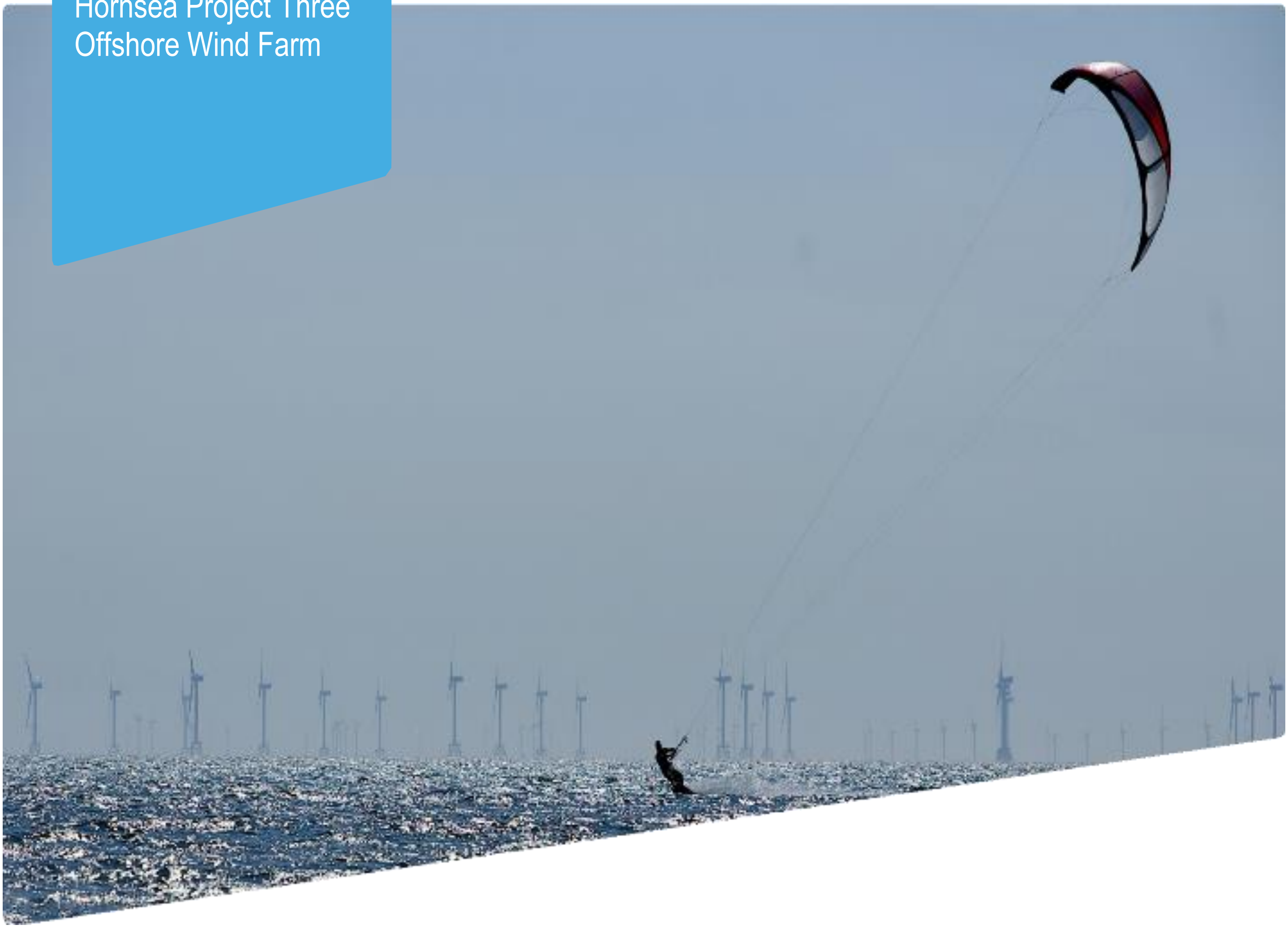
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Appendix 8 to Deadline 7 submission – East Anglia Three Evidence Plan (Meeting 6)

Date: 14th March 2019

Hornsea 3
Offshore Wind Farm

Ørsted

Document Control	
Document Properties	
Organisation	Ørsted Hornsea Project Three
Author	East Anglia Three Project
Checked by	n/a
Approved by	n/a
Title	Appendix 8 to Deadline 7 submission – East Anglia Three Evidence Plan (Meeting 6)
PINS Document Number	n/a

Version History			
Date	Version	Status	Description / Changes
14/03/2019	A	Final	Submitted at Deadline 7 (14th Mar 2019)

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East Anglia Offshore Wind

VATTENFALL

SCOTTISHPOWER RENEWABLES

East Anglia THREE

Appendix 13.1

Offshore Ornithology Evidence Plan

Volume 3
Document Reference – 6.3.13 (1)

Author – MacArthur Green, APEM & Royal Haskoning DHV
East Anglia Three Limited
Date – November 2015
Revision History – Revision A

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13.1.12 Ornithology ETG Meeting 6 Background Paper

14. Provided below is the background paper that was circulated prior to the sixth Ornithology ETG meeting

East Anglia Offshore Wind

VATTENFALL

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East Anglia THREE

Ornithology

Evidence Plan

Expert Topic Group Meeting 6

6th July 2015

Document Reference – ETG 6.1

Author – MacArthur Green
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Date – June 2015
Revision History –First draft for Meeting 6

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1 INTRODUCTION

1.1 Purpose of this Document

1. The purpose of this document is to provide technical information to support the discussions to be held at the sixth ornithology expert topic group (OETG) meeting to be held on 6th July 2015.

2. This meeting will cover ornithological issues both onshore and offshore.

3. This document contains information that updates that presented at the first five OETG meetings held in September and November 2013, March and July 2014 and May 2015. It provides more detailed information on a series of topics related to offshore and onshore ornithology and assessment processes. In some cases an outline approach is described in this paper in recognition that the detail and discussion on it will take place at a future meeting. Background papers supporting this Evidence Plan are provided as Appendices 1 to 7.

4. The record of the discussions at the previous five OETG meetings and the schedule of topic areas on which agreement is sought, with the current position of Natural England and Royal Society for the Protection of Birds (RSPB), are contained within the respective minutes of those meetings.

2 PROJECT TIMETABLE AND DESCRIPTION

2.1 Project Timetable

5. An updated project timeline for East Anglia THREE is presented in Table 2.1.

Table 2.1: Project Timeline for East Anglia THREE

Date	Event
August 2013	Final East Anglia THREE site specific surveys
30th September 2013	Ornithology ETG meeting 1
11th November 2013	Ornithology ETG meeting 2
February 2014	Final East Anglia FOUR site specific surveys
March 2014	Draft High Level HRA Screening Report for East Anglia THREE
28th March 2014	Ornithology ETG meeting 3
27th May 2014	Start of consultation period for East Anglia THREE PEI (under Section 42 of the Planning Act 2008) High Level HRA Screening Report for East Anglia THREE provided alongside PEI
2nd July 2014	PEIR Workshop, attended by East Anglia Offshore Wind, Natural England, RSPB, APEM, Royal Haskoning DHV
2nd July 2014	Ornithology ETG meeting 4
8th July 2014	End of consultation period for East Anglia THREE PEI (under Section 42 of the Planning Act 2008)
3rd June 2015	Ornithology ETG meeting 5
11th June 2015	Start of Phase III consultation period for East Anglia THREE (under section 42 of the Planning Act 2008)
16th July 2015	End of Phase III consultation period for East Anglia THREE (under section 42 of the Planning Act 2008)
6th July 2015	Ornithology ETG meeting 6
September 2015	*Ornithology ETG meeting 7 (TBC)*
November 2015	DCO application East Anglia THREE

3 ORNITHOLOGY REPORTS

3.1 Onshore ornithology update

6. Onshore construction for the proposed East Anglia THREE project will involve pulling cables through pre-installed ducts (installed as part of East Anglia ONE works). In relation to East Anglia THREE this work will be subject to restrictions during the winter to minimise potential disturbance to dark bellied brent geese in the Deben Estuary SPA. The details of this restriction are being discussed with the construction engineers and will be provided at or before the Ornithology ETG meeting 6.

3.2 HRA Screening Report

7. An assessment of the SPA sites and features that should be screened in, or screened out, for Habitats Regulations Assessment (HRA) for the proposed East Anglia THREE project (alone and in-combination) was presented in advance of OETG 5 and discussed at that meeting.

8. Following the meeting it was agreed that as well as the species originally identified for inclusion in the HRA, the following would be added:

- Flamborough and Filey Coast pSPA (kittiwake).
- Outer Thames Estuary SPA (red-throated diver);

9. The updated HRA screening report reflecting these additional SPA features is attached as Appendix 1 (in tracked changes form to aid review).

3.3 Gannet cumulative impact assessment – use of SOSS-04 Gannet PVA report

10. Following recommendations from Natural England at OETG5, the reported mortalities at other wind farms in the cumulative assessment have been updated using the figures reported in the Dogger Bank Teesside A & B HRA (Forewind 2014).

11. It was also agreed at OETG5 that the potential impacts of cumulative mortality on the BDMPS population would be considered using the SOSS-04 gannet population report (WWT 2012).

12. Both the above aspects have been incorporated into the gannet cumulative assessment section of the Environmental Statement. This section is attached as Appendix 2.

13. Following these updates and using the SOSS-04 model outputs to assess cumulative mortality, the potential impacts on the population are considered to be minimal and not significant.

3.4 Kittiwake cumulative impact assessment and development of PVA

14. Following recommendations from Natural England at OETG5, the reported mortalities at other wind farms in the cumulative assessment have been updated using the figures reported in the Dogger Bank Teesside A & B HRA (Forewind 2014).

15. This update has been incorporated into the kittiwake cumulative assessment section of the Environmental Statement. This section is attached as Appendix 3.

16. It was also agreed at OETG5 that a population model would be developed to use in the kittiwake cumulative collision mortality assessment. The demographic rates used in the model were sent to Natural England (5th June 2015) for review and are included in Appendix 4. This note has been updated to include preliminary model outputs in an annex to the note. These results are summarised below.

17. Two different sets of demographic rates have been used, simulated both with and without density dependent regulation of reproduction and using the spring and autumn BDMPS population estimates as the starting size (giving 2x2x2 = 8 simulation scenarios). In addition, the annual mortality was assessed against the autumn population size, generating a further 4 simulation outputs.

18. The modelling indicates that irrespective of the demographic rates or presence of density dependence, the impacts due to East Anglia THREE alone will have a very small (and probably undetectable) effect on the population. At an annual mortality of 250 (the lowest value simulated, which considerably exceeds the estimated East Anglia THREE annual mortality of 149), no model scenario resulted in more than a 1% difference in population size after 25 years.

19. Demographic parameter set 2 generated lower predicted baseline population growth rates than set 1 (density independent: 1.4% pa compared with 3.6% pa), although the difference between the two was reduced in the presence of density dependent regulation (density dependent: 0.9% pa compared with 1.3% pa). However, the most robust approach for interpreting model outputs is to compare the baseline and impacted outputs, rather than the absolute predictions of growth.

20. On this basis, considering the counterfactual of population size after 25 years (CPS25) and the cumulative seasonal mortality against the appropriate BDMPS populations, the greatest reduction in population size was obtained from the less realistic density independent simulations using parameter set 2. In both spring and autumn a maximum relative reduction in population size of approximately 2-3% was obtained (after 25 years).

21. A precautionary approach was adopted for assessing annual cumulative collision mortality for all windfarms. In these simulations, the total mortality was assessed against the autumn BDMPS (on the basis that this is the larger BDMPS and therefore more appropriate when considering the maximum impact level). In these simulations, the maximum reduction in population size (for the unrealistic density independent models) was approximately 7.6%. In the presence of density dependence this reduction was approximately 2.8%. (Table 3.1)

Table 3.1 Counterfactuals of population size for kittiwake BDMPS populations. The mortality levels in the table were selected due to their close proximity to the cumulative totals for each period (actual annual total: 4,041, actual spring total: 1,345, actual autumn total: 1,551) and therefore suitably representative (note full outputs will be provided in the assessment, and figures are presented in Appendix 4). Annual simulations used the autumn BDMPS as the initial population size while autumn and spring simulations used the BDMPS appropriate to those seasons.

Demographic rate set	Density dependent	Period	Mortality	Counterfactual of population size in year:				
				5	10	15	20	25
1	No	Annual	4000	0.988	0.972	0.954	0.932	0.924
1	Yes	Annual	4000	0.993	0.980	0.979	0.970	0.972
1	No	Autumn	1500	0.997	0.989	0.999	0.982	0.979
1	Yes	Autumn	1500	0.992	0.993	0.984	0.989	1.000
1	No	Spring	1500	0.997	0.996	0.988	0.981	0.972
1	Yes	Spring	1500	0.990	0.996	0.991	0.992	0.994
2	No	Annual	1500	0.988	0.972	0.965	0.951	0.930
2	Yes	Annual	1500	0.995	0.984	0.975	0.976	0.975
2	No	Autumn	1500	0.991	0.985	0.977	0.974	0.969
2	Yes	Autumn	1500	0.994	0.995	0.989	0.992	0.990
2	No	Spring	1500	1.003	0.988	0.982	0.985	0.974
2	Yes	Spring	1500	0.998	0.992	0.989	0.988	0.987

22. Overall, the conclusions of the modelling indicate that even with the maximum predicted cumulative mortality and the most precautionary modelling assumptions (density independence, parameters set 2) the magnitude of population impacts is expected to be small. Under more realistic assumptions (e.g. including density dependence) the population impacts are even smaller and can be considered as negligible.

3.5 Evidence basis for cumulative collisions being lower than recent consents

23. Following discussions at OETG5, where appropriate the cumulative collision assessments will include reviews of the consent decisions for recent windfarms made on the basis of the previously used (lower) avoidance rates. This adds to the evidence base that due to modifications in assessment methods (primarily the

increase in collision avoidance rates) the current cumulative mortality estimates are below the levels on which previous consent decisions have been granted, even with the inclusion of additional windfarms.

24. An example of the text to be included in the cumulative sections of the Environmental Statement is provided for great black-backed gull in Appendix 5.

3.6 Combining seasonal displacement mortality

25. Following discussion at OETG5, consideration has been given to the question of how to combine seasonal mortality due to displacement to arrive at an annual estimate. A report detailing this work is provided in Appendix 6.

26. The conclusions of this exercise are that the current approach of assessing displacement mortality using the season with the highest abundance is more precautionary than distributing mortality across all seasons. A possible but simple refinement to this would be to allocate the displacement mortality to the season during which the numbers represent the highest proportion of the seasonal BDMPS population rather than the highest absolute mean number in the survey area. That would retain the present precautionary nature of the matrix approach but assess against the population which would experience the highest impact.

3.7 Nocturnal activity factor – collision risk modelling sensitivity analysis

27. Following discussion at OETG5, a sensitivity analysis has been conducted to provide an understanding of how varying the nocturnal activity factor used in collision risk modelling alters the monthly collision risk estimates for wind farm sites located at northerly and southerly latitudes (e.g. Moray Firth and the English Channel).

28. This analysis has been added to the review of nocturnal activity submitted at ETG5 (Furness 2015) and the updated report is provided in Appendix 7.

29. In summary the results indicate that the effect of reducing nocturnal flight activity scores on collision mortality is greatest in mid-winter and least in mid-summer, reflecting the relative contribution of night across the annual cycle. Therefore the season when birds are present will affect the extent of collision reduction observed at any given windfarm. The latitude of the windfarm has a smaller influence, although the difference between mid-summer and mid-winter is greater for northern locations. There is no difference in the magnitude of reduction for different species, however a reduction from a nocturnal activity score of 2 to 1 (25% to 0%) has a greater effect than from 3 to 2 (50% to 25%). This is due to the interplay of day

and night length across the year, and hence this difference is most pronounced in mid-winter and virtually absent in mid-summer.

30. The smallest mortality reduction was observed in mid-summer (7%) for the northern windfarm site for both a reduction from 2 to 1 and 3 to 2. Therefore, as a precautionary first step, it would be appropriate to reduce collision mortality for all species at all windfarms by 7%. Further reductions, reflecting windfarm latitude and seasonality of bird abundance could be applied to further reduce the overall mortality.

3.8 Key points for discussion and agreement

Table 3.4. Summary of key points on which EATL seeks agreement with NE and RSPB

Item	Summary points for discussion and agreement
1	The SPAs and features screened in for HRA are now agreed.
2	The updated gannet collision numbers are correct for the cumulative assessment and the SOSS-04 Gannet PVA is suitable for assessing cumulative gannet impacts and assessment in this manner indicates that cumulative gannet mortality will not have a significant effect on the population.
3	The updated kittiwake collision numbers are correct for the cumulative assessment and the proposed kittiwake modelling approach is suitable and the results provide comfort that cumulative kittiwake mortality will not have a significant effect on the population.
4	The evidence base for the cumulative collision assessments provides the appropriate level of comfort for NE to conclude that the current total mortality is below that previously consented.
5	Attempting to combine mortality across seasons is unlikely to alter conclusions and introduces considerable complication due to variable degrees of overlap in the relevant populations to be assessed. A possible refinement would be to base assessments on the season when the highest *proportion* of the BDMPS population is considered at risk rather than the one when the highest *absolute* number is at risk. However, following a review of methods and options, the current approach for assessing auk mortality due to displacement across seasons is considered to be appropriate and generates robust precautionary conclusions.
6	The results of the collision risk modelling nocturnal activity factor sensitivity analysis indicate that a minimum reduction in collision risk for all wind farms of 7% for all species is both evidence based and precautionary and therefore appropriate.

4 REFERENCES

Forewind (2014) Dogger Bank Teesside A & B Deadline VI Final HRA ornithology in-combination tables.

http://infrastructure.planningportal.gov.uk/wp-content/ipc/uploads/projects/EN010051/2.%20Post-Submission/Representations/ExA%20Questions/20-11-2014%20-%20ExA%20Second%20Written%20Questions/Forewind%20-%20Final%20HRA%20In-combination%20ornithology%20tables.pdf

Furness, B. (2015). Nocturnal Flight Activity Levels in Seabirds. Report prepared for East Anglia THREE and submitted for discussion at Ornithology Evidence Technical Group Meeting 5.

WWT (2012). SOSS-04 Gannet population viability analysis: demographic data, population model and outputs.

APPENDIX 1: HRA SCREENING REPORT ON ORNITHOLOGY (FINAL SCREENING)

East Anglia Offshore Wind

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East Anglia THREE

HRA Screening

Report on Ornithology (Final Screening)

Author – MacArthur Green
East Anglia Offshore Wind Limited

Date – May 2015
Revision History – Revision C

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1 INTRODUCTION

1.1 Purpose of this document

1. With regard to the proposed East Anglia THREE project, this document considers the Special Protection Areas (SPAs) (some of which are also Ramsar sites) and their features that were included in the high level screening by APEM and Royal HaskoningDHV (2014). It lists those sites that can clearly be screened out of any Likely Significant Effect (LSE) from the proposed East Anglia THREE project, and identifies those SPAs and features requiring further consideration because LSE cannot be ruled out at this stage.

2. Shortly after completion of this report, we were informed by Natural England that they are working to identify a possible extension to the Outer Thames SPA designation to include both little tern and common tern. Work is also being undertaken to identify a possible site in the Greater Wash to include little tern, common tern, Sandwich tern, common scoter, red throated diver and little gull. A post-script to this Screening document has been prepared and is included in Appendix 1.

2 SCREENING SPA SITES AND FEATURES

2.1 High level screening summary

3. A High-Level Screening Report was provided by APEM and Royal HaskoningDHV (2014). That report listed Special Protection Areas (SPAs) that were initially screened in for consideration (Table 2.1), but provided no consideration of the individual listed sites.

2.2 Full Screening

4. Here we indicate the sites from this initial list that can be screened out because no LSE is possible on the basis of impacts either from the proposed East Anglia THREE project alone or in-combination with other plans or projects (summarised in Table 2.1 and discussed where relevant in greater detail in this report).

Table 2.1: List of SPA and Ramsar sites with their respective categories of bird interest feature and summarised screening decisions. Sites screened in are shown in bold text.

SPA or Ramsar site	Category of interest feature	Screening decision	Distance (km)*	Reason for screening decision – further consideration provided in this document where appropriate
Abberton Reservoir SPA and Ramsar	Wintering and passage waterbirds	Out	165	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Alde-Ore Estuary SPA and Ramsar	**Breeding seabirds and breeding, wintering and passage waterbirds**	**IN**	**109**	**Lesser black-backed gull breeding population may have connectivity with the East Anglia THREE site. This SPA holds the closest large colony of the species to East Anglia THREE. Some birds from that SPA may pass through East Anglia THREE site during migration.**
Baie de Seine Occidentale SPA	Breeding, wintering and passage waterbirds	Out	447	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Benfleet & Southend Marshes SPA and Ramsar	Wintering and passage waterbirds	Out	196	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.

SPA or Ramsar site	Category of interest feature	Screening decision	Distance (km)*	Reason for screening decision – further consideration provided in this document where appropriate
Blackwater Estuary SPA and Ramsar	Wintering and passage waterbirds	Out	173	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Borkum-Riffgrund SPA	Non-breeding seabirds	Out	272	Migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration relative to the size of Biologically Defined Minimum Population Scale (BDMPS) regional populations.
Breydon Water SPA and Ramsar	Wintering and passage waterbirds	Out	82	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Broadland SPA and Ramsar	Wintering and passage waterbirds	Out	89	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Bruine Bank (Brown Ridge) pSPA (Netherlands)	Non-breeding seabirds	Out	n/a	Migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration relative to the size of BDMPS regional populations.
Buchan Ness to Colleston Coast SPA	Breeding seabirds	Out	606	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Calf of Eday SPA	Breeding seabirds	Out	810	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Chesil Beach & The Fleet SPA	Migratory waterbirds	Out	437	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Chichester & Langstone Harbour SPA	Migratory waterbirds	Out	334	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.

