National Environmental Research Institute
University of Aarhus · Denmark

Modelling total numbers and distribution of Common Scoter *Melanitta nigra* at Horns Rev

Report request

Commissioned by DONG Energy

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Ib Krag Petersen

Data sheet

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Summary

In 2007 the report "Changes in bird habitat utilisation around the Horns Rev 1 offshore wind farm, with particular emphasis on Common Scoter" was prepared by NERI as commissioned by Vattenfall A/S. This report analysed recent (post-construction) changes in the distribution of Common Scoter in the area within and around the Horns Rev 1 wind farm. This report compared the survey data from the original studies, with those collected during four surveys carried out in early 2007, but no attempt was made to estimate the total numbers present (using distance sampling techniques) nor to generate density estimates at a high spatial resolution using spatial modelling techniques.

The present report utilised the survey data from early 2007 to derive modelled abundance and distribution estimates for Common Scoter. This was performed across the entire study area for each of the four surveys performed in early 2007. The estimated total numbers of Common Scoters in January to April 2007 were 223,122, 269,341, 189,282 and 67,058 birds.

Within the area of the Horns Rev 2 wind farm site the estimated number of Common Scoter for each of the above surveys were 16,131, 25,041, 16,958 and 9,099 birds on 25 January, 15 February, 3 March and 1 April respectively.

It was difficult to assess the magnitude of reduction in Common Scoter density in and near the Horns Rev 2 wind farm site based on experiences from Horn Rev 1. Despite appearances of initial displacement at Horns Rev 1, within 4 years of construction, densities within the wind farm did not differ significantly from those outside, which may suggest some temporal adjustment on behalf of the birds. On the other hand, we cannot exclude the possibility that these patterns observed at Horns Rev 1 were the results of responses to food supply, and had feeding been suitable, the birds would have foraged between the turbines from immediately after construction. Given the uncertainty surrounding the observed responses of the birds, it was decided to offer a series of differing scenarios for displacement to assess the relative effect on the total numbers of individuals present and in relation to established levels for international importance for the flyway population of this species.

The potential number of displaced Common Scoters from the Horns Rev 2 wind farm site was calculated on the basis of a series of four differing scenarios, assuming displacement of 5, 10, 25 and 50% of the birds present within the wind farm site, and with a linear decreasing impact away from the wind farm periphery out to a distance of 500 m. This was performed for each of the four survey data sets. Under these assumptions a calculated total number of 1,528 (5% reduction), 3,055 (10% reduction), 7,638 (25% reduction) and 15,277 (50% reduction) Common Scoters would be displaced with a distribution pattern as found on 15 February 2007 when most birds were estimated present in the wind farm area. In the ornithological impact assessment for the Horns Rev 2 a 100% displacement scenario was assumed, based on the present knowledge from

the Horns Rev 1 wind farm. Results from early 2007 showed a temporal adjustment to the Horns Rev 1 wind farm site. Thus the estimated numbers of displaced Common Scoters are considerably lower than presented in the ornithological impact assessment for Horns Rev 2 in 2006.

It is considered unlikely that substantial numbers of Common Scoters will be displaced from the Horns Rev 2 site post construction, assuming that they show no new response to the construction of the turbines and that the food supply there remains intact. Nevertheless, it is important to stress that whilst the numbers estimated within the Horns Rev 2 impact area constitute between 7 and 14% of the numbers of Common Scoter in the entire study area during early 2007, their absolute numbers exceeded the criteria for international importance (16,000 individuals) in all surveys except that of April 2007.

1 Introduction

In April 2007, DONG Energy received approval to construct the Horns Rev 2 offshore wind farm off Blåvands Huk on the west coast of Jutland. Based on data collected during the Horns Rev 1 pre- and post-construction investigations and the results from six additional aerial surveys carried out in 2006, an ornithological impact assessment of the second planned wind farm was compiled (Christensen et al. 2006).

In late 2006 and early 2007, Vattenfall A/S maintenance crews and helicopter pilots reported increasing numbers of Common Scoters present within the Horns Rev 1wind farm site. For this reason an additional series of four surveys of waterbird distribution in the area was planned and carried out during January to April 2007. The results were reported in "Changes in bird habitat utilisation around the Horns Rev 1 offshore wind farm, with particular emphasis on Common Scoter" (Petersen & Fox 2007), commissioned by Vattenfall A/S, in which bird distributions in the Horns Rev study area were reported up until that time, with particular emphasis on recent (post-construction) changes in the distribution of Common Scoter in the area within and around the Horns Rev 1 wind farm. That report compared the survey data from the original studies, with those collected during these four surveys carried out in early 2007. The aim of the analysis was to describe the very recent changes in waterbird distribution around the Horns Rev 1 wind farm as of the first part of 2007 on the basis of actual observations. Because of resource constrains at that time no attempt was made to estimate the total numbers present (using distance sampling techniques) nor to generate density estimates at a high spatial resolution using spatial modelling techniques.

