

From: [Dominika Phillips](#)
To: [Kay Sully](#); [KJ Johansson](#); [Hornsea Project Three](#)
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Subject: Hornsea Project Three (UK) Ltd response to Deadline 5 (Part1)
Date: 23 January 2019 21:00:57
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[D5_HOW03_Appendix 4_ISH2_ornithology_clarifications.pdf](#)
[D5_HOW03_Appendix 5_Migratory Seabirds Clarification.pdf](#)
[D5_HOW03_IP_WR.pdf](#)
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[HOW03 Guide to the application.pdf](#)
[HOW03_Shell_Position Statement.pdf](#)
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Dear Kay, K-J

We are pleased to enclose Ørsted Hornsea Project Three (UK) Ltd ("the Applicant") response to Deadline 5, Wednesday 23rd Jan 2019. These documents have been prepared by the Applicant and have been produced in response to the Examining Authority's (ExA) letter of 9 October 2018 ("the Rule 8 letter").

These documents are being issued over a series of emails, each email containing a pdf file or files. The **last** email to be issued by the Applicant will contain a supporting file tracking sheet – to help the ExA ensure that it has received each email transmission.

Please acknowledge safe receipt of these documents.

If we can be of any assistance in that regard, please do not hesitate to contact myself or Andrew Guyton.

Best regards,
Dr Dominika Chalder PIEMA
Environment and Consent Manager



Environmental Management UK | Wind Power
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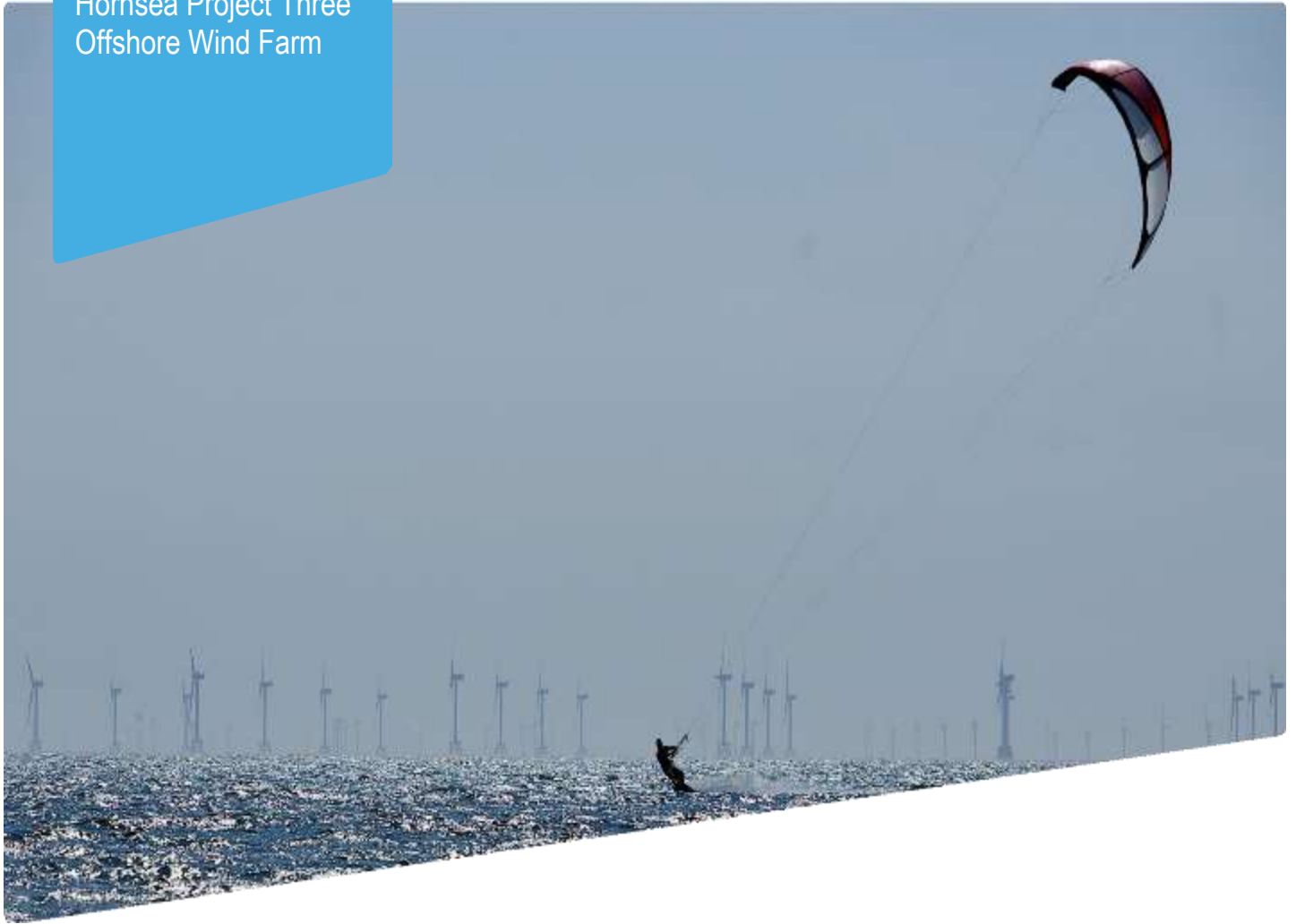
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Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three Offshore Wind Farm