SPA or Ramsar site	Category of interest feature	Screening decision	Distance (km)*	Reason for screening decision – further consideration provided in this document where appropriate
Colne Estuary SPA and Ramsar	Wintering and passage waterbirds	Out	159	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Copinsay SPA	Breeding seabirds	Out	775	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Coquet Island SPA	Breeding seabirds	Out	414	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Cromarty Firth SPA	Wintering and passage waterbirds	Out	715	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Crouch & Roach Estuary SPA and Ramsar	Wintering and passage waterbirds	Out	186	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Deben Estuary SPA and Ramsar	**Wintering and passage waterbirds**	**IN**	**124 [0.0]**	**Dark-bellied brent goose could be disturbed by construction work on both banks of the Deben Estuary where onshore power cables are placed in pre-installed ducts. Other features such as avocet remain on the intertidal areas behind the sea wall and so would not be at risk of disturbance from construction work.**
Dengie SPA and Ramsar	Wintering and passage waterbirds	Out	169	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Dornoch Firth and Loch Fleet SPA	Wintering and passage waterbirds	Out	725	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.

SPA or Ramsar site	Category of interest feature	Screening decision	Distance (km)*	Reason for screening decision – further consideration provided in this document where appropriate
East Caithness Cliffs SPA	Breeding seabirds	Out	735	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Exe Estuary SPA	Migratory waterbirds	Out	490	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Fair Isle SPA	Breeding seabirds	Out	813	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Falaise du Bessin Occidental SPA	Breeding seabirds	Out	451	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Farne Islands SPA	Breeding seabirds	Out	441	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Fetlar SPA	Breeding seabirds	Out	913	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Firth of Forth SPA	Wintering and passage waterbirds	Out	546	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Firth of Tay & Eden Estuary SPA	Wintering and passage waterbirds	Out	563	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.

SPA or Ramsar site	Category of interest feature	Screening decision	Distance (km)*	Reason for screening decision – further consideration provided in this document where appropriate
Flamborough and Filey Coast pSPA	**Breeding seabirds**	**IN**	**257**	**Uncertain proportions of the kittiwake, gannet, common guillemot, razorbill and puffin populations most likely migrate through the East Anglia THREE site. Only gannet has potential for connectivity during the breeding season based on maximum foraging range although tracking data suggest no connectivity of breeding gannets but the site is included based on the precautionary principal.**
Forth Islands SPA	Breeding seabirds	Out	528	Tracking data show breeding gannets from Bass Rock do not commute to East Anglia THREE site although the site is just within maximum foraging range. Except for gannet, SPA is far beyond maximum foraging range of other designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Foula SPA	Breeding seabirds	Out	885	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Foulness SPA and Ramsar	Wintering and passage waterbirds	Out	180	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Fowlsheugh SPA	Breeding seabirds	Out	573	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Frisian Front SPA	Non-breeding seabirds	Out	n/a	Migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration relative to the size of BDMPS regional populations.
Gibraltar Point SPA and Ramsar	Wintering and passage waterbirds	Out	176	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.

SPA or Ramsar site	Category of interest feature	Screening decision	Distance (km)*	Reason for screening decision – further consideration provided in this document where appropriate
Great Yarmouth and North Denes SPA	Breeding seabirds	Out	77	SPA is beyond maximum foraging range of designated seabird species (little tern) and little tern foraging tends to be coastal so has no breeding season connectivity. Proportions of this populations migrating through the East Anglia THREE site are likely to be small as the species is thought to remain close to shore during much of its migration through UK waters.
Hamford Water SPA and Ramsar	Wintering and passage waterbirds	Out	141	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Hermaness, Saxa Vord and Valla Field SPA	Breeding seabirds	Out	937	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Hornsea Mere SPA	Wintering and passage waterbirds	Out	246	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Hoy SPA	Breeding seabirds	Out	791	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Humber Estuary SPA and Ramsar	Wintering and passage waterbirds	Out	226	Survey data show little or no evidence of SPA features occurring in the East Anglia THREE site and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
Imperial Dock Lock, Leith SPA	Breeding seabirds	Out	538	SPA is far beyond maximum foraging range of designated seabird species (common tern) so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Inner Moray Firth SPA	Wintering and passage waterbirds	Out	705	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.

SPA or Ramsar site	Category of interest feature	Screening decision	Distance (km)*	Reason for screening decision – further consideration provided in this document where appropriate
Lindisfarne SPA and Ramsar	Wintering and passage waterbirds	Out	453	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Littoral Seino-Marin SPA	Breeding seabirds	Out	350	The East Anglia THREE site is within the theoretical maximum foraging range of breeding gannets from this SPA, but tracking data show that breeding gannets from the SPA do not reach the East Anglia THREE site. The SPA is far beyond maximum foraging range of other designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are likely to be extremely small relative to BDMPS.
Loch of Strathbeg SPA	Wintering and passage waterbirds	Out	629	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Marwick Head SPA	Breeding seabirds	Out	815	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Medway Estuary & Marshes SPA and Ramsar	Wintering and passage waterbirds	Out	206	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Minsmere - Walberswick SPA and Ramsar	Breeding, wintering and passage waterbirds	Out	94	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Montrose Basin SPA	Wintering and passage waterbirds	Out	568	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.

SPA or Ramsar site	Category of interest feature	Screening decision	Distance (km)*	Reason for screening decision – further consideration provided in this document where appropriate
Moray and Nairn Coast SPA	Wintering and passage waterbirds	Out	690	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Mousa SPA	Breeding seabirds	Out	853	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
North Caithness Cliffs SPA	Breeding seabirds	Out	771	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
North Norfolk Coast SPA and Ramsar	Wintering and passage waterbirds	Out	142	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Northumbria Coast SPA and Ramsar	Wintering and passage waterbirds	Out	414	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Noss SPA	Breeding seabirds	Out	866	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Östliche Deutsche Bucht SPA	Non-breeding seabirds	Out	398	Migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration relative to the size of BDMPS regional populations.
Outer Thames Estuary SPA	**Wintering marine birds**	**In**	**123 [0.0]**	**Boat activity for sub-sea cable-laying work through part of the SPA could cause temporary displacement of a small number of red-throated divers within part of this SPA.**
Papa Stour SPA	Breeding seabirds	Out	899	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.

SPA or Ramsar site	Category of interest feature	Screening decision	Distance (km)*	Reason for screening decision – further consideration provided in this document where appropriate
Papa Westray (North Hill and Holm) SPA	Breeding seabirds	Out	827	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Pentland Firth Islands SPA	Breeding seabirds	Out	768	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Portsmouth Harbour SPA	Migratory waterbirds	Out	343	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Ramsar-Gebiet S-H Wattenmeer und angrenzende Küstengebiete SPA	Breeding, wintering and passage waterbirds	Out	425	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Ronas Hill - North Roe and Tingon SPA	Breeding seabirds	Out	916	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Rousay SPA	Breeding seabirds	Out	814	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Seevogelschutzgebiet Helgoland SPA	Breeding seabirds	Out	425	Tracking data from gannets breeding on Helgoland show these birds do not travel in the direction of or as far as the East Anglia THREE site despite this site being within theoretical maximum foraging range of gannet. The East Anglia THREE site is beyond the maximum foraging range of other seabird species at Helgoland. Proportions of these populations migrating through the East Anglia THREE site are likely to be very small relative to BDMPS regional populations.
Solent & Southampton Water SPA	Migratory waterbirds	Out	359	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.

SPA or Ramsar site	Category of interest feature	Screening decision	Distance (km)*	Reason for screening decision – further consideration provided in this document where appropriate
St Abbbs Head to Fast Castle SPA	Breeding seabirds	Out	489	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Stour & Orwell Estuaries SPA and Ramsar	Wintering and passage waterbirds	Out	134	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Sumburgh Head SPA	Breeding seabirds	Out	840	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Sylter Auβenriff SPA	Non-breeding seabirds	Out	381	Migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration relative to the size of BDMPS regional populations.
Teesmouth and Cleveland Coast SPA and Ramsar	Wintering and passage waterbirds	Out	345	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Thames Estuary and Marshes SPA and Ramsar	Wintering and passage waterbirds	Out	204	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Thanet Coast and Sandwich Bay SPA and Ramsar	Wintering and passage waterbirds	Out	181	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
The Swale SPA	Wintering and passage waterbirds	Out	199	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
The Wash SPA and Ramsar	Wintering and passage waterbirds	Out	176	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE site and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.

SPA or Ramsar site	Category of interest feature	Screening decision	Distance (km)*	Reason for screening decision – further consideration provided in this document where appropriate
Troup, Pennan and Lion`s Heads SPA	Breeding seabirds	Out	647	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Voordelta SPA	Wintering and passage waterbirds	Out	117	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
Waddenzee (Wadden Sea) SPA	Wintering and passage waterbirds	Out	192	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.
West Westray SPA	Breeding seabirds	Out	825	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through the East Anglia THREE site are small relative to BDMPS.
Ythan Estuary, Sands of Forvie and Meikle Loch SPA	Wintering and passage waterbirds	Out	605	Survey data show little or no evidence of SPA features occurring in the proposed East Anglia THREE project and migrations of birds from this SPA are likely to result in negligible numbers passing through the East Anglia THREE site during migration.

*Distance measured from the closest point of the East Anglia THREE site (i.e. the windfarm site) to the closest point of the SPA site rounded to the nearest kilometre except for those additional values in parentheses – [ ] – that are from the closest point of any of the proposed project (including onshore and sub-sea cable) to the closest point of the SPA and rounded to one decimal place.

2.2.1 Migratory birds and trans-boundary considerations

5. Many SPA sites within the UK and in neighbouring Member States can be screened out of HRA as there is no connectivity between the SPA site and the proposed project area in terms of populations of birds that are features of the SPAs. Therefore, LSE can be ruled out. This applies to most SPAs that are distant from the proposed project. However, some bird species are highly mobile and may interact with projects because they range over considerable distances. This applies especially to seabirds.

6. Migratory birds may move into areas where there are projects and so may interact during their migration. From an initial consideration of all SPAs in the UK and in neighbouring Member States that were listed in APEM and Royal HaskoningDHV

(2014), we have scoped out those for which connectivity with the proposed East Anglia THREE project can be ruled out or assessed as negligible. This applies to most of the SPAs in those territories, including all SPAs in Member States on the European mainland designated for coastal birds / waterbirds / seabirds (Table 2.1).

7. Birds of some species that are SPA features, such as shorebirds, may migrate from the mainland of Europe to eastern England (for example from SPAs in Netherlands to the Wash or Thames estuaries) so these birds need to be considered. Migrating shorebirds and other coastal birds tend to fly high when weather conditions are favourable for migration, and normally set off on a migratory flight under such weather conditions, and so are rarely recorded to be collision victims at offshore windfarms, where passerines are the group most at risk of collision (Hüppop et al. 2006). Indeed, Hüppop et al. (2006) reported that only six out of 442 collision carcasses in their study were non-passerine birds. Assessments of collision risk of migrating coastal birds at offshore windfarms in UK waters also indicate that risk is low and for most species does not represent a hazard that would require HRA assessment (Wright et al. 2012; WWT 2013).

8. The Netherlands Ministry of Infrastructure and the Environment stated in a letter of 7 July 2014 that they had a concern that the proposed project could have an effect on the seabirds of Bruine Bank pSPA. The non-breeding seabirds that are the interest feature of the Bruine Bank (Brown Ridge) pSPA are primarily auks. An assessment of potential impacts on auks has been conducted as part of the East Anglia THREE EIA (MacArthur Green 2015, sections 13.7.1.1 and 13.7.2.1, Appendix 2) in relation to construction and operational disturbance and displacement. In all cases impacts were found to be minor or negligible (based on BDMPS populations in UK North Sea waters, Furness 2015). Assessment of impacts over the whole North Sea (i.e. including non UK waters) would greatly increase the estimated seabird population sizes and only slightly increase cumulative impacts (because most offshore windfarms are in UK waters). Accordingly a likely significant effect on the Bruine Bank (Brown Ridge) pSPA can be screened out.

9. The Netherlands Ministry of Infrastructure and the Environment also stated in their letter of 7 July 2014 'on-shore bird colonies in the Netherlands are all situated more than 100km from the Dutch-UK border, so no effects are to be expected there'. We agree with that interpretation (with one exception discussed below), particularly since the seabirds that breed in the Netherlands are predominantly species with coastal and relatively short foraging ranges, such as terns, cormorants and gulls, and there is no evidence that breeding birds from those populations cross into the UK while they are breeding. However, lesser black-backed gulls breed in large numbers

in The Netherlands. Between 32,000 and 57,000 pairs were estimated to breed in The Netherlands in 1992-97 (Mitchell et al. 2004) and the numbers subsequently increased to a peak of over 90,000 pairs in 2005 (Camphuysen 2013). With a maximum foraging range of 181km from breeding colonies (Thaxter et al. 2012a), there is theoretical potential for connectivity between some colonies in The Netherlands and the proposed East Anglia THREE project. However, extensive colour ringing and tracking of breeding lesser black-backed gulls from multiple colonies in The Netherlands has found no evidence for connectivity during the breeding season between birds breeding in those colonies and the UK, and also that there is remarkably little migration of birds from the colonies in The Netherlands through UK waters outside the breeding season (Camphuysen 2013). Not only do breeding adult lesser black-backed gulls from colonies in The Netherlands normally remain on the continental side of the North Sea while breeding, but 95% of foraging trips were less than 135km from those colonies in studies in the 1990s and 2000s (Camphuysen 1995, 2013), while tracking in recent years showed that 95% of foraging trips were within 60.5km of the colony (Camphuysen et al. 2015), so could not reach the East Anglia THREE site. These studies therefore rule out any transboundary impacts of the proposed East Anglia THREE project on any of these breeding lesser black-backed gull populations.

10. Similarly, impacts on seabird breeding populations in Germany, Belgium and France can be screened out due to the distance of colonies in those countries from the proposed project (Table 2.1), which, with two exceptions, exceeds maximum foraging ranges of breeding seabirds (Thaxter et al. 2012a).

11. There are breeding gannets at colonies where the East Anglia THREE site lies within the reported maximum foraging range of breeding gannets (590km, Thaxter et al. 2012a). These colonies are at Seevogelschutzgebiet Helgoland SPA (Germany) and Littoral Seino-Marin SPA (France). However, tracking studies of breeding adults at each of these colonies show that birds from those colonies do not travel into the East Anglia THREE site but forage relatively close to their breeding colonies (Stefan Garthe, pers. comm., Wakefield et al. 2013, Amelineau et al. 2014).

12. Therefore, **no trans-boundary issues are screened in to this assessment**.

2.2.2 Examples set by East Anglia ONE

13. Ornithological interests of the proposed East Anglia THREE project are closely similar to those of the preceding and consented East Anglia ONE Project (APEM 2012), and therefore it is likely that HRA concerns around the proposed East Anglia THREE project will be very similar to those raised during the Scoping and Assessment of East Anglia ONE.

14. The initial East Anglia ONE screening listed a large number of SPA populations to be considered, but these were reduced following agreement with Natural England (EAOL 2013).

15. The HRA assessment for East Anglia ONE considered that there was potential for sufficient connectivity between that proposed project and the SPA features listed in Table 2.2 to require an assessment of interactions with sites and species. Based on a robust assessment in line with duties under Regulation 25, with regard to East Anglia ONE offshore windfarm, LSE was ruled out by the Secretary of State (SoS) for most of the SPA features assessed (Table 2.2, DECC 2014).

Table 2.2. SPAs and features initially screened in for East Anglia ONE assessment and decisions on LSE.

SPA	Feature	LSE features ruled out by SoS
Benfleet & Southend Marshes SPA	Brent goose	All
Blackwater Estuary SPA	Brent goose	All
Chesil Beach & The Fleet SPA	Brent goose	All
Chichester & Langstone Harbour SPA	Brent goose	All
Colne Estuary SPA	Brent goose	All
Crouch & Roach Estuary SPA	Brent goose	All
Exe Estuary SPA	Brent goose	All
Foulness SPA	Brent goose	All
Hamford Water SPA	Brent goose	All
Lough Foyle SPA	Brent goose	All
Medway Estuary & Marshes SPA	Brent goose	All
North Norfolk Coast SPA	Brent goose	All
Portsmouth Harbour SPA	Brent goose	All
Solent & Southampton Water SPA	Brent goose	All
Stour & Orwell SPA	Brent goose	All
The Swale SPA	Brent goose	All
The Wash SPA	Brent goose	All
Deben Estuary SPA	Brent goose and avocet	Avocet
Outer Thames Estuary SPA	Red-throated diver	All
Firth of Forth Islands SPA	Gannet	All

SPA	Feature	LSE features ruled out by SoS
Hermaness Saxa Vord and Valla Field SPA	Gannet and great skua	All
Noss SPA	Gannet and great skua	All
Fair Isle SPA	Gannet and great skua	All
Fetlar SPA	Great skua	All
Foula SPA	Great skua	All
Hoy SPA	Great skua	All
Flamborough Head and Bempton Cliffs SPA	**Kittiwake**	**None**
Flamborough and Filey Coast pSPA	**Kittiwake, gannet, herring gull, common guillemot, razorbill**	**Herring gull, common guillemot, razorbill**
Alde-Ore Estuary SPA	**Lesser black-backed gull**	**None**

16. Therefore, following advice from the Planning Inspectorate (Planning Inspectorate 2013), the SoS concluded that for East Anglia ONE offshore windfarm, LSE could not be ruled out for:

- Lesser black-backed gull, at Alde-Ore Estuary SPA and Ramsar Site due to cumulative collision impacts,
- Gannet and kittiwake at Flamborough and Filey Coast pSPA and at Flamborough Head and Bempton Cliffs SPA due to cumulative collision impacts.

17. Since cumulative collision impacts were the main issue requiring Appropriate Assessment for these populations in relation to the East Anglia ONE planning application, we give particular consideration to the cumulative collision impacts relating to these same species in the context of the proposed East Anglia THREE project.

18. Species considered by the East Anglia ONE project were:

- Dark-bellied brent goose,

- Avocet,
- Red-throated diver,
- Gannet,
- Great skua,
- Kittiwake,
- Herring gull,
- Lesser black-backed gull,
- Common guillemot, and
- Razorbill.

19. Since the range of birds recorded in the East Anglia THREE site is similar to that recorded in East Anglia ONE site (and the sites are roughly comparable in area at 305km^2 and 300km^2 for East Anglia THREE and East Anglia ONE respectively), we consider the same bird species here. These species are considered in turn in relation to the East Anglia THREE site in the following sections of this report. Part of the assessment considers estimated foraging ranges (Table 2.3) for each species and how these relate to distances to SPA colonies.

Table 2.3. Summary of the distances of key SPA breeding populations of seabirds from the East Anglia THREE site and the foraging ranges of those species from colonies as summarised by Thaxter et al. (2012a). Shading (green) indicates those species whose foraging range(s) do not overlap with the East Anglia THREE site and for which connnectivity during the breeing period is therefore likely to be negligible.

SPA name	Minimum distance to site (km)	Breeding feature	Maximum range (km)	Mean maximum range (km)	Mean range (km)
Alde-Ore Estuary	105	Lesser black-backed gull	181	141	72
		Herring gull	92	61	11
Flamborough & Filey Coast	250	Gannet	590	229	93
		Kittiwake	120	60	25
		Common guillemot	135	84	38
		Razorbill	95	49	24
		Puffin	200	105	4

20. Each section includes a summary of the species account as presented in the East Anglia ONE HRA, the final conclusions from the Planning Inspectorate examination, and discussion of the implications for the proposed East Anglia THREE project HRA.

2.2.3 Dark-bellied brent goose

21. Natural England agreed with the Applicant that impacts of the East Anglia ONE project on all of the SPAs for dark-bellied brent goose listed in Table 2.2 except Deben Estuary SPA could be ruled out. This was also the view of the Secretary of State (DECC 2014).

22. Since the proposed East Anglia THREE project involves much more limited onshore activity, making use of infrastructure previously developed and constructed as part of the East Anglia ONE project, it is logical that impacts of the proposed East Anglia THREE project on SPAs other than the Deben Estuary can also be ruled out. Therefore, all except Deben Estuary SPA are screened out of further consideration for the proposed East Anglia THREE project.

23. **It is proposed that the Deben Estuary SPA dark-bellied brent goose population is screened in for HRA since that component of East Anglia THREE construction work are adjacent to the boundary of the Deben Estuary SPA and have the potential to cause disturbance to brent geese that are qualifying features of the Deben Estuary SPA.**

2.2.4 Avocet

24. Natural England concluded that the East Anglia ONE project would have no adverse effect on the avocet population of Deben Estuary SPA because those birds remain on the mud flats of the SPA and would not be at risk of disturbance by activities onshore behind the sea wall (Calbrade and Mason 2012).

25. Since this applies also for the proposed East Anglia THREE project, and the level of activity onshore in the proposed East Anglia THREE project is considerably less than for the East Anglia ONE project, **it is proposed that the avocet feature of Deben Estuary SPA is scoped out of HRA for the proposed East Anglia THREE project**.

2.2.5 Gannet and great skua

26. The East Anglia ONE HRA considered possible collision impacts on gannets and great skuas from SPA populations in Scotland. Natural England agreed with the Applicant that impacts of the East Anglia ONE project on all of the SPAs for gannets and great skuas in Scotland could be assessed as negligible, as the East Anglia ONE site lies far beyond the foraging range of breeding birds from those SPA populations, and

numbers of gannets and great skuas observed in the East Anglia ONE site did not suggest that a significant effect could occur on these populations during their migrations. It is therefore relevant to compare numbers of gannets and great skuas recorded in the East Anglia THREE site compared to numbers previously recorded in the East Anglia ONE site. Numbers of gannets and great skuas recorded in the East Anglia ONE site and East Anglia THREE site are compared in Table 2.4.

