PROPOSED NAVITUS BAY WIND PARK

PRELIMINARY ENVIRONMENTAL INFORMATION 3

CHAPTER 12
OFFSHORE ORNITHOLOGY

SEPTEMBER 2013

NAVITUSBAY

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12. ORNITHOLOGY

Introduction

12.1. This chapter assesses the potential impacts on birds in the marine environment arising from the construction, operation and maintenance ('O&M') and decommissioning phases of the offshore components of the proposed Navitus Bay Wind Park ('the Project'). For the purpose of this assessment the Offshore Development Area comprises two elements; the Turbine Area and an Offshore Export Cable Corridor. For details of the Project description used within this assessment refer to Chapter 2, Navitus Bay Wind Park Project.

12.2. This chapter is also supported by site specific surveys undertaken in support of the Project, including boat based and aerial surveys, as well as migration and collision risk modelling, to inform the assessment of potential effects on species migrating through the wind farm. Information from surveys and modelling reports is provided in summary within this chapter, further detail will be provided within the Technical Reports submitted in support of the Environmental Statement for the Project.

12.3. Within this chapter the assessment is focused on individual bird species, rather than designated sites. Only where significant impacts are identified are associated designated sites considered as receptors within their own right. A full assessment of Natura 2000 sites (including Ramsar sites) will be provided within the Habitats Regulations Assessment (HRA) Report submitted in support of the application for development consent. An overview of the HRA process is provided in Chapter 4 'HRA Overview'.

Legislation, Policy and Guidance

12.4. This section outlines the legislation, policy and guidance that are relevant to the assessment of the potential impacts on offshore ornithology associated with the Project. Professional judgement has been applied on their relevance and importance to the assessment of the Project.

International

12.5. The international legislation, agreements and conventions relevant to the Project include:

- United Nations Convention on Biological Diversity 1992 ('the Rio Convention');
- The Convention on Wetlands of International Importance, especially as Waterfowl Habitat ('the Ramsar Convention');
- European Council Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora ('the Habitats Directive');
- European Council Directive 2009/147/EC on the conservation of wild birds ('the Birds Directive');
- The Convention on the Conservation of European Wildlife and Natural Habitats 1979 ('the Bern Convention'); and
- The Agreement on the Conservation of African-Eurasian Migratory Waterbirds 1999 ('the Bonn Convention').

National

12.6. The Overarching National Policy Statement ('NPS') for Energy ('EN-1'), in conjunction with the NPS for Renewable Energy Infrastructure ('EN-3'), provides the primary policy framework within which the Project should be assessed.

12.7. National legislation and policy that is relevant to the Project includes:

- The Conservation of Habitats and Species Regulations 2010 (as amended, 2012) ('the Habitats Regulations'); and
- The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended) ('the Offshore Marine Conservation Regulations'); and
- Natural Environment and Rural Communities Act 2006 ('the NERC Act'); and
- Countryside and Rights of Way Act 2000 ('CRoW'); and
- Wildlife and Countryside Act 1981 (as amended) ('WCA'); and
- National Parks and Access to the Countryside Act 1949 (as amended) ('National Parks Act'); and
- National Planning Policy Framework 2012 ('NPPF').

Table 12.1 provides a summary of the relevant provisions in EN-1 and EN-3 with regard to the offshore ornithological assessment, and how they have been considered within this chapter.

Table 12.1 Compliance with National Policy Statements

Summary of NPS provision	Consideration in PEI
NPS EN-1: Part 5.3	
Paragraph 5.3.3: "*Where the development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity.*"	The potential effects on designated sites are considered within this chapter (refer to 'Baseline' and 'Impact Assessment'). Further assessment of Natura 2000 and Ramsar sites will be provided in the Habitats Regulation Assessment ('HRA') for the Project submitted in support of the application for development consent. Nature conservation designations, where relevant to onshore ornithology, are addressed in Chapter 28, 'Onshore Ornithology'.
Paragraph 5.3.4: "*The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.*"	Measures to conserve and enhance bird populations are outlined in the onshore ornithological assessment (Chapter 28, 'Onshore Ornithology).
Paragraph 5.3.18: "*The applicant should include appropriate mitigation measures as an integral part of the proposed development. In particular, the applicant should demonstrate that;* ➢ *During construction, they will seek to ensure all activities will be confined to the minimum areas required for the works;* ➢ *During construction and operation best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised, including as a consequence of transport access arrangements;* ➢ *Habitats will, where practicable, be restored after construction works have finished;* ➢ *Opportunities will be taken to enhance existing habitats and, where practicable, to create new habitats of value within the site landscaping proposals.*"	The construction footprint has been determined by the activities required. Chapter 2, 'Navitus Bay Wind Park Project' provides summary information on the Project development while Chapter 28, 'Onshore Ornithology' provides further information for the onshore assessment. Provision has been made through project design and proposed embedded and additional mitigation to ensure that damage or disturbance to species and habitats is minimised (see 'Embedded Mitigation' and 'Impact Assessment'). Habitats will be restored, where possible, post construction. Enhancements for ornithological receptors are detailed in the onshore ornithology chapter (refer to Chapter 28, 'Onshore Ornithology'). Opportunities will be taken to enhance and create new habitats as part of the Project. These measures will benefit birds using the terrestrial environment, including those that migrate through marine areas. Enhancements for ornithological receptors are detailed in the onshore ornithology chapter (refer to Chapter 28, 'Onshore Ornithology').
NPS EN-3: Part 2	
Paragraph 2.6.64: "*Assessment of offshore ecology and biodiversity should be undertaken by the applicant for all stages of the lifespan of the proposed offshore wind farm and in accordance with appropriate policy for offshore wind farm EIAs.*"	The construction, O&M and decommissioning phases of the Project are considered within this chapter (refer to 'Impact Assessment').
Paragraph 2.6.65: "*Consultation on the assessment methodologies should be undertaken at early stages with the statutory*	Consultation has been central to the design of the ornithological survey, programme and assessment methodology. Details of consultation are

Table 12.1 Compliance with National Policy Statements	
consultees as appropriate."	provided in Table 12.2.
Paragraph 2.6.66: *"Any relevant data that has been collected as part of post-construction ecological monitoring from existing, operational offshore wind farms should be referred to where appropriate."*	Information on existing wind farm installations has been used where relevant to the assessment (refer to 'Impact Assessment').
Paragraph 2.6.67: *"The assessment should include the potential of the scheme to have both positive and negative effects on marine ecology and biodiversity."*	Both positive and negative effects associated with the Project are assessed within this chapter (refer to 'Impact Assessment').
Paragraph 2.6.102: *"The scope, effort and methods required for ornithological surveys should have been discussed with the relevant statutory advisor."*	Consultation has been central to the design of the ornithological survey programme. Details of consultation are provided in Table 12.2.
Paragraph 2.6.103: *"Relevant data from operational offshore wind farms should be referred to in the applicant's assessment."*	Information on existing wind farm installations has been incorporated where relevant to the assessment (refer to 'Impact Assessment').
Paragraph 2.6.104: *"It may be appropriate for the assessment to include collision risk modelling for certain bird species."*	Collision risk assessments are provided within the Impact Assessment section of this Chapter.

Regional and local

12.8. There are no offshore specific policies at either a regional or local level which are considered relevant to this assessment.

Guidance

12.9. The following guidance and best practice documents have informed the preparation of this ornithology chapter:

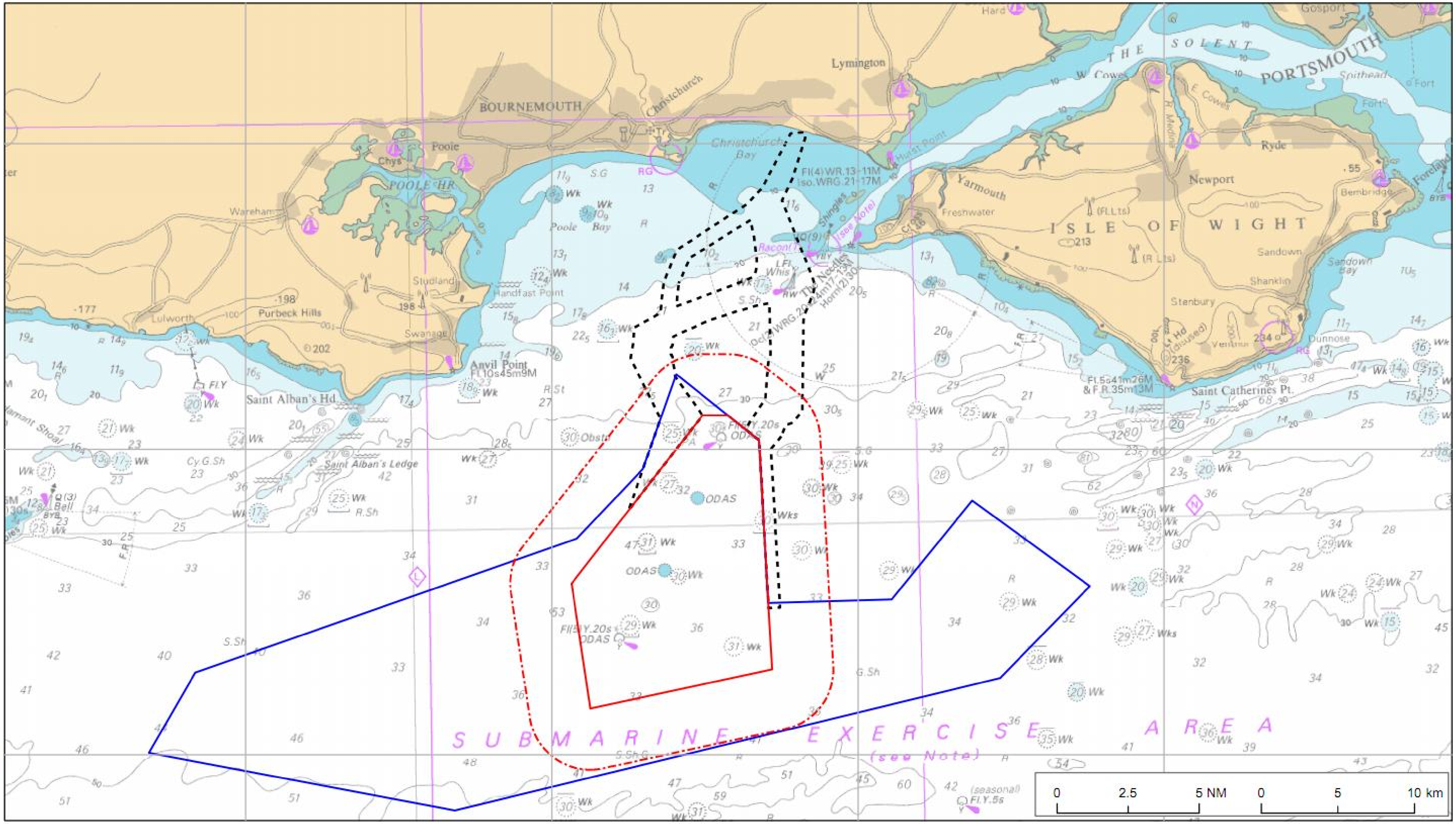
- Government Circular 06/05 Biodiversity and Geological Conservation ('Government Circular 06/05');
- UK Post 2010 Biodiversity Framework ('Biodiversity Framework');
- Defra (2012). Biodiversity 2020: A strategy for England's wildlife and ecosystem services;
- Defra (2002). Working with the grain of nature: A biodiversity strategy for England;
- Institute of Environmental Management and Assessment ('IEMA') (2006). Guidelines for Environmental Impact Assessment; and
- Institute of Ecology and Environmental Management ('IEEM' – now Chartered Institute of Ecology and Environmental management ('CIEEM')) (2010). Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal;
- Natural England ('NE') and Joint Nature Conservation Committee ('JNCC') Interim Advice Note (2012). Advice on assessing displacement of birds from offshore wind farms;
- Band (2012). Using a Collision Risk Model to Assess Bird Collision Risks for Offshore Wind Farms;
- Wright *et al*. (2012). Assessing the risk of offshore wind farm development to migratory birds designated as features of UK Special Protection Areas (and other Annex 1 species);
- Furness and Wade (2012). Vulnerability of Scottish Seabirds to Offshore Wind Turbines. Report for Marine Scotland; and
- Maclean *et al*. (2009). Review of Assessment Methodologies for Offshore Wind Farms. BTO Research Report for COWRIE.

Assessment Methodology

Study area

12.10. The extent of the study area was determined by the extent of the Round 3, Zone 7 licence area, ornithological survey guidance for offshore wind farms (Camphuysen *et al*., 2004) and consultation with Natural England (NE).

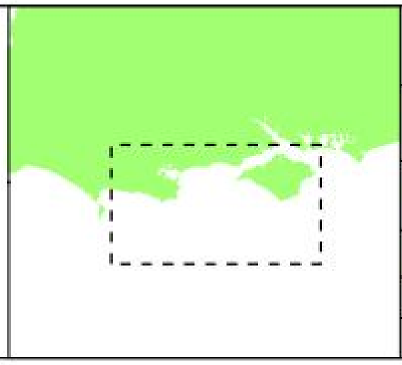
12.11. The study area consists of three sections, the Offshore Development Area, a 4 km buffer zone around the Turbine Area (size determined by the survey guidance, Camphuysen *et al*., 2004) and the Round 3 Zone 7 licence area. The study area is presented in Figure 12.1.



Legend

Study Area

- Turbine Area
- Offshore Export Cable Corridor
- Turbine Area 4km Buffer
- Zone 7



Scale @A3 1:250,000	**Coordinate System:** WGS 1984 UTM Zone 30N
Date: 13/08/2013	**Datum:** WGS 1984
Ref. No.: 0210130813325/01	**Data Source** SeaZone
Fig. No.: Figure 12.1	
Author: CG	
Rv.No.: 01 **Checked:** SS	**Approved:** SS

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Offshore Ornithology Study Area

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Consultation

12.12. This section provides information on the consultation undertaken to date, to inform the assessment. Advice and information provided by the consultees has shaped both the assessment methodology and the scope of the assessment. The organisations consulted, the date of consultation and the subject of each contact are provided in Table 12.2.