Appendix 4 to Deadline 5 submission - Second Issue
Specific Hearing clarifications in relation to offshore
ornithology

Date: 23rd January 2019

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Front cover picture: Kite surfer near a UK offshore wind farm © Ørsted Hornsea Project Three (UK) Ltd., 2019.

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1. Introduction

- 1.1 At the second Issue Specific Hearing (5th December 2018) for Hornsea Three in relation to ornithology, the Examining Authority requested that the Applicant provide clarifications in relation to a number of issues. These included:
- Clarify the potential for LSE on Montagu's harrier as a feature of the North Norfolk Coast SPA;
 - Identify the implications for the assessment of impacts relating to attraction to lighting when considering OSPAR guidance¹; and
 - Identify those migratory species considered for collision risk modelling at other offshore wind farm projects that are comparable to Hornsea Three.
- 1.2 These clarifications are provided in this report in the following sections.

2. Montagu's harrier

Overview

- 2.1 At the second Issue Specific Hearing for Hornsea Three in relation to ornithology, the Examining Authority requested that the Applicant clarify the position in relation to the potential for LSE for Montagu's harrier at the North Norfolk Coast SPA, as that the species was not listed in the HRA Screening report (APP-052) where the consideration of the potential for LSE on features of the North Norfolk Coast SPA was set out.

Application

- 2.2 Montagu's harrier was not referred to in Table 6.32 of the HRA Screening Report (APP-052) which identified the features of the North Norfolk Coast SPA. However, Montagu's harrier was included in the HRA Screening and Integrity Matrices submitted as Appendix 1 to the Applicant's submission at Deadline 1 (REP1-187). In the matrix for the North Norfolk Coast SPA (which is included as Annex A to this report) no LSE is identified for Montagu's harrier in relation to any impact either from the project alone or in-combination.

Conclusion

- 2.3 There is some uncertainty as to the formal status of Montagu's harrier as an interest feature of the North Norfolk SPA however, the Applicant has treated the species as a qualifying feature of the SPA and has not identified an LSE for impacts associated with Hornsea Three alone or in-combination with other plans or projects as there is considered to be no direct impact from Hornsea Three on either the species breeding area or the supporting habitat it may utilise. This conclusion has been agreed with Natural England through the Statement of Common Ground (REP1-218).

¹ <http://www.ospar.org/documents?d=33046>

3. Attraction to lighting

Overview

- 3.1 As part of their response to Q1.2.65 of the Examining Authorities first round of questions, Natural England highlighted OSPAR guidance in relation to reducing the impacts of lighting on birds and advised that the Applicant should consider this in any assessments. At the second Issue Specific Hearing the Applicant indicated that further information would be provided in relation to the implications of this guidance for the assessments conducted in Volume 2, Chapter 5: Offshore Ornithology (APP-065).
- 3.2 It is worth noting that National Policy Statement (NPS) EN3 states (at paragraph 2.6.107) that “*Aviation and navigation lighting should be minimised to avoid attracting birds, taking into account impacts on safety*”.
- 3.3 The Applicant would highlight that they are unaware of Natural England having raised this as an issue at other offshore wind farm projects included those that have produced comparable assessments and other projects that are currently progressing through the planning process.