Table 2.4. Mean numbers of gannets and great skuas in the windfarm site each season (seasons as defined in East Anglia ONE EIA for ease of comparison). Data for the summer season, which is the period when apportioning to SPA populations might be most appropriate, are shown in bold, indicating the close similarity between East Anglia ONE and East Anglia THREE for these two species at that time of year, with very small numbers of birds present.

Species	Winter		Spring		Summer		Autumn	
	East Anglia ONE	East Anglia THREE	East Anglia ONE	East Anglia THREE	East Anglia ONE	East Anglia THREE	East Anglia ONE	East Anglia THREE
Gannet	27	76	17	36	**10**	**10**	688	224
Great skua	0	0	0	0	**0**	**0**	5	20

27. Since numbers of gannets and great skuas recorded in the East Anglia THREE site are fairly similar to numbers previously reported in the East Anglia ONE site, the same conclusion will apply for the the proposed East Anglia THREE project with regard to HRA Scoping.

28. Even in autumn, when mean numbers recorded within the East Anglia THREE site peaked at 224 gannets and 20 great skuas, these totals are extremely small in the context of the SPA population sizes of these species in Scotland. Latest counts at gannet colonies (Murray et al. 2015) indicate a breeding population of about 240,000 gannets at Scottish North Sea colonies with an associated population of about 190,000 immature birds, so a total population of about 430,000 birds. The mean of 224 gannets in autumn within the East Anglia THREE site represents about 0.05% of this population.

29. Latest counts at great skua colonies (JNCC Seabird Colony Register database) indicate a breeding population of about 8,000 great skuas at Scottish North Sea colonies with an associated population of about 10,000 immature birds, so a total population of about 18,000 birds. The mean of 20 great skuas in autumn within the East Anglia THREE site represents about 0.1% of this population.

30. Therefore, the following can be screened out of HRA for the proposed East Anglia THREE project:

- Firth of Forth Islands SPA (gannet),
- Hermaness Saxa Vord and Valla Field SPA (gannet and great skua),
- Noss SPA (gannet and great skua),
- Fair Isle SPA (gannet and great skua),
- Fetlar SPA (great skua),
- Foula SPA (great skua), and
- Hoy SPA (great skua).

31. Impacts on these populations are more appropriately assessed in relation to seasonal BDMPS populations (Furness 2015), since gannets migrating through the East Anglia THREE site in autumn and spring and overwintering in the area are likely to originate from many different colonies in east Scotland, Orkney, Shetland, Faroe Islands, Iceland and Norway, so any impact would be apportioned over the large numbers in those SPAs and non-SPA populations.

32. The precautionary Collision Risk Model (CRM) (Band 2000, 2012) indicates few gannet collisions during the entire year predicted for the proposed East Anglia THREE site: 17 using Band Option 1 and 80 using Band Option 2 (Band 2012) with avoidance rate 0.989, with two-thirds of these during post-breeding migration (MacArthur Green 2015). Apportioning those to individual SPA populations, non-SPA UK populations and overseas populations would reduce the numbers apportioned to individual SPA populations to levels that would add a negligible increase to annual mortality of gannets.

33. On the basis of the higher annual estimate of 80, even if as many as 50% of these were apportioned to Flamborough and Filey Coast pSPA (which is an unrealistically high proportion), and those 40 birds were considered to all be adults, 40 adults from the 11,061 pairs of gannets at that colony would represent an additional 0.18% mortality. Since natural mortality is 8% for adults (WWT 2012), an additional 0.18% mortality relative to a baseline mortality of 8 - 58% per annum represents a negligible increase to natural mortality even in this highly precautionary scenario.

34. When considering breeding season impacts, the closest gannet SPA colony (Flamborough and Filey Coast pSPA) is >250km away. Therefore, this is likely to be

the only gannet colony with the potential for breeding season connectivity to the East Anglia THREE site (on the basis of estimates of breeding season foraging range of gannets (maximum 590km, mean maximum 229km, Thaxter et al. 2012a) and tracking studies (RSPB 2012; Wakefield et al. 2013), and it is an SPA where cumulative impacts should be considered due to the proximity of several consented or constructed offshore windfarms.

35. **Therefore, gannet from Flamborough and Filey Coast pSPA is screened in for HRA on the basis of potential for in-combination impacts.**

36. Similarly, great skuas migrating through the East Anglia THREE site in autumn are likely to originate from many different colonies in Orkney and Shetland, from Faroe Islands, Iceland and Norway. Impacts would therefore be more appropriately assessed in the context of the relevant BDMPS population.

37. The East Anglia ONE HRA concluded no LSE for great skuas. **Therefore based on the similar numbers in East Anglia THREE assessment, it is proposed great skua is screened out for HRA for the proposed East Anglia THREE project alone and in-combination.**

2.2.6 Red-throated diver

38. Mean numbers of red-throated divers in the East Anglia THREE site are consistently lower than the numbers in the East Anglia ONE site, which is most likely due to a tendency for red-throated diver at-sea density to decline with increasing distance further offshore in the region off the East Anglia coast (Webb et al. 2009; O'Brien et al. 2012). Numbers counted show a similar seasonal pattern in the East Anglia ONE site and East Anglia THREE site, with highest numbers in spring and lowest numbers in summer (Table 2.5). In all cases many fewer were recorded within the East Anglia THREE site than within the East Anglia ONE site.

Table 2.5. Mean numbers of red-throated divers in the East Anglia ONE and East Anglia THREE sites each season. For this comparison, seasons are as defined in the East Anglia ONE EIA to allow comparability between Project data sets.

Species	Winter		Spring		Summer		Autumn	
	East Anglia ONE	East Anglia THREE	East Anglia ONE	East Anglia THREE	East Anglia ONE	East Anglia THREE	East Anglia ONE	East Anglia THREE
Red-throated diver	45	14	119	42	**0**	**0**	74	16

39. Since diver numbers are smaller in the East Anglia THREE site than in the East Anglia ONE site, displacement by the proposed East Anglia THREE project will be less than displacement by the East Anglia ONE project. Displacement of birds from the East Anglia ONE and East Anglia THREE sites could possibly result in a marginal (and probably undetectable) increase in numbers within the Outer Thames Estuary SPA.

40. Nevertheless, the principal consideration in relation to HRA will be whether displacement of red-throated divers may result from sub-sea cable laying activities within the Outer Thames Estuary SPA.

41. Red-throated diver has been identified as being particularly sensitive to human activities in marine areas, including through the disturbance effects of ship and helicopter traffic (Garthe and Hüppop 2004; Schwemmer et al. 2011; Furness et al. 2013; Bradbury et al. 2014).

42. There is potential for disturbance and displacement of non-breeding red-throated divers resulting from the presence of a vessel installing the offshore cable through the Outer Thames Estuary SPA. **Therefore, red-throated diver at Outer Thames Estuary SPA is screened in for HRA.**

2.2.7 Gulls

43. Mean numbers of kittiwakes, lesser black-backed gulls and herring gulls in the East Anglia THREE site are broadly similar to numbers reported in the East Anglia ONE site during the same season, and the seasonal patterns for these species are also similar between the two sites (Table 2.6). All three species were present in the East Anglia THREE site throughout the year, but numbers of kittiwakes were lowest in summer and highest in winter, numbers of lesser black-backed gulls were lowest in spring and highest in autumn, and numbers of herring gulls were low in spring and autumn and highest in winter.

Table 2.6. Mean numbers of kittiwakes, lesser black-backed gulls, and herring gulls. For this comparison, seasons are as defined in the East Anglia ONE EIA to allow comparability between project data sets.

Species	Winter		Spring		Summer		Autumn	
	East Anglia ONE	East Anglia THREE	East Anglia ONE	East Anglia THREE	East Anglia ONE	East Anglia THREE	East Anglia ONE	East Anglia THREE
Kittiwake	424	1045	110	123	47	60	397	133
Lesser black-backed gull	126	23	8	12	59	18	113	69
Herring gull	53	267	49	32	4	82	63	25

2.2.7.1 Kittiwake

44. The SoS was unable to conclude for the East Anglia ONE project that there would be no LSE for cumulative impact of collision mortality on Flamborough and Filey Coast pSPA kittiwake population (DECC 2014). However, since that assessment, SNCBs have reviewed the appropriate avoidance rate for kittiwake in CRM and have raised that value from 0.98 to 0.989, which approximately halves the estimated numbers likely to be killed by collisions, bringing the cumulative numbers in autumn migration season well below the Potential Biological Removal (PBR) threshold (MacArthur Green 2015).

45. Kittiwake numbers in the East Anglia THREE site in the breeding season are relatively low (mean count of 60 birds), but impacts on the population of Flamborough and Filey Coast pSPA (and its predecessor Flamborough Head and Bempton Cliffs SPA) could possibly be screened in for HRA because it is the closest large colony of kittiwakes despite this colony being well outside the maximum foraging range of breeding kittiwakes. Tracking data from Flamborough suggest that breeding birds from that colony may travel unusually long distances, although probably not as far as the 250km between Flamborough and Filey Coast pSPA and the East Anglia THREE site (RSPB FAME and STAR projects, unpublished data; see also Table 2.3).

46. **Therefore, kittiwake at Flamborough and Filey Coast pSPA is screened in for HRA on the basis of potential for in-combination impacts.**

47. Other kittiwake SPA populations are **screened out** as being far too distant to have significant connectivity with the East Anglia THREE site during the breeding season (the next nearest SPAs with kittiwake as a breeding feature being Farne Islands SPA, St Abbs Head to Fast Castle SPA, and Forth Islands SPA, which are between 400km and 500km from the East Anglia THREE site, so considerably beyond the maximum foraging range of this species during the breeding season (which is 120km, Thaxter et al. 2012a). Due to the high mobility of kittiwakes during the migration seasons when birds from many populations are thoroughly mixed at sea, cumulative/in combination assessments for SPA populations in Scotland or north-east England would apportion mortality pro rata in relation to population sizes, such that estimated individual population-level impacts would be equivalent to that assessed for the BDMPS population. Numbers during migration and winter are therefore more appropriately considered in relation to BDMPS populations since at those times of year kittiwakes in the East Anglia THREE site are likely to originate from many different populations, including from overseas populations.

2.2.7.2 Lesser black-backed gull

48. Lesser black-backed gull numbers on the East Anglia THREE site in the breeding season are relatively low (mean count of 18 birds).

49. The East Anglia THREE site is approximately 105-130km from the Alde-Ore Estuary SPA where lesser black-backed gull is a breeding feature. This is within the maximum foraging range of breeding lesser black-backed gulls (181km, Thaxter et al. 2012a; see also Table 2.3), and tracking studies indicate some connectivity between this SPA population and the East Anglia THREE site, although connectivity varies seasonally and between years (Thaxter et al. 2012b; Thaxter et al. 2015).

50. **It is proposed that the lesser black-backed gull population of the Alde-Ore Estuary SPA is <u>screened in</u> for HRA, including in terms of cumulative/in combination impacts.**

51. A population viability analysis (PVA) has been carried out on this SPA population and is available to inform impact assessment (Trinder 2012).

52. The Alde-Ore Estuary is the only SPA in the UK with breeding lesser black-backed gulls as a feature that is located within the maximum recorded foraging range for the species so all other UK lesser black-backed gull populations are <u>screened out</u> of HRA. Colonies in The Netherlands have already been screened out (see paragraph 8) because although some are within 181km, tracking and colour ringing studies show that breeding adults from those colonies do not forage in UK waters during the breeding season, and very few of those birds migrate through UK waters during the nonbreeding season.

2.2.7.3 Herring gull

53. Herring gull numbers in the breeding season are moderate (mean count of 82 birds). The East Anglia THREE site is greater than 105km from the Alde-Ore Estuary SPA where herring gull is a feature as a named member of the breeding seabird assemblage. Since this is the closest large colony of herring gulls to the East Anglia THREE site this SPA population could possibly be considered for HRA, despite being slightly further away than the longest recorded foraging range of herring gulls from breeding sites. This is the only SPA with breeding herring gulls as a feature that is located close to the maximum recorded foraging range for the species (92km, Thaxter et al. 2012a; see also Table 2.3) so all other herring gull populations are screened out of HRA.

54. **On the basis that:**

- Numbers in the East Anglia THREE site are relatively low except in winter when migrants arrive from northern populations (Furness 2015),

- The East Anglia THREE site is at least 13km beyond the maximum foraging range of breeding herring gulls from the Alde-Ore Estuary SPA (based on Thaxter et al. 2012a) so can be considered not to have any connectivity,
- Birds at the East Anglia THREE site in summer may be from numerous non-SPA colonies elsewhere in East Anglia (particularly including urban 'roof-top nesting' gulls whose numbers increased as numbers at the Alde-Ore declined (Mitchell et al. 2004; Brown & Grice 2005) and are now numerous in Great Yarmouth, Lowestoft, Felixstowe, Ipswich, Mendlesham, Bungay, Aldeby and Beccles) rather than from the Alde-Ore Estuary SPA,
- Many of the birds within the East Anglia THREE site in summer may be nonbreeding birds from many different populations, including populations from north Norway and Russia (Furness 2015),
- Precautionary CRM results indicate no herring gull collisions during the breeding season (Band Option 2 with avoidance rate 0.995 indicates no collisions in March - October, with collisions predicted only during November - February when the birds present include large numbers wintering in the area from colonies in north Norway and Russia),
- Cumulative / in-combination assessment of collision risk for herring gulls in the regional BDMPS population concluded that the cumulative impact on herring gulls in the nonbreeding season is of low magnitude (MacArthur Green 2015). Apportioning this to individual SPA populations would be difficult due to the mobility of herring gulls in the nonbreeding season, but would imply an impact of low magnitude on all individual SPA populations that are components of the regional BDMPS population,
- The SoS concluded there was no LSE for herring gull at Alde-Ore Estuary SPA due to the East Anglia ONE project (DECC 2014), and since that assessment the SNCBs have advised an increase in the appropriate avoidance rate for herring gull from 0.98 to 0.995, which reduces the estimated numbers of collisions by a factor of four.

55. **It is proposed that the herring gull feature of the Alde-Ore Estuary SPA is <u>screened out</u> of the HRA.**

2.2.8 Auks

56. Mean numbers of common guillemots, razorbills and puffins in the East Anglia THREE site during summer were considerably higher than the numbers that had been

recorded in the East Anglia ONE site, and this was also true in spring, autumn and winter (Table 2.7).

Table 2.7. Mean numbers of common guillemots, razorbills, and puffins in the East Anglia ONE and East Anglia THREE sites each season (corrected means, allowing for birds underwater when photographs were taken). For this comparison, seasons are as defined in the East Anglia ONE EIA to allow comparability between project data sets.

Species	Winter		Spring		Summer		Autumn	
	East Anglia ONE	East Anglia THREE	East Anglia ONE	East Anglia THREE	East Anglia ONE	East Anglia THREE	East Anglia ONE	East Anglia THREE
Common guillemot	687	875	461	775	18	91	24	343
Razorbill	150	798	145	664	9	356	15	297
Puffin	17	80	4	6	0	32	4	38

57. It is unclear at this stage whether this is due to natural year-to-year variation, or to differences in habitat quality for auks between the East Anglia ONE and East Anglia THREE sites. The relatively high numbers in the East Anglia THREE site in summer are difficult to attribute to breeding colonies since the nearest SPA populations of auks (and the only large populations of auks in the region) are at Flamborough and Filey Coast pSPA which is >250km distant. This is the closest colony of auks to the East Anglia THREE site, and other large colonies are much further away.

58. **On the basis that:**

- Maximum foraging ranges of these three auk species are all considerably less than the distance between the East Anglia THREE site and Flamborough and Filey Coast pSPA, so that the foraging range data (Table 2.3) appear to exclude the possibility that the birds observed in the East Anglia THREE site in summer are birds that are breeding at Flamborough and Filey Coast pSPA,
- Since the windfarm site is beyond the maximum foraging range of these species, the birds in the East Anglia THREE site in summer are more likely to be nonbreeding (possibly mainly immature) birds from a variety of populations from east England to Norway (Furness 2015),
- There is evidence that many younger immature birds remain in their winter quarters through their first summer (Furness 2015), and many immature birds from northern populations are known to winter in the southern North Sea, so these birds are likely to be predominantly immatures from northern

populations rather than adults from the Flamborough and Filey Coast pSPA. It would, therefore, be more appropriate to assess auk displacement impacts through the EIA process considering appropriate BDMPS,

- Screening out would be consistent with the conclusion for the East Anglia ONE project that LSE on auks could be ruled out (DECC 2014).

59. **It is proposed that common guillemot, razorbill and puffin are screened out of the HRA at all SPAs.**

2.3 Conclusions

60. Decisions about screening in or out SPA bird populations are summarised in Table 2.8.

Table 2.8. Decisions on screening in or out SPA bird populations for HRA for East Anglia THREE

SPA	Feature	East Anglia ONE	East Anglia THREE	Reason for change from East Anglia ONE, if any
Deben Estuary	Dark-bellied brent goose	In	In	Consistent (but no LSE concluded for East Anglia ONE following mitigation plan; Planning Inspectorate 2013)
Deben Estuary	Avocet	Out	Out	Consistent
Outer Thames Estuary	Red-throated diver	Out	In	It is considered appropriate to assess whether LSE may occur as a result of displacement due to cable laying.
Alde-Ore Estuary	Lesser black-backed gull	In	In	Consistent (though SNCB advice on increased avoidance rate (JNCC et al. 2014) reduces impact compared with previous decision)
Alde-Ore Estuary	Herring gull	Out	Out	Consistent (though SNCB advice on increased avoidance rate (JNCC et al. 2014) reduces impact compared with previous decision)
Scottish SPAs	Great skua	Out	Out	Consistent
Scottish SPAs	Gannet	Out	Out	Consistent
Flamborough & Filey Coast	Gannet	In	In	Consistent (though SNCB advice on increased avoidance rate (JNCC et al. 2014) reduces impact compared with previous decision)

SPA	Feature	East Anglia ONE	East Anglia THREE	Reason for change from East Anglia ONE, if any
Flamborough & Filey Coast	Kittiwake	**In**	**In**	Consistent, but SNCB advice to increase avoidance rate (JNCC et al. 2014) reduces impact
Flamborough & Filey Coast	Common guillemot, razorbill and puffin	Out	Out	Consistent

61. In summary, this leaves four SPAs and five features requiring HRA for the proposed East Anglia THREE project on the basis of potential impacts either alone or in-combination with other plans or projects (Table 2.9):

Table 2.9. SPAs and features for which HRA will be required in relation to potential impacts from the proposed East Anglia THREE project alone or in-combination with other plans or projects.

SPA	Feature	Potential impact
Deben Estuary	Dark-bellied brent goose	Construction disturbance (project alone and in-combination)
Outer Thames estuary	Red-throated diver	Construction disturbance: displacement caused by cable laying (project alone and in-combination)
Alde-Ore Estuary	Lesser black-backed gull	In-combination collision risk
Flamborough & Filey Coast	Gannet	In-combination collision risk
Flamborough & Filey Coast	Kittiwake	In-combination collision risk

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4 APPENDIX 1

HRA Screening - Report on Ornithology (Final Screening) - Postscript

62. Shortly after completion of this report, we were informed by Natural England that they are working to identify a possible extension to the Outer Thames SPA designation to include both little tern and common tern. Work is also being undertaken to identify a possible site in the Greater Wash to include little tern, common tern, Sandwich tern, common scoter, red throated diver and little gull. We assume that the terns will be added as breeding features of these SPAs and that common scoter, red-throated diver and little gull will be added as nonbreeding features (those details not being provided in the email of 15 May from Natural England).

63. It has been assumed at this stage that the East Anglia THREE site does not overlap with either SPA, although the cable route will cross the Outer Thames Estuary SPA.

64. Maximum foraging ranges of breeding terns from their colonies are short (maximum range 54km for Sandwich tern, 30km for common tern, 11km for little tern; Thaxter et al. 2012a) and so none would have connectivity with the East Anglia THREE site. Furthermore, foraging by these tern species tends to follow coastlines and be in shallow water, so the East Anglia THREE site is not optimal habitat for tern foraging. Terns (identified as either common or Arctic) were recorded in the East Anglia THREE site in only four of the 24 surveys, all during migration periods, so we conclude no LSE for these proposed additional breeding features (terns) of the Outer Thames Estuary SPA and Greater Wash SPA.

65. Common scoter was not recorded in the East Anglia THREE site so we conclude no LSE for that feature.

66. Red-throated diver was present in small numbers in the East Anglia THREE site during the nonbreeding season, especially in spring. Due to the high sensitivity of this species to disturbance the red-throated diver feature of the Outer Thames Estuary SPA was screened in for assessment in relation to cable laying activities within the SPA boundary. However, due to the relatively small numbers and low population density present in East Anglia THREE site and no obvious connectivity with the proposed Greater Wash SPA, no LSE is predicted in relation to the Greater Wash SPA.

67. Little gull is a species about which very little is known. The main breeding population is in central Asia, but extends to western Europe where it has been increasing in numbers in recent decades. BirdLife International (2004) suggest that about 24,000

to 58,000 pairs breed in Europe and that this represents 25 to 49% of the global population, which implies a global population of 49,000 to 232,000 pairs.

68. Considerably increasing numbers pass through UK waters on migration, perhaps reflecting a more westerly migration route developing in this species as well as increasing breeding numbers particularly in Finland (del Hoyo et al. 1996; Brown and Grice 2005). Musgrove et al. (2013) and BTO BirdFacts were unable to give an estimate of numbers occurring in the UK, but Skov et al. (2007) estimated that 5,400 birds winter in the North Sea although this represents only a small fraction of the numbers passing though on migration.

69. Brown and Grice (2005) report that the little gull is most numerous in English waters during spring and autumn migration and that 'numbers passing through England have increased enormously since the 1950s'. They report also that 'outside the breeding season, little gulls are largely coastal'.

70. Large numbers may occur on passage. For example, 4,100 were seen at Flamborough Head on 21 September 1995, 5,413 passed Flamborough Head between 24 September and 7 October 1982 (Brown and Grice 2005), and 10,000 were seen off Spurn on 11 September 2003 (Hartley 2004). The species is recorded along the entire English coastline in autumn, winter and spring, with largest counts in autumn, and often associated with onshore gales (Balmer et al. 2013).