The present report uses the data from the four surveys conducted in January to April 2007 to estimate the total numbers of Common Scoter within the entire study area and to describe their distribution using spatial modelling. In addition, this report presents the numbers of Common Scoters within the Horns Rev 2 wind farm site. In order to present a range of different scenarios relating to potential displacement effects, the report also presents calculations relating to the potential number of displaced individuals in four scenarios with corresponding to reductions of 5, 10, 25 and 50% of the observed Common Scoter densities within the wind farm site, and with a declining effect with distance from the periphery of the wind farm site, modelled on the basis of a simple linear decline in impact out to a distance of 500 m from the periphery of the site. Previous results from Horns Rev 1 indicated an almost total exclusion of Common Scoters from the wind farm site during the first years of operation (Petersen et al. 2006). Thus, for the ornithological impact assessment for Horns Rev 2 in 2006, the assessment of the number of potentially displaced Common Scoters was based on a 100% displacement within the wind farm (Christensen et al. 2006). The temporal adjustment by Common Scoters towards the Horns Rev 1 wind farm found in early 2007 (Petersen & Fox 2007) showed that the birds by that time utilised the area within the wind farm much more. The displacement scenarios used in this report range from 5 to 50%. Within the frame of the present work it has not been possible to access the exact magnitude of change in habitat utilisation. The chosen displacement scenarios are therefore examples, not suggesting any exact degree of change.

For description of study area, data collection method and description of bird distributions we refer to the above mentioned previous report.

Of the most numerous species present in and around the vicinity of the Horns Rev 2 proposed project areas, only the Common Scoter occurred in numbers exceeding the thresholds which qualify a site as being of international importance. Since Danish waters are of outstanding importance as moulting and wintering quarters for a very large proportion of the Western Palearctic population of this species, Denmark has a particular responsibility for the protection and maintenance of habitat of this species. For this reason, throughout this report, data are only presented for this species.

The previous report, "Changes in bird habitat utilisation around the Horns Rev 1 offshore wind farm, with particular emphasis on Common Scoter" (Petersen & Fox 2007) focused on bird distributions around the Horns Rev 1 wind farm. The aim of the present report was to use the data from four surveys in January to April to model total numbers and distribution of Common Scoter within the entire study area and relate this to numbers found in the Horns Rev 2 wind farm area. Thus, this report calculates the number of Common Scoters within the entire study area, including the Horns Rev 2 wind farm site. With particular focus on Horns Rev 2 we also calculate the number of potentially displaced individuals in scenarios assuming a 5, 10, 25 and 50% density reduction within the wind farm site, and with a linear decreasing impact out to a distance of 500 m from the periphery of the site.

2 Methods used to monitor bird abundance and distribution

A description of the method used for data collection can be found in Petersen and Fox (2007). In this chapter we focus on description of methods used for data analysis.

Spatial modelling of Common Scoter densities

Petersen & Fox (2007) presented the raw distributional data relating to Common Scoter in the vicinity of both Horns Rev 1 and the planned options for Horns Rev 2 wind farms. This report presents a more detailed analysis of the precise spatial distribution and abundance of this species using more sophisticated analytical techniques, known as spatial modelling. These techniques have not been applied to other species which occur in very much lower numbers and which fail to reach levels of abundance that qualify as being of national or international concern.

Here, spatial modelling has been used to generate bird (in this case Common Scoter) density in each cell of a grid of 500 x 500 m squares covering the entire study area based on aerial survey transect data. Counts were initially adjusted for observers, count conditions and spatial heterogeneity in the detectability of birds using standard methods of distance sampling techniques (Buckland et al. 2001). These data were then subject to spatial modelling using relatively simple generalised additive modelling techniques which incorporate spatially explicit environmental parameters which are known to influence, or suspected to have some influence over, the distribution of birds. In this case, we obtained water depth for all observations from the Coast Guard and incorporated into a GIS platform, because this parameter has such a powerful influence on the distribution of Scoters. We also used facilities within the GIS itself to generate distance from coast and mean distance from the nearest ten wind turbine as parameters to see if these also contributed significantly to explaining the variance inherent in the bird observation data. Finally, a two-dimensional x and y values (i.e. easting and northing coordinates used as spatial reference for each observation) was also incorporated. The incorporation of this two-dimensional geographical value implies some level of spatial autocorrelation. In order to achieve information on the deviance explained by the covariates used, unaffected by spatial autocorrelation, modelling of the density estimates was carried out both with and without the two-dimensional geographic covariate. The explanatory power of the models incorporating x and y coordinates are naturally higher than those without.