Table 12.2 Consultation response

Organisation and date	Summary of response	Where addressed in ES
Scoping response		
NE on behalf of the JNCC (Scoping Response October 2011)	JNCC and NE noted that many of the Strategic Ornithological Support Services ('SOSS') projects will be reported before submission of the ES in 2013 and therefore suggest that any guidance contained in these documents are considered regarding the assessment process.	The SOSS reports have been used where relevant to inform the assessment. Reference has been made directly to SOSS report numbers 2 (Cook *et al*., 2012), 3 (Collier *et al*., 2012) and 5 (Wright *et al*., 2012).
	JNCC and NE disagreed with the definition of an impact in Section 5.1.14 of the Scoping Report. JNCC and NE suggest an impact on a population of birds may constitute a measurable decline in population size resulting from a measurable physical effect on their environment resulting from a development. The significance of that impact should then be assessed objectively as the magnitude of a real biological change and have nothing to do with judgments that society may make about whether that biological change matters.	The assessment methodology has been updated following the scoping phase of the project. The general methodology is provided in Chapter 3 (EIA Methodology); the topic specific methodology for the assessment of offshore ornithology is outlined within the 'Impact Assessment Methodology' of this chapter; this is based on impacts on bird population sizes at different geographical scales.

Table 12.2 Consultation response		
	JNCC and NE noted that the Scoping Report outlines details of some of the European sites and their notified features that may be impacted by the development, but that the details of sites with nationally important features (e.g. Sites of Special Scientific Interest ('SSSI')) have been documented to a lesser extent. Additionally, there may be impacts on migratory species from, as yet unidentified Special Protection Areas ('SPAs').	Designated sites are considered within this chapter (refer to 'Baseline' and 'Impact Assessment'. This chapter identifies sites close to the Project and those, further afield. Both internationally and nationally important sites have been described. European sites will be considered in detail within the HRA submitted in support of the application for development consent.
	JNCC and NE stated that the ES should not be too restrictive in terms of geographical extent of the area within which designated sites and their features might be affected. JNCC and NE reference the phrase "*in the vicinity of the proposed project*" (Section 6.4.2 of Scoping Report). JNCC and NE stated that this is not appropriate, e.g. in the case of birds and their mobility, the consideration of sites only within 1 km of mean low water ('MLW') is too restrictive. It is possible that the Project may lie on migratory routes followed by species moving to or from designated sites many hundreds of miles from it e.g. dark bellied brent geese (*Branta bernicla bernicla)* may migrate along the south coast en-route to the Exe Estuary SPA and terns that pass through the Project in spring and Autumn may be heading to or from designated breeding colonies on the east coast. Many migrant species that breed on designated sites far inland, e.g. nightjar (*Caprimulgus europaeus)* on heathland SPAs, may well be impacted by collisions with offshore infrastructure, therefore using 100 km distance to identify SPAs/Ramsar sites may not be sufficient to capture all the sites which may be impacted by the Project.	The list of designated sites described within this chapter, was determined using species-specific information on foraging range and data on the potential extent of changes to the physical environment (refer to Chapter 5, 'Physical Processes'). Consideration of migratory species that potentially pass through the Turbine Area in spring and autumn has been undertaken as part of the migration modelling exercise carried out in support of the Project. The approach used (including geographic extent) has been discussed and agreed as appropriate with Natural England. A nightjar workshop was held on 20/06/2013 to gather relevant information and opinion on this species (see specific entry in this table for details). A refined approach to the modelling of nightjar was discussed, and an outline agreement on further work reached with NE and other participants. This work is currently on-going.

Table 12.2 Consultation response

	JNCC and NE welcomed that recognition is given to the need to consider other statutory designated sites besides SPAs and Ramsar sites. JNCC and NE advise that they wish to see the list of other sites for which birds may be a qualifying feature and for impacts on these to be considered.	Sites designated for ornithological importance are described in Table 12.11. The potential impacts on these sites are determined only where significant effects on cited species are identified. Natura 2000 sites (including Ramsar sites) will be assessed within the HRA Report submitted in support of the application for development consent.
	SOSS Project 5 (Wright *et al.*, 2012) is developing guidance on assessing impacts on migrants, this should be taken into account when undertaken the assessment.	The assessment of migratory birds within this chapter is based on the SOSS 5 report.
	JNCC and NE recommended further discussion should be undertaken, as soon as possible, to identify sites and species that may be affected and the likely requirements for a Habitats Regulations Assessment. Generally, JNCC and NE advises that in assessing the potential for impact on birds, consideration should be given not only to populations associated with European designated sites, or indeed only to those species listed on Annex 1 of the Birds Directive but to all regularly occurring migrants. Information should also be presented in the ES to enable the regulator to give due regard to the conservation of UK populations of all species of bird that may be found to be subject to impact from the proposed Project i.e. to allow the regulator to fulfil their duty under the NERC Act to have due regard to the conservation of biodiversity in general.	An HRA is currently being undertaken for the Project in consultation with NE and RSPB. The impact assessment considers all species noted (or expected) to occur in numbers within the Offshore Development Area where a significant impact could be realised. Details of all birds noted within the survey programme are summarised in this chapter, full details will be provided in survey technical reports submitted in support of the forthcoming ES for the Project.
	While NE had been informed of the offshore survey plan, it had not been involved in discussions regarding the details of the concurrent onshore migratory surveys (at the time of the Scoping Response).	NE has been informed of all aspects of the survey and assessment procedures detailed within this chapter. NE has agreed that the baseline data collected is sufficient to inform an assessment of the Project.

Table 12.2 Consultation response		
	Three criteria were listed in Section 6.8.13 of the Scoping Report that will be used to identify species for which Collision Risk Modelling ('CRM') will be carried out (conservation importance, regularity of over-flights and large numbers). JNCC and NE stated that the ES should not be too restrictive in the suite of species for which CRM is conducted. An assessment of significance of collision impact is better informed by the results of a CRM than by a judgement about whether or not CRM may be necessary.	The rationale for the inclusion of species within the CRM all workings and outputs of the model for each of these species will be provided within technical reports submitted in support of the forthcoming ES for the Project. Summary information is provided in this chapter to inform the assessment undertaken.
	In carrying out CRM, the latest guidance available at the time should be used rather than that quoted in the Scoping Report. In particular, the results of the SOSS 2 project are likely to have produced a revised version of the Band model by the time the ES is published.	The SOSS 2 project output (Band, 2012 from Cook *et al*., 2012) was used to inform the CRM for this project.
	JNCC and NE stated that it is not clear from the Scoping Report how "bird populations of importance within the Offshore Development Area and its surrounds" will be defined. The standard practice of comparing peak population estimates on a given day with 1% national thresholds is highly questionable and risks screening out species which fail to meet this threshold but for which the site in question may nonetheless be one of the most heavily used sea areas. This issue is a particular problem for species that occur only on passage and where numbers passing through a site over time may far exceed the numbers seen on any one survey day.	The bird species recorded during the survey have been set in the context of the regional, national and international populations. The use of different geographic areas, and therefore different threshold levels, negates the risk of screening out species that should be considered.
	JNCC and NE stated that the list of data sources should include more recent editions of waterbirds in the UK than the 2008 one listed. Unpublished records of coastal bird observatories should also be examined. Recent results of surveys for Balearic shearwaters (*Puffinus mauretanicus)* to the west of the Project may be informative and available via JNCC.	The data sources used within this assessment include the latest publications. Information from local ornithological groups and scientific papers are incorporated into the assessment and are referenced where informative (refer to 'Data Sources').
	For cumulative impacts, JNCC and NE required that assessment should include not only the Rampion Wind Farm ('Rampion'), but any other more distant wind farms with which birds noted in Zone 7 could interact. This may include wind farms on the east of England and beyond.	The potential for cumulative impacts associated with the Project and other plans and projects will be provided within the forthcoming ES submitted in support of the application for development consent.

Table 12.2 Consultation response		
Infrastructure Planning Committee (‘IPC’) (now the Planning Inspectorate) (Scoping Response November 2011)	The IPC agreed with NBDL that cumulative impacts should be assessed and appropriate mitigation measures identified in the ES. The potential for cumulative effects on birds should not be limited to other wind farm projects, but all other relevant plans or projects.	The potential for cumulative impacts associated with the Project and other plans and projects will be provided within the forthcoming ES submitted in support of the application for development consent.
	Effects on offshore or onshore ornithology may have implications on tourism, therefore the inter-relationships should be assessed and appropriate cross reference made in the ES.	An assessment of inter-relationships will be provided within the forthcoming ES submitted in support of the application for development consent.
Section 42 responses to preliminary environmental information		
Christchurch Sailing Club (‘CSC’) (S42 Response 25/07/12).	CSC noted that Hengistbury Head is a first/last stop for migrating birds. The potential for collisions of birds with the turbines was raised as a concern.	Collision risk is assessed for a variety of migratory and seabird species within this chapter (refer to ‘Impact Assessment’).
Dorset County Council (‘DCC’) (S42 Response 27/07/12).	The potential for Vertical Look Radar (‘VLR’) to inform the assessment of potential effects on birds should be evaluated.	The potential use of VLR (and other radar systems) has been considered. However, following discussions with NE, its usage was discounted.
Dorset Wildlife Trust (‘DWT’) (S42 Response 27/07/12).	Lights on turbine blades that are visible to birds (but invisible on the shore) should be considered to reduce potential impacts on night flying birds.	Lighting of turbines has been designed to accord with UK safety policies with regard to aviation and shipping. Flashing lights are to be used on the top of wind turbines to minimise the attraction of birds. The design does not allow for the lighting of blades to avoid attracting birds towards them.
Hampshire and Isle of Wight Wildlife Trust (S42 Response 30/07/12).	The cumulative impacts associated with oil exploration should be taken into account in the assessment.	The potential for cumulative impacts associated with the Project and other plans and projects will be provided within the forthcoming ES submitted in support of the application for development consent.

Table 12.2 Consultation response		
Milford Parish Council ('MPC') (S42 Response 30/07/12).	Concern was raised regarding potential effects on birds.	This chapter provides a full assessment of the potential effects on birds using or crossing the marine environment. Chapter 28 'Onshore Ornithology' assesses the potential effects on birds associated with proposed works within the terrestrial environment.
Royal Society for the Protection of Birds ('RSPB') (S42 Response 30/07/12).	RSPB raised concerns regarding adequacy of survey efforts to inform possible impacts on migrating birds and on seabirds on passage. Other concerns raised were the potential difficulties in linking behavioural information with other physical data, the potential difficulties in linking terrestrial and offshore observations, and the difficulties in providing robust explanations of temporal and spatial distribution and density of birds relative both to Zone 7 and other offshore areas.	The survey methodologies, scope of the assessment and assessment methodologies have been discussed and agreed with NE and RSPB to enable conclusions to be drawn. The survey effort (other than bespoke methods requested by consultees) followed standard industry guidelines (Camphuysen *et al*., 2004).
NE (S42 Response 27/07/12).	Where impacts are being modelled (e.g. collision risks for migratory birds) the EIA should detail the different scheme options considered so that NE can come to a view regarding the worst case scenario. NE raised concerns regarding the potential to use radar to identify migrating nightjar. There is no evidence to suggest that this technique can reliably identify this species.	The Realistic Worst Case Scenario ('RWCS') provided in Table 12.18 describes the combination which is considered to give rise to the maximum impact. Radar has not been used to try and identify nightjar migrating across the Turbine Area. Further information regarding the survey of nightjar is provided within this table.
Other consultations		
RSPB (Meeting – 8/02/10).	RSPB provided information regarding The Crown Estate commissioned aerial surveys having had input into the methodology and confirmed that they would be happy to input into on-going discussions on the survey programme for the Project. It was confirmed that NE had been consulted on the survey methodology prior to it beginning in winter 2009. RSPB were informed that the boat based surveys were being undertaken in line with COWRIE guidance. It was agreed that this was an appropriate approach to the survey of Zone 7. RSPB highlighted species of potential concern such as Balearic shearwater. These species are outlined in an RSPB report (Langston 2010).	The methods and baseline data gathered were discussed with RSPB and NE both during and after completion of the survey programme (refer to 'Baseline Environment'). The survey effort (other than bespoke methods requested by consultees) followed standard industry guidelines (Camphuysen *et al*., 2004). Langston (2010) was used to inform the assessment (refer to 'Impact Assessment').

Table 12.2 Consultation response		
	RSPB enquired as to how potential cumulative effects with Zone 6 were being dealt with. Given the early stage of the project, it was agreed that further information would be provided as the topic progressed. Information on potential landfall sites was provided to RSPB.	Discussions regarding cumulative impacts have been undertaken with NE and RSPB. The potential for cumulative impacts associated with the Project and other plans and projects will be provided within the forthcoming ES submitted in support of the application for development consent.
RSPB, MarineLife, National Oceanographic Centre (Meeting 28/04/10).	An update on the on-going bird survey programme was provided and information on the potential design parameters (e.g. turbine size, turbine spacing, landfall points etc.) was discussed. Balearic shearwater was highlighted as the only species on the International Union for Conservation of Nature ('IUCN') red list likely to be present within Zone 7. This species was noted to fly across the water at a height under the lowest point of a wind turbine blade sweep and tended to forage inshore (Portland Bill being noted as an important area). Distribution of seabirds offshore was noted as being variable and patchy. Large aggregations of auks and gannets are regularly observed and numbers have increased over time. This increase is thought to be due to an increase in prey. Auks are not considered to be at particular risk of collision but are a medium risk for displacement. Potential for impacts on migrant birds were highlighted. The Isle of Wight to Portland Bill is a key entry/exit point for birds moving to/from the Cotentin Peninsular in France. Key periods are mid-March to mid-May and mid-August to mid/late October (for a good idea of the extent of the migration period, data from the Portland Bill Bird Observatory could be used). A suggestion was made to use coastal observers during peak periods of migration to record field data. Possible impacts on east-west channel passage of seabirds including roseate terns, Skuas and waders should be considered. It was noted that these flyways vary considerably with weather.	The survey effort (other than bespoke methods requested by consultees) followed standard industry guidelines (Camphuysen *et al*., 2004). Balearic shearwater was recorded within the Turbine Area and is included within the assessment in this chapter (refer to 'Impact Assessment'). The distribution and density of seabirds recorded during the survey programme reflects the information provided. Full details of the survey data will be provided within technical reports submitted in support of the forthcoming ES for the Project. The assessment considers the potential collision and displacement risk to Auks in section (refer to 'Impact Assessment'). Coastal based observers (co-ordinated with boat based observers) were used to collect data on migrant birds (refer to 'Baseline Environment'). Consideration of migratory species that potentially pass through the Turbine Area in spring and autumn has been undertaken as part of the migration modelling exercise summarised within this chapter. Full details will be provided within technical reports submitted in support of the forthcoming ES for the Project.