OSPAR guidance

- 3.4 The OSPAR guidance provides the following guidance of relevance to the lighting used at offshore wind farms:
- Assessment of light sources (Section 3.1):
 - “*All lighting equipment on offshore installations potentially emitting light outside the physical boundary of an installation should be assessed to determine whether the light is essential for safety reasons and whether there is the potential for reducing external emissions*” (paragraph 10)
 - Reduction of light emissions (Section 3.2):
 - “*The lighting on offshore installations should be reduced to a minimum compatible with safe operations whenever and wherever possible. This includes minimizing the number of lights and the intensity of the lights and/or adapting the spectrum of the lights to bird-friendly lighting systems*” (paragraph 11)
 - “*Unnecessary light sources should be removed, as far as possible*” (paragraph 12)
 - Optimum alignment and light shields (Section 3.3):
 - “*Light sources should, if possible and consistent with safe working practices, be positioned in places where emissions to the surrounding environment can be minimized*” (paragraph 15)

Assessment undertaken APP-065

- 3.5 The design of Hornsea Three includes measures that would reduce the attraction of birds to the wind farm. An extract of Table 5.16 of Volume 2, Chapter 5: Offshore Ornithology (APP-065) is included in

3.6 Table 3.1 which outlines these designed-in measures.

Table 3.1: Extract from Table 5.16 of Volume 2, Chapter 5: Offshore Ornithology (APP-065)

Measures adopted as part of Hornsea Three	Justification
Installation of appropriate lighting on wind farm structures.	Lighting of wind turbines will meet minimum requirements, namely as set out in the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation O-117 on 'The Marking of Offshore Wind Farms' for navigation lighting and by the Civil Aviation Authority in the Air Navigation Orders (CAP 393 and guidance in CAP 764). In keeping with the minimum legal requirements, this will minimise the risks of migrating birds becoming attracted to, or disorientated by turbines at night or in poor weather.

3.7 The proposed design for Hornsea Three, with respect to lighting, is, therefore, consistent with OSPAR guidance and NPS EN-3. The design aims to minimise the emission of light whilst still complying with safety protocols and regulations in relation to aviation and shipping navigation.

3.8 Volume 2, Chapter 5: Offshore Ornithology concluded:

"An impact of low magnitude on low sensitivity receptors during the migratory periods will produce a negligible or minor adverse effect, which is considered to be not significant in EIA terms for all receptors. This evaluation is supported by literature evidence that those species that are most active at night are unlikely to be affected by lit turbines and other structures, whereas those species that may have been sensitive on account of their conservation status or recoverability are unlikely to be present on site at night."

3.9 In addition, the Applicant would highlight that turbines are not as extensively lit as, for example, oil and gas installations (see paragraph 5.11.2.220 in APP-065), where birds often occur and this further supports the conclusions reached in Volume 2, Chapter 5: Offshore Ornithology (APP-065).

4. Statistical clarifications

Overview

4.1 At the second Issue Specific Hearing for Hornsea Three in relation to ornithology, the Examining Authority queried aspects of some of the statistical analyses presented as part of the Hornsea Three application.

Questions raised and applicant responses

4.2 Responses in relation to those questions raised by the Examining Authority at the second Issue Specific Hearing are provided in Table 4.1.

Table 4.1: Responses to questions raised by the Examining Authority at the second Issue Specific Hearing

Question raised by ExA at ISH2	Applicant response
Variance Estimates (two data points) – clarify how central dispersion has been measured?	Monthly density and population estimates in separate years were calculated as mean density values. Central dispersion can be calculated in multiple ways, but we chose to use the standard method for all offshore EIAs, which is to use the bootstrap mean. There are many arguments in favour of using the median, but in the interests of standardisation, we stuck with the mean. The sample variance is one measure of variation in the samples; we did not calculate this out separately, but the methods can be described as the sum of the difference between the density or population value from the sample mean squared, and this sum divided by the sample size minus one. We used a bootstrapped method to estimate standard error and lower and upper 95% confidence limits for each month.
What was the sample size associated with mean values?	When calculating the monthly mean values in separate years, each transect is treated as an independent sample and there were 20 transects per survey and were used to calculate the bootstrap mean.
Bootstrapping – standard error and sample size - How was the 'bootstrap' number (>1000) obtained for a sample size for statistical modelling?	Using a sample size of 20 samples (transects), we used 10,000 bootstrap samples for our calculation of the bootstrapped mean, standard error and 95% confidence limits (2.5 and 97.5 percentiles). We used a non-parametric moving blocks bootstrap method in which the size of the sample is limited by the total length of the transects in the samples. This sample size is more than sufficient for such purposes and it is debatable whether it even offers any improvement over a bootstrap sample of 1000.
Mean Monthly Data estimates : Pooled variance and unbiased simple – how was this assumption tested? How were pooled variances obtained, do we accept that variances are equal and how to test that assumption?	We have not been able to test the scale of bias associated with different survey methods, when boat-based and digital aerial data are used together. However, we know from another study (Webb & Hawkins 2013 – already cited in the hierarchical data selection report) that the two