Building models incorporating these environmental covariates, it was possible to generate bird density surfaces based on values for each grid cell unit, combining observed densities and the environmental parameters available. Fitting a model describing the relationship between found bird densities and the incorporated environmental covariates from a sample of grid cells along the surveyed transect lines enable us to predict densities to grid cells throughout the entire survey area and hence the total overall number present, as well as enabling an assessment of the precise numbers of birds within the proposed wind farm areas. A brief overview of the methods used here follow, but more detail can be obtained from the authors on request.

Modelling approach

Software for modelling bird densities and spatial distribution was developed in close collaboration with the RUWPA group at the University of St. Andrews, Scotland. This custom-built software was written in the statistical free-ware "R". The basic principle built on a version of the 'count' model described in Hedley *et al*. (1999), a two-stage model incorporating variability in detectability (with perpendicular distance, and other covariates) and spatial variability in density.

(i) Detection function estimation

The data from the surveys were collected in three perpendicular distance interval bins: 44-163m; 163-432m; and 432-1000 meters. An area from 0-44 meter (i.e. below the aircraft) was not visible to the observer in the survey aircraft, so data were truncated from this point outwards (a so-called left-truncation of data). Two possible methods are available for analysing left-truncated line transect data. One is to specify the left truncation point - which serves to mark the leftmost point on the distance histogram – and extrapolate the fitted detection function back to zero distance. The other is to subtract the left truncation point (LW) from all observed distances, and analyse the data as if they were on (0, RW-LW) rather than (LW, RW), where RW is the right truncation distance. In this analysis, the latter approach was adopted, and thus the perpendicular distances were analysed as being grouped into three bin categories: namely 0-119m; 119-388m; and 388-956m from the aircraft track line.

Estimation of the detection function was carried out allowing for the effect of covariates to be incorporated into the model. This was achieved by setting the scale parameter as an exponential function of the covariates (Marques 2001). In this case it is assumed that the covariates may affect the rate at which detectability decreases as a function of distance, but not the shape of the detection function. For this exercise we used the half-normal model.

A forward stepwise selection procedure was adopted to decide which covariates to include in the model. First, a model containing perpendicular distance only (null model) was fitted, and its Bayes Information Criterion (BIC; Schwarz 1978) value computed. BIC was used in preference to AIC as it tends to favour lower dimensional models (Schwarz 1978). Covariates (factors or continuous explanatory variables) thought from exploratory data analysis and/or prior intuition to influence detection probability, were then added sequentially to the null model, and the BIC values for each new model were computed. A reduction in BIC indicated a better model fit; the covariate which produced the largest reduction in BIC (if any) was then added to the model.

The following covariates were included in the detection function model: Observer, cluster size (number of individuals in a flock) and sea state.

(ii) Spatial modelling of density

We applied the 'count model' of Hedley *et al.* (1999) to model the trend in spatial distribution of Common Scoters at Horns Rev. The response variable was the estimated number of individual birds in segment *i*, $\hat{N}_i$, estimated using the Horvitz-Thompson estimator (Horvitz and Thompson, 1952):

$$\hat{N}_i = \sum_{j=1}^{n_i} \frac{s_{ij}}{\int \hat{g}_{ij}(x,z)\,\pi(x)\,dx}, \qquad i = 1,\ldots,\nu, \tag{1}$$

where n_i is the number of flocks detected in segment *i*, s_{ij} is the observed number of Scoters in flock *j* in segment *i*, $\int \hat{g}_{ij}(x,z)\,\pi(x)\,dx$ is its estimated probability of detection assuming that the probability density function (pdf) of perpendicular distances, *x*, is uniform with respect to the survey track lines (and is obtained from the fitted model for the detection function), *z* being its covariate attributes (used in the detection function model), and ν is the total number of segments. In this analysis, most segments were of approximate length 243m, corresponding to a time interval of about 5 seconds.

A generalized additive model (GAM) with spatially referenced covariates was used to model the response, with the following general formulation:

$$E\left[\hat{N}_i\right] = \exp\left[\ln(a_i) + \beta_0 + \sum_{k=1}^{q} f_k(z_{ik})\right], \qquad i = 1,\ldots,\nu. \tag{2}$$

Here a_i is an offset that corresponds to the area of the *i*th segment. β_0 denotes the intercept, and the f_k is a two-way interaction between the geographic covariates, X and Y, incorporated via a two-dimensional smooth (fitted using thin plate splines) (Wood 2003). The formulation shown in equation (2) assumes a logarithmic link function for the GAM; an appropriate form for the variance-mean relationship must be selected according to the data.