Table 12.2 Consultation response		
Hampshire and Isle of Wight Wildlife Trust (Meeting 22/06/10).	The project was introduced to Hampshire and Isle of Wight Wildlife Trust and technical questions regarding turbine size, installation techniques and lifespan were answered.	No actions relevant to the undertaking of the impact assessment were identified.
NE and JNCC (Meeting 17/08/10).	NE stated that boat based surveys provide greater certainty about flight height and bird behaviour than aerial surveys. NE welcomed the collection of 2 years of boat based transect data, but raised the potential need for further survey of migratory birds.	Boat based surveys provided the primary input to the ornithological data set. These surveys were carried out following best practice guidelines (Camphuysen *et al.*, 2004). Boat and land based migration surveys were undertaken to provide more information on migrating birds and results are summarised within this chapter. Full details of the survey data will be provided within technical reports submitted in support of the forthcoming ES for the Project.
NE (Conference call 18/10/10).	NE questioned whether any onshore work to record migrant birds was planned. NE stated that nightjars on migration need to be considered and a discussion was held as to how data may be collected for this nocturnal species. The potential for radio-tagging and radar was raised. NE questioned whether one year's data for the whole of Zone 7, and two years for the turbine area only was sufficient. It was suggested that the whole of Zone 7 should also be surveyed for 2 years.	Boat and land based migration surveys were undertaken to provide more information on migrating birds and results are summarised within this chapter. Full details of the survey data will be provided within technical reports submitted in support of the forthcoming ES for the Project. A nightjar workshop was held on 20/06/2013 to gather relevant information and opinion. No tagging study of nightjar was undertaken as no satellite tag is currently available that is small enough to fit to a nightjar. Geolocators and classic radio tags are not suitable for informing the assessment of the Project; these tracking methods were ruled out as they cannot provide more than a general idea of whether or not individuals will fly through the Turbine Area. Modelling was agreed as an appropriate way forward with field surveys (potentially using a network of radio masts) only required if the modelling outputs suggested a potentially detectable

Table 12.2 Consultation response

		effect on population size. Two years of data collection across the whole of Zone 7 was undertaken.
NE (Conference call 16/02/11).	An update of the continuing ornithology survey programme was provided. NE flagged that the survey strategy previously agreed, of providing coverage of the whole Zone 7 for a single year, with a second year focused on the wind turbine area only, was of concern. NE noted that they would rather the main thrust of the survey work in year 2 remain boat based with aerial surveys used for context and contingency. It was noted that boat surveys in February and October 2010 had been missed due to poor weather conditions. It was agreed that two boat surveys would be undertaken in October 2011 and a single boat survey and an aerial survey in February 2011. The scope of the land based migration surveys and the potential surveyor locations were discussed. The potential use of thermal imaging cameras to detect night migrants was discussed, but dismissed due to health and safety issues. NE agreed that this was acceptable but noted that desk-based effort would be required to inform the assessment of the issue. The potential for fitting satellite tags to nightjar was discussed, as this species is of particular concern. It was noted that there is no tag currently small enough to be placed on a nightjar. Further research into potential methods of survey was agreed.	The survey programme was extended to ensure that Zone 7 was covered for a 24 month period and the survey programme was agreed with NE. Boat based surveys were used throughout the 24 month survey period, and were the principal method from which data was collected. Full details of the survey data will be provided within technical reports submitted in support of the forthcoming ES for the Project. Surveys to account for data gaps were undertaken as agreed with NE. Simultaneous land and boat based migration surveys were undertaken. The design of the survey was agreed with NE. Full details of the survey data will be provided within technical reports submitted in support of the forthcoming ES for the Project. A nightjar workshop was held on 20/06/2013 to gather relevant information and opinion (see previous row in this table for discussion of potential survey methodologies).
NE (Meeting 12/12/11).	Defining the study area for highly mobile species should not be restricted by spatial scales within the project area. The issue of nocturnal migrant birds was discussed. It was suggested that to determine a worst-case for nightjar it may be possible to assume that all individuals fly through the turbine area. It was noted that guidance from SOSS on this topic would be available in 2012.	The spatial scale of the assessment is based on individual species to reflect differences in mobility. A migration model for nightjar is currently being developed in consultation with NE. A RWCS is presented in Table 12.11. The maximum number of turbines is used in the

Table 12.2 Consultation response		
	A mixture of different turbine heights could be considered a worst-case as birds may have to adjust to variable heights.	RWCS as it results in the highest predicted mortality figures within the CRM.
NE, JNCC, RSPB (Meeting 12/04/12).	The baseline bird survey data collected by boat based surveys was presented to the stakeholders. Various amendments to the baseline report were suggested by the meeting participants. NE/RSPB noted that the bird densities calculated for the Turbine Area need to be placed in the context of Zone 7 and the wider area. RSPB noted that inclusion of information on water depths and habitats within the assessment process may be useful in explaining bird distribution. RSPB suggested using data on migrant movements from the Portland Bill Bird Observatory to compare with the data collected during boat and land based surveys for the Project. Collecting information from local ornithology groups was also suggested. All parties discussed the use of migration modelling and suggested that the BTO and SOSS group approach could be a useful tool. NE and RSPB noted that they would like to see the modelling protocols and sign-off the procedures as valid. Balearic shearwaters were noted to be present mainly to the west of Portland. However, an increase of range eastwards was suggested as being likely in the future. Nightjar flight heights over land (when foraging) were discussed following the publication of recent information from onshore wind farm applications. Nightjars were generally recorded flying at less than 20 m in height; however no one present was aware of information about flight heights over water when on migration.	NE's suggested changes to the baseline bird report were undertaken. Densities of each species are calculated for the Turbine Area, the Turbine Area plus buffer and Zone 7. Data for each species are placed in the context of the regional, national and international population size. Full details will be provided within technical reports submitted in support of the forthcoming ES for the Project. Information on water depths and habitat types has not been used within the assessment as the data suggested no clear pattern in the distribution of birds. Data from local ornithological groups was collected and has been used to contextualise the survey results. The migration model has been developed from the SOSS 5 report (Wright *et al.*, 2012). The migration modelling protocol has been discussed with NE and RSPB. Balearic shearwaters were recorded within the Turbine Area and an assessment has been made of potential effects on this species (refer to 'Impact Assessment'). Further discussion on nightjar was held in the nightjar workshop on 20/06/2013 – details are provided in this table.
Updated Draft Baseline Ornithological Report submission (05/02/13).	Updated offshore ornithological baseline report submitted to NE and RSPB.	Survey methods, format and results were discussed in subsequent consultation.

Table 12.2 Consultation response		
NE (Conference Call 15/02/13).	The biological periods (i.e. spring and autumn migration, breeding and wintering periods) being attributed to each species within the ornithological assessment were discussed. An agreement with NE was made on each species.	The agreed biological periods are used within this assessment.
NE and RSPB (Meeting 3/05/13).	The adequacy of the offshore ornithological surveys was discussed. NE confirmed that the survey programme was adequate to inform the assessment when presented alongside model outputs. NE and RSPB comments on the offshore ornithological baseline report were discussed. These comments were used to update the report. The potential to hold a workshop, prior to summer 2013, aimed at gathering evidence regarding nightjar migration (anecdotal or otherwise) was discussed. It was agreed that this would be scheduled as soon as possible and the discussion topics would be agreed between all parties prior to the workshop taking place. Further justification for the decision to include species within the migration model was requested by NE.	The baseline ornithological report was updated to respond to comments. The report will be submitted in support of the forthcoming ES for the Project. A nightjar workshop was held on 20/06/2013. Justification of which species to include in the migration model is summarised in this Chapter. Full details will be provided within the forthcoming ES for the Project.
EN, RSPB and MMO (Meeting 10/05/13).	Progress on the organisation of the nightjar workshop was provided to NE and RSPB. The scope of the in-combination/cumulative effects assessment was discussed and the need for a follow up conference call on 16/05/13 was identified (see below).	A nightjar workshop was held on 20/06/2013.
NE and RSPB (Conference call 16/05/13).	The scope of the in-combination/cumulative effects assessment was discussed with reference to the latest interim guidance from Natural England (published in February 2013). Discussions regarding specific topics at a workshop on nightjars were held. It was agreed that local experts would be invited to attend and provide their views (and any evidence) regarding nightjar migration in order to make best endeavours to gather as much information on this species as possible.	The potential for cumulative impacts associated with the Project and other plans and projects will be provided within the forthcoming ES submitted in support of the application for development consent. The in-combination effects assessment will be provided within the HRA submitted in support of the application for development consent. A nightjar workshop was held on 20/06/2013 (for details see other entries within this table)

Table 12.2 Consultation response		
Updated Draft Baseline Ornithological Report submission (21/05/13).	Updated offshore ornithological baseline report submitted to NE and RSPB.	Survey methods, format and results were discussed in subsequent consultation.
NE (Email 13/06/13).	NE had no further comments on baseline report issued on 21/05/13 following the updates undertaken to address comments on the version issued on 05/02/13.	The baseline environment is summarised within this chapter to inform the assessment. The full Baseline Report will be provided in support of the forthcoming ES for the Project.
NE, RSPB, Dorset Bird Club ('DBC') and Biotrack (Meeting 20/06/13).	The approach to modelling the potential impacts on nightjar during the migration period was discussed. Anecdotal evidence of behaviour and expert opinion was also gathered. A discussion on the pros and cons of survey techniques such as satellite tagging and radar was held.	A model led approach was advocated during the workshop that both aimed to quantify the worst case (i.e. all nightjars in the UK move through the Turbine Area on migration) and amend the current modelling procedure to reflect the realistic worst case (as discussed by the participants). This modelling work is currently on-going.

Scope of the assessment

12.13. The scope of the assessment has been based on responses to the Scoping Report and consultations under Section 42 of the Planning Act with relevant statutory and non-statutory organisations (see Table 12.2), guidance and best practice.

12.14. The key issues for ornithological assessment for offshore wind farm developments, as identified by stakeholders include:

- Disturbance and/or displacement of foraging seabirds from the Study Area during the construction, O&M and decommissioning phases of the Project with specific reference made to Balearic shearwater;
- Collision of individual seabirds and migratory birds (particularly nightjar) with offshore infrastructure leading to injury or mortality; and
- Impacts on bird populations listed as features of national and international designated sites.

12.15. Consultation, desk-study and survey information identified a range of species that occurred in sufficient numbers or regularity within the Study Area to warrant assessment. These species could be placed in to three categories:

- Key seabirds – seabird species (11 species in total) occurring regularly or in mean peak numbers in excess of 1% of the regional population estimate;
- Passage seabirds – seabirds (4 species in total) recorded during the survey period that are likely to have been underestimated using field data when on passage; and
- Migrant birds – birds (mainly wildfowl and waders – 10 species in total) identified from Wright *et al.* (2012) that could pass through the Project area and had the potential to be impacted upon at the population level.

12.16. For the key seabird species the potential for habitat loss, disturbance/ displacement, collision and barrier effects to impact upon the regional, national and international populations was considered (where applicable) during the construction, O&M and decommissioning phases of the Project (refer to 'Impact Assessment').

12.17. The potential for barrier effects and collision losses to result in impacts on passage seabirds and collision losses to impact on other migratory birds during the O&M phase have also been considered (refer to 'Impact Assessment').

Issues scoped out

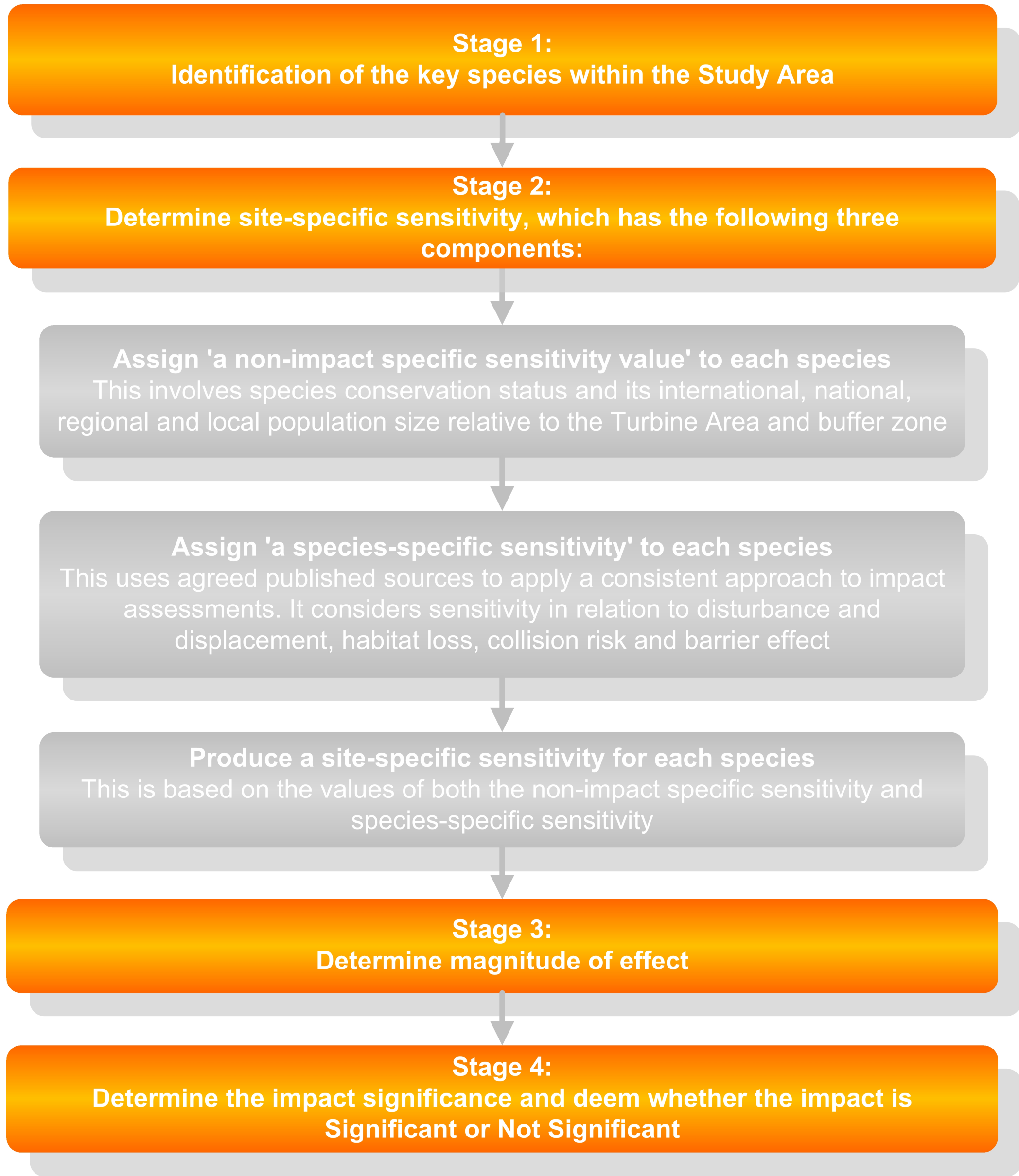
12.18. Not all species recorded during the survey period were considered within the assessment. Species that were recorded in very low numbers and/or were not identified as being of conservation importance or concern during the consultation process were not included. Species of seabirds that are considered within the assessment are termed 'key seabird species'.

