Identifying spatial conflicts between seabirds and offshore wind farms in Norwegian waters

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Abstract

In Norway increased focus is now being put on the possibilities for utilizing the energy obtained from wind. The new Norwegian "offshore energy act" identifies the needs for environmental impact assessments for the establishment of offshore wind power plants. Following this, we performed an initial sensitivity assessment for seabirds in Norwegian waters using the methodology developed by Garthe & Hüppop (2004) but adapted to Norwegian conditions (Christensen-Dalsgaard et al. 2010). The results showed a clear variation in seabird sensitivity between areas and seasons. During breeding the highest vulnerability indices were mainly found in the vicinity of the largest seabird colonies. During winter the areas with high vulnerability were typically shallow areas, probably with good feeding conditions.

Methods

We used the methods developed by Garte & Hüppop (2004), with some modifications for Norwegian conditions. Seabird vulnerability was evaluated using nine factors derived from species' attributes, focusing on risk of collision with turbines, vulnerability to disturbance and conservation status. Based on these factors a species-specific vulnerability index (SSI; table 1) was calculated and combined with the relative proportion of species present in 10 x 10 km squares to calculate a wind farm sensitivity index (WSI).

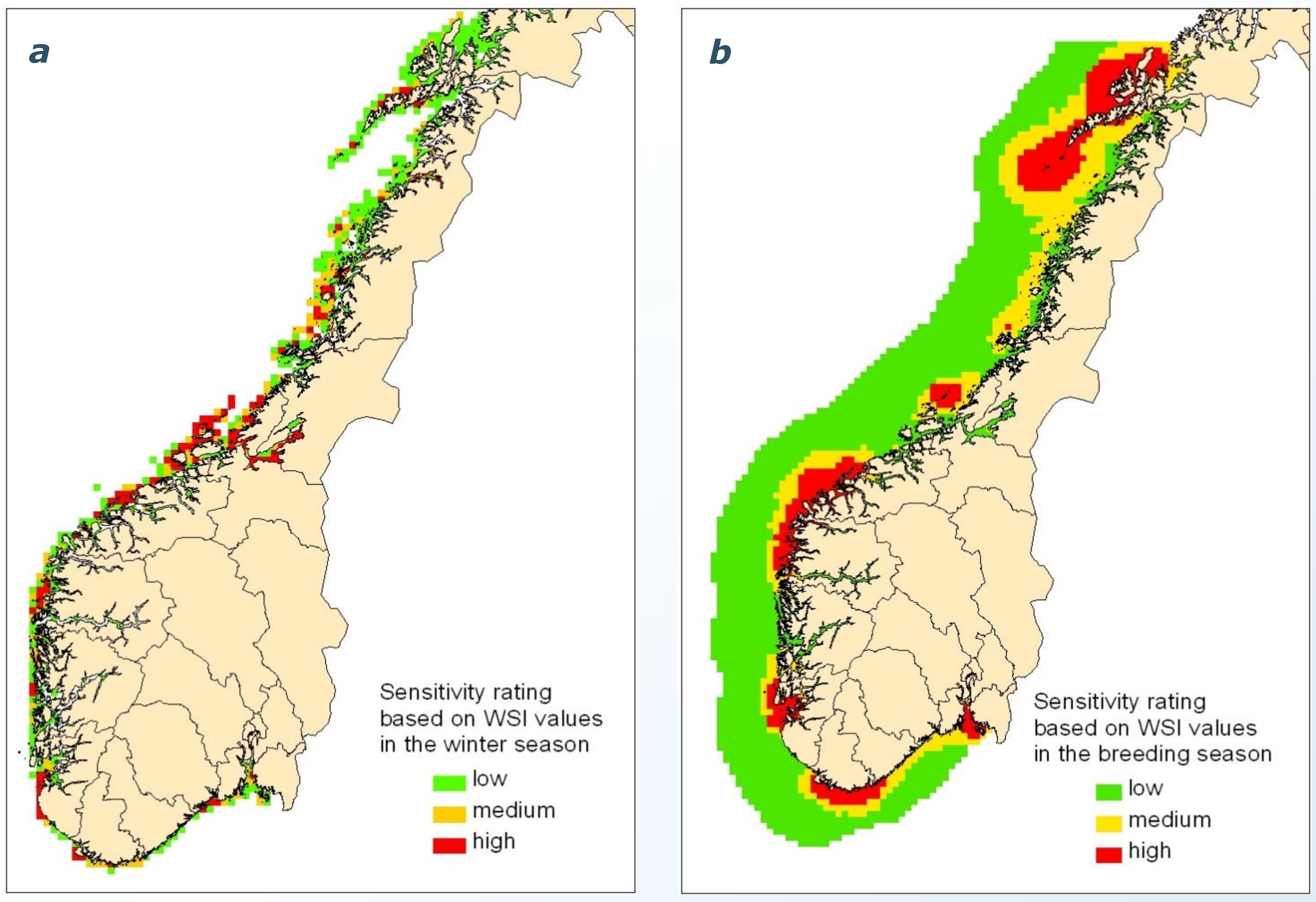

Figure 2. *Sensitivity rating on a tripartite scale based on WSI values in the winter season (a) and breeding season (b). To summarise the vulnerability in the different areas the WSI-sensitivity rating was divided in three groups by percentile, respectively low- (0-65), medium- (65-85) and high- (85-100) sensitivity*