The following covariates were used; two-dimensional X and Y coordinates, water depth, distance to coast and mean distance to ten closest wind turbines. Model selection was carried out using Generalised Cross Validation (GCV), as implemented in the *mgcv* package (Wood 2001) within *R*. The decision on whether to include or exclude a term was also made on the basis of diagnostic plots of the smoothed density against each covariate term (Wood 2001). Models that clearly overfitted the data (predicting a few small spurious hotspots of high density, and no birds elsewhere) were excluded either by examination of the fitted spatial density surface, or by considering that the predicted abundance estimates were unrealistically high or low.

(iii) Variance estimation

The current status of the software does not yet permit reliable estimation of variance, and thus estimation of confidence intervals for the derived density estimates could not be performed.

Output from this modelling was used to describe densities and spatial distribution of the Common Scoters across the study area, survey by survey.

(iv) Modelling displacement scenarios of Common Scoters at Horns Rev 2

Calculation of the potential number of displaced Common Scoters from the Horns Rev 2 wind farm site was made under a series of scenarios assuming that 5, 10, 25 and 50% of the birds will be displaced from within the area of the wind farm site (i.e. all 500 by 500 meter grid cells that have their centre in the area of the wind farm), and with a linear declining effect out to a distance of 500m from the periphery of the wind farm site. In this way the number of displaced Common Scoters could be estimated for each of four scenarios, based upon this set of assumptions.

Percentages of Common Scoters in eastern and western parts of the study area

The percentage of Common Scoters in the western and eastern parts of the study area was based on the estimated total number of birds present. The two sub-areas were defined using a line through the deep strait between coastal areas and Horns Rev, called Slugen.

3 Results

The distributions of observed Common Scoters during four aerial surveys in January to April 2007 are described in Petersen & Fox (2007), where illustrations of distribution during the individual surveys are found in Figure 8. The spatial modelling was undertaken on the same data.

In three out of the four surveys hazard rate models were selected as providing the best fit to describe the detection function, while in one case (3 March 2007) a half normal model was selected (Table 1). The detection function for each of the four surveys is given in Figure 1. The four covariates used explained from 43.1 to 54.0% of the deviance in the data sets. Because the approach used does not account of all spatial autocorrelation we ran models excluding the two-dimensional geographical X and Y as a covariate in order to achieve an estimation of the deviance explained from the covariates depth, distance to coast and mean distance to nearest 10 turbines only. These values are therefore unaffected by spatial autocorrelation and ranged from 31.6 to 45.3% (Table 1).

Table 1. The model type selected and the estimated number of degrees of freedom used for each of the covariates in the GAM model, for each of the four surveys. The deviance explained by all covariates is given. In addition the deviance explained by all covariates, excluding the two-dimensional X and Y, are gives.

Date	Model	Two-dimensional X and Y	Depth	Distance to coast	Mean distance to nearest 10 wind turbines	Deviance explained (%)	Deviance explained, without X and Y (%)
25 JAN 2007	Hazard rate	27.8	8.8	6.7	8.0	54.0	45.3
15 FEB 2007	Hazard rate	28.0	7.5	6.5	6.9	45.4	38.8
3 MAR 2007	Half normal	28.1	6.9	7.0	8.5	43.1	31.8
1 APR 2007	Hazard rate	29.0	5.9	6.5	8.4	48.3	31.6

These model outputs provided estimates of total numbers of Common Scoters for the entire study area, varying between 67,058 (1 April 2007) and 269,341 (15 February 2007, Table 2).

Table 2. The estimated total numbers of Common Scoters present in the study area for each of four surveys conducted from January to April 2007. The percentage of birds found in the westernmost parts of the study area, west of the deep strait between the coastal areas and Horns Rev.

Date	Total estimated numbers	% of birds west of the deep strait "Sluen"
25 JAN 2007	223,122	27
15 FEB 2007	269,341	41
3 MAR 2007	189,282	46
1 APR 2007	67,058	75