12.19. Throughout the impact assessment, for certain potential effects, a screening exercise is initially undertaken to identify at a high level those species that require detailed assessment and those that can be scoped out early stages. The approach to each impact assessment and the screening process applied is described in detail (refer to 'Impact Assessment').

Impact assessment methodology

12.20. The impact assessment methodology used within this chapter is ornithology specific and deviates from that described within Chapter 3 'EIA Methodology'. However, the general principle of determining impact significance from levels of sensitivity and magnitude of effect is followed. It uses methodologies published in the literature and recognised by the Statutory Nature Conservation Bodies ('SNCB'). References to the published literature are provided in the relevant paragraphs below.

12.21. The impact assessment for the Project was based on the following four-stage process:



Site-specific sensitivity (Stage 2)

Non-impact specific sensitivity value

12.22. The 'non-impact specific sensitivity value' for each seabird species found within the Study Area was determined with consideration of conservation status and the mean peak population estimates, with respect to international, national, regional and local thresholds (1% or more of the international, national or regional population estimates). Value is attributed in accordance with the five different categories shown in Table 12.3.

Table 12.3 Definition of the non-impact specific sensitivity value (see Peterson et al., 2006)

Non-impact specific sensitivity value	Definition
Very high (International)	➢ Species that are designated features of SPA or Ramsar sites and which may interact with the Project at some stage of their life cycle; ➢ A species which is present within the Turbine Area in numbers of greater than 1% of the international population.
High (National)	➢ Species that form part of an assemblage qualification of an SPA that may potentially interact with the study area at some stage of their life cycle; ➢ A species which is present within the Turbine Area in numbers of greater than 1% of the national population.
Medium (Regional)	➢ Species that are listed on Annex I of the Birds Directive or on Schedule 1 of the WCA and which require increased legal protection from disturbance during the breeding season; ➢ Species listed on the Birds of Conservation Concern ('BoCC') Red list; ➢ Species that are the subject of a specific action plan within the UK or are listed as Species of Principal Importance in England (Section 41 of the NERC Act 2006); ➢ A species which is present within the

Table 12.3 Definition of the non-impact specific sensitivity value (see Peterson et al., 2006)

	Turbine Area in numbers of greater than 1% of the regional population.
Low (Local)	➢ Any other species of conservation interest (e.g. species listed on the BoCC Amber list).
Negligible	➢ All other species of low conservation concern.

12.23. The key seabird species identified for assessment are presented in Table 12.4 together with information on conservation status according to the following:

- Birds Directive: Annex 1 and migratory species;
- WCA Schedule 1 (breeding only);
- Designated features of nearby SPA and Ramsar sites;
- NERC Section 41 species; and
- BoCC listing (Eaton *et al.,* 2009).

12.24. The population size of the majority of seabirds recorded within the Turbine Area and buffer zone were low and did not account for 1% or more of international, national or regional populations in any biological period. Only three species were recorded in numbers of regional importance, in one or more biological period. No species were recorded in nationally or internationally important levels, although the Migropath model outputs estimated that the passage populations of common and Sandwich tern and great and Arctic skua passing through the Turbine Area could potentially exceed the 1% threshold for international importance. This is described further below (refer to 'Modelling methodology').

12.25. The rationale for taking species through the assessment was not solely based on its population estimate within the Study Area. The following factors were also considered to be appropriate for the inclusion of species within the assessment:

- Any seabed species identified as having conservation importance during stakeholder consultations e.g. Balearic shearwater (*Puffinus mauretanicus)*;
- Common seabirds that occurred within the Turbine Area in reasonable numbers (based on expert judgement);
- Predicted seabird populations estimated through modelling that determined potentially regionally, nationally or internationally important numbers during migration periods, such as common tern; and
- Predicted waders and wildfowl identified through migration modelling (Migropath) as at risk from collision with turbines, such as golden plover (*Pluvialis apricaria)*.

12.26. Expert judgement was used in assigning non-impact sensitivity values where individual criteria were not consistent. For example, the sighting of a single individual of a species listed as an SPA feature, and also occurring on the BoCC Red list, during the 24 month survey programme would not warrant a non-impact specific sensitivity value of very high.

Table 12.4 Non-impact specific value for key seabirds species recorded within the Turbine Area and being assessed (based on their conservation status and level of importance within the Turbine Area from site-specific surveys or modelling).

Species	Birds Directive annex 1	Birds Directive migratory species	WCA Schedule 1	SPA or Ramsar feature	NERC S41	BoCC	Importance level of Project population	Non-impact specific sensitivity value
Fulmar		✓				Amber	Local	Low
Balearic shearwater	✓				✓	Red	Local	Medium
Gannet		✓		✓		Amber	Local	Very High
Arctic skua		✓				Red	International	Very High
Great skua		✓				Amber	International	Very High
Kittiwake		✓				Amber	Local	Low
Mediterranean gull	✓	✓	✓	✓		Amber	Local	Very High
Lesser black-backed gull		✓				Amber	Local	Low
Herring gull		✓			✓	Red	Local	Medium
Great black-backed gull		✓				Amber	Local	Low
Sandwich tern	✓	✓		✓		Amber	International	Very High
Common tern	✓	✓		✓		Amber	International	Very High
Guillemot		✓				Amber	Regional	Medium
Razorbill		✓				Amber	Regional	Medium
Puffin		✓				Amber	Local	Low

Species-specific sensitivity (or general sensitivity)

12.27. The species-specific (or general) sensitivity of a receptor to the potential impacts associated with disturbance and displacement, habitat loss, collision risk and barrier effects is assigned a category ranging from very low to very high (Table 12.5). The following paragraphs describe each potential impact and how their categories of sensitivity were determined.

12.28. **Disturbance and displacement:** The behaviour or reaction of seabirds to offshore wind turbines and other structures, ship and helicopter traffic and other disturbing activities is predominantly species group or species specific (Furness & Wade, 2012). Scoring a species' response to disturbance can best be categorised into five levels in order to define its value for assessment purposes: Very high, high, medium, low and very low. Very high is assigned to a species that shows a strong escape behaviour and a large response distance (Furness & Wade, 2012), but is also more sensitive to being displaced as it is less flexible in its choice of habitats to feed, forage or roost (Langston, 2010). Very low is assigned to species that exhibit minimal or no escape behaviour and that only fly a very short distance when approached, but are also flexible in the habitats they can utilise, so are less impacted by being displaced from an area of sea.

12.29. Maclean *et al*. (2009) put forward values associated with species groups to disturbance, based on Garthe & Hüppop (2004) and these are considered alongside the Furness & Wade (2012) scoring index which has incorporated more recent studies into the derivation of the score. Wherever possible consideration is given to the most recent studies, where statistically robust data is presented on disturbance and displacement from wind farm activities on specific species. Further consideration has been given to the sensitivity of a species associated with disturbance, if it results in a bird being physically displaced from a site. For the purpose of this assessment a species' flexibility to being displaced from a site, or habitat, is based on the values presented in Langston (2010) and Furness & Wade (2012). The information provided by these authors and expert judgement was used to allocate each species to one of the five levels of species-specific sensitivity to disturbance and displacement, noting that the species-specific sensitivity can vary with the season.

12.30. The NE / JNCC interim guidance on displacement (NE / JNCC Interim Displacement Guidance, 2013) has been followed to produce 'biological period specific' displacement matrices that quantify the number of any given species displaced from the Turbine Area (and an appropriate buffer area).

12.31. **Habitat loss:** The loss of key habitats affects different species in different ways. Any affect on a species or population is largely dependent upon the availability of suitable habitat within areas that they are displaced into and the number and densities of that displaced population. Maclean *et al*. (2009) defined a species that has very specific habitat requirements as most likely to be sensitive to the effects of habitat loss, whilst species with more generalist habitat choices are less sensitive.

12.32. Sensitivity to habitat loss was based on habitat flexibility scores provided by Furness and Wade (2012), Garthe and Hüppop (2004), King *et al*. (2009) and Maclean *et al.* (2009). Moreover, sensitivity to habitat/prey changes defined by Langston (2010) was also considered when assigning a final value.

12.33. **Collision risk:** In line with best practice, this assessment modelled collision risk for key seabird species using the Band model (Band 2012). The sensitivity of a species was considered, together with numerical estimates from CRM. For the purpose of this assessment the species sensitivity to collision risk was based on flight manoeuvrability, flight altitude, percentage of time spent in flight and nocturnal flight activity (see Garthe and Hüppop, 2004; Furness and Wade, 2012) and SOSS rankings of perceived collision risk (Collier *et al*., 2012). A final category for each species was assigned using expert judgement (see Table 12.5). The sensitivity of certain migrant birds (i.e. those waders and wildfowl included within the Migropath modelling process) to collision risk was based on the classifications described by King *et al.* (2009) and supported by expert judgement (Table 12.6).

12.34. **Barrier effects:** A number of criteria were considered in assigning a species to a general sensitivity category with regard to barrier effects from operational wind farms. Maclean *et al. (*2009) noted that a wind farm located between a breeding colony and a key foraging area may result in more sensitive species flying around the wind farm, than taking a direct route through it, to reach their foraging areas. These birds will be subject to a barrier effect more than those species that may choose to fly through it.

12.35. For the purpose of this assessment the level of sensitivity to barrier effects was based on Maclean *et al*. (2009), published studies and supported by expert judgement (see Table 12.5).

Table 12.5 Summary of species-specific sensitivity (or general sensitivity)

Species	Disturbance / displacement	Habitat loss	Collision risk	Barrier effect
Fulmar	Very Low	Very Low	Low	Low
Balearic shearwater	Low	Very Low	Low	Low
Gannet	Low	Very Low	Medium	Medium
Arctic skua	Very Low	Low	Medium	Low
Great skua	Very Low	Low	Medium	Low
Kittiwake	Low	Low	Medium	Low
Mediterranean gull	Low	Low	Medium	Low
Lesser Black-backed gull	Low	Very Low	Medium	Low
Herring gull	Low	Very Low	Medium	Low
Great Black-backed gull	Low	Low	Medium	Low
Sandwich tern	Low	Medium	Medium	Very Low
Common tern	Low	Medium	Medium	Very Low
Guillemot	Medium	Medium	Low	Medium
Razorbill	Medium	Medium	Low	Medium
Puffin	Low	Medium	Low	Medium

Table 12.6 General migrant species sensitivities to specific wind park impacts

Table 12.6 General migrant species sensitivities to specific wind park impacts

Species	General sensitivity to collision risk
Dark-bellied brent goose	Medium
Common scoter	Low
Little egret	High
Avocet	High
Golden plover	Low
Grey plover	Low
Knot	Low
Black-tailed godwit	High
Bar-tailed godwit	High
Nightjar	High

12.36. **Assigning site-specific sensitivity:** To assign an overall site-specific value of sensitivity to key seabird species, both the non-impact specific sensitivity value and species-specific sensitivity were combined to give the values in Table 12.7; this follows Maclean *et al*. (2009).

Table 12.7 Overall site-specific sensitivity

Non impact-specific sensitivity value	Species-specific sensitivity				
	Very high	**High**	**Medium**	**Low**	**Very low**
Very high	Very high	Very high	Very high	Medium	Low
High	Very high	High	High	Medium	Low
Medium	Very high	High	Medium	Low	Low
Low	High	Medium	Low	Low	Very low
Very low	Medium	Low	Low	Very low	Very low

Magnitude of effect (Stage 3)

12.37. Magnitude of effect is the degree of change predicted to occur to the sensitive receptor and, for the purposes of this assessment, is largely based on the CIEEM (2010) guidance. This guidance offers a standardised ecological impact assessment approach, which has been tailored for this assessment using expert judgement (Table 12.8).

12.38. Magnitude of effect was based on the following factors:

- Extent: The geographical area and population size;
- Duration: based on short term (1 year), medium (2 to 10 years) or long term (>10 years);
- Frequency: Whether the receptor is subject to the effect once, intermittently or continuously;
- Timing: Whether the impact coincides with a critical life stage such as a migration or breeding event.

Table 12.8 Magnitude of effect

Magnitude	Description
Very high	Total loss or major alteration of a whole feature / population, or sufficient damage to a feature to immediately affect its viability. Potential effects are irreversible.
High	Major effects on the feature/population, which would have a sufficient effect to irreversibly alter the nature of the feature in the short-to-long term and affect its long-term viability. Recovery expected to be long term (i.e. 10 years) following cessation of activity.
Medium	Effects that are detectable in short and long-term, but which should not alter the long-term viability of the feature/population. Recovery expected to be medium term (i.e. 5 years) following cessation of activity.

Table 12.8 Magnitude of effect

Low	Minor effects from baseline, either of sufficiently small-scale or of short duration to cause no long-term harm to the feature/population. Recovery expected to be short-term (i.e. 1 year) following cessation of activity.
Negligible	A potential impact that is not expected to affect the feature/population in any way. Very slight or no change from baseline. Therefore no effects are predicted. Any recovery expected to be rapid (*i.e.* ~ 6 months) following cessation of activity.

Impact significance (Stage 4)

The overall significance of an impact is determined by combining the site-specific sensitivity of the receptor and magnitude of effect (the impact significance matrix is illustrated below). This impact significance matrix differs from that described in Chapter 3 'EIA Methodology', as it has a further category of 'very high'.

		Site-specific sensitivity				
		Very high	High	Medium	Low	Negligible
Magnitude of effect	Very high	Major	Major	Moderate	Moderate	Minor
	High	Major	Moderate	Moderate	Minor	Negligible
	Medium	Moderate	Moderate	Minor	Minor	Negligible
	Low	Moderate	Minor	Minor	Negligible	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible

12.39. Following the determination of impact significance, it is necessary to understand whether the result is considered to be Significant or Not Significant. Table 12.9 describes the levels of impact significance and how these relate to the assessment undertaken.