Question raised by ExA at ISH2	Applicant response
	methods give broadly similar density estimates in comparable situations. This is borne out in the data we have presented; at the same times of year, the digital aerial survey results give broadly similar density and population estimates as historical boat-based data. This becomes especially true when considering the scale at which seabird abundance varies at sea at these latitudes, sometimes by as much as two orders of magnitude (e.g. Moray West), and the effect of using different observers in a boat-based survey (between three and seven times depending on the species; Van der Meer & Camphuysen 1996). We have assumed, but not tested that the sampling method for digital aerial survey is unbiased, as it is based on sound principles of survey design (see Buckland et al. 2001), which for surveys of mobile species at sea recommends randomly-placed equally-spaced transects across the entire study area. Sampling bias for the boat-based survey data has been more difficult to control following the advice from Natural England that density estimates from boat-based surveys for the entire Hornsea Zone should be used in months when digital aerial data were only available for one year. Originally, the applicant offered the inclusion of boat-based data only where these overlapped the proposed Hornsea Three site, and steps were taken to reduce any bias by not using months in any given year in which transect coverage of the site was unequal spatially. The switch to using the Hornsea Zone from the Hornsea Three site was requested because of the often poor coverage during the winter months. It is likely that the Hornsea Zone data will be biased because survey effort was concentrated around the Hornsea One and Hornsea Two project areas. The use of pooled mean density estimates is a requirement from the use of the Band (2012) model for estimating collision risk, and the adoption of this method was, at the time of submission, a requirement of the SNCBs including Natural England. This method simply takes two or more mean estimates of flying bird

Question raised by ExA at ISH2	Applicant response
	density and takes the average of these values and takes no account of any bias in the sampling or the variance that sits behind the component mean density estimates. Importantly, the method also does not weight the pooled density estimate according to the amount of survey data, so for example, a monthly density value based on an original sample of 25 will have the same weighting in the pooled density estimate as a monthly density estimate based on a sample of 10. This is important because, if bootstrapping were to be used to estimate the pooled mean, standard deviation and confidence limits, these would be biased toward the data in which there were most samples. As described above, we presented the variance in the monthly mean density and population size pooled across different years using a method based on a calculation of the pooled coefficient of variation rather than simply presenting the lowest and highest mean value, which underestimates the underlying variance by ignoring the sample variance in the mean values in each individual year. We used the standard method for calculating pooled coefficient of variation (Equation 3.5 in Buckland et al. 2001), but weighted the calculation to take account of the different abundances in the different samples; this was preferable to other methods for estimating pooled variance which would weight the variance toward those data with largest sample size. Having obtained a pooled co-efficient of variation, we could calculate the pooled standard deviation as the pooled coefficient of variation multiplied by the pooled mean. From this, the standard error was calculated as the standard deviation divided by the root of the sample size and the standard error times 1.96 added to or subtracted from the mean to give the lower and upper confidence limits of the mean (assuming a normal distribution). We have continued to investigate appropriate methods for calculating confidence limits for datasets such as these. An alternative method would be to calculate the equivalent of the

Question raised by ExA at ISH2	Applicant response
	population standard error rather than the equivalent of the sample standard error. The approach is similar to that set out above except the standard error is assumed to be equivalent to standard deviation (rather than dividing it by the root of the sample size). This would not affect the mean values, but for those months for which there are 2 DAS data points, the confidence intervals would be 1.41 higher/lower (for upper and lower confidence limits respectively) than those currently presented. As stated in our response to written question 1.2.43, we do not accept that variances are equal in the sample data. This will almost never occur in seabird data regardless of survey method. Equal variance is not a requirement for pooling mean density in Band (2012) so we did not test whether the variance was equal.

