult survival rate and European threat and Conservation status. Each factor was scored on a 5-point-scale from 1 (low vulnerability of seabirds) to 5 (high vulnerability of seabirds). Five of these factors could be dealt with by real data but four could only be assessed by subjective considerations based on at-sea experience; in the latter cases, suggestions of the first author were independently modulated by experts.

3. Species differed strongly in sensitivity index. Black-throated diver *Gavia arctica* and red-throated diver *Gavia stellata* ranked highest (= most sensitive), followed by velvet scoter *Melanitta fusca*, sandwich tern *Sterna sandvicensis* and great cormorant *Phalacrocorax carbo*. Lowest values were calculated for black-legged kittiwake *Rissa tridactyla*, black-headed gull *Larus ridibundus* and northern fulmar *Fulmarus glacialis*.

4. The wind farm sensitivity index for areas of the North Sea and Baltic Sea was calculated from the species-specific sensitivity index values. Coastal waters in the southeastern North Sea had greater vulnerability than waters further offshore throughout the whole year.

5. Derived from the frequency distribution of the WSI, we suggest a "level of concern" and a "level of major concern" which are visualized spatially and could act as a basis for the selection of marine wind farm locations.

6. Synthesis and applications: The wind farm sensitivity index might be useful in Strategic Environmental Impact Assessments. Results from small-scale EIAs about wind installations should be set into a more global perspective provided for example by large mapping projects and detailed behavioural studies. Because this is difficult in normal EIAs, particularly in highly dynamic coastal/marine habitats, this paper fills an important gap on the potential sensitivity of seabirds and important locations to wind installations.