Table 1. *Score of the nine vulnerability factors used and the final SSI score, for* ***some*** *of the seabird species included in the current study. During breeding the birds were given a higher factor score due to their affinity to the colonies.*

	a) Flight manoeuvrability	b) Flight altitude	c) % flying	d) Nocturnal flight activity	e) Disturbance by ship and helicopter traffic	f) Habitat use flexibility	g) Biogeographical population size	h) Adult survival rate	i) Norwegian threat and conservation status	SSI General	SSI breeding season
Black-throated diver	5	2	3	1	4	4	4	3	5	44,0[1]	58,5
Red-necked grebe	4	2	1	1	3	5	5	1	1	18,7[1]	
European shag	4	1	3	1	4	3	4	4	4	31,5[2]	44,0
Common eider	4	1	2	3	3	4	2	4	2	23,3[1]	32,0
Velvet scoter	3	1	2	3	5	4	4	2	4	33,8[1]	
Red-breasted merganser	3	1	2	3	3	4	4	3	1	21,0[2]	29,3
Black guillemot	4	1	1	2	3	3	4	4	3	22,0[2]	32,1
Common guillemot	4	1	1	2	3	3	1	4	5	20,0[1]	29,2
Atlantic puffin	3	1	1	1	2	3	1	5	5	13,8[1]	28,9

1) SSI modified from Garthe & Hüppop (2004), 2) SSI modified from King et al. (2009)

For seabird breeding colonies a buffer zone was created around the colonies to include feeding areas in the considerations (figure 1, table 2).

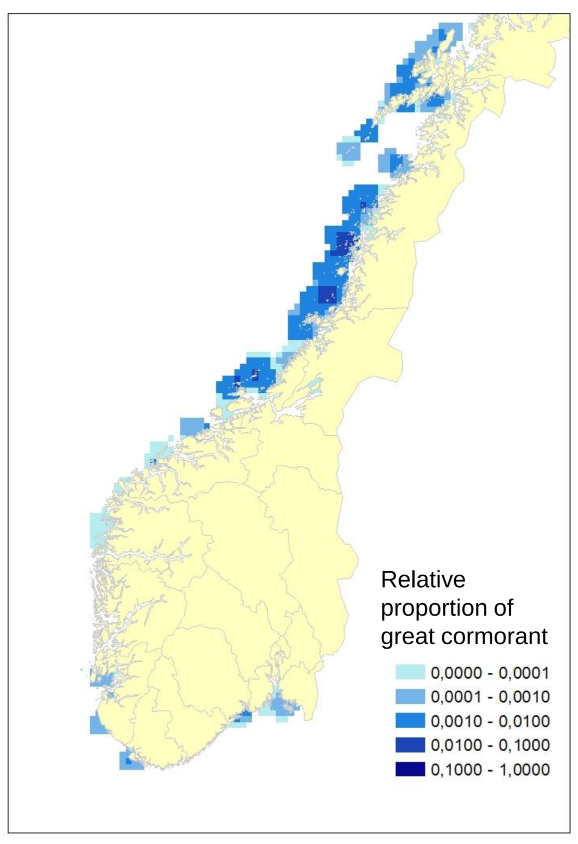

Table 2. *Summary of the size of the buffer zones around breeding colonies for the different species included in the study. The proportion of birds in each of the bufferzones is a function of colonysize such that bufferzone 1, 2 and 3 are respectively 2/3, 2/9 and 1/9 of the size of the colony.*

Species	*Buffer zone 1 (km)*	*Buffer zone 2 (km)*	*Buffer zone 3 (km)*
Great cormorant, European shag, common eider, black guillemot	5	10	15
Great skua, arctic skua, herring gull, lesser black-backed gull, great black-backed gull, common tern, arctic tern	20	40	60
Northern fulmar, northern gannet, black-legged kittiwake, razorbill, common guillemot, Atlantic puffin	33	66	99

Figure 1*.Relative proportions of great cormorant in the study area. Buffer zones have been created around the breeding colonies.*

Results

The results showed a clear difference in the amplitude of the WSI-values between areas and seasons, to a large extent reflecting the distribution of seabirds along the Norwegian coast (figure 2). In the breeding season the highest WSI-values were found mainly in connection with the large colonies. In contrast, the areas with the highest WSI-values in winter were shallow areas being important to the species with coastal affiliation, such as loons, grebes and marine ducks.

Application and limitations

This study is only suitable for large-scale assessment of potential conflicting areas. In this context the method seems to be a useful tool for comparing large-scale spatial vulnerability of seabirds towards offshore wind farms. To assess the suitability of specific areas for the development of wind power plants it is, however, necessary to study local occurrences of birds and identify important functional areas for seabirds throughout the annual cycle.

It should be noted that the methodology used is only as good as the input data allows. In this study we saw clear sign of the effects of observer intensity in that well studied areas displayed the highest WSI-values. This is a problem that should be addressed in future studies.

Literature cited:

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