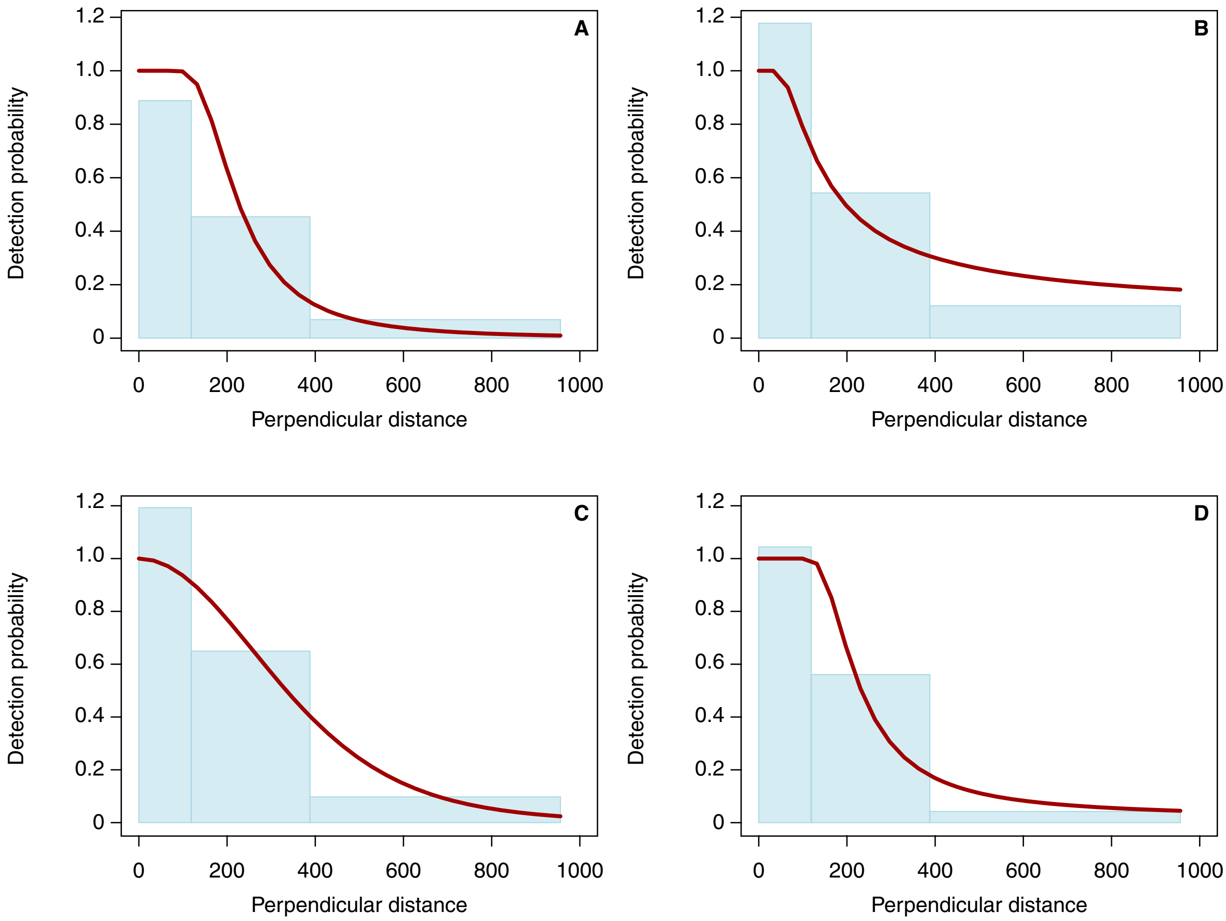

Figure 1. The modelled detection function for Common Scoter for each of four line transect surveys at Horns Rev in January (A), February (B), March (C) and April (D) 2007. Apart from the mandatory variable of "perpendicular distance" covariates as "observer", "cluster size" and "sea state" were used. For details on the modelling background see text.

The modelled spatial distribution of the Common Scoters is shown in Figure 2. Through the survey period on increasing percentage of the total number of Common Scoter in the study area was found in the western parts of the study area, west of the deep strait between the coastal areas and Horns Rev. In January 27% of the birds was estimated to be present in the western area of the study area, with a gradually increasing percentage up to the survey performed on 1 April, when 75% of the Common Scoters was found in the western parts of the area (Table 2 and Figure 2).