Table 12.9 Definitions for impact levels and significance

Category	Impact Levels	Significance
Negligible Impact	A very slight reduction in site conditions, which will not be of concern	Not significant
Minor Impact	A small change in site conditions, which may be raised as a local issue on a receptor, but is of limited concern and unlikely to be important in the decision-making process	
Moderate Impact	Intermediate change in site conditions causing some concern for a receptor, which is likely to be an important consideration at the regional level	Significant
Major Impact	A large change in site conditions, causing potentially serious concern for a receptor, which is likely to be an important consideration at the national level or could result in excedance of statutory objectives and or breeches of legislation	

Likelihood

12.40. It is important to note that in assigning impact significance, there is some uncertainty associated with data and the confidence in predictions. The likelihood of an impact occurring is a key consideration in determining significance. This requires knowledge of the receptor, and the proposed development, to determine whether a receptor is likely to encounter a potential impact. This is determined based upon a combination of site-specific data, expert opinion and published evidence. A scale of confidence, put forward by CIEEM (2010) was used where appropriate (Table 12.10).

Table 12.10 Scales of likelihood of impacts occurring (CIEEM 2010)	
Scale	Definition
Certain / near certain	Probability estimated at 95% chance or higher
Probable	Probability estimated above 50% but below 95%
Unlikely	Probability estimated above 5% but less than 50%
Extremely unlikely	Probability estimated at less than 5%

Modelling methodology

12.41. A detailed migration model (Migropath) was constructed by APEM (under guidance from SOSS –to provide information on passage migrants; predominantly those waterbirds that are non-breeding features of SPAs in the UK. Other groupings of birds (with the exception of nightjar and some seabirds), were not modelled owing to their extreme broad front migration, disparate UK distribution and r-selected ecology (i.e. they are highly productive, have a short generation time and early sexual maturity).

12.42. The Migropath model was used to estimate the numbers of certain species moving through the Turbine Area, as opposed to population estimates from survey data. These species were modelled as they can move across the sea in large numbers over a short time period, often at night or in bad weather (Cook *et al*., 2012). These characteristics make it difficult to record these species adequately with conventional survey techniques. The species modelled include:

- Dark-bellied Brent goose;
- Common scoter (*Melanitta nigra)*;
- Little egret (*Egretta garzetta)*;
- Avocet (*Recurvirostra avosetta)*;
- Golden plover;
- Grey plover (*Pluvialis squatarola)*;
- Knot (*Calidris canutus)*;
- Black-tailed godwit (*Limosa limosa)*;
- Bar-tailed godwit (*Limosa lapponica)*;
- Nightjar;
- Common tern (*Sterna hirundo)*;
- Sandwich tern (*Sterna sandvicensis)*;
- Great skua (*Sterncorarius skua)*; and
- Arctic skua (*Sterncorarius parasiticus)*.

12.43. A species scoping matrix was completed to facilitate the species selection process for the migration modelling. Nightjar associated with breeding SPAs in the UK have been included within the migration modelling at the request of NE and other stakeholders. Further information on the migration modelling undertaken including the methodology and criteria used for selecting species to be modelled will be provided within Technical Reports submitted in support of the forthcoming ES for the Project.

12.44. The population estimates from the survey and modelling for key seabirds and migrants have been assessed for appropriateness to run through a Collision Risk Model ('CRM'). The CRM used for this assessment was the Band (2012) model, which is recommended by NE for use in offshore wind farm impact assessments. CRM has been undertaken for key seabird and migrant species for each of the biological periods (i.e. breeding, wintering, spring migration and autumn migration) when they are present in the Turbine Area.

Limitations and embedded mitigation

Limitations

12.45. It is well known that boat surveys can have both an attractive and repellent effect on birds, depending on foraging ecology and escape response. Several species of seabird, especially aerial foragers, are frequently associated with fishing vessels as they often act as food sources. Consequently, these same species can be attracted to survey boats; this may result in population estimates being artificially inflated. Other species avoid boats as they represent a source of disturbance. Therefore, these birds may not be detected, or only detected in flight, which may result in population size being under-estimated.

12.46. Due to the snap-shot nature of boat based surveys it was recognised that some migrating waders, wildfowl and seabirds passing through the Turbine Area may have been under recorded or not recorded at all. A simple scoping exercise was, therefore, completed to identify any species that may have fallen into this category. These species were modelled using the Migropath model. In addition to waders, wildfowl and seabirds, nightjar was modelled in response to consultation with NE.

Embedded mitigation

12.47. The scoping of the assessment within this chapter takes into account mitigation measures that have been incorporated into the project as part of the design process. The design embedded mitigation measures that are directly relevant to ornithological receptors include:

- The provision of flashing warning lighting for aircraft, as opposed to a constant red light, to reduce the potential for lighting to attract birds towards the wind turbines during the hours or darkness or during bad weather;
- The turbine designs specified for the Project will ensure the distance between the sea surface and the blade tips will not be less than 22 m. Maximising this distance minimises the number of individual seabirds that may be subject to increased collision risk (i.e. most seabirds within the site fly at low altitudes);
- The level of sediment disturbance is lower when ploughing techniques are used as opposed to jetting techniques as sediment is backfilled rather than fluidised. It is assumed that the southern half of the export cable corridor (with cohesive soils) will not be buried using jetting methods due to seabed sediment conditions; and
- Additionally, Horizontal Directional Drilling ('HDD') will be used at the landfall. This will avoid the suspension of sediment in the intertidal region.

12.48. Best practice measures are also considered throughout the assessment as appropriate. These include correct servicing and maintenance of all equipment and machinery (including vessels), as well as adherence to best practice and appropriate legislation to avoid the risk of accidental spillage. Such as, appropriate Pollution Control Plans, Site Environmental Plans, EA Pollution Prevention Guidelines and on-site monitoring and reporting.

12.49. Strict control will be implemented through the project Environmental Management Plan which includes pollution control and spillage response plans.

12.50. In some instances, embedded mitigation is sufficient to prevent any significant impacts from occurring.

Baseline Environment

12.51. The following section details the baseline data gathering methodology for the assessment including data sources used and details of site specific surveys undertaken.

Data sources

12.52. Data required to inform the baseline was collected from a literature review, ornithological survey and a modelling programme.

12.53. A literature review was undertaken to inform the production of the Baseline Report for the Project and to underpin the impact assessment process. Data sources used for this included:

- Langston (2010). Offshore wind farms and birds: Round 3 zones, extensions to Round 1 and Round 2 sites and Scottish Territorial Waters. RSPB;
- Mackey and Giménez (2004). SEA678 Data Report for Offshore Seabird Populations. DTI;
- Musgrove *et al*. (2013). Population estimates of birds in Great Britain and the United Kingdom. British Birds;
- Holt *et al*. (2012). Waterbirds in the UK 2010/11. The Wetland Bird Survey. BTO;
- Brown and Grice (2005). Birds in England; Poyser;

- Del Hoyo *et al*. (1996). Handbook of the Birds of the World, Volume 3: Hoatzin to Auks. Lynx Edicions;
- Wright *et al*. (2012). Assessing the risk of offshore wind farm development to migratory birds designated as features of UK Special Protection Areas (and other Annex 1 species). BTO;
- Information where relevant and available for other offshore wind farm developments in the English Channel (e.g. Rampion Wind Farm, Fecamp Wind Farm);
- Other published material including atlases of seabirds, seabird populations, and migration movements (Stone *et al*., 1995; Wernham *et al*., 2002; Mitchell *et al*., 2004; Flegg, 2004; Kober *et al*., 2010);
- Offshore data from aerial surveys from January to March 2007 and autumn 2007 undertaken by WWT Consulting ('WWT') of the south-west wind farm strategic areas (SW16 and SW17 most relevant to the Navitus Bay area: WWT Consulting, 2008 a and b) and data from winter 2007/08 and summer 2008 surveys also undertaken by WWT consulting of the south-west and south-east wind farm strategic areas (SW124, SW125 and SE1 most relevant to Navitus Bay area: WWT Consulting, 2009); and
- Additional data from local bird reports (e.g. Dorset Bird Report 2009 (Lane, 2011); Hampshire Bird Report 2010 (Cox, 2011); Isle of Wight Bird Report 2010 (Hunnybun and Hart, 2011); Christchurch Harbour Ornithological Group Bird Report, 2009, 2010 and 2011 (Pyke *et al.*, 2010, 2011 and 2012); Durlston Country Park Bird Report 2009, 2010 and 2011 (Murray *et al*., 2010; 2011 and 2012); Portland Bill Bird Observatory Report 2009, 2010 and 2011 (Cade, 2010; 2011 and 2012) and SeaWatch SW Annual Report 2009 (Wynn *et al.*, 2010)) and wider reports.

Site-specific ornithological surveys

12.54. The Study Area (see Figure 12.1) was surveyed using both boat based and aerial techniques. Some additional land based observations were undertaken to complement these surveys during migration periods in spring and autumn.

12.55. Boat based surveys were undertaken over 24 months between December 2009 and November 2011, and provided the information needed to produce population estimates. These surveys were based on recognised guidelines produced by COWRIE (Camphuysen *et al*., 2004).

12.56. Additional boat based and land based surveys were completed during the spring and autumn periods of 2011 to record migrating birds through and around the Turbine Area. This data was collected to complement those recorded during the standard boat based surveys, on the advice of NE (see Table 12.2).

12.57. In addition, aerial surveys of the Turbine area, Turbine Area plus buffer and Zone 7 were undertaken between November 2009 to February 2010 and between January 2011 and March 2011.

12.58. The methodologies adopted and the nature of the resulting data will be provided in detail within Technical Reports submitted in support of the forthcoming ES. A summary is provided within this chapter and includes the following:

- Population estimates for each species/group for every survey month for the Turbine Area, the Turbine Area plus buffer and Zone 7 for both the boat based and the aerial surveys;
- Mean peak population estimates for the relevant biological periods/ seasons for each species (i.e. wintering, spring migration, breeding and/or autumn dispersal/migration);
- Summed seasonal distribution maps for each species/group; produced in the Geographical Information System ('GIS') package ESRI ArcGIS;
- Flight heights of birds recorded during the boat based surveys.

12.59. The survey methodology was designed and agreed with NE (see Table 12.2).

General ornithological context and designated sites

12.60. The south coast of England has relatively few cliff based colonies of auks and no gannet colonies, due to a limited number of suitable nesting cliffs in the region. However, there are colonies of these species on the Channel Islands and on the coast of northern France. Large tern colonies are found along the south coast of England and this region is also important for breeding Mediterranean gulls and avocets. As with many regions around the UK there are also estuarine and coastal habitats that support nationally and internationally important numbers of waders and wildfowl during the winter (Holt *et al*., 2012).

12.61. Outside of the breeding season, large numbers of migrant seabirds funnel through the 'bottle neck' between Dover and Calais, particularly during spring and autumn migration. The seabirds involved in these movements are migrating between their northerly breeding grounds to and from wintering areas off the south coast of England, south-west Europe, north-west Africa and even as far as southern Africa (Stienen *et al*., 2007). In addition to seabirds, waders and wildfowl it is recognised that the English Channel plays host to millions of other migrating birds, whose flight paths run from the UK to Continental Europe and Africa during the late summer and autumn, returning back on an annual basis during the spring (Stienen *et al*., 2007). As the area lies closer to the European Continent than most of Britain this means that it is usually the first to see summer migrants arriving in the spring (Green, 2004; Green and Cade, 2010).

12.62. Several coastal and marine areas on the south coast of England, the Channel Islands and on the north French coast are designated for their ornithological importance. There are several sites designated at the international level; these sites are Special Protection Areas ('SPA') and Ramsar sites. There are also a large number of sites designated at the national level (UK only); these Sites of Special Scientific Interest ('SSSI') are often constituent parts of the international designations outlined above. Table 12.11 lists the sites that are within the breeding season foraging ranges of the seabirds noted during the survey programme (based on Thaxter *et al*., 2012 where possible), or within the area where potential impacts associated with changes in physical processes (e.g. wave regime) could manifest (see Chapter 5 'Physical Processes'). The potential impacts on SPAs related to migratory birds or associated with long-range dispersal of wintering seabirds are considered separately within the HRA for the Project, following specific guidance produced by JNCC and NE (2013).

Within this chapter the assessment is focused on individual bird species, rather than designated sites. Only where residual impacts of Major or Moderate Significance are identified are associated designated sites considered as receptors within their own right. Potential significant effects on internationally designated sites are assessed within the HRA for the Project, submitted in support of this application.

Table 12.11 Ornithological Nature Conservation Designations

Site	Qualifying features of most relevance for international sites (site descriptions for SSSIs)	Distance to project (km)
Chichester and Langstone Harbours SPA	Little tern (*Sterna albifron)* Sandwich Tern	41.9
Poole Harbour Ramsar site	Common tern Mediterranean gull (*Larus melanocephalus)*	12.3
Poole Harbour SPA	Common Tern Mediterranean Gull	12.3
Solent and Southampton Water SPA	Common Tern Little Tern Mediterranean Gull Roseate Tern (*Sterna dougallii*) Sandwich Tern	3.1
Alderney West Coast and the Burhou Islands Ramsar site	Gannet (*Morus bassanu)*	77.7
Cap d'Erquy-Cap Fréhel SPA	12.1.1 Fulmar (*Fulmarus glacialis*) Kittiwake (*Rissa tridactyla*) Guillemot (*Uria aalge)* Razorbill (*Alca torda*)	179.6
Chausey SPA	Razorbill Guillemot Lesser black-backed gull (*Larus fuscus)*	152.6
Côte de Granit Rose-Sept Iles SPA	12.1.2 Razorbill Puffin (*Fratercula arctica*) Fulmar Kittiwake Gannet	184.2

Table 12.11 Ornithological Nature Conservation Designations

	Guillemot	
Falaise du Bessin Occidental SPA	Razorbill Guillemot Fulmar Lesser black-backed gull Kittiwake	121.3
Littoral seino-marin SPA	Razorbill Guillemot Fulmar Kittiwake	130.5
Ouessant-Molène SPA	Razorbill Puffin Fulmar	297.7
Tregor Goëlo SPA	Fulmar	179.1
Arne SSSI (This SSSI is a constituent part of the Poole Harbour SPA/Ramsar site and Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC)	The Arne Peninsula lies on the southern shore of Poole Harbour and holds an extensive area of lowland heath on the Bagshot Beds with diverse plant and animal communities of dry heath, wet heath and bog, which show many characteristics typical of Purbeck heaths. There are fine transitions from heathland into saltmarsh, reed swamp, coniferous and deciduous woodland and the site contains a geological exposure of high fossil plant interest.	18.3
Brading Marshes to St. Helens Ledges SSSI (a component of the Solent and Southampton Water SPA/Ramsar site)	The site supports a range of coastal habitats including neutral and acid grassland, saline and freshwater lagoons and pools, botanically rich ditches, reedbeds and areas of ancient woodland. There is also a variety	34.9