71. In most aerial surveys in the East Anglia THREE site no little gulls were present. However, over the 24 aerial surveys one large flock of little gulls was recorded, in May 2013. This is consistent with spring migration passage of birds. Given the high variation in numbers of little gulls seen on the English coast from day to day and year to year, the presence of a flock in the East Anglia THREE site on only one occasion is not unexpected; little gulls may occur anywhere along the English east coast and in highly variable numbers (Balmer et al. 2013).

72. Little gulls tend to fly low over the water, with none flying at collision risk height (Johnston et al. 2014). The only flock recorded by the aerial surveys in the East Anglia THREE site was of birds that were mostly sitting on the sea, so were presumably resting. The empirical data translate into a negligible collision risk because very few little gulls were observed in flight in the East Anglia THREE site even when birds were present, and that, combined with absence of little gulls in the East Anglia THREE site in most surveys, and lack of any specific connectivity between the East Anglia THREE site and the Greater Wash SPA, and the fact that no birds of this species flew at collision risk height in generic studies, indicates no LSE for this proposed additional SPA feature as a consequence of collisions.

73. There is very little consistent evidence regarding displacement of little gulls by offshore wind farms. Leopold et al. (2011) found significant displacement of little gulls by Dutch offshore windfarms in one survey but not in six other surveys at the same windfarms. Petersen et al. (2006) tentatively suggest that little gulls were attracted by Horns Rev offshore windfarm after construction, but the data appear somewhat inconclusive. Vanermen et al. (2012) present evidence that little gull numbers increased significantly at Thorntonbank offshore windarm post-construction, but that there was no change in little gull numbers at Blighbank offshore windfarm post-construction. Displacement of little gulls by offshore wind farms would therefore appear to be negligible, indicating no LSE for this proposed additional SPA feature as a consequence of displacement.

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5 APPENDIX 2

Auk disturbance and displacement assessment – extracted from ES Chapter 13 Offshore Ornithology

13.7.1 Potential Impacts during Construction

13.7.1.1 Impact 1: Direct Disturbance and Displacement

58. The construction phase of the proposed project has the potential to affect bird populations in the marine environment through disturbance due to construction activity leading to displacement of birds from construction sites. This would effectively result in temporary habitat loss through reduction in the area available for feeding, loafing and moulting. The worst case scenario, outlined in Table 13.2, describes the elements of the proposed project considered within this assessment.

59. The maximum duration of offshore construction for the proposed project would be 2.5 years which would overlap with a maximum of two breeding seasons, two winter periods and up to five migration periods.

60. The construction phase would require the mobilisation of vessels, helicopters and equipment and the installation of foundations, export cables and other infrastructure. These activities have the potential to disturb and displace birds from within and around the site of the offshore elements of the proposed project, including the location of the wind turbines and the offshore cable corridor. The level of disturbance at each work location would differ dependent on the activities taking place, but there could be vessel movements at any time of day or night over the 2.5 year construction period.

61. Any impacts resulting from disturbance and displacement from construction activities are considered likely to be short-term, temporary and reversible in nature, lasting only for the duration of construction activity, with birds expected to return to the area once construction activities have ceased. Construction related disturbance and displacement is most likely to affect foraging birds.

62. Some species are more susceptible to disturbance than others. Gulls are not considered susceptible to disturbance, as they are often associated with fishing boats (e.g. Camphuysen 1995; Hüppop and Wurm 2000) and have been noted in association with construction vessels at the Greater Gabbard offshore windfarm (GGOWL 2011) and close to active foundation piling activity at the Egmond aan Zee (OWEZ) windfarm, where they showed no noticeable reactions to the works (Leopold and Camphuysen 2007). However, species such as divers and scoters have been noted to avoid shipping

by several kilometres (Mitschke et al. 2001 from Exo et al. 2003; Garthe and Hüppop 2004).

63. There are a number of different measures used to assess bird disturbance and displacement from areas of sea in response to activities associated with an offshore windfarm. Garthe and Hüppop (2004) developed a scoring system for such disturbance factors, which is used widely in offshore windfarm EIAs. Furness and Wade (2012) developed disturbance ratings for particular species, alongside scores for habitat flexibility and conservation importance. These factors were used to define an index value that highlights the sensitivity of a species to disturbance and displacement. As many of these references relate to disturbance from helicopter and vessel activities, these are considered relevant to this assessment.

64. Birds recorded during the species specific spring and autumn migration periods are assumed to be moving through the area between breeding and wintering areas. As these individuals will be present in the site for a short time and the potential zone of construction displacement will be comparatively small (that located around two construction vessels) it has been assumed that there are negligible risks of impact at these times of year. Consequently the following assessment considers the breeding and nonbreeding periods only (seasons following Furness 2015).

Guillemot

74. Guillemots have been recorded in the East Anglia THREE site year round, with numbers peaking in January (mean density on the East Anglia THREE site alone 5.92/km^2) and at their lowest in June (mean density on the East Anglia THREE site alone 0.047/km^2). Guillemots are considered to have a Low to Medium general sensitivity to disturbance and displacement, based on their sensitivity to ship and helicopter traffic in Garthe and Hüppop (2004), Furness and Wade (2012), Furness et al. (2013) and Bradbury et al. (2014).

75. There is potential for disturbance and displacement of guillemots due to construction activity, including wind turbine construction and associated vessel traffic. However, construction will not occur across the whole of the East Anglia THREE site simultaneously or every day but will be phased, with a maximum of two foundations expected to be installed simultaneously. Consequently the effects will occur only in the areas where vessels are operating at any given point and not the entire East Anglia THREE site.

76. During the nonbreeding season, at a mean peak density of 5.92/km^2 and with a highly precautionary 2km radius of disturbance around each construction vessel, 148

individuals (5.92 x 12.56 x 2) could be at risk of displacement. The nonbreeding season BDMPS for common guillemot is 1.6 million birds (Furness 2015). Displacement of 148 birds will have a negligible influence on population density in areas outwith the site of displacement, and therefore an impact on 148 individuals during the nonbreeding season will be negligible.

77. The construction works are temporary and localised in nature and the magnitude of effect has been determined as negligible. As the species is of low to medium sensitivity to disturbance, the impact significance is negligible.

78. During the breeding season the maximum mean peak density on the site was 3.016/km^2 (March) which suggests that 76 individuals (3.016 x 12.56 x 2) could be at risk of displacement. There are no breeding colonies for guillemot within foraging range of the East Anglia THREE site, therefore it is reasonable to assume that individuals seen during the breeding season are nonbreeding (e.g. immature birds). Since immature seabirds are known to remain in wintering areas, the number of immature birds in the relevant population during the breeding season may be estimated as 43% (the proportion of the population that is of immature status) of the total wintering BDMPS population (Furness 2015). This gives a breeding season population of 695,441 (BDMPS for the UK North Sea and Channel, 1,617,306 x 43%). Therefore an impact on 76 (likely immature) individuals during the breeding season will be negligible.

79. The construction works are temporary and localised in nature and the magnitude of effect has been determined as negligible. As the species is of low to medium sensitivity to disturbance, the impact significance is negligible.

Razorbill

80. Razorbills have been recorded in the East Anglia THREE site year round, with numbers peaking in January (mean density on the East Anglia THREE site alone 4.42/km^2) and at their lowest in June (mean density on the East Anglia THREE site alone 0.022/km^2). Razorbills are considered to have a Low to Medium general sensitivity to disturbance and displacement, based on their sensitivity to ship and helicopter traffic in Garthe and Hüppop (2004) and Furness and Wade (2012).

81. There is potential for disturbance and displacement of razorbills due to construction activity, including wind turbine construction and associated vessel traffic. However, construction will not occur across the whole of the East Anglia THREE site simultaneously or every day but will be phased with a maximum of two foundations expected to be installed simultaneously. Consequently the effects will occur only in

the areas where vessels are operating at any given point and not the entire East Anglia THREE site.

82. During the nonbreeding season, at a mean peak density of 2.74/km^2 and with a highly precautionary 2km radius of disturbance around each construction vessel, 69 individuals (2.74 x 12.56 x 2) could be at risk of displacement. The nonbreeding season BDMPS for razorbill is 218,622 (Furness 2015), therefore an impact on this many individuals during the nonbreeding season will be negligible.

83. The construction works are temporary and localised in nature and the magnitude of effect has been determined as negligible. As the species is of low to medium sensitivity to disturbance, the impact significance is negligible.

84. During the breeding season the maximum mean peak density on the site was 4.35/km^2 (April) which suggests that 109 individuals (4.35 x 12.56 x 2) could be at risk of displacement. There are no breeding colonies for razorbill within foraging range of the East Anglia THREE site, therefore it is reasonable to assume that individuals seen during the breeding season are nonbreeding (e.g. immature birds). Since immature seabirds are known to remain in wintering areas, the number of immature birds in the relevant population during the breeding season may be estimated as 43% of the total wintering BDMPS population (Furness 2015). This gives a breeding season population of 94,007 (BDMPS for the UK North Sea and Channel, 218622 x 43%). Therefore an impact on 109 (likely immature) individuals during the breeding season will be negligible.

85. The construction works are temporary and localised in nature and the magnitude of effect has been determined as negligible. As the species is of low to medium sensitivity to disturbance, the impact significance is negligible.

Puffin

86. Puffins have been recorded in the East Anglia THREE site in low numbers in most months, with numbers peaking in November (mean density on the East Anglia THREE site alone 0.63/km^2) and with none present in June and September. Puffins are considered to have a Low to Medium general sensitivity to disturbance and displacement, based on their sensitivity to ship and helicopter traffic in Garthe and Hüppop (2004) and Furness and Wade (2012).

87. There is potential for disturbance and displacement of puffins due to construction activity, including wind turbine construction and associated vessel traffic. However, construction will not occur across the whole of the East Anglia THREE site simultaneously or every day, but will be phased with a maximum of two foundations

expected to be installed simultaneously. Consequently the effects will occur only in the areas where vessels are operating at any given point and not the entire East Anglia THREE site.

88. During the nonbreeding season, at a mean peak density of 0.63/km^2 and with a highly precautionary 2km radius of disturbance around each construction vessel, 16 individuals (0.63 x 12.56 x 2) could be at risk of displacement. The nonbreeding season BDMPS for puffin is 231,957 (Furness 2015), therefore an impact on this many individuals during the nonbreeding season will be negligible.

89. The construction works are temporary and localised in nature and the magnitude of effect has been determined as negligible. As the species is of low to medium sensitivity to disturbance, the impact significance is negligible.

90. During the breeding season the maximum mean peak density on the site was 0.35/km^2 (April) which suggests that 9 individuals (0.35 x 12.56 x 2) could be at risk of displacement. There are no breeding colonies for puffin within foraging range of the East Anglia THREE site, therefore it is reasonable to assume that individuals seen during the breeding season are nonbreeding (e.g. immature birds). Since immature seabirds are known to remain in wintering areas, the number of immature birds in the relevant population during the breeding season may be estimated as 45% of the total wintering BDMPS population (Furness 2015). This gives a breeding season population of 104,381 (BDMPS for the UK North Sea and Channel, 231,957 x 45%). Therefore an impact on 9 (likely immature) individuals during the breeding season will be negligible.

91. The construction works are temporary and localised in nature and the magnitude of effect has been determined as negligible. As the species is of low to medium sensitivity to disturbance, the impact significance is negligible.

13.7.2 Potential Impacts during Operation

13.7.2.1 Impact 3: Direct Disturbance and Displacement

96. The presence of wind turbines has the potential to directly disturb and displace birds from within and around the proposed East Anglia THREE site. This is assessed as an indirect habitat loss, as it has the potential to reduce the area available to birds for feeding, loafing and moulting. Vessel activity and the lighting of wind turbines and associated ancillary structures could also attract (or repel) certain species of birds and affect migratory behaviour on a local scale.

97. Seabird species vary in their reactions to the presence of operational infrastructure (e.g. wind turbines, substations and met mast) and to the maintenance activities that are associated with it (particularly ship and helicopter traffic), with Garthe and Hüppop (2004) presenting a scoring system for such disturbance factors, which is used widely in offshore windfarm EIAs. As offshore windfarms are a new feature in the marine environment, there is limited evidence as to the disturbance and displacement effects of the operational infrastructure in the long term.

98. Natural England and JNCC issued a joint Interim Displacement Guidance Note (Natural England and JNCC 2012), which provides recommendations for presenting information to enable the assessment of displacement effects in relation to offshore windfarm developments. This guidance note has shaped the assessment provided below.

99. There are a number of different measures used to determine bird displacement from areas of sea in response to activities associated with an offshore windfarm. Furness and Wade (2012), for example, use disturbance ratings for particular species, alongside scores for habitat flexibility and conservation importance to define an index value that highlights the sensitivity to disturbance and displacement. These authors also recognise that displacement may contribute to individual birds experiencing fitness consequences, which at an extreme level could lead to the mortality of individuals.

100. Both the presence of the infrastructure and the operational activities associated with the proposed project have the potential to directly disturb birds. These activities could potentially displace birds from important areas for feeding, moulting and loafing. Reduced access to some areas could result, at the extreme, in changes to feeding and other behavioural activities resulting in a loss of fitness and a reduction in survival chances. This would be unlikely for seabirds that have large areas of alternative habitat available, but would be more likely to affect seabirds with highly

specialised habitat requirements that are limited in availability (Furness and Wade 2012; Bradbury et al. 2014).

101. The methodology presented in the Natural England / JNCC joint Interim Advice Note (Natural England and JNCC 2012) recommends a matrix is presented for each key species showing bird losses at differing rates of displacement and mortality. This assessment uses the range of predicted losses, in association with the scientific evidence available from post-construction monitoring studies, to quantify the level of displacement and the potential losses as a consequence of the proposed project. These losses are then placed in the context of international, national and regional population estimates to determine the magnitude of effect.

102. Birds are considered to be most at risk from operational disturbance and displacement effects when they are resident (e.g. during the breeding season or wintering season). The small risk of impact to migrating birds is better considered in terms of barrier effects, which are discussed in the following section.

103. Following installation of the offshore cable, the required operational and maintenance activities (in relation to the cable) may have short-term and localised disturbance and displacement impacts on birds using the Site. However, disturbance from operational activities would be temporary and localised, and is unlikely to result in detectable effects at either the local or regional population level. Therefore no impact due to cable operation and maintenance is predicted. The focus of this section is therefore on the disturbance and displacement of birds due to the presence and operation of wind turbines, other offshore infrastructure and any maintenance operations associated with them.

104. In order to focus the assessment of disturbance and displacement, a screening exercise was undertaken to identify those species most likely to be at risk (Table 13.15), focussing on the main species described in the Baseline Offshore Ornithology Technical Report (Appendix 13.1). The species identified as at risk were then assessed within the biological seasons within which effects were potentially likely to occur. Any species with a low sensitivity to displacement, or recorded only in very small numbers within the East Anglia THREE site during the breeding and wintering seasons, was screened out of further assessment. As described above, any effects from displacement during the migration seasons are covered through an assessment of the barrier effect, which is discussed in the following sections.

Auks (Guillemot, Razorbill and Puffin)

116. Auks have been recorded in the East Anglia THREE site in regionally important numbers (during the breeding season for guillemot and for the spring migration, breeding and wintering seasons for razorbill). They are also considered to have low to medium sensitivities to disturbance and displacement, based on their sensitivity to ship and helicopter traffic in Garthe and Hüppop (2004), Langston (2010) and an interpretation of the Furness and Wade (2012) species concern index value in the context of disturbance and/or displacement from a habitat.

117. Displacement of foraging seabirds due to the presence of turbines cannot readily be assessed from observing birds in flight as only a very small proportion of flying seabirds land in any particular location. There is not yet very much empirical data on displacement of foraging seabirds from offshore windfarms with the consequence that assessment of the amount of displacement arising from developments is somewhat speculative. Available pre- and post-construction data have yielded variable results, but indicate that auks may be displaced to some extent by some windfarms, but is partial and apparently negligible at others.

118. Common guillemots were displaced at Blighbank (Vanermen et al. 2012), were displaced only in a minority of surveys at two Dutch windfarms (OWEZ and PAWP; Leopold et al. 2011, Krijgsveld et al. 2011), but were not significantly displaced at Horns Rev (although the data suggest that slight displacement was probably occurring; Petersen et al. 2006) or Thorntonbank (Vanermen et al. 2012). Razorbills were displaced in one out of six surveys at two Dutch windfarms (OWEZ and PAWP; Leopold et al. 2011, Krijgsveld et al. 2011), but not at Horns Rev (Petersen et al. 2006), Thorntonbank or Blighbank (Vanermen et al. 2012).

119. In line with guidance (Natural England and JNCC 2012) the abundance estimates for the most relevant biological periods have each been placed into individual displacement matrices. Each displacement matrix completed for this assessment has been prepared to present the abundances of each auk species within the East Anglia THREE site and a 2km buffer only.

120. Each matrix displays displacement rates and mortality rates for each species (Tables 13.17 to 13.24). For the purpose of this assessment a displacement rate range of 30-70% and a mortality rate range of 1-10% are highlighted in each matrix, as recommended by Natural England, with the 70%/10% representing the worst case scenario.

121. There are no breeding colonies for any of these species within foraging range of the East Anglia THREE site, therefore it is reasonable to assume that individuals seen during the breeding season are nonbreeding (e.g. immature birds). Since immature

seabirds are known to remain in wintering areas, the number of immature birds in the relevant populations during the breeding season may be estimated as 43% of the total wintering BDMPS population for guillemot and razorbill and 45% for puffin (Furness 2015). This gives breeding season populations of nonbreeding individuals of 695,441 guillemot (BDMPS for the UK North Sea and Channel, 1,617,306 x 43%), 94,007 razorbills (BDMPS for the UK North Sea and Channel, 218622 x 43%) and 104,381 puffins (BDMPS for UK North Sea and Channel, 231,957 x 45%). For guillemot and puffin there is only one defined nonbreeding season (Aug-Feb and mid-August to March respectively), while for razorbill there are three (Aug-Oct, Nov-Dec and Jan-Mar; Table 13.12). The number of birds which could potentially be displaced has been estimate for each species specific relevant season.

Guillemot

122. The estimated number of guillemots subject to mortality during the breeding period (Table 13.17) is between 5 and 117 individuals (from 30%/1% to 70%/10%). From a breeding season BDMPS of 695,441 this represents a maximum loss of 0.01% which is not considered to cause any real change to the population level. Therefore, during the breeding season, even though the species is considered to be low to medium sensitivity, the impact significance of displacement is negligible.

123. The estimated number of guillemots subject to mortality during the wintering period (Table 13.18) is between 9 and 200 individuals (from 30%/1% to 70%/10%). From a nonbreeding season BDMPS of 1,617,306 this represents a maximum loss of 0.01% which is not considered to cause any real change to the population level. Therefore, during the nonbreeding season, even though the species is considered to be low to medium sensitivity, the impact significance of displacement is negligible.

Table 13.17 Displacement matrix presenting the number of guillemots in the East Anglia THREE site and 2km buffer during the breeding season that may be subject to mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)										
	0	1	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	2	3	5	7	8	10	12	13	15	17
10	0	2	17	33	50	67	83	100	117	134	150	167
20	0	3	33	67	100	134	167	200	234	267	300	334
30	0	5	50	100	150	200	250	300	350	401	451	501
40	0	7	67	134	200	267	334	401	467	534	601	668
50	0	8	83	167	250	334	417	501	584	668	751	835
60	0	10	100	200	300	401	501	601	701	801	901	1001
70	0	12	117	234	350	467	584	701	818	935	1051	1168
80	0	13	134	267	401	534	668	801	935	1068	1202	1335
90	0	15	150	300	451	601	751	901	1051	1202	1352	1502
100	0	17	167	334	501	668	835	1001	1168	1335	1502	1669

Table Notes: a) Green shaded cells highlight most likely displacement range of 30% to 70% as appropriate from the evidence base; b) Pink shaded cells represent the most likely range of mortality associated with displaced birds (1% to 10%) during the breeding season.

Table 13.18 Displacement matrix presenting the number of guillemots in the East Anglia THREE site and 2km buffer during the wintering season that may be subject to mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)											
	0	1	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	3	6	9	11	14	17	20	23	26	29
10	0	3	29	57	86	114	143	172	200	229	257	286
20	0	6	57	114	172	229	286	343	400	457	515	572
30	0	9	86	172	257	343	429	515	600	686	772	858
40	0	11	114	229	343	457	572	686	801	915	1029	1144
50	0	14	143	286	429	572	715	858	1001	1144	1287	1430
60	0	17	172	343	515	686	858	1029	1201	1372	1544	1715
70	0	20	200	400	600	801	1001	1201	1401	1601	1801	2001
80	0	23	229	457	686	915	1144	1372	1601	1830	2058	2287
90	0	26	257	515	772	1029	1287	1544	1801	2058	2316	2573
100	0	29	286	572	858	1144	1430	1715	2001	2287	2573	2859

Table Notes: a) Green shaded cells highlight most likely displacement range of 30% to 70% as appropriate from the evidence base; b) Pink shaded cells represent the most likely range of mortality associated with displaced birds (1% to 10%) during the wintering season.

Razorbill

124. The estimated number of razorbills subject to mortality during the breeding period (Table 13.19) is between 5 and 126 individuals (from 30%/1% to 70%/10%). From a breeding season BDMPS of 94,007 this represents a maximum loss of 0.13% which is not considered to cause any real change to the population level. Therefore, during the breeding season, even though the species is considered to be low to medium sensitivity, the impact significance of displacement is negligible.

125. The estimated number of razorbills subject to mortality during the autumn migration period (Table 13.20) is between 3 and 79 individuals (from 30%/1% to 70%/10%). From an autumn season BDMPS of 591,874 this represents a maximum loss of 0.01% which is not considered to cause any real change to the population level. Therefore, during the autumn season, even though the species is considered to be low to medium sensitivity, the impact significance of displacement is negligible.