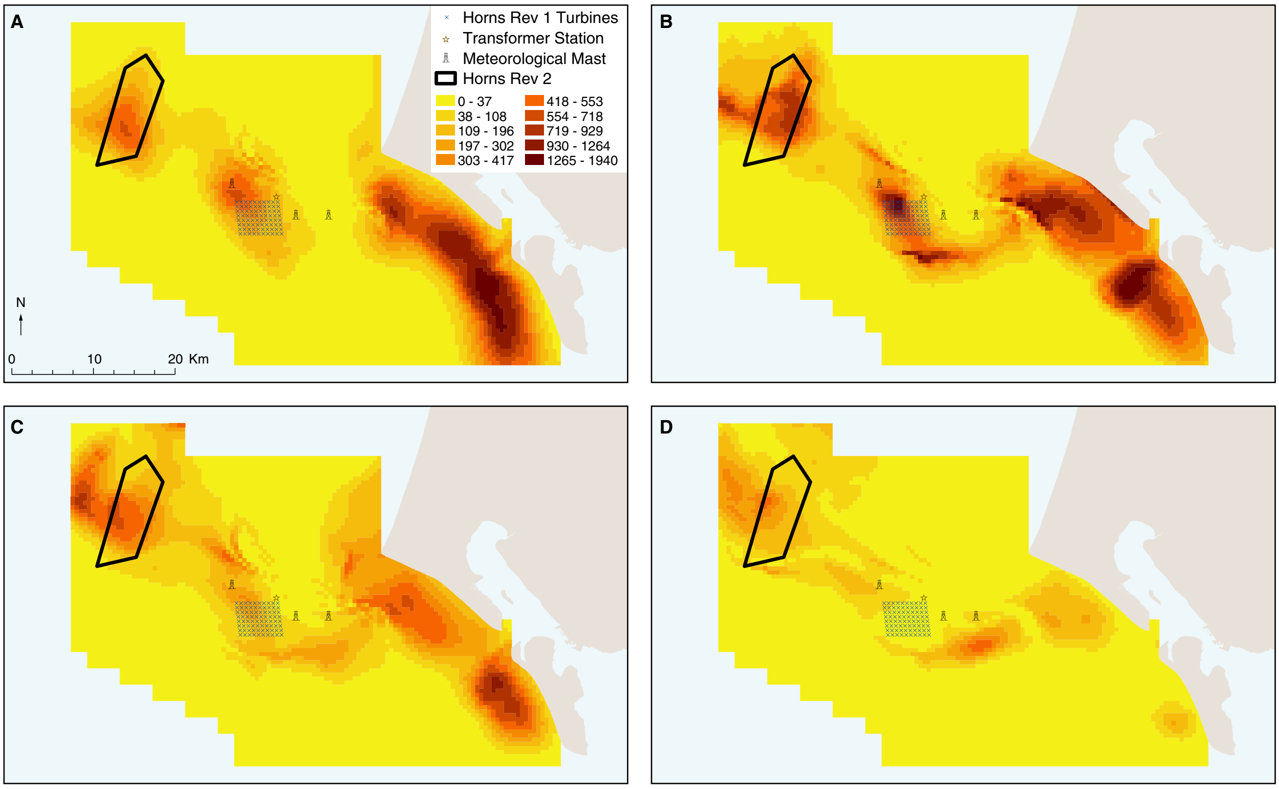

Figure 2. The modelled spatial distribution of 223,122 Common Scoters in the Horns Rev study area on 25 January 2007 (A), of 269,341 Common Scoters on 15 February 2007 (B), of 189,282 Common Scoters on 3 March 2007 (C) and of 67,058 Common Scoters on 1 April 2007 (D) For details on the modelling background see text.

The estimated number of Common Scoters within the area of the Horns Rev 2 wind farm site could be calculated for each of the four surveys, varying between 9,099 (1 April 2007) and 25,041 (15 February 2007, Table 3).

Four displacement scenarios was described, assuming reductions of 5, 10, 25 and 50% of the Common Scoters within the wind farm site, and with a decreasing displacement effect out to a distance of 500 m from the periphery of the wind farm site. This was performed for each of the four survey data sets. Under these assumptions a calculated total number of 1,528 (5% reduction), 3,055 (10% reduction), 7,638 (25% reduction) and 15,277 (50% reduction) Common Scoters would be displaced with a distribution pattern as found on 15 February 2007 when most birds were estimated present in the wind farm area (Table 3 and Figure 3).

Table 3. The estimated numbers of Common Scoters present within the area of the Horns Rev 2 wind farm site for each of four surveys conducted from January to April 2007. The calculated numbers of potentially displaced Common Scoters, assuming a 5, 10, 25 and 50% reduction in density and a linear decreasing effect with increased distance away from the wind farm site out to 500 m, is also giver for each of the surveys. The 1% criterion for internationally important concentrations of Common Scoter is 16,000 birds.