Table 12.11 Ornithological Nature Conservation Designations

	of estuarine habitats including mudflats and sand flats. The site is important for over-wintering waders and wildfowl and breeding waders.	
Christchurch Harbour SSSI (a component of the Chichester and Langstone Harbours SPA/Ramsar site)	The site comprises of the drowned estuary of the rivers Stour and Avon and the peninsula of Hengistbury Head. The varied habitats include saltmarsh, wet meadows, drier grassland, heath, sand dune, woodland and scrub and the site is of great ornithological interest.	4.3
Eling and Bury Marshes (a component of the Solent and Southampton Water SPA/Ramsar site)	The site supports two areas of dissimilar saltmarsh and the intertidal mudflats that lie between them. The marshes are an important autumn and winter feeding area for wildfowl and waders.	22.4
Headon Warren and West High Down SSSI	The site comprises parallel tertiary and chalk ridges. The former supports mainly acid, heath vegetation and the latter, species rich chalk grassland. The cliffs of Alum Bay to Totland Bay are geologically important as a classic section of the Lower tertiary strata. The chalk ridge terminates in the chalk stack known as The Needles and the eroded chalk foundations here are of great Geomorphological interest. The cliffs support colonies of breeding seabirds.	3.1
Hurst Castle and Lymington River Estuary SSSI (a component of the Solent and Southampton Water SPA/Ramsar site)	The site supports features of biological and geological importance. The SSSI, below the seawall, comprises estuaries of three substantial streams, intertidal muds, cord-grass (*Spartina anglica)* marshes and high level mixed saltmarsh; behind the seawall is	3.2

Table 12.11 Ornithological Nature Conservation Designations

	a belt of fresh and brackish marsh including fresh and saline lagoons. These lagoons support an assemblage of rare invertebrates and plants of international importance. An internationally important aggregation of over-wintering waterbirds uses this SSSI (as part of the Solent estuarine system).	
Hythe to Calshot Marshes (a component of the Solent and Southampton Water SPA/Ramsar site)	An extensive area of saltmarsh and mudflats that support high numbers of migratory and over-wintering waders and wildfowl.	22.6
King's Quay Shore (a component of the Solent and Southampton Water SPA/Ramsar site)	This site comprises the estuary of a small stream known as Palmers Brook, with flanking low cliffs and ancient woodland. From the estuary mouth there is also an area of intertidal habitats including mudflats and saltmarsh. The intertidal habitat supports over-wintering wildfowl and waders.	26.9
Langstone Harbour SSSI (a component of the Chichester and Langstone Harbours SPA/Ramsar site)	Langstone Harbour is a tidal basin that is drained by three main channels. At low water extensive mud flats are exposed. It also supports one of the largest areas of mixed saltmarsh on the south coast. The site is among the 20 most important assembly grounds (in summer and autumn) for waders during the moult and as a post-moult wintering ground. It also supports a substantial population of wintering dark-bellied brent geese.	42.1
Lee-on-the-Solent to Itchen Estuary (a	The site comprises extensive intertidal muds with a littoral fringe of vegetated shingle,	24.5

Table 12.11 Ornithological Nature Conservation Designations

component of the Solent and Southampton Water SPA/Ramsar site)	valley gravels and Bracklesham Beds. The site supports large numbers of over-wintering dark bellied brent geese, great crested grebe (*Podiceps cristatus*), teal (*Anas crecca*) and wigeon (*Anas penelope*).	
Lower Test Valley (a component of the Solent and Southampton Water SPA/Ramsar site)	The site comprises the upper estuary of the River Test and exhibits a graduation from salt, through brackish to freshwater conditions. It is one of the most extensive reedbeds on the south coast with flanking unimproved meadows and tidal creeks. The site supports wetland breeding birds and acts as a feeding and roosting site for wildfowl and waders. It is also a notable pre-migratory feeding site for passerines.	23.5
Lymington River Reedbeds (a component of the Solent and Southampton Water SPA/Ramsar site)	The site supports a reed bed that provides an important habitat for breeding passerines, autumn roosts for migratory birds and an area where migrant passerine species assemble to feed prior to making migratory southward movements.	7.5
Medina Estuary (a component of the Solent and Southampton Water SPA/Ramsar site)	The site supports a narrow tidal channel flanked by mudflats and saltmarsh that are in close association with a variety of brackish, freshwater and terrestrial habitats. These habitats support a range of wildfowl and waders.	23.7
Newtown Harbour (a component of the Solent and Southampton Water SPA/Ramsar site)	The site supports extensive areas of estuarine mudflats and saltmarsh which are flanked by unimproved grassland, woodland, ponds and hedgerows. The site supports a diverse range of invertebrates and flora and also supports	14.1

Table 12.11 Ornithological Nature Conservation Designations		
	large numbers of over-wintering waders and wildfowl. Gulls, terns and waders also breed within the boundary.	
North Solent (a component of the Solent and Southampton Water SPA/Ramsar site)	The site supports coastal mudflats, saltmarsh, shingle beaches and spits, fresh and brackish marshland and pools, maritime grassland, species rich grassland, valley mire, heathland and ancient semi-natural woodland. It also supports large populations of wintering and migratory wildfowl and waders and breeding populations of gulls, terns and waders.	13.2
Poole Harbour SSSI (This SSSI is a constituent part of the Poole Harbour SPA/Ramsar site)	One of the largest natural harbours in the world which comprises wide expanses of mudflat and intertidal marsh. These habitats support large numbers of wildfowl and waders over winter and fringing habitats support breeding common and sandwich terns.	12.9
Ryde Sands and Wootton Creek (a component of the Solent and Southampton Water SPA/Ramsar site)	This site supports extensive areas of inter-tidal habitats at low water. There are fine estuarine muds, cobbles, boulders and extensive sandflats present. These habitats are an important breeding area for waders, gulls and terns and an important over-wintering area for wildfowl and waders.	28.6
Sowley Pond (a component of the Solent and Southampton Water	This site is an important refuge for ducks such as wigeon and teal.	11.6

Table 12.11 Ornithological Nature Conservation Designations		
SPA/Ramsar site)		
Studland Cliffs SSSI	An outstanding stratigraphic and structural site of national importance, the strike and dip cliff section displays unequalled exposures of mid-Campanian Chalk, especially important for paleontological studies. The site also includes a strip of maritime, cliff top grassland and woodland that supports a rich invertebrate fauna. The cliffs are also important for several species of breeding bird including cormorant (*Phalacrocorax carbo)* and house martin (*Delichon urbica*).	9.5
Thorness Bay (a component of the Solent and Southampton Water SPA/Ramsar site)	The site comprises of soft maritime cliffs with large expanses of intertidal sand and shingle interspersed with rocky outcrops; there are also areas of brackish marsh. The site is important for breeding and wintering waterfowl.	17.5
Titchfield Haven (a component of the Solent and Southampton Water SPA/Ramsar site)	The site is the former estuary of the River Meon – tidal water is excluded by a one-way tidal valve. The result is the creation of a large area of fresh marsh with extensive reedbeds and wet unimproved meadows. In addition there are extensive scrapes. The area is important for wigeon and teal and is an important pre-migratory feeding area for many wetland birds.	28.7
Upper Hamble Estuary and Woods (a component of the Solent and	The site comprises the uppermost section of the estuary of the River Hamble and its flanking zones of saltmarsh, reed swamp	29.7

Table 12.11 Ornithological Nature Conservation Designations		
Southampton Water SPA/Ramsar site)	and ancient semi-natural woodland. The narrow mud flats support a range of waders and wildfowl.	
Wareham Meadows (This SSSI is a constituent part of the Dorset Heathlands and Poole Harbour SPA/Ramsar sites and Dorset Heaths (Purbeck and Wareham) and Studland Dunes SAC)	The site comprises the grazing meadows along the lower reaches of the River Frome and Piddle adjoining Poole Harbour. The site provides a large feeding site and high water roost for waders and wildfowl.	22.0
Yar Estuary SSSI (a component of the Solent and Southampton Water SPA/Ramsar site)	The Yar estuary supports extensive areas of mixed saltmarsh and extensive stands of common reed (*Phragmites australis)*. The mudflats are used extensively by wintering wildfowl and waders.	9.0

Abundance and distribution of key seabirds within the Turbine Area

12.63. For the purpose of this assessment, species were considered in three groups:

- Key seabirds: These birds were recorded during the survey programme in numbers of, or close to, regional importance during one or more of the biological periods, or were present in smaller numbers in the Turbine Area, but were identified during the consultation phase as being of concern;
- Migrant seabirds: These birds were recorded passing through the Turbine Area in small numbers only. Population estimates derived from survey data for these species were likely to be underestimates. Therefore, the number of individuals of each species passing through the Turbine Area during migration was estimated using the Migropath model. These species were only assessed with regard to collision risk and barrier effects, due to their transitory use of the site; and
- Migratory species (non-seabirds): These birds were largely unrecorded during the survey programme due to the difficulties in recording migrant species (see Section 12.3.8). They were mostly waders and wildfowl, with the exception of nightjar. The Migropath model was used to estimate numbers flying through the Turbine Area to enable an assessment of collision risk to be made.

12.64. The following sections provide information on bird populations and their distribution. Tables 12.13 to 12.15 provide mean peak estimates and densities of seabirds within the Turbine Area, and comparisons with the 1% thresholds of the regional, national and international populations during the breeding, wintering and migratory periods. More detailed information will be provided in Technical Appendices submitted in support of the forthcoming ES for the Project.

Key Seabirds

Fulmar

12.65. Fulmars were one of the most frequently recorded species during the survey programme, although densities were low ranging from 0 - 0.2 birds/km^2. Within the Turbine Area, numbers peaked at an estimated 25 birds during April 2010, with the mean peak estimate for spring migration being 21 birds. The distribution of fulmars did not suggest any preference for a specific location within the Turbine Area.

12.66. The majority of fulmars recorded within the Turbine Area and buffer were flying, with 17 birds (9%) sitting on the water. Of those birds recorded in flight, 179 (99%) were flying below Potential Collision Height ('PCH').

12.67. Fulmars are on the BoCC Amber list, although population estimates did not reach the 1% thresholds necessary for regional, national or international importance during any biologically relevant period. Therefore, fulmars scored **low** for their non-impact specific sensitivity value. Moreover, the site-specific (or general) sensitivity of fulmars to the potential impacts from an offshore wind farm were as follows:

- Disturbance and Displacement — Very low;
- Habitat Loss — Very low;
- Collision Risk — Low; and

- Barrier Effect Low.

Balearic Shearwater

12.68. Post-breeding, Balearic shearwaters migrate west out of the Mediterranean Sea and then northwards on reaching the Atlantic Ocean (Wernham *et al*., 2002; BirdLife, 2004). The Balearic shearwater is listed by Langston (2010) as a species potentially at risk of displacement through development of Zone 7.

12.69. Very few Balearic shearwaters were recorded within the survey areas. All individuals were in flight and well below PCH. The distribution of Balearic shearwaters did not suggest any preference for a specific location within the Turbine Area.

12.70. Balearic shearwaters were recorded in very low numbers, but they are listed on the IUCN Red List, Annex I of the Birds Directive, the BoCC Red list, and a species of principal importance in England. Therefore, Balearic shearwaters have a non-impact specific sensitivity value of **medium** and site-specific sensitivities as follows:

- Disturbance and Displacement Low;
- Habitat Loss Low;
- Collision Risk Low; and
- Barrier Effect Low.

Gannet

12.71. Gannets were one of the most frequently recorded species during the survey programme, with densities ranging between 0.0 – 0.66 birds/km^2. Numbers were highest during the 2010 and 2011 breeding seasons, consistent with other surveys (e.g. WWT Consulting 2008a; 2008b and 2009). Peak numbers occurred in June 2011, when an estimated 112 gannets were present in the Turbine Area.

12.72. The majority (89%) of gannets in the Turbine Area plus buffer were in flight. This is to be expected as gannets are wide-ranging aerial foragers, spending much of their time on the wing. Of the 1,679 flying gannets recorded across all surveys, 109 (6%) were flying at PCH, with 94% flying below the rotor swept height. During the breeding period, gannet numbers increased and distribution was similar across the survey area.

12.73. Gannet population estimates did not reach the 1% threshold necessary for regional, national or international importance during any biologically relevant period and are a BoCC Amber listed species. However, gannets are a designated feature of the Alderney West Coast and Burhou Islands Ramsar site (a site within the mean maximum foraging distance of the Turbine Area – Thaxter *et al*., 2012) resulting in a non-impact specific value of **very high**. The site-specific sensitivities for this species are:

- Disturbance and Displacement Medium;
- Habitat Loss Low;
- Collision Risk Very high; and
- Barrier Effect Very high.

Kittiwake

12.74. Very few kittiwake breeding colonies exist along the south coast of England, reflecting a shortage of suitable habitat (Stroud *et al*., 2001). Kittiwakes were recorded within the Turbine Area during all surveys; numbers were highest during the winter and spring with a peak estimate of 55 birds within the Turbine Area in January 2011.

12.75. The distribution of kittiwakes did not suggest there was any preference for a specific location within the Turbine Area. The majority of kittiwakes recorded were in flight (91%); of these birds 99% were flying below PCH. Of the kittiwakes recorded in flight across the Turbine Area and buffer zone only, 10% were recorded at PCH.

12.76. Kittiwakes are on the BoCC Amber list, although population estimates were well below the 1% thresholds necessary for regional, national or international importance. Therefore, kittiwakes were scored **low** for their non-impact specific sensitivity value. The site-specific sensitivities for this species are:

- Disturbance and Displacement Low;
- Habitat Loss Low;
- Collision Risk Low; and

- Barrier Effect Low.

Mediterranean Gull

12.77. The peak estimate for Mediterranean gulls was in June 2011 when an estimated 15 birds were present in the Turbine Area and buffer zone. Birds were only recorded during four boat based surveys over the two year programme.

12.78. During land based migration surveys, peak numbers of Mediterranean gulls were observed in October and November 2011. However, during simultaneous boat based migration surveys very few Mediterranean gulls were recorded, reflecting their preference for near-shore habitat. Use of the Turbine Area by Mediterranean gulls was relatively low and population estimates were well below that required to reach the 1% threshold necessary for regional, national or international importance. No clear pattern in the distribution of Mediterranean gulls was apparent.