126. The estimated number of razorbills subject to mortality during the midwinter period (Table 13.21) is between 4 and 105 individuals (from 30%/1% to 70%/10%). From a midwinter season BDMPS of 218,622 this represents a maximum loss of 0.04% which is not considered to cause any real change to the population level. Therefore, during the midwinter season, even though the species is considered to be low to medium sensitivity, the impact significance of displacement is negligible.

127. The estimated number of razorbills subject to mortality during the spring migration period (Table 13.22) is between 5 and 107 individuals (from 30%/1% to 70%/10%). From a spring season BDMPS of 591,874 this represents a maximum loss of 0.02% which is not considered to cause any real change to the population level. Therefore, during the spring season, even though the species is considered to be low to medium sensitivity, the impact significance of displacement is negligible.

Table 13.19 Displacement matrix presenting the number of razorbills in the East Anglia THREE site and 2km buffer during the breeding season that may be subject to mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)											
	0	1	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	2	4	5	7	9	11	13	14	16	18
10	0	2	18	36	54	72	90	108	126	145	163	181
20	0	4	36	72	108	145	181	217	253	289	325	361
30	0	5	54	108	163	217	271	325	379	434	488	542
40	0	7	72	145	217	289	361	434	506	578	651	723
50	0	9	90	181	271	361	452	542	632	723	813	904
60	0	11	108	217	325	434	542	651	759	867	976	1084
70	0	13	126	253	379	506	632	759	885	1012	1138	1265
80	0	14	145	289	434	578	723	867	1012	1156	1301	1446
90	0	16	163	325	488	651	813	976	1138	1301	1464	1626
100	0	18	181	361	542	723	904	1084	1265	1446	1626	1807

Table Notes: a) Green shaded cells highlight most likely displacement range of 30% to 70% as appropriate from the evidence base; b) Pink shaded cells represent the most likely range of mortality associated with displaced birds (1% to 10%).

Table 13.20 Displacement matrix presenting the number of razorbills in the East Anglia THREE site and 2km buffer during the autumn season that may be subject to mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)											
	0	1	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	1	2	3	4	6	7	8	9	10	11
10	0	1	11	22	34	45	56	67	79	90	101	112
20	0	2	22	45	67	90	112	135	157	180	202	224
30	0	3	34	67	101	135	168	202	236	269	303	337
40	0	4	45	90	135	180	224	269	314	359	404	449
50	0	6	56	112	168	224	281	337	393	449	505	561
60	0	7	67	135	202	269	337	404	471	539	606	673
70	0	8	79	157	236	314	393	471	550	628	707	785
80	0	9	90	180	269	359	449	539	628	718	808	898
90	0	10	101	202	303	404	505	606	707	808	909	1010
100	0	11	112	224	337	449	561	673	785	898	1010	1122

Table Notes: a) Green shaded cells highlight most likely displacement range of 30% to 70% as appropriate from the evidence base; b) Pink shaded cells represent the most likely range of mortality associated with displaced birds (1% to 10%).

Table 13.21 Displacement matrix presenting the number of razorbills in the East Anglia THREE site and 2km buffer during the midwinter season that may be subject to mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)											
	0	1	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	1	3	4	6	7	9	10	12	13	15
10	0	1	15	30	45	60	75	90	105	120	135	150
20	0	3	30	60	90	120	150	180	210	240	270	300
30	0	4	45	90	135	180	225	270	315	360	405	450
40	0	6	60	120	180	240	300	360	420	480	540	600
50	0	7	75	150	225	300	375	450	525	600	675	750
60	0	9	90	180	270	360	450	540	630	720	809	899
70	0	10	105	210	315	420	525	630	735	839	944	1049
80	0	12	120	240	360	480	600	720	839	959	1079	1199
90	0	13	135	270	405	540	675	809	944	1079	1214	1349
100	0	15	150	300	450	600	750	899	1049	1199	1349	1499

Table Notes: a) Green shaded cells highlight most likely displacement range of 30% to 70% as appropriate from the evidence base; b) Pink shaded cells represent the most likely range of mortality associated with displaced birds (1% to 10%).

Table 13.22 Displacement matrix presenting the number of razorbills in the East Anglia THREE site and 2km buffer during the spring season that may be subject to mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)										
	0	1	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	2	3	5	6	8	9	11	12	14	15
10	0	2	15	30	46	61	76	91	107	122	137	152
20	0	3	30	61	91	122	152	183	213	244	274	305
30	0	5	46	91	137	183	229	274	320	366	411	457
40	0	6	61	122	183	244	305	366	427	488	549	610
50	0	8	76	152	229	305	381	457	533	610	686	762
60	0	9	91	183	274	366	457	549	640	732	823	914
70	0	11	107	213	320	427	533	640	747	853	960	1067
80	0	12	122	244	366	488	610	732	853	975	1097	1219
90	0	14	137	274	411	549	686	823	960	1097	1234	1372
100	0	15	152	305	457	610	762	914	1067	1219	1372	1524

Table Notes: a) Green shaded cells highlight most likely displacement range of 30% to 70% as appropriate from the evidence base; b) Pink shaded cells represent the most likely range of mortality associated with displaced birds (1% to 10%).

Puffin

74. The estimated number of puffins subject to mortality during the breeding period (*Table 13.23*) is between 0 and 8 individuals (from 30%/1% to 70%/10%). From a breeding season BDMPS of 104,381 this represents a maximum loss of 0.007% which is not considered to cause any real change to the population level. Therefore, during the breeding season, even though the species is considered to be low to medium sensitivity **no impact** would occur as a result of displacement.

75. The estimated number of puffins subject to mortality during the midwinter period (*Table 13.24*) is between 1 and 14 individuals (from 30%/1% to 70%/10%). From a midwinter season BDMPS of 231,957 this represents a maximum loss of 0.006% which is not considered to cause any real change to the population level. Therefore, during the midwinter season, even though the species is considered to be low to medium sensitivity, **no impact** would occur as a result of displacement.

Table 13.23 Displacement matrix presenting the number of puffins in the East Anglia THREE site during the breeding season that may be subject to mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)											
	0	1	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	1	1	1	1	1	1
10	0	0	1	2	3	4	5	6	8	9	10	11
20	0	0	2	4	6	9	11	13	15	17	19	22
30	0	0	3	6	10	13	16	19	23	26	29	32
40	0	0	4	9	13	17	22	26	30	35	39	43
50	0	1	5	11	16	22	27	32	38	43	49	54
60	0	1	6	13	19	26	32	39	45	52	58	65
70	0	1	8	15	23	30	38	45	53	60	68	76
80	0	1	9	17	26	35	43	52	60	69	78	86
90	0	1	10	19	29	39	49	58	68	78	87	97
100	0	1	11	22	32	43	54	65	76	86	97	108

Table Notes: a) Green shaded cells highlight most likely displacement range of 30% to 70% as appropriate from the evidence base; b) Pink shaded cells represent the most likely range of mortality associated with displaced birds (1% to 10%).

Table 13.24 Displacement matrix presenting the number of puffins in the East Anglia THREE site during the nonbreeding season that may be subject to mortality (highlighted in pink)

Displacement (%)	Mortality Rates (%)											
	0	1	10	20	30	40	50	60	70	80	90	100
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	1	1	1	1	1	2	2	2
10	0	0	2	4	6	8	10	12	14	16	18	20
20	0	0	4	8	12	16	20	23	27	31	35	39
30	0	1	6	12	18	23	29	35	41	47	53	59
40	0	1	8	16	23	31	39	47	55	62	70	78
50	0	1	10	20	29	39	49	59	68	78	88	98
60	0	1	12	23	35	47	59	70	82	94	105	117
70	0	1	14	27	41	55	68	82	96	109	123	137
80	0	2	16	31	47	62	78	94	109	125	140	156
90	0	2	18	35	53	70	88	105	123	140	158	176
100	0	2	20	39	59	78	98	117	137	156	176	195

77. Table Notes: a) Green shaded cells highlight most likely displacement range of 30% to 70% as appropriate from the evidence base; b) Pink shaded cells represent the most likely range of mortality associated with displaced birds (1% to 10%).

13.8.1.4 Cumulative Assessment of Operation Displacement Risk

78. Guillemot

79. The East Anglia THREE site is located beyond the mean maximum foraging range of any guillemot breeding colonies. Outside the breeding season, guillemots disperse from their breeding sites with an overall southward trend. Thus large numbers are found throughout the North Sea in the nonbreeding season (defined as August to February). Consequently it was during this period that numbers peaked on the East Anglia THREE site (plus 2km buffer), with a mean maximum of 2,859 individuals.

80. In the recent cumulative assessment for the Hornsea 2 project (Smart Wind 2015) an estimate of the impact on nonbreeding guillemots was presented for 23 of the windfarms listed in Table 13.29 (exceptions were: Gunfleet Sands, Kentish Flats, Lynn and Inner Dowsing, Scroby Sands, Rampion, Blyth, Navitus Bay and the possible future Round 3 developments). The collated data were presented on the basis of a displacement rate of 30% and mortality of 1%, giving rise to a total nonbreeding mortality of 189 individuals (Smart Wind 2015). Back calculating from the windfarm values presented (dividing by 0.003; 0.01 x 0.3) gives the total number of birds at risk of displacement as 63,000 across the North Sea, to which the proposed East Anglia THREE project adds 2,859. While this omits the windfarms listed above, this is also likely to over-estimate the number present due to the use of peak numbers at each site which probably leads to double counting as birds move through the North Sea.

81. The figure of 198 (189 plus the proposed East Anglia THREE project's contribution of 9) represents the lower boundary defined by the range of displacement (30-70%) and mortality levels (1-10%) advised by Natural England. The upper boundary, calculated for 65,859 individual is 4,610 (70% displacement, 10% mortality). Thus the key question for assessing the impact is where within this range (198 to 4,610) is the most realistic value.

82. Post-construction monitoring of nonbreeding season auks has found evidence of windfarm avoidance behaviour, with indications that turbine density may affect the magnitude of avoidance (Leopold et al. 2011; Krijgsveld et al. 2011). The estimated guillemot avoidance rate from these studies was around 68%, although it should be noted that this was based on observations of flying birds and this value may not be appropriate for swimming birds. Furthermore these studies were conducted at sites with relatively closely spaced turbines (e.g. 550m) which is in the region of half that at windfarms currently being developed. Thus, a figure of 70% displacement represents a precautionary estimate.

83. The pressures on nonbreeding birds in terms of energy requirements are lower outside the breeding season when they only need to obtain sufficient food to maintain their own survival. In addition, for species such as auks they can remain at sea for extended periods and thus flight costs are minimised. Recoveries of ringed guillemots have indicated a wide distribution in winter, with birds spread throughout the North Sea (Furness 2015). This pattern has received further support from recent studies using geolocator tags, which have revealed that birds from Scottish colonies spread out through much of the North Sea (S. Wanless pers. comm.). These studies have also found quite marked levels of variation between years, which suggests that birds are relatively flexible in terms of where they spend the winter and are not dependent on particular foraging locations. Hence, the consequence of winter displacement from windfarms in terms of increased mortality is likely to be minimal. Given that, even when fish stocks have collapsed, adult survival rates have shown declines of no more than 6-7% (e.g. kittiwake, Frederiksen et al. 2004) an increase in mortality due to displacement from windfarm sites seems likely to be at the low end of the proposed 1-10% range, and a value of 1% when combined with the precautionary 70% displacement rate is considered appropriate. On this basis a precautionary cumulative nonbreeding displacement figure of 461 is obtained (65,859 x 0.7 x 0.01).

84. The nonbreeding guillemot BDMPS is 1,617,306 (Furness 2015). Additional mortality of 461 individuals from this population is a loss of only 0.03% of the population.

85. Consequently, the potential for the proposed East Anglia THREE project to contribute to a significant displacement effect on guillemot during migration is considered to be very small and the impact significance of cumulative displacement is negligible.

Razorbill

86. The East Anglia THREE site is located beyond the mean maximum foraging range of any razorbill breeding colonies. Outside the breeding season razorbills migrate southwards in a similar manner to guillemots, although they tend to move further south. Three nonbreeding seasons were identified for razorbill (spring and autumn migration and winter), with numbers in the North Sea during the migration period estimated to be 591,874 and in midwinter 218,622.

87. At these times the total numbers on the East Anglia THREE site (and 2km buffer) were 1,122, 1,499 and 1,524 respectively.

88. In the recent cumulative assessment for the Hornsea 2 project (Smart Wind 2015) an estimate of the impact on nonbreeding razorbills was presented for 23 of the windfarms listed in Table 13.29 (exceptions were: Gunfleet Sands, Kentish Flats, Lynn and Inner Dowsing, Scroby Sands, Rampion, Blyth, Navitus Bay and the possible future Round 3 developments). The collated data were presented on the basis of a displacement rate of 40% and mortality of 2% (migration seasons) and 1% (midwinter), giving rise to respective total mortality estimates of 211, 54 and 160 for each period (Smart Wind 2015). Back calculating from the windfarm values presented (dividing by 0.008; 0.02 x 0.4 and 0.004; 0.01 x 0.4) gives the seasonal total number of birds at risk of displacement as 23,375, 13,500 and 20,000 across the North Sea, to which the numbers for the proposed East Anglia THREE project can be added (1,122, 1,499 and 1,524 respectively) giving cumulative totals of 27,497, 14,999 and 21,524 for each season. While these omit the windfarms listed above, they are also likely to over-estimate the number present due to the combination of peak numbers at each site which probably leads to double counting as birds move through the North Sea.

Autumn migration period

89. The figure of 220 (211 plus the proposed East Anglia THREE project's contribution of 9 at a 40%/2% rate) is slightly more than double the lower boundary value of 82 calculated using a 30% displacement (range 30-70%) and 1% mortality rate (range 1-10%) as advised by Natural England. The equivalent upper boundary, calculated for 27,497 individuals is 1,925 (70% displacement, 10% mortality). Thus the key question for assessing the impact is where within this range is the most realistic value.

90. The evidence for displacement and consequent mortality is based on the same observations made for guillemot (see above). Therefore the same precautionary rates (70% displacement and 1% mortality) have been applied. On this basis a precautionary cumulative autumn migration displacement figure of 192 is obtained (27,497 x 0.7 x 0.01).

91. The autumn migration nonbreeding razorbill BDMPS is 591,874 (Furness 2015). Additional mortality of 192 individuals from this population is a loss of only 0.03% of the population. Consequently, the potential for the proposed East Anglia THREE project to contribute to a significant displacement effect on razorbill during autumn migration is considered to be very small and the impact significance of cumulative displacement is negligible.

Midwinter period

92. The figure of 60 (54 plus the proposed East Anglia THREE project's contribution of 6 at a 40%/1% rate) is slightly higher than the lower boundary value of 45 calculated using a 30% displacement (range 30-70%) and 1% mortality rate (range 1-10%) as advised by Natural England. The equivalent upper boundary, calculated for 14,999 individuals is 1,050 (70% displacement, 10% mortality). Thus the key question for assessing the impact is where within this range is the most realistic value.

93. The evidence for displacement and consequent mortality is based on the same observations made for guillemot (see above). Therefore the same precautionary rates (70% displacement and 1% mortality) have been applied. On this basis a precautionary cumulative autumn migration displacement figure of 105 is obtained (14,999 x 0.7 x 0.01).

94. The midwinter nonbreeding razorbill BDMPS is 218,622 (Furness 2015). Additional mortality of 105 individuals from this population is a loss of only 0.05% of the population. Consequently, the potential for the proposed East Anglia THREE project to contribute to a significant displacement effect on razorbill during the midwinter period is considered to be very small and the impact significance of cumulative displacement is negligible.

Spring migration period

95. The figure of 172 (160 plus the proposed East Anglia THREE project's contribution of 12 at a 40%/2% rate) is almost three times the lower boundary value of 65 calculated using a 30% displacement (range 30-70%) and 1% mortality rate (range 1-10%) as advised by Natural England. The equivalent upper boundary, calculated for 21,524 individuals is 1,507 (70% displacement, 10% mortality). Thus the key question for assessing the impact is where within this range is the most realistic value.

96. The evidence for displacement and consequent mortality is based on the same observations made for guillemot (see above). Therefore the same precautionary rates (70% displacement and 1% mortality) have been applied. On this basis a precautionary cumulative autumn migration displacement figure of 151 is obtained (21,524 x 0.7 x 0.01).

97. The autumn migration nonbreeding razorbill BDMPS is 591,874 (Furness 2015). Additional mortality of 151 individuals from this population is a loss of only 0.03% of the population. Consequently, the potential for the proposed East Anglia THREE project to contribute to a significant displacement effect on razorbill during autumn migration is considered to be very small and the impact significance of cumulative displacement is negligible.

Complete nonbreeding period

98. Overall the impact of cumulative displacement on the nonbreeding razorbill population mortalities together (weighted average) amounts to a loss of 0.03% of the population. Consequently, the potential for the proposed East Anglia THREE project to contribute to a significant displacement effect on razorbill during the complete nonbreeding season is considered to be very small and the impact significance of cumulative displacement is negligible.

Puffin

99. The East Anglia THREE site is located beyond the mean maximum foraging range of any puffin breeding colonies. Outside the breeding season puffins disperse from their breeding sites with an overall southward trend. Thus large numbers are found throughout the North Sea in the nonbreeding season (defined as August to February). Consequently it was during this period that numbers peaked on East Anglia THREE with a mean maximum of 195 individuals.

100. In the recent cumulative assessment for the Hornsea 2 project (Smart Wind 2015) an estimate of the impact on nonbreeding puffins was presented for 23 of the windfarms listed in Table 13.29 (exceptions were: Gunfleet Sands, Kentish Flats, Lynn and Inner Dowsing, Scroby Sands, Rampion, Blyth, Navitus Bay and the possible future Round 3 developments). The collated data were presented on the basis of a displacement rate of 40% and mortality of 1%, giving rise to a total nonbreeding mortality of 51 individuals (Smart Wind 2015). Back calculating from the windfarm values presented (dividing by 0.004; 0.01 x 0.4) gives the total number of birds at risk of displacement as 12,750 across the North Sea, to which the proposed East Anglia THREE project adds 195 giving a cumulative total of 12,945. While this omits the windfarms listed above, this is also likely to over-estimate the number present due to the use of peak numbers at each site which probably leads to double counting as birds move through the North Sea.

101. The figure of 52 (51 plus the proposed East Anglia THREE project's contribution of 1 at a 40%/1% rate) is slightly higher than the lower boundary value of 39 calculated using a 30% displacement (range 30-70%) and 1% mortality rate (range 1-10%) as advised by Natural England. The equivalent upper boundary, calculated for 12,945 individuals is 906 (70% displacement, 10% mortality). Thus the key question for assessing the impact is where within this range is the most realistic value.

102. The evidence for displacement and consequent mortality is based on the same observations made for guillemot (see above). Therefore the same precautionary

rates (70% displacement and 1% mortality) have been applied. On this basis a precautionary cumulative autumn migration displacement figure of 91 is obtained (12,945 x 0.7 x 0.01).

103. The nonbreeding puffin BDMPS is 231,957 (Furness 2015). Additional mortality of 91 individuals from this population is a loss of only 0.04% of the population.

104. Consequently, the potential for the proposed East Anglia THREE project to contribute to a significant displacement effect on puffin during the nonbreeding season is considered to be very small and the impact significance of cumulative displacement is negligible.

6 APPENDIX 3

Kittiwake cumulative collision risk assessment – extracted from ES Chapter 13 Offshore Ornithology

Kittiwake

105. The cumulative kittiwake collision risk prediction is set out in the form of a 'tiered approach' in *Table 13.36*. This table collates collision predictions from other windfarms which may contribute to the cumulative total. This table includes revised estimates for East Anglia ONE following a revision to the analysis (Appendix 13.#).

106. Seasonal kittiwake collisions at the East Anglia THREE site only exceeded 10 during spring and autumn migration (breeding season 8, autumn migration 90, spring migration 49). Therefore the project mainly contributes to a cumulative impact during the migration periods. The collision values listed in *Table 13.36* include annual, spring and autumn period collisions. The data have been obtained from recent windfarm submissions (e.g. Teesside A & B, Forewind 2014) and Natural England responses (e.g. Natural England 2013c).

107. The original assessments were conducted using a range of avoidance rates and alternative collision model options. In order to simplify interpretation of the data across sites and also to bring these assessments up to date with the current Natural England Advice the values in *Table 13.36* are those estimated using the Band model Option 1 (or 2, if that was the one presented) at an avoidance rate of 98.9%.

Table 13.36. Cumulative Collision Risk Assessment for kittiwake. Shaded cells indicate all projects up to Tier 3.