Date	No. within the periphery of Horns Rev 2 wind farm site	No. displaced assuming a 5% density reduction	No. displaced assuming a 10% density reduction	No. displaced assuming a 25% density reduction	No. displaced assuming a 50% density reduction
25 JAN 2007	16,131	957	1,915	4,787	9,573
15 FEB 2007	25,041	1,528	3,055	7,638	15,277
3 MAR 2007	16,958	1,039	2,078	5,194	10,388
1 APR 2007	9,099	572	1,143	2,858	5,715

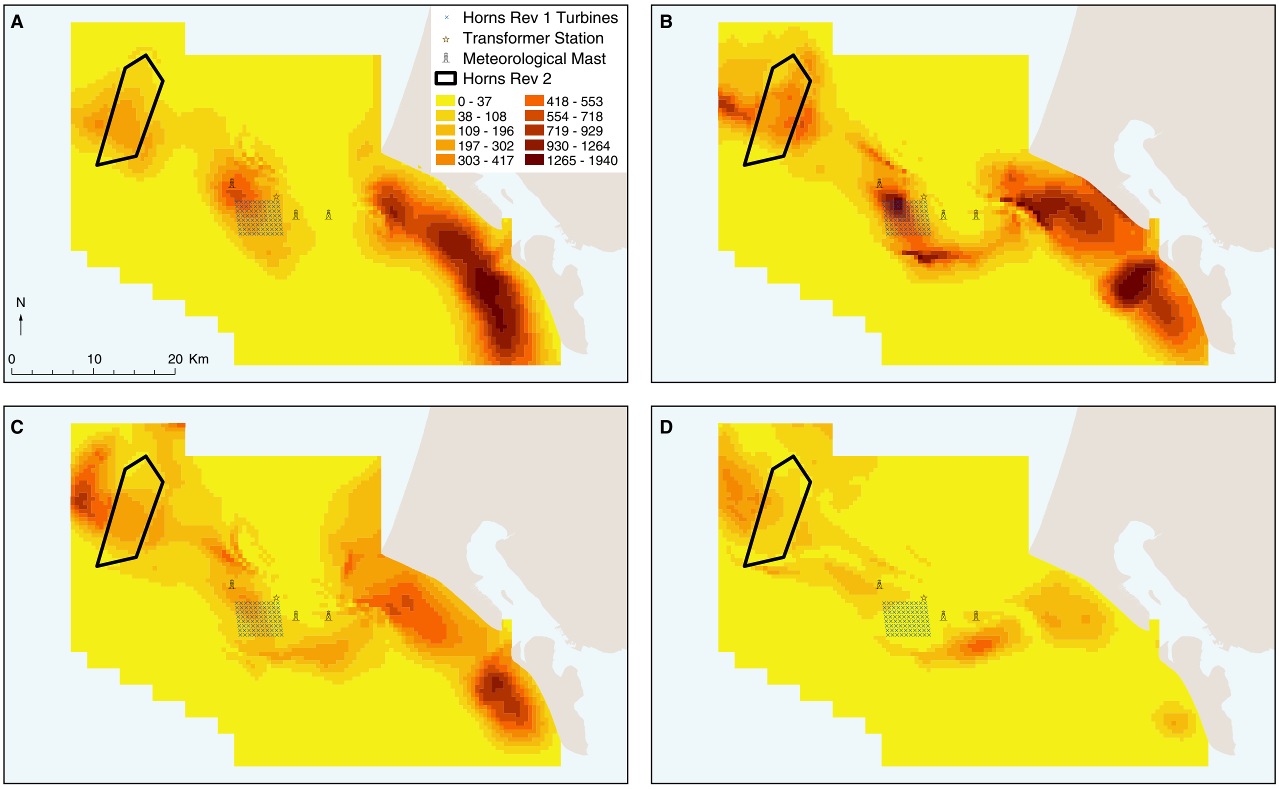

Figure 3. The modelled displacement of common scoters from the proposed Horns Rev 2 wind farm, assuming a 50% density reduction from the wind farm site and a graduate reduced effect out to a distance of 500 m from the site for each of the four survey scenarios (A to D). For details on the modelling background see text.

4 Discussion and conclusions

The estimated total numbers of Common Scoters in the Horns Rev study area during each of four aerial surveys in January to April 2007 were 223,122, 269,341, 189,282 and 67,058, based on surveys conducted on 25 January, 15 February, 3 March and 1 April respectively.

Within the area of the Horns Rev 2 wind farm site the estimated number of Common Scoter for each of the above surveys were 16,131 (7% of the total in the overall survey area on that date), 25,041 (9%), 16,958 (9%) and 9,099 (14%) birds on 25 January, 15 February, 3 March and 1 April respectively.

Experience from the first three years of operation at Horns Rev 1 and at the Nysted 1 offshore wind farms demonstrated effects on the distribution of divers, Common Scoter and Long-tailed Duck (Petersen et al. 2006). Investigations in January to April 2007 showed that Common Scoters by that time utilised the wind farm area to a much higher extent than had been the case during the construction phase and the first years of operation (Petersen & Fox 2007). These observed changes in distribution could potentially be caused by a behavioural response towards the wind turbines, but changes in the distribution of food resources is a possible alternative explanation.