12.79. All Mediterranean gulls were observed in flight, with the exception of one individual which was sitting on the water. Of the 22 birds in flight six (27%) were flying at PCH. Since breeding Mediterranean gulls are a designated feature of the Solent and Southampton Water SPA and Poole Harbour SPA (both SPAs being within published foraging range of this species – Thaxter *et al*., 2012), listed on Annex I of the Birds Directive and Schedule 1 of the WCA , their non-impact specific value is **very high**. The site-specific sensitivities for this species are:

- Disturbance and Displacement Medium;
- Habitat Loss Medium;
- Collision Risk Very high; and
- Barrier Effect Medium.

Lesser Black-backed Gull

12.80. Lesser black-backed gulls are scarce residents in areas close to the Project (Green, 2004; Cox, 2011; Lane, 2011). Low numbers of lesser black-backed gulls were recorded within the Turbine Area across all seasons. Numbers peaked during autumn migration with a mean peak of 24 individuals estimated. The distribution of lesser black-backed gulls did not suggest any preference for a specific location within the survey area.

12.81. Lesser black-backed gulls which breed in the UK were thought to be largely sedentary (Stone *et al*., 1995). However, recent data from a satellite tagging study of lesser black-backed gulls suggests the opposite; five of six tagged birds from Orford Ness, Suffolk migrated to Spain and Morocco during the winter (Thaxter *et al*., 2011). These birds moved south across the English Channel, with some birds passing close to the Turbine Area (Ross-Smith, 2012).

12.82. The majority (95%) of lesser black-backed gulls recorded within the Turbine Area plus buffer zone were in flight, with 11 birds sitting on the water. Of those recorded in flight, 157 (79%) were flying below PCH.

12.83. Use of the Turbine Area by lesser black-backed gulls was relatively low and population estimates were well below the 1% threshold necessary for regional, national or international importance. As the species is on the BoCC Amber list and was not present in anything more than locally important numbers, it scores **low** for its non-impact specific value. The site-specific sensitivities for this species are:

- Disturbance and Displacement Low;
- Habitat Loss Very low;
- Collision Risk Low; and
- Barrier Effect Low.

Herring Gull

12.84. Herring gulls are a scarce to common breeding bird along the south coast of England, and can be an abundant winter visitor and passage migrant (Lane, 2011; Cox, 2011; Hunnybun *et al*., 2011). Herring gulls were recorded within the Turbine Area in all seasons except the 2011 breeding season, peaking in June 2010. However, herring gull density in all surveyed areas was no greater than 0.52 birds/km^2 during any period. During the winter, herring gulls peaked at 26 birds (0.14 birds/km^2) in the Turbine Area during December 2009.

12.85. The majority of herring gulls recorded within the Turbine Area and buffer zone were in flight, with 65 birds (14%) sitting on the water. Of those recorded in flight, 312 (81%) were flying below PCH. Use of the Turbine Area was relatively low (maximum of 66 birds) and population estimates were well below the 1% thresholds necessary for regional, national or international importance.

12.86. As herring gulls are on the BoCC Red list, this species scores **medium** for its non-impact specific sensitivity value. The site-specific sensitivities for this species are:

- Disturbance and Displacement Low;
- Habitat Loss Low;
- Collision Risk Medium; and
- Barrier Effect Low.

Great Black-backed Gull

12.87. Low numbers of great black-backed gulls were recorded during the surveys. Indeed, the species was absent from the Turbine Area during the 2010 and 2011 breeding periods. This was expected since great black-backed gulls are a scarce resident, fairly common winter visitor and passage migrant in the south of England (Green, 2004; Cox, 2011; Hunnybun *et al*., 2011). In the Turbine Area great black-backed gull numbers peaked at an estimated 15 individuals during winter and spring migration respectively (January and March 2011). In the Turbine Area plus buffer zone, the peak was of 192 estimated individuals during the winter period (January 2011). The distribution of great black-backed gulls did not suggest any preference for a specific location within the survey areas.

12.88. A high proportion (38%) of the great black-backed gulls recorded were in flight at PCH, with the remainder below PCH. A total of 42 (22%) great black-backed gulls were sitting on the water.

12.89. Great black-backed gulls are listed on the BoCC Amber list. However, population estimates were well below the 1% thresholds necessary for regional, national or international importance. Therefore, great black-backed gulls were scored **low** for their non-impact specific sensitivity value. The site-specific sensitivities for this species are:

- Disturbance and Displacement Low;
- Habitat Loss Low;
- Collision Risk Low; and
- Barrier Effect Low.

Guillemot

12.90. Guillemots were recorded within the Turbine Area and the buffer zone in all seasons. Guillemot numbers peaked during April 2011 with an estimated 1,057 individuals in the Turbine Area and 2,430 in the Turbine Area plus buffer zone. The mean peak estimate of guillemots during February (the month agreed with NE as representing spring passage) did not reach the regional 1% threshold. The high numbers recorded in April were recognised as being mostly migrating birds, as opposed to breeding birds, due to the difference between known local breeding numbers and those recorded during the survey. The mean peak figures of February and April increased the numbers during spring migration to that of regional importance.

12.91. Guillemots were recorded in numbers of regional importance during the winter, spring migration and breeding periods. Although relatively high numbers of guillemots were recorded during the non-breeding season, no clear pattern in their spatial distribution was apparent.

12.92. In contrast to the other key seabird species recorded, the majority (72%) of guillemots recorded in the Turbine Area and buffer zone were sitting on the water. This is to be expected as guillemots are pursuit divers, meaning that most of their time is spent on or under the water. Of the 629 (28%) individuals recorded in flight, only one (0.16%) was recorded at PCH.

12.93. Since guillemots were recorded in regionally important numbers and are on the BoCC Amber list, they score medium for their non-impact specific value. The site-specific sensitivities for guillemots are:

- Disturbance and Displacement Medium;
- Habitat Loss Medium;
- Collision Risk Low; and
- Barrier Effect Medium.

Razorbill

12.94. Very few razorbills breed along the coastline of southern England, although they are a spring passage migrant and winter visitors to the coasts of Hampshire, Dorset and the Isle of Wight (Green, 2004; Cox, 2011; Hunnybun *et al*., 2011). Razorbill numbers were relatively high during the 2011 breeding period. However, it is recognised that birds recorded in April 2011 represented a late spring migration movement through the Turbine Area, as the number recorded (263 individuals) was greater than the number of individuals recorded as breeding at nearby.

12.95. The spatial distribution of razorbills varied across the biological periods, with higher densities towards the north of the Turbine Area and buffer. As with guillemots, the majority of razorbills recorded were observed sitting on the water, 67% were sitting across the Turbine Area plus buffer zone. Of the birds recorded in flight all 493 birds (100%) were recorded below PCH. The surveys suggest that razorbills use the Turbine Area in regionally important numbers during the winter and spring periods. As razorbills are on the BoCC Amber list and present in regionally important numbers, the species scores **medium** for its non-impact specific sensitivity value. The site-specific sensitivities for guillemots are:

- Disturbance and Displacement Medium;
- Habitat Loss Medium;
- Collision Risk Low;
- Barrier Effect Medium.

Puffin

12.96. Very few puffins are found along the south coast of England, with some very small colonies in Dorset (Green, 2004). However, regular small numbers of puffins (<10) are observed during passage at coastal sites such as Hengistbury Head, Durlston, Portland Bill and Chesil Cove (Lane, 2011). Numbers in the Turbine Area and buffer peaked during April 2011, when an estimated 52 puffins were present in the Turbine Area and 95 were recorded in the Turbine Area plus buffer zone. These birds have been categorised as passage migrants returning to northern breeding colonies. As birds are known to disperse widely following breeding and during the winter, this may explain the variations in numbers recorded between the two years surveyed.

12.97. All puffins were recorded sitting on the water. This is expected since puffins are pursuit divers and spend most of the time on or under the water.

12.98. The surveys suggest that puffins use the Turbine Area in relatively low numbers and population estimates were well below the 1% thresholds necessary for regional, national or international importance. Since puffins are on the BoCC Amber list and present in locally important numbers only, their non-impact specific value is **low**. Following the assessment methodology presented, the site-specific sensitivities for this species are:

- Disturbance and Displacement Low;
- Habitat Loss Low;
- Collision Risk Low;
- Barrier Effect Low.

Migrant Seabirds

12.99. Most seabirds were adequately recorded during the survey programme, as an increase during the autumn migration period was observed and recorded. Therefore it was reasonable to assume that migratory birds were recorded to some degree. However, some migratory birds may not have been accounted for as they move across seas in large numbers, but over a short time period. These movements are also often at night and sometimes in bad weather (Cook *et al*., 2012). Most of the key seabirds migrating through the Turbine Area were frequently detected on surveys. Therefore, assessments were based on field data, allowing for passage through the Turbine Area on a relevant number of days.

12.100. APEM's Migropath model was used to provide a detailed and consistent method for estimating turnover for four seabird species during the spring and autumn migration; great skua, Arctic skua, Sandwich tern and common tern. These four species were identified as potentially flying through the Turbine Area during migration periods in large numbers in the SOSS 05 report (Wright *et al*., 2012). Analysis of the survey data also suggested that under-recording of these species was likely to have occurred.

12.101. Table 12.12 presents the results of the Migropath modelling for migrant seabirds. The model provides a total turnover per period, so this figure is used to account for each migration period. The percentage of flights at PCH is taken from published sources as the number of birds recorded during the surveys was so low that the data was not considered to be representative.

Table 12.12 Migrant seabirds (results of Migropath modelling)

Species	Total spring migration turnover	Total autumn migration turnover	% flying at potential collision height (from Cook *et al.*, 2012)
Great skua	1,114	1,114	4.3%
Arctic skua	713	713	3.8%
Sandwich tern	2,736	2,736	3.6%
Common tern	3,086	3,086	12.7%

12.102. The number of birds estimated to pass through the Turbine Area reached international or national importance for all four species listed in Table 12.14. As all four species are associated with UK SPAs they have a **very high** non-impact specific value.

12.103. Migrant seabirds have been assessed within this chapter with regards to collision risk and the barrier effect only. Habitat loss and disturbance/ displacement were not considered as these species are unlikely to use the area extensively for foraging when on passage.

12.104. The site-specific sensitivities for these species, noting the non-impact specific sensitivity value of **very high** are as follows:

Great skua

- Collision Risk Very high;
- Barrier Effect Medium.

Arctic skua

- Collision Risk Very high;
- Barrier Effect Medium.

Sandwich tern

- Collision Risk Very high;
- Barrier Effect Low.

Common tern

- Collision Risk Very high;
- Barrier Effect Low.

Table 12.13 Mean peak estimates and densities of seabirds within the Turbine Area (based on data collected during the standard monthly boat based surveys and to the base of the table those modelled using Migropath)

Species	Winter		Spring migration		Breeding		Autumn migration	
	Mean peak estimate	Mean peak density (birds/km^2)	Mean peak estimate	Mean peak density (birds/km^2)	Mean peak estimate	Mean peak density (birds/km^2)	Mean peak estimate	Mean peak density (birds/km^2)
Fulmar	4	0.02	21	0.12	8	0.05	0	0.00
Balearic shearwater	0	0.00	0	0.00	0	0.00	4	0.02
Gannet	13	0.07	4	0.02	100	0.57	50	0.29
Kittiwake	51	0.29	50	0.29	11	0.06	11	0.06
Mediterranean gull	4	0.02	0	0.00	8	0.05	0	0.00
Lesser black-backed gull	0	0.00	5	0.03	18	0.10	24	0.14
Herring gull	24	0.14	4	0.02	33	0.19	2	0.01
Great black-backed gull	11	0.06	12	0.07	0	0.00	10	0.06
Guillemot	637	3.64	598	3.42	144	0.82	23	0.13
Razorbill	352	2.01	187	1.07	13	0.07	19	0.11
Puffin	5	0.03	26	0.15	10	0.06	0	0.00
Modelled estimates of seabirds migrating through the Navitus Bay Offshore Wind Park site (based on Migropath modelling)								
Arctic skua	n/a*	n/a	1,114	n/a	n/a	n/a	1,114	n/a
Great skua	n/a	n/a	713	n/a	n/a	n/a	713	n/a
Sandwich tern	n/a	n/a	2,736	n/a	n/a	n/a	2,736	n/a
Common tern	n/a	n/a	3,086	n/a	n/a	n/a	3,086	n/a

Note: Migropath modelling estimates numbers of migrating birds only.

Table 12.14 Species populations and Regional, National and International importance thresholds (wintering / breeding), based on data collected during the standard monthly boat based surveys

Species	Regional 1% threshold		National 1% threshold		International 1% threshold		Mean peak estimate in project site		Importance of site	
	Wintering	Breeding	Wintering	Breeding	Wintering	Breeding	Wintering	Breeding	Wintering	Breeding
Fulmar	65	75	10,000	10,000	56,000	56,000	4	8	Local	Local
Balearic shearwater	N/A	N/A	N/A	N/A	50 (33)	50 (33)	0	0	None**	None
Gannet	638	557	4,400	4,400	6,000	6,000	13	100	Local	Local
Arctic skua	N/A	N/A	50 (42)	50 (42)	800	800	0	0	None	None
Great skua	50 (45)	N/A	192	192	320	320	0	0	None	None
Kittiwake	347	50 (2)	7,600	7,600	20,000	42,000	51	11	Local	Local
Mediterranean gull	50 (1)	50 (1)	50 (18)	50 (6)	6,600	2,400	4	8	Local	Local
Lesser black-backed gull	116	50 (47)	1,300	2,200	5,500	6,000	0	18	None	Local
Herring gull	379	50 (32)	7,400	2,800	5,900	15,200	24	33	Local	Local
Great black-backed gull	164	50 (2)	770	340	4,406	2,200	11	0	Local	None
Sandwich tern	N/A	50 (8)	N/A	240	1,700	1,640	0	0	None	None
Common tern	N/A	50 (5)	N/A	240	1,900	1,700	0	4	None	Local
Guillemot	239	104	19,000	19,000	40,000	40,000	637	144	Regional	Regional
Razorbill	91	50 (24)	2,600	2,600	8,600	8,600	352	13	Regional	Local
Puffin	50 (38)	50 (1)	11,600	11,600	106,000	106,000	5	10	Local	Local

**None – refers to species where the mean peak estimate was zero.

Table 12.15 Species populations and Regional, National and International importance thresholds (migration), based on data collected during the standard monthly boat based surveys (Population estimates for those seabirds modelled using Migropath are also provided)

Species	Regional 1% threshold	National 1% threshold	International 1% threshold	Mean peak estimate in Project Site (Spring / Autumn)	Importance of site
Fulmar	1,000	10,000	56,000	21 / 0	Local
Balearic shearwater	50	50	50 (33)	0 / 4	Local
Gannet	400	4,400	6,000	4 / 50	Local
Kittiwake	840	7,600	42,000	50 / 11	Local
Mediterranean gull	50 (1)	50 (2)	2,400	0 / 0	None
Lesser black-backed gull	1,250	2,200	6,000	5 / 24	Local
Herring gull	140	2,800	15,200	4 / 2	Local
Great black-backed gull	60	340	2,200	12 / 10	Local
Guillemot	200	19,000	40,000	598 / 23	Regional (spring)
Razorbill	50 (4)	2,600	8,600	187 / 19	Regional (spring)
Puffin	50 (1)	11,600	106,000	26 / 0	Local
Modelled estimates of seabirds migrating through the Turbine Area (based on Migropath modelling)					
Arctic skua	n/a	50 (42)	800	1,114	International
Great skua	272	192	320	713	International
Sandwich tern	1,000	240	1,640	2,736	International
Common tern	1,000	240	1,700	3,086	International

Note: Migropath modelling estimates numbers of migrating birds only.