Tier	Windfarm (source of annual data / source of autumn data)	Predicted collisions (@ 98.9% avoidance rate, Band Model option 1 or 2)					
		Annual	Annual migration Cumulative total	Spring migration	Spring migration Cumulative total	Autumn migration	Autumn migration Cumulativ e total
1	Beatrice Demonstrator [1 / A]	4.9	4.9	1.6	1.6	2.1	2.1
1	Greater Gabbard [2 / B]	27.5	32.4	11.4	13.1	15.0	17.1
1	Gunfleet Sands [2 / B]	0.0	32.4	0.0	13.1	0.0	17.1
1	Kentish Flats [2 / B]	0.0	32.4	0.0	13.1	0.0	17.1
1	Lincs [2 / B]	2.7	35.2	0.9	14.0	1.2	18.2
1	London Array (Phase 1) [2 / B]	5.5	40.7	1.8	15.9	2.3	20.5

1	Lynn and Inner Dowsing [2/B]	0.0	40.7	0.0	15.9	0.0	20.5
1	Scroby Sands [2/B]	0.0	40.7	0.0	15.9	0.0	20.5
1	Sheringham Shoal [2/B]	0.0	40.7	0.0	15.9	0.0	20.5
1	Teesside [2/B]	77.0	117.7	15.0	30.8	24.0	44.5
1	Thanet [2/B]	1.1	118.8	0.4	31.2	0.4	45.0
2	Humber Gateway [2/B]	7.7	126.5	2.6	33.7	3.2	48.1
2	Westermost Rough [2/B]	0.5	127.0	0.2	33.9	0.2	48.4
3	Beatrice [2/B]	145.2	272.2	39.8	73.7	10.7	59.1
3	Blyth (NaREC Demonstration) [2/B]	5.5	277.7	1.8	75.5	2.3	61.4
3	Dogger Bank Creyke Beck A & B [2/B]	718.3	996.0	362.4	437.9	135.1	196.5
3	Dudgeon [2/B]	0.0	996.0	0.0	437.9	0.0	196.5
3	East Anglia ONE [1/C]	314.0	1310.0	71.0	508.9	242.0	438.5
3	EOWDC (Aberdeen OWF) [2/B]	18.7	1328.7	1.1	510.0	5.9	444.4
3	Firth of Forth Alpha and Bravo [2/B]	715.0	2043.7	247.6	757.6	313.1	757.5
3	Galloper [2/B]	66.0	2109.7	31.8	789.5	27.8	785.3
3	Hornsea Project 1 [2/B]	123.2	2232.9	24.7	814.2	53.9	839.2
3	Inch Cape [2/B]	301.4	2534.3	63.5	877.7	224.8	1064.0
3	Moray Firth (EDA) [2/B]	82.5	2616.8	35.0	912.7	3.9	1067.9
3	Neart na Goithe [2/B]	93.5	2710.3	4.4	917.1	56.6	1124.5
3	Race Bank [2/B]	31.3	2741.7	5.6	922.7	23.9	1148.4
3	Rampion [2/B]	121.0	2862.7	29.7	952.4	37.4	1185.8
3	Triton Knoll [2/B]	209.0	3071.7	50.2	1002.7	138.9	1324.7
4	Dogger Bank Teesside A & B [2/B]	444.4	3516.1	256.6	1259.3	90.7	1415.4
4	Hornsea Project 2 [3/C]	340.4	3856.5	19.0	1278.3	28.0	1443.4
4	Navitus Bay [2/B]	38.5	3895.0	17.6	1295.9	18.1	1461.6
5	East Anglia THREE [3/C]	146.3	4041.3	49.0	1344.9	90.0	1551.6
	Total	4041.3		1344.9		1551.6	

Annual data sources: 1 = Natural England (2013) submission for Rampion kittiwake assessment; 2 = Teesside A & B submission;3 = Developer Assessment;

Spring and Autumn data sources: A = no seasonal data, collisions apportioned equally among months; B = Teesside A & B submission; C = Developer assessment

108. On the basis of the values in *Table 13.36*, the cumulative kittiwake annual migration mortality is 4,041, of which the proposed East Anglia THREE project contributes 146. Note, however that many of the collision estimates were calculated for larger windfarms than have been built or are planned to be built. Therefore this value is an overestimate of the total risk. All but four of the windfarms in *Table 13.36* are either operational, under construction or consented. The cumulative annual mortality for these windfarms (up to tier 3) is 3,072. The four tier 4 and 5 projects contribute an additional 970 to this, of which 15% is attributable to the proposed East Anglia THREE project.

109. Previous kittiwake collision assessments were made on the basis of Band model option 1 and an avoidance rate of 98%, with the change to 98.9% dating from November 2014 (JNCC et al. 2014). Therefore, projects consented prior to this date were done so on the basis of a cumulative collision mortality 1.8 times that presented in *Table 13.36*. The only projects consented after November 2014 were Hornsea Project 1 (123 annual collisions at 98.9%) and Dogger Bank Creyke Beck A&B (718 annual collisions at 98.9%). Therefore the previous cumulative annual collision total (at 98%) excluding these two projects would have been 4,016 (3,072 - (123 + 718) x 1.8). The current cumulative total of 4,041, including all consented and still to be consented projects, is therefore only slightly higher than the previously accepted cumulative total.

110. Furthermore, with the recently applied update to the East Anglia ONE collision assessment (with the removal of birds on the water from the calculation the annual East Anglia ONE mortality decreased from 580 to 314 at an avoidance rate of 98.9%; this change is reflected in *Table 13.36*) the cumulative annual total decreased by 266 which is 1.8 times bigger than the contribution from the proposed East Anglia THREE project.

111. On the basis of the values in *Table 13.36*, the cumulative kittiwake spring migration mortality is 1,345, of which the proposed East Anglia THREE project contributes 49 (although many of the collision estimates were calculated for larger windfarms than have been built or are planned to be built). All but four of the windfarms in *Table 13.36* are either operational, under construction or consented. The cumulative spring mortality for these windfarms (up to tier 3) is 1,003. The four tier 4 and 5 projects contribute an additional 342 to this, of which approximately 14% is attributable to the proposed East Anglia THREE project. With the recently applied correction to the East Anglia ONE collision assessment the cumulative total decreased from 290 to 71, which is 1.4 times higher than the contribution from the proposed East Anglia THREE project.

112. On the basis of the values in *Table 13.36*, the cumulative kittiwake autumn migration mortality is 1,552, of which the proposed East Anglia THREE project contributes 90 (although many of the collision estimates were calculated for larger windfarms than have been built or are planned to be built). All but four of the windfarms in *Table 13.36* are either operational, under construction or consented. The cumulative autumn mortality for these windfarms (up to tier 3) is 1,325. The four tier 4 and 5 projects contribute an additional 227 to this, of which approximately 40% is attributable to the proposed East Anglia THREE project.

113. A review of nocturnal activity in seabirds has indicated that the value currently used for this parameter (50%) to estimate collision risk at night for kittiwake is almost certainly an overestimate, possibly by as much as a factor of 4 (i.e. study data suggest that 12.5% is more appropriate). Even reducing the nocturnal activity factor to 25% reduces collision estimates at East Anglia THREE by around 20% (note this reduction varies depending on the time of year and wind farm latitude due to the consequent effects on the balance of day and night). A correction along these lines would reduce the overall collision estimate by a significant amount (e.g. in the region of 20%) for all windfarm estimates.

114. Recent windfarm assessments have included use of Potential Biological Removal (PBR) to identify mortality impacts which exceed allowable thresholds during particular periods of the year (e.g. Smart Wind 2015).

115. During the autumn migration period the BDMPS for kittiwake is 829,937 and during spring is 627,816 (Furness 2015). A PBR conducted by Smart Wind (2015) on a population of 843,077 (i.e. very similar to the autumn BDMPS) indicated that even with precautionary parameters the PBR estimate of allowable mortality would exceed the cumulative collision total of 4,041 (e.g. at f=0.2, PBR=10,316). The same conclusion was reached on the basis of calculations conducted for a spring migration population of 639,742 (i.e. very similar to the spring BDMPS), which revealed a precautionary mortality threshold of 7,828 (f=0.2). The smallest of these seasonal thresholds (7,828) is greater than the maximum annual mortality (4,041), and this is based on a BDMPS population size which cannot be smaller than that against which the total annual collisions would be assessed. Therefore the cumulative annual total remains below the level identified by PBR as the threshold for allowable mortality.

116. *TO BE INSERTED – CONCLUSIONS FROM PVA*.

117. [To be updated following PVA conclusions] In conclusion, the proposed East Anglia THREE project contributes a relatively small amount to the cumulative total for this species and the cumulative impacts on the kittiwake population due to annual and

seasonal collisions are considered to be of low magnitude, resulting in impacts of **minor** adverse significance.

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APPENDIX 2: GANNET CUMULATIVE IMPACT ASSESSMENT

This section was taken from the draft Environmental Statement. It is included in Chapter 13, Offshore Ornithology.

APPENDIX 3: KITTIWAKE CUMULATIVE IMPACT ASSESSMENT

This section was taken from the draft Environmental Statement. It is included in Chapter 13, Offshore Ornithology.

APPENDIX 4: KITTIWAKE PVA

This section included preliminary results from the Kittiwake PVA which was subsequently updated and is included as Technical Appendix 13.4.

APPENDIX 5: EXAMPLE OF CUMULATIVE COLLISION ASSESSMENT

This section was extracted from the draft Environmental Statement. The final assessment is included in Chapter 13, Offshore Ornithology.

APPENDIX 6: SEASONAL CONSIDERATIONS REGARDING SEABIRD DISPLACEMENT AND INFERRED MORTALITY CONSEQUENCES

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Appendix 6 - Seasonal considerations regarding seabird displacement and inferred mortality consequences

6th July 2015

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Date – July 2015

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1 INTRODUCTION

1. There is only a very incomplete and poorly quantified evidence base for the extent of displacement of seabirds by offshore windfarm structures. Furthermore, there is no evidence at all to support the suggestion that any birds displaced by offshore windfarms are subject to any increased risk of mortality. Therefore, the matrix approach developed by Natural England to assess possible impacts of seabird displacement by offshore windfarms is a precautionary assessment that is not evidence-based, but considers a somewhat arbitrary set of assumptions in order to achieve a precautionary assessment. Practice in recent assessments has been to consider a matrix of displacement rates from 0% to 100% and consequent mortality from 0% to 100%, taking the affected population as the mean peak count of birds present in the season with highest numbers present on the project area plus buffer. This normally represents a 'worst case scenario' because numbers present at other times of year are, by definition, smaller than the mean peak number used in the matrix calculations.

2. Natural England wish to explore whether this approach can be refined to consider seasonal numbers present and then to sum impacts across seasons (a 'seasonally disaggregated' approach), rather than using the mean peak numbers alone. This paper explores some aspects of a seasonally disaggregated approach as an alternative to the presently accepted matrix method based on mean peak numbers.

2 HYPOTHETICAL SCENARIOS

3. Consider a model (hypothetical) scenario as follows. Auks are present in a development area at different abundances in four seasons of equal duration: spring (1000 birds), summer (200 birds), autumn (2000 birds) and winter (400 birds). Therefore, the annual mean number present is 900 birds. For the annual mean number of 900 birds present, a 50% displacement and 10% mortality of displaced birds would result in 450 birds being displaced and a consequent 45 hypothetical deaths.

4. If the assumed 10% mortality in the year is split equally across the four seasons, then there would be 2.5% mortality of displaced birds in each season. The allocation of 2.5% mortality in each of the four seasons against mean numbers present in each season also results in the same estimate, of 45 deaths over the year (Table 1). This annual mortality estimate could be split in many different ways among seasons, the equal attribution suggested just being the most parsimonious and simplest approach. One immediate problem with this suggested approach is a lack of evidence on which to base seasonal splitting of mortality (limited evidence for which is discussed later).

5. However, application of a 50% displacement and 10% mortality to the peak mean seasonal total: 2000 in autumn, so 1000 displaced and 100 deaths (Table 1), and ignoring numbers present at other times of year when numbers are smaller, provides a precautionary assessment by loading all mortality onto the seasonal peak number rather than spreading the mortality pro rata across the seasons. That approach essentially allocates all of the 10% mortality to the season with the highest numbers and allocates 0% to the other seasons. The case for following such an approach is that it is broadly precautionary to impose all of the (annual) mortality onto the largest number of birds present at any time of the year, rather than following what would appear to be a biologically more realistic approach of allocating the mortality equally across time periods. While it may seem appropriate to sum the mortality in each season (e.g. a total of 180 for the example in Table 1.1), this actually introduces considerable complications due to the different populations present in each season which are also likely to overlap in terms of the members of those populations to a variable degree. Consequently, summing in this manner will introduce an unknown degree of double counting to the assessment.

Table 1.1. Hypothetical scenario of auk displacement assessment.

Season	Period	Mean number present	Displaced (50%)	Deaths (10%)	Deaths (2.5%)
Spring	Mar-May	1000	500	50	12.5
Summer	Jun-Aug	200	100	10	2.5
Autumn	Sep-Nov	2000	1000	100	25
Winter	Dec-Feb	400	200	20	5
Annual mean		900	450	45	

6. A model applying all displacement mortality to the peak seasonal numbers will always result in a higher assessed impact than a model applying the same annual mortality rate to a mean combining all seasons of the year. Furthermore, the greater the seasonal variation in numbers of birds present, the greater the discrepancy will be between a model that applies all the displacement mortality on the seasonal peak numbers rather than equally across the seasons. Note that a model with seasons of differing duration (so more realistic) gives the same conclusions but the arithmetic becomes more complex so it is a less convenient example to consider.

Given that the mortality rates being applied are entirely arbitrary, and not evidence-based, the established approach of loading the mortality entirely onto the peak numbers rather than allocating it uniformly across the year, is apparently as appropriate a scenario as any other, and is clearly precautionary if applied to the numbers present in the context of the appropriate reference population scale. However, it invites some consideration of whether or not that approach is consistent with any existing evidence. That is discussed in the following section.

3 EVIDENCE FOR SEASONAL VARIATION IN MORTALITY RATES OF SEABIRDS

7. In many species of seabirds, there is high mortality of juveniles during the first autumn of their life, which is likely to relate mainly to their inexperience and consequent poor foraging success (Greig et al. 1983) but may also relate to their lack of experience of migration (Wernham et al. 2002), and lack of experience in avoiding hazards. For example, juvenile seabirds are more likely than adults to drown due to entanglement and are at higher risk of being killed by hunting (Wernham et al. 2002). They are also more likely than adults to be attracted to and killed by collision with lights (Rodriguez and Rodriguez 2009).

8. Coulson et al. (1983) noted that herring gull ring recoveries of adults and immatures mainly occurred in April to September, which is the time of year when the body mass of the birds is lowest, suggesting that mortality of herring gulls occurs mainly in summer rather than in winter. However, ring recovery rates may be affected by seasonal variation in habitat use by herring gulls and by human seasonal activity patterns in areas where dead gulls might be found, so there may be bias in the recovery data that obscure seasonality of mortality in this species (Wernham et al. 2002).

9. Based on direct observations of individually colour-ringed birds, Coulson (2011) reported that in his kittiwake study population in NE England, 81% of adults which disappeared and were presumed to have died, did so between September and March (7 months). Only 19% disappeared between April and August (i.e. during the 5 month breeding season). However, Oro and Furness (2002) found that sandeel stock biomass and breeding success of great skuas were the main factors determining annual survival rates of adult kittiwakes at a Shetland colony. These two factors act during the breeding season, so suggest that Shetland kittiwake mortality was mainly determined by events during the breeding season rather than during winter, although possibly involving carry-over effects between seasons. It is unclear whether the seasonal patterns therefore differ between kittiwake populations in Shetland and NE England but the latter are not exposed to predation by great skuas, and have not been affected as much by declines in sandeel abundance as the birds in Shetland.

10. Nettleship and Birkhead (1985) reported that auks in their first year of life tend to be found dead mostly in September to November, whereas peak mortality of adults occurs between January and March. Harris and Wanless (2011) found that ring recoveries indicate puffins from colonies in the North Sea mostly died in January and February, whereas most recoveries from west coast colonies were in summer.

Supporting their conclusion, one-third of colour-ringed adult puffins that disappeared from Skomer did so between April and July whereas virtually none of the colour-ringed adults at the Isle of May disappeared during those months (Harris and Wanless 2011). Beached bird surveys on southern North Sea coasts find dead seabirds washed up in all months of the year, but with more dead seabirds in winter than in summer (Camphuysen and Heubeck 2001). However, this is at least in part a reflection of the fact that there are more seabirds at sea in the southern North Sea in winter than in summer (Camphuysen and Heubeck 2001). Nevertheless, the numbers of carcasses increase more in winter than numbers of seabirds at sea, supporting the suggestion that seabird mortality tends to be higher in winter, but possibly only slightly so.

11. The limited evidence regarding seasonal variation in mortality rates of UK seabirds suggests that there may be some seasonality, but that the patterns may differ between populations of a species as well as between species. There may be a tendency for juvenile mortality to peak in autumn (particularly because newly-fledged independent young have to learn to forage and are much less successful than adults until they gain experience; e.g. Greig et al. 1983). There may be a general tendency for mortality to peak during late winter in adult seabirds, but the seasonal variation appears to be no more than moderate, and at least in some species and populations there is evidence for higher mortality during the breeding season, and so a model assuming that mortality is apportioned equally across the seasons may be a reasonable first approximation.

4 SEASONAL BDMPS POPULATIONS

12. Any assessment that considers mortality in separate seasons would need not only to apportion annual mortality into seasons, but would also need to assess the estimated seasonal mortality against the appropriate seasonal population scale (BDMPS population size; Furness 2015). This becomes difficult where the BDMPS population size differs between seasons. For example, razorbill BDMPS in the UK North Sea and Channel is about 590,000 birds during the migration seasons but only 219,000 in winter (Furness 2015). It is not clear how impacts could be added across seasons when the population against which the impact has to be assessed is different in the different seasons.

5 CONCLUSION

13. Given the uncertainty about the seasonality of mortality, and the lack of evidence to quantify mortality associated with displacement, it seems sensible to retain the current precautionary approach which assumes that mortality will be loaded onto the seasonal peak numbers rather than equally spread across the seasons, particularly since summing estimates of mortality across seasons would be made more difficult by the seasonal variation in appropriate population scales against which to apply mortality in any assessment. A possible but simple refinement to this would be to allocate the displacement mortality to the season during which the numbers represent the highest proportion of the seasonal BDMPS population rather than the highest absolute mean number in the survey area. That would retain the present precautionary nature of the matrix approach but assess against the population which would experience the highest impact.

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APPENDIX 7: SENSITIVITY ANALYSIS OF COLLISION MORTALITY IN RELATION TO NOCTURNAL ACTIVITY FACTORS AND WIND FARM LATITUDE

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Appendix 7 - Sensitivity analysis of collision mortality in relation to nocturnal activity factors and wind farm latitude

6th July 2015

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Date – July 2015

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1 INTRODUCTION

1. Surveys of seabird fluxes at proposed offshore wind farm sites only record numbers of birds flying through the area during daylight. When using the Band model, this requires some estimate of nocturnal flight activity to be made to estimate total collision risk of seabirds. In the absence of empirical data, it has been suggested that nocturnal flight activity of seabirds should be incorporated into CRM by taking the nocturnal flight activity scores given by Garthe and Hüppop (2004) on a 1 to 5 scale, and transcribing these into 0%, 25%, 50%, 75% and 100% of daytime flight activity level to provide a factor representing the unknown nocturnal flight activity of seabirds as a percentage of the observed daytime level (e.g. as done by APEM 2015).

2. This approach was not anticipated by Garthe and Hüppop (2004), who considered that their 1 to 5 scores were simply categorical, and were not intended to represent a scale of 0 to 100% of daytime activity (not least because the lowest score given by Garthe and Hüppop (2004) was 1 and not 0). This is clear from their descriptions of the scores: for example for score 1 'hardly any flight activity at night'. It is also clear from the highly nonlinear scoring that they used for other factors in their analysis (for example biogeographic population size).

3. Recently however, a number of studies have deployed loggers on seabirds, and data from those studies can provide empirical evidence of the actual flight activity level. Table 1 provides a summary of the tag derived observations with further details provided in the following sections.

Table 1. Hypothetical scenario of auk displacement assessment.

Species	Study	Season	Flight during night (% of time at sea)	Flight during day (% of time at sea)	Nocturnal activity as % of daytime rate	Standard CRM value
Gannet	Garthe et al. 1999	Breeding	0%	55%	0%	25%
	Hamer et al. 2000	Breeding	0%	50%	0%	25%
	Hamer et al. 2007	Breeding	0%	50%	0%	25%
	Garthe et al. 2012	Autumn	0.5-0.8%	30-40%	2%	25%
	Garthe et al. 2012	Winter	<0.5%	26%	<2%	25%
Kittiwake	Hamer et al. 1993	Breeding	0%	-	-	
	Daunt et al. 2002	Breeding	0%	60%	0%	50%
	Kotzerka et	Breeding	0%	35%	0%	50%

Species	Study	Season	Flight during night (% of time at sea)	Flight during day (% of time at sea)	Nocturnal activity as % of daytime rate	Standard CRM value
	al. 2010					
	Orben et al. 2015	Winter	<5%	40%	12%	50%
Lesser black-backed gull	Klaassen et al. 2012	Migration	12%	48%	25%	50%

2 GANNETS

2.1 Autumn and winter

4. Garthe et al. (2012) deployed geolocator loggers on breeding adult gannets on the Bass Rock in 2002, 2003, and 2008. During the peak of autumn migration, in October, birds that were going to remain overwinter in the North Sea or Channel spent a mean of 0.5% of the night in flight. Birds that were migrating to winter off West Africa spent a mean of 0.8% of the night in flight. In autumn, flight activity was highest immediately after sunrise (50% of time in flight) and lowest immediately before sunset (20% of time in flight), with flight activity decreasing approximately linearly over the daylight period. In winter, birds spent even less of the dark period in flight, with a mean of slightly less than 0.5% of the night spent flying.

5. During daylight hours, birds spent more time flying in autumn than in winter, and birds that were migrating to West Africa spent more time flying (40% of daylight hours) than birds that wintered in UK waters (30% of daylight hours flying). In winter, birds spent on average 26% of daylight hours in flight, but with considerable variation between winters and with less flight activity off West Africa than in wintering areas in Europe.

6. From these data we can compare flight activity in gannets at night with the level during the day.

- During autumn migration, flight activity at night (<0.8% of night) compares with 35% of daylight hours in flight; flight activity at night was therefore about 2.3% of flight activity during daylight in autumn.
- Flight activity in winter revealed <0.5% of the night spent in flight, compared with flight activity 26% of daylight hours in winter; flight activity at night was therefore about 1.9% of the level of flight activity during daylight in winter.

7. Flight activity at night of about 2% of the daytime level is considerably lower than the standard rate applied in CRM of 25% based on the Garthe and Hüppop (2004) score of 2 for gannet nocturnal flight activity. The logger data indicate that CRM will overestimate collision numbers when taking 25% as the correction for nocturnal flight when empirical evidence indicates a correction of around 2% for gannets.