5. References

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Stroud, D.A., Bainbridge, I.P., Maddock, A., Anthony, S., Baker, H., Buxton, N., Chambers, D., Enlander, I., Hearn, R.D., Jennings, K.R, Mavor, R., Whitehead, S. & Wilson, J.D. - on behalf of the UK SPA & Ramsar Scientific Working Group (eds.) 2016. The status of UK SPAs in the 2000s: the Third Network Review. [c.1,108] pp. JNCC, Peterborough.

Van der Meer, J. & Camphuysen 1996. Effect of observer differences on abundance estimates of seabirds from ship-based strip transect surveys. Ibis 138: 433 – 437.

Annex A – Screening matrix for North Norfolk Coast SPA

Name of European site: North Norfolk Coast SPA												
Distance to array area: 128 km												
Distance to cable route: 0.3km												
European site features	Likely Effects of Hornsea Three											
<u>Article 4.1 – Breeding</u>	<i>Changes to habitat</i>			<i>Release of contaminants</i>			<i>Invasive species</i>			<i>In-combination</i>		
	C	O	D	C	O	D	C	O	D	C	O	D
Avocet <i>Recurvirostra avosetta</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Bittern <i>Botaurus stellaris</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Common Tern <i>Sterna hirundo</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Little Tern <i>Sterna albifrons</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Marsh Harrier <i>Circus aeruginosus</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Mediterranean Gull <i>Larus melanocephalus</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Roseate Tern <i>Sterna dougallii</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Sandwich Tern <i>Sterna sandvicensis</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc

Name of European site: North Norfolk Coast SPA												
Montagu's harrier <i>Circus pygargus</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
<u>Article 4.1 – Over winter</u>	Changes to habitat			Release of contaminants			Invasive species			In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D
Avocet <i>Recurvirostra avosetta</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Bar-tailed Godwit <i>Limosa lapponica</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Bittern <i>Botaurus stellaris</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Golden Plover <i>Pluvialis apricaria</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Hen Harrier <i>Circus cyaneus</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Ruff <i>Philomachus pugnax</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
<u>Article 4.2 – Migratory (Breeding)</u>	Changes to habitat			Release of contaminants			Invasive species			In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D
Redshank <i>Tringa totanus</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Ringed Plover <i>Charadrius hiaticula</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
<u>Article 4.2 – Migratory (On passage)</u>	Changes to habitat			Release of contaminants			Invasive species			In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D

Name of European site: North Norfolk Coast SPA												
Ringed Plover <i>Charadrius hiaticula</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Article 4.2 – Migratory (Over winter)	Changes to habitat			Release of contaminants			Invasive species			In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D
Dark-bellied Brent Goose <i>Branta bernicla bernicla</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Knot <i>Calidris canutus</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Pink-footed Goose <i>Anser brachyrhynchus</i>	✓a	✓a	✓a	✓b	✓b	✓b				✓a,b	✓a,b	✓a,b
Pintail <i>Anas acuta</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Redshank <i>Tringa totanus</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Wigeon <i>Anas penelope</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Article 4.2 – Assemblage (Waterfowl)	Changes to habitat			Release of contaminants			Invasive species			In-combination		
	C	O	D	C	O	D	C	O	D	C	O	D
Shelduck <i>Tadorna tadorna</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Avocet <i>Recurvirostra avosetta</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc

Name of European site: North Norfolk Coast SPA												
Golden Plover <i>Pluvialis apricaria</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Ruff <i>Philomachus pugnax</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Bar-tailed Godwit <i>Limosa lapponica</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Pink-footed Goose <i>Anser brachyrhynchus</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Dark-bellied Brent Goose <i>Branta bernicla bernicla</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Wigeon <i>Anas penelope</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Pintail <i>Anas acuta</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Knot <i>Calidris canutus</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Redshank <i>Tringa totanus</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Bittern <i>Botaurus stellaris</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
White-fronted Goose <i>Anser albifrons albifrons</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Dunlin <i>Calidris alpina alpina</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Gadwall <i>Anas strepera</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc

Name of European site: North Norfolk Coast SPA												
Teal <i>Anas crecca</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Shoveler <i>Anas clypeata</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Common Scoter <i>Melanitta nigra</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Velvet Scoter <i>Melanitta fusca</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Oystercatcher <i>Haematopus ostralegus</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Ringed Plover <i>Charadrius hiaticula</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Grey Plover <i>Pluvialis squatarola</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Lapwing <i>Vanellus vanellus</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Sanderling <i>Calidris alba</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc
Cormorant <i>Phalacrocorax carbo</i>	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc	Xc