During the period from initiation of the wind farm related ornithological investigations at Horns Rev in 1999 up until the present time Common Scoters have displayed marked changes in their distribution within the study area, caused by other factors than the presence of the wind farm but presumably linked in some way to changes in the availability and distribution of their food supply. For this reason it was difficult to assess the magnitude of reduction in Common Scoter density in and near the Horns Rev 2 wind farm site based on experiences from Horn Rev 1. Despite appearances of initial displacement at Horns Rev 1, within 4 years of operation, densities within the wind farm did not differ significantly from those outside, which may suggest some temporal adjustment on behalf of the birds. This observation can be interpreted in two different ways. First, it could mean that after a period of acclimatisation, Common Scoter will forage amongst turbines post construction. Because there is only 13 km between the two Horn Rev wind farms, we might expect that Common Scoter in the vicinity will experience both sites and therefore are more likely to forage within Horn Rev 2 having been exposed to and begun to feed within Horns Rev 1. On the other hand, we cannot exclude the possibility that these patterns observed at Horns Rev 1 were the results of responses to food supply, and had feeding been suitable, the birds would have foraged between the turbines from immediately after construction. In this case, we may expect that if there are similar changes in the food supply that make the Horns Rev 2 area unattractive to Scoters immediately post construction, birds will assort themselves in a way which avoid some parts of the area. Given the uncertainty surrounding the observed responses of the birds, it was decided to offer a series of differing scenarios for displacement to assess the relative effect on the total numbers of individuals present and in relation to established levels for international importance for the flyway population of this species.

The potential number of displaced Common Scoters from the Horns Rev 2 wind farm site was therefore calculated on the basis of a series of four differing scenarios, assuming displacement of 5, 10, 25 and 50% of the birds present within the wind farm site, and with a linear decreasing impact away from the wind farm periphery out to a distance of 500 m. The 500 m impact zone around the wind farm was also chosen without exact information of the actual relation between distance from wind farm and distribution effect. Visual behavioural observations of Common Scoters at Horns Rev 1 showed that the birds displayed avoidance response out to a distance of approximately 500 m (Petersen et al. 2006), and was used as the background chosen value for this analysis. Previous results from Horns Rev 1 indicated an almost total exclusion of Common Scoters from the wind farm site during the first years of operation (Petersen et al. 2006). Thus, for the ornithological impact assessment for Horns Rev 2 in 2006, the assessment of the number of potentially displaced Common Scoters was based on a 100% displacement within the wind farm (Christensen et al. 2006). The temporal adjustment by Common Scoters towards the Horns Rev 1 wind farm found in early 2007 (Petersen & Fox 2007) showed that the birds by that time utilised the area within the wind farm much more. The displacement scenarios used in this report range from 5 to 50%, with the 50% being a worst case scenario. Within the frame of the present work it has not been possible to access the exact magnitude of change in habitat utilisation. The chosen displacement scenarios are therefore examples, not suggesting any exact degree of change.

For the reasons outlined above, it is considered unlikely that substantial numbers of Common Scoters will be displaced from the Horns Rev 2 site post construction, assuming that they show no new response to the construction of the turbines and that the food supply there remains intact. Nevertheless, it is important to stress that whilst the numbers surveyed lying within the Horns Rev 2 impact area constitute between 7 and 14% of the numbers of Common Scoter in the entire area during early 2007, their absolute numbers exceeded the criteria for international importance (16,000 individuals) in all surveys except that of April 2007.

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National Environmental Research Institute
Frederiksborgvej 399
PO Box 358
DK-4000 Roskilde
Denmark
Tel: +45 4630 1200
Fax: +45 4630 1114

Management
Personnel and Economy Secretariat
Monitoring, Advice and Research Secretariat
Department of Policy Analysis
Department of Atmospheric Environment
Department of Marine Ecology
Department of Environmental Chemistry and Microbiology
Department of Arctic Environment

National Environmental Research Institute
Vejlsøvej 25
PO Box 314
DK-8600 Silkeborg
Denmark
Tel: +45 8920 1400
Fax: +45 8920 1414

Monitoring, Advice and Research Secretariat
Department of Marine Ecology
Department of Terrestrial Ecology
Department of Freshwater Ecology

National Environmental Research Institute
Grenåvej 14, Kalø
DK-8410 Rønde
Denmark
Tel: +45 8920 1700
Fax: +45 8920 1514

Department of Wildlife Ecology and Biodiversity

Modelling total numbers and distribution of Common Scoter *Melanitta nigra* at Horns Rev

National Environmental Research Institute
University of Aarhus · Denmark