8. The logger data from non-breeding adult gannets are considered robust as they are from a large sample size over several winters. The geolocator loggers used are small so are unlikely to have any influence on bird behaviour, and all loggers were recovered from birds that bred successfully in the season following logger

deployment. The low level of flight activity shown by the loggers is consistent with the understanding of gannet natural history; as a visual hunter gannets will not be able to locate fish on which to plunge-dive during hours of darkness, and in the non-breeding season will not need to fly at night to return to nest sites. Gannet migrations are slow compared to migrations of other seabird species (Fifield et al. 2014) and so birds are not under any pressures to migrate during the night.

2.2 Breeding season

9. Garthe et al. (1999) deployed data loggers on chick-rearing gannets in Shetland. The data showed that there was no flight activity during the hours of darkness, but that during daylight hours birds at sea spent 55% of the time in flight and 45% on the sea surface. Hamer et al. (2000) deployed satellite transmitters on chick-rearing gannets at the Bass Rock and also found that there was no flight activity by birds at sea during the hours of darkness. They reported that during daylight hours the birds spent 50% of the time in flight and 50% on the water. Exactly the same results were obtained by deployment of GPS loggers on birds by Hamer et al. (2007).

10. The complete lack of any flight activity at night by birds foraging for chicks was despite the fact that birds were apparently working at maximum capacity and were occasionally leaving chicks unattended, increasing risk of chick mortality (Hamer et al. 2007). Empirical evidence therefore indicates that no adjustment should be made to account for flight activity by gannets at night during the breeding season. This is supported by the latest study reporting on logger deployments on breeding adult gannets. Warwick-Evans et al. (2015) reported on activity of birds from Alderney. They reported that gannets showed some surface-based activity during darkness that they interpreted as foraging while swimming, but that no plunge-diving behaviour was recorded during dark. However, high levels of plunge-diving activity started before sunrise (but after daylight had become available to allow visual foraging). Their results therefore further support the evidence that gannets do not normally fly during the dark, but will fly before sunrise once daylight is becoming available. So definition of 'night' would more appropriately be the hours of darkness rather than time of sunset to time of sunrise.

11. The logger data from breeding adult gannets are considered robust as they are from a large sample size over several years and several different colonies. GPS loggers provide accurate data on position, giving reliable data on flight speed (Hamer et al 2007). It may at first seem odd that gannets show less flight activity during darkness in summer than in winter, since breeding gannets may be under greater pressures to forage and provision their chick. However, darkness during summer is short, and flight is energetically expensive. Therefore, breeding gannets are likely to be at a

metabolic limit when foraging for much of the day. Since they cannot increase flight activity beyond their metabolic limit, it would make sense to fly when foraging success will be high and avoid flight costs at times when foraging success will be low. Therefore, there may be an energetic constraint on flight activity of breeding adults that does not apply during winter. This would explain lower levels of flight activity during dark by breeding birds compared to non-breeding birds either in summer or during winter.

12. The standard rate applied in CRM of 25% of daylight level based on the Garthe and Hüppop (2004) score of 2 for gannet nocturnal flight activity is inappropriate for breeding gannets.

3 KITTIWAKES

3.1 Breeding season

13. From radio-tracking studies of breeding kittiwakes in Shetland in a period when food supply was poor and adults were working to their maximum capacity to feed chicks, Hamer et al. (1993) inferred that adults on foraging trips were roosting on the sea throughout the hours of darkness and displaying no flight activity at night. Daunt et al. (2002) deployed activity loggers on breeding kittiwakes in June at the Isle of May and reported that 'birds did not fly at all during the darkest part of the night', but that during daylight hours the birds at sea spent about 60% of the time flying and 40% on the water. Kotzerka et al. (2010) reported that breeding kittiwakes carrying GPS loggers spent 35% of daylight hours at sea in flight, but that birds on long foraging trips and away from the colony overnight spent 100% of the period of darkness at night resting on the sea surface.

14. Empirical evidence therefore indicates that no adjustment is required to account for flight activity by kittiwakes at night during the breeding season. The standard rate applied in CRM of 50% of daylight level based on the Garthe and Hüppop (2004) score of 3 for kittiwake nocturnal flight activity is inappropriate for breeding kittiwakes, as the empirical evidence indicates 0% flight activity during darkness by breeding kittiwakes.

3.2 Autumn and winter

15. Orben et al. (2015) provide the first published data on kittiwake activity budgets during migration and winter, based on deployment of geolocator data loggers on a large sample of breeding adults at a colony in the Pacific (the study was of both red-legged kittiwakes and black-legged kittiwakes but only the data from the latter species are reported here). Birds spent less than 5% of darkness in flight, and the little flight activity that did occur at night was more often on nights with bright moonlight. During daylight, birds spent about 40% of the time in flight, equivalent to 15% of the 24-hour day. The rest of the time was spent on the water. Nocturnal flight activity of kittiwakes studied by Orben et al. (2015) was therefore very considerably less than the 50% of daylight level used as the standard rate applied in CRM as based on the Garthe and Hüppop (2004) score of 3 for kittiwake nocturnal flight activity.

16. There is some possibility that behaviour of kittiwakes in the Pacific may differ from behaviour of kittiwakes in the Atlantic, so the data from Orben et al. (2015) should be used with caution. However, since the cloud cover over the North Atlantic in

winter is likely to be thicker than over the North Pacific, and since kittiwakes in Orben's study were less active at night when there was little or no moonlight, the flight activity of kittiwakes over the Atlantic in winter is more likely to be lower, rather than higher than reported by Orben et al. (2015).

17. The logger data from breeding adult kittiwakes are considered robust as they are from a large sample size, from several different colonies in different marine regions, in different years. The data from non-breeding birds are also considered robust as they are from a large sample size, although from the Pacific Ocean where environmental conditions could make behaviour differ from that of conspecifics wintering in the North Sea. It may at first seem odd that kittiwakes show less flight activity during darkness in summer than in winter, since breeding kittiwakes may be under greater pressures to forage and provision their chicks. However, darkness during summer is short, and flight is energetically expensive. Therefore, breeding kittiwakes are likely to be at a metabolic limit when foraging for much of the day (as reported for example by Daunt et al. 2002). Since they cannot increase flight activity beyond their metabolic limit, it would make sense to fly when foraging success will be high and avoid flight costs at times when foraging success will be low. Therefore, there may be an energetic constraint on flight activity of breeding adults that does not apply during winter. This would explain lower levels of flight activity during dark by breeding birds compared to non-breeding birds either in summer or during winter.

4 LESSER BLACK-BACKED GULLS

4.1 During migration

18. From a project funded by DECC, the BTO hold data on flight activity of lesser black-backed gulls equipped with GPS loggers at nests in Suffolk and tracked while breeding, as well as throughout their migrations and winter. Flight activity during the day and at night has been examined. However, those data have not yet been published and BTO are unwilling to make the data available until after publication (Chris Thaxter pers. comm.).

19. Klaassen et al. (2012) reported on the migration behaviour of lesser black-backed gulls equipped with GPS satellite transmitters. During migration, birds spent an average of 48% of daylight hours in flight, and 12% of the night in flight. Flight activity decreased from about 25% of the time early and late during the night to zero at the darkest period of the night. Flight activity was lowest on days when the migration distance travelled was least, and was highest when birds made long migratory flights. This would suggest that flight activity at night would be likely to be lower when the birds are not migrating, but the same is probably true of daytime flight activity. Flight activity at night averaged 25% of the level seen in the same birds during daylight. Nocturnal flight activity of lesser black-backed gulls studied by Klaassen et al. (2012) was therefore considerably less than the standard rate applied in CRM of 50% of daylight level based on the Garthe and Hüppop (2004) score of 3 for lesser black-backed gull nocturnal flight activity.

20. Our biological understanding of nocturnal flight activity of large gulls is not good. It is known that breeding gulls tend to sleep at night at their breeding territory. This even applies in Arctic colonies where there is daylight during the night. Larus gulls can be active at night when feeding on storm petrels or Manx shearwaters, although that activity may be mainly close to sunset and sunrise. Larus gulls tend to roost at night, either on the sea surface or on remote (predator-free) islands. However, they may fly around fishing vessels at night during winter, perhaps especially when those vessels have lights to allow them to feed visually by artificial light.

5 HERRING GULL AND GREAT BLACK-BACKED GULL

21. There have been surprisingly few studies that have deployed loggers or GPS tracking devices on herring gulls or great black-backed gulls and apparently no relevant activity data have been published. Analysis of raw data (if available) to derive flight activity data would require a non-trivial amount of work and time (probably taking at least a year to complete). However, as a first approximation, the relationship between nocturnal and daytime flight activity of herring gulls and great black-backed gulls is likely to be similar to that in lesser black-backed gulls, as all three species forage in broadly similar ways. All three were given the same nocturnal flight activity score (of 3) in Garthe & Hüppop (2004) and Furness et al. (2013).

6 CONCLUSIONS OF NOCTURNAL ACTIVITY REVIEW

22. We consider that it would be more appropriate to carry out Collision Risk Modelling using the empirical data on nocturnal flight activity reviewed above, rather than the arbitrary percentages previously suggested by Natural England. We recommend use of the values in Table 2.

Table 2. Recommended nocturnal flight activity percentages for use in collision risk modelling.

Species	Nocturnal flight activity as % of daylight flight activity by non-breeding birds	Nocturnal flight activity as % of daylight flight activity by breeding birds
Gannet	2%	0%
Kittiwake	12%	0%
Large Larus gulls	25%	25%*

*Precautionary value that probably overestimates nocturnal flight activity but is suggested because there is a lack of empirical data to give a more appropriate value.

23. We would welcome dialogue as to how this could be applied across other projects to inform cumulative/in combination assessments.

7 COLLISION MODELLING SENSITIVITY ANALYSIS

24. To aid understanding of how reductions in nocturnal activity affect collision mortality estimates in relation to month and latitude a sensitivity analysis was conducted as follows:

- Seabird density was kept at a constant value in all months;
- Two wind farm locations were used, located in the Moray Firth (58.25°N) and adjacent to the Isle of Wight (50.45°N);
- The same wind farm parameters were used in both locations;
- Three species were simulated (gannet, kittiwake and great black-backed gull);
- Nocturnal activity scores were adjusted down by 1 point on the 1-5 scale used in the collision model;
- All other parameters were kept at fixed values throughout.

25. The results of this analysis are presented in Figure 1 and Table 3 and are summarised as follows:

- The reduction in collision mortality observed with a reduction in nocturnal flight activity is due solely to the reduced amount of time birds are at risk, therefore the effect is consistent across species (i.e. bird size and percentage at flight height have no effect on the results);
- The reduction in collision mortality with reducing nocturnal flight activity is greatest in mid-winter and least in mid-summer, reflecting the relative durations of day and night;
- The difference between wind farms located in the north of Scotland and the south of England is smaller than that for month, although the difference between summer and winter is greater for northern sites;
- Reducing flight activity from class 2 to 1 (25% to 0%) has a greater reductive influence than from class 3 to 2 (50% to 25%), although this difference is most pronounced in mid-winter and virtually absent in mid-summer. This is due to the seasonal variation of adding variable day length to the reciprocal period of night multiplied by a constant proportion (of nocturnal activity).

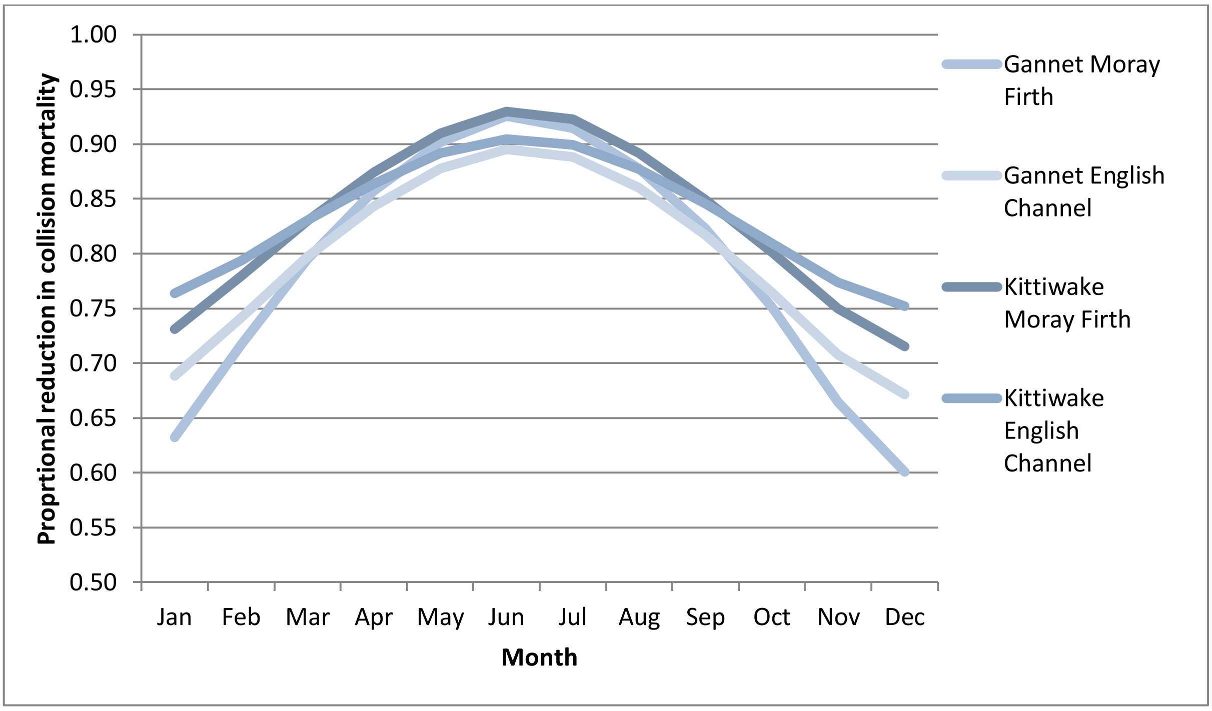

Figure 1. Ratio of collision estimates obtained using current nocturnal flight activity scores (gannet: 2, kittiwake: 3) to those obtained with scores reduced by 1 (gannet: 1, kittiwake: 2) at simulated wind farms in the Moray Firth and the English Channel. Results for great black-backed gull are not shown to aid clarity as these overlap with those for kittiwake (ratio 1:2) and gannet (ratio 2:3; see Table 3).

26. The magnitude of reduction in collision risk obtained with reduced nocturnal flight activity is most dependent on the time of year when birds are present, with the effect greatest when the night is longest (i.e. mid-winter). Therefore, to calculate annual collisions at a lower rate requires a monthly breakdown of collision estimates. However, as a precautionary first step the minimum collision mortality reduction observed during mid-summer (e.g. 7%) could be applied to all wind farm collision estimates to reflect a reduction of 1 point on the 1 to 5 score.

Table 3. Comparison of monthly collision mortality estimates at different nocturnal flight activity scores. In all cases the wind farm data remained the same. The ratio of the lower score to the higher is provided. For gannet and kittiwake 2 rates are presented (2 and 1, 3 and 2 respectively). For great black-backed gull rates of 3, 2 and 1 are presented.

Species	Region	Latitude	NAF	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gannet	Moray Firth	58.25	2	419	431	545	596	682	697	704	645	558	506	426	401
			1	265	309	433	511	615	645	644	566	459	380	283	241
			Ratio (1:2)	0.632	0.717	0.794	0.857	0.902	0.925	0.915	0.878	0.823	0.751	0.664	0.601
	English Channel	50.45	2	456	449	547	581	647	650	661	621	552	518	455	444
			1	314	333	436	490	568	582	587	534	451	396	322	298
			Ratio (1:2)	0.689	0.742	0.797	0.843	0.878	0.895	0.888	0.860	0.817	0.764	0.708	0.671
Kittiwake	Moray Firth	58.25	3	621	598	711	738	810	811	825	783	710	683	615	607
			2	454	466	590	645	737	754	761	698	603	547	461	434
			Ratio (2:3)	0.731	0.779	0.830	0.874	0.910	0.930	0.922	0.891	0.849	0.801	0.750	0.715
	English Channel	50.45	3	647	611	713	727	784	777	795	766	706	692	636	638
			2	494	485	592	628	699	703	715	672	597	560	492	480
			Ratio (2:3)	0.764	0.794	0.830	0.864	0.892	0.905	0.899	0.877	0.846	0.809	0.774	0.752
Great black-backed gull	Moray Firth	58.25	3	1663	1603	1906	1978	2170	2172	2212	2100	1903	1830	1648	1628
			2	1216	1249	1580	1729	1976	2020	2039	1870	1616	1466	1235	1162
			1	768	895	1254	1480	1782	1869	1866	1641	1330	1102	821	697
			Ratio (2:3)	0.731	0.779	0.829	0.874	0.911	0.930	0.922	0.890	0.849	0.801	0.749	0.714
			Ratio (1:2)	0.632	0.717	0.794	0.856	0.902	0.925	0.915	0.878	0.823	0.752	0.665	0.600
	English Channel	50.45	3	1734	1637	1910	1947	2102	2081	2130	2053	1892	1854	1705	1711
			2	1323	1300	1586	1683	1874	1884	1916	1800	1600	1501	1320	1287
			Ratio (2:3)	0.763	0.794	0.830	0.864	0.892	0.905	0.900	0.877	0.846	0.810	0.774	0.752

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13.1.13 Minutes of Ornithology ETG 6 Meeting

15. Provided below are the minutes of the sixth Ornithology ETG meeting

East Anglia Offshore Wind Limited - East Anglia THREE

East Anglia THREE, Ornithology ETG Meeting 6 – 06/07/15

Attendees		
Name	**Initials**	**Organisation**
Marcus Cross	MC	EAOW (video)
Holly Cartwright	HC	EAOW
Claire Ludgate	CL	Natural England
Lou Burton	LB	Natural England (phone)
Tim Frayling	TF	Natural England
Jacqui Miller	JM	RSPB (phone)
Sarah Lee	SL	RSPB
Sue Hooton	SH	SCC (phone / joined section 2 and 10)
Mark Trinder	MT	MacArthur Green
Paolo Pizzolla	PP	Royal HaskoningDHV
Apologies	Keith Morisson	

AGENDA		
Item	**Description**	**Action**
1	Health and Safety – HC Introductions - All	n/a
2	Finalised onshore construction mitigation provides required clarity and detail for Natural England to agree no risk of significant impacts will occur. (Slide 3) MC – this restriction would be captured in SoCG and would be a condition within the DCO TF – this is welcomed. 1) are these dates appropriate? 2) is intrusive activities adequate? MC – intrusive seems to cover any actual construction LB – from the EA1 hearings there was an understanding that there would no be works over consecutive winters, NE position hasn't changed. EATL need to set parameters around this to clarify what will and will not be undertaken in consecutive winters. JM – (*post-meeting clarification*) also concerned about this issue; a commitment to avoid consecutive winter work in the section between the east bank of the Deben and Queens Fleet may provide some comfort. Can this or a similar commitment be made? MC: Highlighted that this was not EAOW understanding prior to the hearings and we never agreed with NE position	

	SH – could we use the definition of activity from EA1? *"If potentially disturbing construction works take place within all or part of the period September to March inclusive then the two additional measures set out below will be implemented. Potentially disturbing construction works are defined as those operations during the construction phase that produce percussive noises (short, sharp, loud and resembling gunshot) such as earth moving and tipping and/or require construction workers to operate from outside of vehicles potentially in sight of Brent Geese. Operations excluded from that definition include the use of the haul road to transport workers and materials between locations along the route of the onshore works."* MC – the only activities we propose undertaking during the restricted period would be walk-over surveys that would potentially be excluded if we accepted the EAOL condition. PP – could we turn this around, defining what we *can* do e.g. 'no works would be permitted other than vehicular access and walk-over survey" JM - (*post-meeting clarification*) support the proposed time period for the restriction in this definition, but agree that consideration should be given to whether it is preferable to define allowable activities, and all other activities would be excluded, as discussed below. LB – can we define the number of visits? MC – EATL will need to discuss this with the project engineers and will look at potential re-wording TF – are the dates for the proposed restriction appropriate (i.e. November to the end of February) MC – looking at the site specific evidence, yes the dates are appropriate TF - agreed	ACTION – EATL to look at the definition of the potential activity again ACTION – All agree that the dates proposed will be used for the restriction
3	SPA features identified in the updated screening report are the only ones for which HRA will be required. (slide 5) MT – EATL have added back in the two features as discussed at the last meeting (i.e. red throated diver (Outer Thames estuary) and kittiwake (Flamborough and Filey)) TF – agreed the SPA features identified screen into the HRA are appropriate	ACTION – All agree the following features and sites are screened into to HRA • **Deben Estuary SPA** (dark-bellied brent goose); • **Outer Thames Estuary** SPA (**red-throated diver**); • **Alde-Ore Estuary SPA** (lesser black-backed gull);

	JM – noted that the Screening document needs to be updated in all cases to reflect the change for consistency (para 66, appendix 1) and agree with the SPA features identified as screened into the HRA.	• **Flamborough and Filey Coast pSPA** (gannet, **kittiwake**). ACTION – ensure HRA screening is consistent
4	Updated gannet collision nos. are correct, use of SOSS-04 Gannet PVA report is appropriate and cumulative mortality is not significant. (Slide 6 - 10) TF – is this the correct figure for EA3? Does EATL have confidence in the flight heights? (this is in reference to the point made in the letter sent with response to OETG5 minutes) – need to justify the PCH figure MT – EATL have been in touch with Apem, a response will be sent through covering all the points in the letter TF – appreciate the figures are being updated and this is unlikely to materially change the assessment as EA3 makes a small contribution to the cumulative total. TF – broadly agreed with the collision figures, would like to see the excel band model spreadsheet for the various options JM (*post-meeting clarification*) Whilst the RSPB accept the recently recommended amendment to gannet avoidance rate (from 98% to 98.9%) for non-breeding birds, we do not agree that this figure should be applied to the breeding season due to the lack of available evidence relating to breeding birds. We therefore consider that an AR of 98% should be presented (alongside a range of figures from 95% to 98.9%). MT – SOSS gannet PVA was used to look at significance. Key output is that 95% of simulations had positive growth until additional mortality >3,500 which is higher than the revised cumulative total that we currently have for collisions. In addition the PVA is based on the 2004 population, the population is now known to be 30% larger – therefore the threshold at which additional mortality will cause the lower 95% confidence interval to reach 1 will now be up to a third higher. Therefore cumulative impact is not significant. 1 – does this make sense? TF – understands the logic, in principle this is correct. MT – this shows that there is little justification for undertaking any new modelling TF – NE would not request any new modelling JM – logic straight-forward	ACTION – EATL to respond to NE letter of 26th June ACTION – circulate the spreadsheet covering all Band models AGREED – no requirement for new modelling

	2 – do you agree on the significance TF - Agree project alone is not significant, not sure that the cumulative can be ruled out JM - (*post-meeting clarification*) **Project alone impacts** - Due to the low number of birds present at EA3 in the breeding season position remains that collision mortality is unlikely to be significant for EA3 alone in terms of the population considered under EIA. JM - *(post-meeting clarification)* **In-combination impacts -** We note that ARs have been altered retrospectively for other OWFs. As noted above, we do not agree with the change to AR for birds present in the breeding season, however, based on the figures presented, it is unclear whether this affects the figures significantly. We would therefore like to see in–combination mortality figures presented for the breeding season, as well as the autumn period, so that the contribution of the different seasons to total annual mortality can be determined. JM - (*post-meeting clarification*) **HRA -** For clarity we note that we our comments at this stage relate to significance of effects on populations considered under EIA. As stated at the meeting, we are keen to see collision mortality, both for the project alone and in-combination, attributed to SPAs. Our position on significance of effects on these populations will be determined following provision of the relevant data.	
5	Updated kittiwake collision numbers are correct, proposed PVA methods are appropriate and preliminary results indicate that cumulative mortality is not significant. (Slide 11 – 15) MT – do you agree with the figures TF – NE would like to review figures, does not agree that cumulative impact is not significant MT – has used BDMPS seasons which may account for differences in numbers from Dogger Bank Teesside. JM - (*post-meeting clarification*) there is inadequate empirical basis for the density dependent model to *replace* the density independent model and instead we recommend that both are presented and assessed. MT – outlined the PVA he has developed for interpreting impact a the BDMPS scale and note that the figures have been updated (presentation correct, papers have been corrected)	 ACTION – check definition Assessment methods indicate the following summary of impact assessment:

	1 – Does logic make sense? TF - understands the logic, in principle this is correct. 2 – do you agree on the significance SL – RSPB would find the worst case worrying. MC – this is highly unlikely TF – NE find 2-3% potentially worrying, MT – most of this impact is already happening as it is due to other projects and EA3 contribution alone is negligible. TF – cannot say that the cumulative impact is not significant. Confident that alone this is not significant. MC – need to check back with regard to what we have said 'significant' will be within the EIA methodology TF - Agree that the project alone is not significant but have some concerns about concluding non-significant cumulatively JM – cannot agree that cumulative impacts are not significant at this stage MC: We will consider the appropriate wording and make suggestions in the SoCG JM – will the impact be apportioned to SPAs for the HRA? MC – will have to apportion for the in-combination MC – do you have general concern regarding kittiwake JM – not for EA3 only, in-combination looks like it could be a concern – for the Flamborough colony TF – Flamborough kittiwake are screened in therefore this will be addressed in the HRA	**Sensitivity -** rank derives from tolerance to disturbance: High = very limited tolerance Medium = limited tolerance Low = some tolerance **Conclude – low to medium sensitivity.** **Conservation value** - rank derives from SPA connectivity: High = clear connectivity Medium = probable connectivity, but non-SPA connected too Low = no SPAs for species or no predicted connectivity **Conclude – Medium conservation value.** **Magnitude** – rank derives from population impact High = irreversibly alter population and alter long term viability, >5 yrs to recover Medium = no effect on long term viability, recovery with 5 years Low = no long term harm, <1 year to recover **Conclude – Medium magnitude** **Combined these give an impact due to cumulative mortality of minor to moderate significance.**
6	Evidence base for cumulative gull collisions provides appropriate level of comfort to conclude that current totals are below previously consented levels. MT – slide 16 provides a summary of the cumulative totals for 4 gull species (sources and numbers).	

VATTENFALL SCOTTISHPOWER RENEWABLES

	Comparing the consented totals and EA3 totals, all current totals are below what has been agreed. TF – yes this makes sense and follow logic of the argument JM – yes, subject to confirming the numbers	
7	Following a review of methods, it is concluded that the existing approach for assessing displacement (based on peak season) remains precautionary and appropriate. Alternatives introduce considerable uncertainty due to population overlaps, although could base on highest proportional abundance rather than highest absolute abundance. (Slide 17) MT – has TF position changed on this? TF – recognises the points made and that summing seasons precautionary and involves double counting. However, NE would still like EATL to provide an annual figure by summing across seasons and use the highest BDMPS population MT – if we do this the population against which considered should be the biogeographic population not the highest BDMPS, to avoid risk of double counting TF – will consider which population against which impacts should be measured further MT – which mortality levels should be used? TF – there is no evidence for what should be used, therefore present a matrix with a range JM/SL -(*post-meeting clarification*) agree that mortality should be loaded onto seasonal peak numbers, for species present primarily during non-breeding periods. However, this approach should be considered on a species by species basis. For example, where reasonable numbers of an individual species are present during the breeding season it may be appropriate to consider the potential impacts on these birds (and their survival/productivity) even if this does not represent the highest proportion of the seasonal BDMPS population.	ACTION – TF to consider which baseline population is appropriate for this assessment
8	Nocturnal activity factor sensitivity review indicates a precautionary minimum reduction of 7% should be applied to all collision mortalities for a reduction of 1 level (e.g. from level 3 to 2). MT – it would be possible to recalculate collision for all spp. at all sites LB – have any other OWFs done this? MT – this was an exercise undertaken by McArthur Green	

	TF – how do EATL intend to use this information – will it be added to the narrative or will the collision numbers be reduced? MT – the report will be a technical appendix, this will be referred to in ES as context for why the cumulative collision numbers are precautionary MC – EATL have not yet decided how to present this information in the ES. It is worth considering that if CIA is majorly influenced by wintering impacts that this could be very important – i.e. longer nights in winter TF – would like to get a joint SNCB position MC – The technical report can be circulated to SNCBs MC – EATL reserve right to use this in the ES JM - (*post-meeting clarification*) For gannet and kittiwake, the sample size is reasonably large and uses data from more than one study. An adjustment in nocturnal activity rates (breeding/non-breeding) is justified for these species. For large gulls, the sample size is small (14 individuals) and uses data from just one study for one species (LBBG). An adjustment in nocturnal activity rate is NOT justified for large gulls. JM - (*post-meeting clarification*) We cannot agree the proposed reduction in flight activity of 7% for gannet and kittiwake at this stage. The derivation of this figure should be more clearly supported before it can be used. As the degree of adjustment for large gulls is not supported by a strong evidence base we do not consider it will be possible to apply any reduction in collision estimates for these species.	ACTION – TF to circulate the report within the SNCBs (Mig-bird)
9	SL – RSPB noted from the s42 Phase III report that there may be increased vessel numbers with a Two phased approach to construction PP – The point about vessel numbers is that if the Two Phased approach is taken there will be losses of economies of scale and it is likely that many more trips overall would be required to construct the project (7600 trips for Two Phased compared to 5700 trips for Single Phase) however the majority of this difference would be within the windfarm. For the cable route, however, under either approach the cabling operations last for a total of 22 months (or 2 x 11 months) and each approach would have two vessels laying cables at any one time. Therefore with regard to the SPA there would be little difference in any disturbance effects from cabling laying vessels	ACTION – explain the vessel numbers within the ES
10	**Document review** EATL will supply the HRA documents by 27th July – NE	

	to return by 14th August – there is no time to review the ES chapter. DML / DCO – potential for workshop w/c 10th August **Evidence plan documents** PP – suggested that for the presentation of the evidence plan documentation we include the overarching paper from each meeting together with the finalised minutes. Appendices will only be included if these are not reproduced in some form within the ES or HRA documents. There will be a cover sheet explaining that Appendices have been a work in progress and these have been updated with agreed figures/baseline populations etc and are included in the ES chapter appendices. This will reduce the materials submitted and prevent confusion over superseded parts of the assessment. LB / SL - Agreed	
11	AOB None raised	

Agreement log

ID	Issue on which EATL seek agreement on	NE Position	RSPB Position	SCC
	OETG6			
	That the wording of the proposed restriction at the Deben is appropriate No intrusive construction activities between the Queens Fleet and the HDD compound on the east bank of the Deben Estuary crossing. Intrusive activities are those that are directly required to construct or reinstate the haul road, jointing pit and use of plant associated with the pull-through. Activities excluded from this restriction include walk over site investigation works and vehicle access.	*Clearer wording required particularly with regard to activities over multiple winters*	*Work in consecutive winters should be avoided between the Deben east bank and Queens Fleet. We agree that works potentially causing disturbance should be avoided during September to March inclusive and recommend that further consideration is given to the definitions used.*	*Clearer wording required particularly with regard to activities over multiple winters. Could wording be aligned with that agreed for EA1*
	SPA features identified in the updated screening report are the only ones for which HRA will be required. • **Deben Estuary SPA** (dark-bellied brent goose); • **Outer Thames Estuary** SPA (**red-throated diver**); • **Alde-Ore Estuary SPA** (lesser black-backed gull); • **Flamborough and Filey Coast pSPA** (gannet, **kittiwake**).	*Agreed*	*Agreed*	*Agreed*
	Updated gannet collision nos. are correct, use of SOSS-04 Gannet PVA report is appropriate and cumulative mortality is not significant.	*Agree that the method is correct in principle* *Project only impact is non-significant*	*We disagree with the use of a 98.9% AR during the breeding season.* *Project only impact is non-*	*n/a*

		Reserve judgement on the significance of impact	*significant for populations considered under EIA* *Reserve judgement on the significance of impact in-combination* *Attribution of mortality to SPAs is required*	
	Updated kittiwake collision numbers are correct, proposed PVA methods are appropriate and preliminary results indicate that cumulative mortality is not significant.	*Agree that the method is correct in principle* *Project only impact is non-significant* *Reserve judgement on the significance of cumulative impact*	*Agree that the method is correct in principle but consider that density independent outputs should be retained and assessed along with density dependent outputs* *Project only impact is non-significant for populations considered under EIA* *Reserve judgement on the significance of cumulative impact* *Attribution of mortality to SPAs is required*	*n/a*
	Evidence base for cumulative gull collisions provides appropriate level of comfort to conclude that current totals are below previously consented levels.	*Subject to confirming the numbers used, would agree that the totals are lower*	*Subject to confirming the numbers used, would agree that the totals are lower*	*n/a*
	Following a review of methods, it is concluded that the existing approach for assessing displacement (based on	*NE would like to see monthly numbers and will respond on the*	*Agree that mortality should be loaded onto seasonal peak*	*n/a*

	peak season) remains precautionary and appropriate. Alternatives introduce considerable uncertainty due to population overlaps, although could base on highest proportional abundance rather than highest absolute abundance.	*appropriate population baseline for assessing the impact*	*numbers, for species present primarily during non-breeding periods. However, this approach should be considered on a species by species basis - where reasonable numbers of an individual species are present during the breeding season it may be appropriate to consider the potential impacts on these birds (and their survival/productivity) even if this doesn't represent the highest proportion of the seasonal BDMPS population.*	
	Nocturnal activity factor sensitivity review indicates a precautionary minimum reduction of 7% should be applied to all collision mortalities for a reduction of 1 level (e.g. from 3 to 2).	*There is no agreed SNCB position on how to use this information at the current time.*	*We cannot agree the proposed reduction in flight activity of 7% for gannet and kittiwake at this stage. The derivation of this figure should be more clearly supported before it can be used.* *As the degree of adjustment for large gulls is not supported by a strong evidence base we do not consider it will be possible to apply any reduction in collision estimates for these species.*	*n/a*
	OETG5			

	That use of season definitions and minimum population sizes is appropriate	*Agree*	*Agree*	
	That potential phasing of construction of offshore components has little / no bearing on assessment	*Agree*	*Would like to see more detail re factors which could increase displacement of red-throated diver, e.g. increase in vessel numbers (as noted in the Phase 3 consultation)*	
	That approach for assessing displacement (alone and cumulative) is appropriate and outputs do not indicate significant impacts	*NE recommend summing the seasonal displacement outputs– noting the caveats in (6) above namely* • *EATL to include full tables of ranges of displacement* • *There needs to be a consideration of how to determine annual mortalities* • *Red throated diver assessment to use a flat displacement rate across buffer*	*Agree – subject to caveats noted by NE (as left)* • *EATL to include consideration of Sizewell C in CIA for red-throated diver*	
	That approach for assessing collision risk (alone and cumulative) is appropriate and outputs do not indicate significant impacts	*Agree with following caveats* • *EATL to provide confirmation of source of cumulative numbers* • *If the argument is made that impacts below previously consented totals are acceptable, the full referencing /audit trail must be provided*	*We will comment on this point once we have seen the PVA outputs for gannet and kittiwake. We also support NE's comments (as left)*	

	That impacts are of such small magnitude that population modelling (PBR or PVA) is unnecessary **EATL will undertake PVA for kittiwake and use SOSS-04 gannet report**	*Agree with following caveats* • *PVA required for gannet & kittiwake*	*Agree that PVA is required for gannet and kittiwake*	
	That gannet avoidance rate is likely to be >98.9% and this should be reflected in the assessment **EATL is no longer challenging the 98.9% AR**	*Advise continue to use 98.9% AR for gannet with Basic Band Model Option 1 and 2 , and outputs calculated using i) mean AR and ± 2 SD and ii) mean, upper and lower 95% CLs of flight density data by month;*	*N/A*	
	That revised collision estimates for East Anglia ONE should be used in the CIA	*Agree*	*Agree*	
	That nocturnal activity factor used in CRM is overestimated and that use of evidence based values is appropriate for the assessment. However, the intention is not to re-work the CRM figures but to provide additional text	*Agree – NE will discuss this matter further with SNCBs if nocturnal activity factors are amended*	*Cannot agree at this stage. We agree that this may provide useful context within the narrative (as noted in the minutes), but consider that it is too early to use this in the assessment.*	
	That the SPA features identified in the screening report are the only ones for which HRA will be required.	*Agree with following caveats* • *Red throated diver (Outer Thames Estuary SPA) screened in* • *Kittiwake (Flamborough and Filey Coast) screened in*	*Agree with following caveats* • *Red throated diver (Outer Thames Estuary SPA) screened in* • *Kittiwake (Flamborough and Filey Coast) screened in*	

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	OETG4			
	Discussions focussed on points raised on the detail of the PEIR assessments, the meeting worked through points provided as a draft response to the PEIR by Natural England.	*All points were captured in the final Natural England response to the Section 42 consultation (8th July 2014).*		
	OETG3			
	Discussion surrounded detail of assessments, no agreement as continuing actions.			
	OETG2			
1	**From OETG2 Paper** **Para 30**. Agreement, based on the information supplied at OETG Mtg 1, is sought on: • Sufficient offshore and onshore baseline survey data has been collected to inform the assessment. • No additional survey required for the offshore or onshore cable route (the additional targeted brent goose surveys are not related to baseline information gathering). • Existing onshore data will be augmented with new WeBS data recorded at greater spatial detail and an additional brent goose survey. • Natural England to supply (if it can be made available) its	Agree Agree – with exception of additional brent goose work Agree TBC	*Agree that 18 months of continuous survey data are sufficient.* *Agree that sufficient baseline information already exists* *Agree that this approach is acceptable* *Support the use of NE RTD data within assessment*	

	Outer Thames Estuary RTD survey data to augment the existing offshore cable route data (**Note for inclusion in PEI these data must be supplied by January 2014**)			
	Para 31. Agreement, based on the updated information supplied at OETG Mtg 2, is sought on: • Biological periods – agreed in principle subject to working up the figures	Need for nuanced approach agreed in principle.	*We are satisfied in principle with the revised Biological periods table supplied for OETG Mtg 2*	
2	**Section 4** Agreement of the impacts to be assessed as listed in Section 4.1 (offshore) and 4.2 (onshore)	Agreed	*We support the change to the impacts in Section 4.1 suggested by NE. The operational impacts will also need to include in-combination/ cumulative impacts.*	
3	**Data** Mean peaks shall be used unless there is great disparity between years, in which case contextual data will be consulted for justification of numbers used	Agree in principle but note requirement to present each year's monthly peaks separately (in appendix?) to enable any large discrepancies between years to be identified	*This approach is acceptable.*	
4	**Data** Flight height methodology Agree that the methodology for determining flight height from aerial imagery is a general matter outside of the EP process, NE and APEM to discuss outwith EP meetings	Agree	*We would like to be consulted on any methodology for flight height agreed between NE and APEM.*	
5	**Assessment methodologies – terminology** EAOW will look again at magnitude definitions, but this is not critical to agreement All accept that 'very high' category for sensitivity/magnitude	Agree to need for further consideration of wording to define categories of magnitude. Agree	*We consider revised magnitude definitions are a major improvement. However, they still require some refinement in line with comments of NE and*	

	adds little to assessment and this will not be used		*RSPB at OETG Mt 2.*	
	OETG1	*Note that NE did not provide responses to the minutes prior to OETG2, these responses were added in OETG2*	*Responses provided – 9/11/13* *The RSPB's position is made in relation to the information available to us at this time. However, we reserve the right to alter our position to East Anglia 3 & 4 should new information (i.e research and data) become available which significantly alters the situation.*	
1	**ONSHORE**			
	Data			
	Sufficient baseline survey data have been collected to inform the assessment	Happy with approach in document, that is when these 5 onshore elements are taken together	No the RSPB considers that further survey work will be required in regard to Brent Geese.	
	No additional survey required for the cable route	Happy with approach in document, that is when these 5 onshore elements are taken together	The RSPB supports NE's position on this issue.	
	Existing baseline data will be augmented with new WeBS data	Happy with approach in document, that is when these 5 onshore elements are taken together	The RSPB supports the use of the latest WeBS data to augment the baseline data.	
	If possible new WeBS data to include greater detail on location of birds within the large WeBS count sectors	Happy with approach in document, that is when these 5 onshore elements are taken together	The RSPB agrees in principle that a more detailed understanding of the location	

			of birds on the Deben is essential. However, we will need to see the details of what has been agreed with the BTO before we can make any further comments. *	
	EAOW to undertake additional brent goose survey (winter 2013/2014)	Happy with approach in document, that is when these 5 onshore elements are taken together	The RSPB supports the additional Brent Goose survey being undertaken during the winter of 2013/14.	
	Species			
	Likely species for assessment listed in App 7 & 8	OK	The RSPB agrees with NE's advice on this issue.	
	Species to be selected for assessment on basis that are listed features of Deben Estuary SPA and SSSI or are Schedule 1 breeding species	OK	The RSPB supports this approach	
	Assessment will include both listed features and relevant assemblage species	OK	The RSPB supports this approach	
	Impacts			

	The following impacts will be assessed
	• Construction
	    • Disturbance / Displacement
	• Operation
	    • High-level assessment
	• Decommissioning
	    • Disturbance / Displacement
		OK	The RSPB agrees that the impacts proposed for assessment are appropriate.	

2	**OFFSHORE**			
	Data			
	Sufficient baseline survey data have been collected to	OK	The RSPB agrees that 24	

	inform the assessment (24 months of aerial for each site)		months of aerial surveys will provide sufficient baseline data, provided that the data set is continuous and there are no gaps.	
	No additional survey required for the cable route	OK	The RSPB supports NE's position on this issue	
	NE's Outer Thames Estuary RTD survey data will be used if it can be made available	RC happy in principle	The RSPB supports the use of the Red Throated Diver survey data	
	EA ONE and Zone data will be used as contextual information where relevant	OK	The RSPB agrees that using EA1 and zone data as contextual information could be useful.	
	Data analysis			
	Population estimates will be design based but more sophisticated modelling will be applied if the data warrants it and the modelling approach is acceptable	OK	The RSPB supports this approach	
	Flight parameters [awaits information on how flight height method has been validated]	Not part of EP process (APEM and NE, RSPB to deal with)	The RSPB supports NE's position on this issue.	
	Species			
	Species specific bio-periods [awaits feedback from NE to create new bio-period table]	For OETG2	The RSPB supports NE's advice on the bio-period table	
	If a species falls under any one of these criteria it will be taken forward in the assessment: 1) population of regional importance or greater. 2) adult seabirds within maximum foraging distance of SPA or SSSI with that species as interest feature 3) migration modelling shows connectivity and numbers occurring are significant (irrespective of collision risk).	*The proposal will not screen out spp prior to migration modelling, model run using BTO/SoSS and screen on that list* *Assumption <1% of regional population = not significant, based*	The RSPB agrees in principle that the criteria being used are appropriate, However, we would like clarification about point 3, in particular how 'significant' is being defined.	

		upon the BTO approach to definition of migrant populations (waders/waterfowl), still need to define for seabirds – modified migration method approach (awaiting the Scottish methods) ***Action for NE (RC) to look at SNH project and feedback as to whether appropriate***		
	Impacts			

	The following impacts will be assessed
	• Construction
	    • Disturbance / Displacement
	    • Indirect through prey species
	• Operation
	    • Disturbance / Displacement
	    • Indirect through prey species
	    • Collision risk
	    • Barrier effect
	• Decommissioning
	    • Disturbance / Displacement
	    • Indirect through prey species
		OK	The RSPB seeks clarification about whether the assessment will include cumulative, in-combination and transboundary impacts.
			Once this has been clarified then we will be able to provide our position.	

Appendix 13.1 Ends Here