Migratory Species (non-seabirds)

12.105. Whilst field surveys can inform passage movements through the Turbine Area, for some species such surveys alone may not be able to identify the full extent of migration movements.

12.106. To help determine connectivity between SPAs (i.e. the major concentrations of certain birds) and the operational Turbine Area, together with potential mortality rates, population estimates of migrating birds passing through the Turbine Area were predicted using Migropath. The species modelled were those associated with non-breeding SPAs (i.e. waders and wildfowl migrating into the UK for the winter, with a point-to-point migration between continental Europe and the UK). NE, British Trust for Ornithology ('BTO') and RSPB were involved in developing and agreeing the scope of these works and the model was further refined following their input.

12.107. Ten wildfowl and wader species were selected for inclusion in the model. Wildfowl and waders, unlike passerines, typically migrate along narrow corridors known as flyways (Davidson *et al*., 1995, Wernham *et al*., 2002; Newton, 2010). Therefore, any offshore wind farm situated within these routes is likely to pose a threat at both the individual and species level. Species were selected which were at potential risk of collision in the Turbine Area. These included wildfowl and waders migrating between continental breeding areas and their designated non-breeding SPAs along the south coast of England, as outlined in Wright *et al*. (2012). These ten species were selected using a combination of the SOSS 05 report (Wright *et al,*. 2012), known SPAs along the English Channel and expert opinion on those species potentially most at risk from the Project.

12.108. Following the nightjar workshop held on 20/06/2013 (refer to consultation table), an approach to the modelling of nightjar migration was agreed. This approach uses a refinement of the Migropath model and a range of scenarios to enable a range of outcomes to be visualised. This work is currently on-going.

12.109. The outputs of this migration model are summarised in Table 12.16. Full details will be provided within Technical Reports submitted in support of the forthcoming ES for the Project.

Table 12.16 Migration modelling outputs for wildfowl and wader species through the Turbine Area

Species	Flyway population	GB and Ireland population	% of flyway population staging at the Wadden Sea	Migration season	Migrant estimate	Lower confidence limit	Upper confidence limit	Percentage of flyway population within Turbine Area	Percentage of GB and Ireland population within Turbine Area
Dark-bellied brent goose	200,000	91,000	99.8	Spring	0	0	0	0.00	0.00
			41.6	Autumn	0	0	0	0.00	0.00
Common scoter	1,600,000	123,190	-	Spring/Autumn	1,564	1,511	1,622	0.10	1.27
Little egret	125,000	4,500	-	Spring/Autumn	390	373	408	0.31	8.67
Avocet (breeding)	73,000	877	-	Spring/Autumn	10	9	11	0.01	1.14
Avocet (non-breeding)	73,000	7,500	-	Spring/Autumn	7	6	9	0.01	0.09
Golden plover (breeding)	173,846	45,000	-	Spring/Autumn	3,125	3,018	3,230	1.80	6.94
Golden plover (non-breeding)	1,070,000	566,700	-	Spring/Autumn	0	0	0	0.00	0.00
Grey plover	250,000	49,315	-	Spring/Autumn	456	443	468	0.18	0.92
Knot	450,000	338,970	75.0	Spring	1,168	1,138	1,201	0.26	0.34
Knot			79.7	Autumn	948	916	975	0.21	0.28
Black-tailed godwit (breeding)	160,000	104	-	Spring/Autumn	5	4	5	0.003	4.81
Black-tailed godwit (non-breeding)	57,000	56,880	-	Spring/Autumn	932	908	955	1.64	1.64
Bar-tailed godwit	120,000	54,280	58.0	Spring	0	0	0	0.00	0.00
Bar-tailed godwit			25.3	Autumn	0	0	0	0.00	0.00
Nightjar	940,000	9,200	-	Spring/Autumn	482	470	494	0.05%	5.24%

Dark-bellied Brent goose

12.110. Dark-bellied Brent geese migrate along the Western Palearctic flyway from breeding sites in arctic Russia via staging sites in the Wadden Sea, and along the North Sea coast, the English Channel and the French Atlantic coast. Birds spend the winter largely on southern and eastern coasts of England and along the Atlantic west coast of France (Wernham *et al.,* 2002; Ward, 2004).

12.111. Migration may be either nocturnal or diurnal and takes place almost exclusively over the sea or along the coast, although overland movements are occasionally recorded (Harrison, 1979).

12.112. The same route is used during both autumn and spring migrations. British wintering birds account for almost half of the entire flyway population (91,000 individuals or 46%). Dark-bellied Brent geese arrive at British wintering sites from October and numbers generally peak in January / February. Return migration begins in late February, with the last birds leaving in May (Wernham *et al*., 2002). The migration model estimated that no dark-bellied Brent geese would pass through the Turbine Area during the spring or autumn migration periods (Table 12.16).

12.113. As dark-bellied Brent geese are a feature of the Solent and Southampton Water SPA their non-impact specific value is **very high**. Their general sensitivity to collision risk is **medium** (Table 12.6), therefore, the overall site-specific sensitivity for dark-bellied Brent geese is **very high**.

Common Scoter

12.114. There are an estimated 123,190 common scoters wintering off British and Irish shores (Wright *et al.*, 2012), comprising both British breeders and those that breed elsewhere.

12.115. It is thought that many of these birds may migrate across the North Sea from moulting sites in the Baltic or the eastern North Sea (Wernham *et al.,* 2002). Birds from these populations are also known to migrate south-west through the English Channel in autumn after moulting, returning in spring.

12.116. The migration model estimated that 1,564 common scoters would pass through the Turbine Area during both the spring and autumn migration periods (Table 12.16). This accounts for 1.27% of the Great Britain and Ireland population and 0.28% of the total flyway population.

12.117. As common scoter are linked to several SPAs in the UK, and these birds may migrate through the Turbine Area their non-impact specific value is **very high**. Their general sensitivity to collision risk is **low** (see Table 12.6), therefore, the overall site-specific sensitivity for common scoter is **medium**.

Little Egret

12.118. A northwards expansion of the little egret within Europe has caused the status of this species in the UK to change dramatically in recent years. Whilst records of little egret are limited during the breeding season, numbers increase during the autumn and winter.

12.119. Numbers peak in September and October as birds from colonies in north-western France disperse after breeding (Stroud *et al.,* 2001). Numbers decline during the winter months, presumably as some birds return to France, or perhaps migrate further south (Wernham *et al.,* 2002). However, substantial numbers remain in the UK during the winter and this is reflected in little egret being a feature of three SPAs (i.e. Tamar Estuaries Complex SPA, Chichester and Langstone Harbours SPA and Poole Harbour SPA) on the south coast of England outside the breeding season (Wright *et al.,* 2012).

12.120. The migration model estimated that 390 little egrets would pass through the Turbine Area during both the spring and autumn migration periods (Table 12.16). This accounts for 8.67% of the Great Britain and Ireland population and 0.31% of the flyway population.

12.121. As little egret are a feature of Poole Harbour SPA their non-impact specific value is **very high**. Their general sensitivity to collision risk is **high** (Table 12.6), therefore, the overall site-specific sensitivity for little egret is **very high**.

Avocet

12.122. Avocets in the UK are concentrated on the south and east coasts of England throughout the year (Wernham *et al*., 2002). Indeed, avocets are a designated feature of three coastal SPAs along the south coast of England (i.e. Exe Estuary SPA, Tamar Estuaries Complex SPA and Poole Harbour SPA - Stroud *et al.,* 2001).

12.123. During winter there is an influx of birds from the Low Countries, with the total UK wintering population representing 10% (7,500 individuals) of the international avocet population (Holt *et al*., 2012). Some birds from the UK migrate south to sites in France, Iberia or North Africa. Key migration times are July-November and March-April (Wernham *et al*., 2002).

12.124. The migration model estimated that ten avocets from the UK breeding population and seven avocets from the non-breeding population would pass through the Turbine Area during both the spring and autumn migration periods (Table 12.16). This accounts for 1.14% of the Great Britain and Ireland breeding population, 0.09% of the Great Britain and Ireland non-breeding population and 0.01% of the flyway population.

12.125. As avocets are a feature of Poole Harbour SPA their non-impact specific value is **very high**. Their general sensitivity to collision risk is **high** (Table 12.6), therefore, the overall site-specific sensitivity for avocet is **very high**.

Golden Plover

12.126. Three populations of golden plover occur during the winter that originate or migrate to the UK; individuals from Iceland and the Faeroes winter in Ireland and western Britain, individuals from northern Europe winter in eastern Britain and some British breeders migrate southwards to France, Iberia and North Africa (Wernham *et al*., 2002).

12.127. This combination of three different populations moving in different directions, means that golden plovers are likely to be moving across most offshore areas around Britain. Individuals migrating from Ireland to Iceland are likely to pass across the Irish Sea and to the west and north of Scotland, those migrating from mainland Europe migrate across the North Sea, and those breeding in the UK probably migrate across the English Channel.

12.128. Autumn migration occurs soon after chicks fledge, from late June until September, and most birds return to breeding grounds in the UK by February. However, birds may move long distances, potentially crossing the sea at any time during the winter in response to harsh weather (Wernham *et al*., 2002).

12.129. The migration model estimated that 3,125 golden plovers breeding in the UK would pass through the Turbine Area during both the spring and autumn migration periods (Table 12.16). This accounts for 6.91% of the Great Britain and Ireland breeding population or 0.20% of the flyway breeding population.

12.130. As golden plover are linked to several SPAs in the UK, and these birds may migrate through the Turbine Area their non-impact specific value is **very high**. Their general sensitivity to collision risk is **low** (see Table 12.6), therefore, the overall site-specific sensitivity for golden plover is **medium**.

Grey Plover

12.131. Grey plover occurs as both a passage migrant and winter visitor to coastal areas of the UK, with all birds coming from Russian breeding populations (Wernham *et al*., 2002).

12.132. Birds seen on passage, winter around the coasts of south-west Europe and north-west Africa. Autumn arrivals to the UK begin in late July and continue until October, with a peak during September. Data from ringing-recoveries suggest that the coast of Denmark is an important staging area for birds on their way to the UK in the autumn. Following the peak in September, numbers decline through October and November as passage populations move out of the UK to the south and west, presumably flying across the English Channel at this time (Wright *et al.,* 2012).

12.133. The return spring migration occurs from March, when passage birds arrive in the UK, having presumably crossed the English Channel once again. Wetland Bird Survey (WeBS) counts demonstrate that numbers in the UK remain high until May, suggesting that many passage and wintering birds remain in the UK before migrating back across the North Sea, to their breeding sites in the east and north (Wernham *et al*., 2002).

12.134. The migration model estimated that 456 grey plovers would pass through the Turbine Area during both the spring and autumn migration periods (Table 12.16). This accounts for 0.92% of the Great Britain and Ireland breeding population and 0.18% of the flyway population.

12.135. As grey plover are linked to several SPAs in the UK, and these birds may migrate through the Turbine Area their non-impact specific value is **very high**. Their general sensitivity to collision risk is **low** (see Table 12.6), therefore, the overall site-specific sensitivity for grey plover is **medium**.

Knot

12.136. Most knot wintering in Britain breed in the high Arctic and migrate, via staging sites in Iceland and/or Norway in autumn, to wintering sites on large estuaries in western Europe. Upon return to their northern breeding grounds, knot migrate via Iceland or northern Norway, with some birds also staging at sites in the Wadden Sea in autumn and/or spring (Wernham *et al*., 2002).

12.137. The UK is internationally important for knot, both as a wintering site and as a staging site in spring and autumn; more than 70% of the population may be present within 25 estuaries designated as SPAs for this species. Large concentrations of moulting knot occur in autumn on the Wash, Dee Estuary, Ribble Estuary and in Morecambe Bay. Autumn passage across UK waters occurs from mid-July to September, with the majority of arrivals in August (adults) or September (juveniles).

12.138. Birds migrating between the UK and their breeding grounds may travel across a variety of waters surrounding the UK depending on the route they take (via Iceland, Norway and/or the Wadden Sea). The English Channel is also likely to be crossed by many birds wintering in France or further south. Further movements of birds between passage or moulting/wintering sites occur between October and December, with many birds moving across the North Sea between the Wadden Sea and the UK, or across the English Channel between the UK and France (Wernham *et al*., 2002). There is also considerable movement between estuaries in the UK at this time, with birds tending to move towards the north and west.

12.139. In March, more than half of the British wintering population move eastwards across the North Sea to staging sites in the Wadden Sea. The majority of spring departures occur in the first two weeks of May, and birds may pass over the sea almost anywhere around the UK at this time, though probably with concentrations in particular areas where birds have departed from large estuaries (Wernham *et al.,* 2002).

12.140. The migration model estimated that 1,168 knots would pass through the Turbine Area during spring migration and 948 knots would pass through during autumn migration (Table 12.16). This accounts for 0.34% of the Great Britain and Ireland population and, 0.26% of the flyway population during spring; and 0.28% of the Great Britain and Ireland population and 0.21% of the flyway population during autumn.

12.141. As knot are linked to several SPAs in the UK, and these birds may migrate through the Turbine Area their non-impact specific value is **very high**. Their general sensitivity to collision risk is **low** (see Table 12.6), therefore, the overall site-specific sensitivity for knot is **medium**.

Black-tailed godwit

12.142. The British breeding population of black-tailed godwits is very small (44-52 pairs) and concentrated at two main breeding sites in the east of England which are designated as SPAs. These individuals migrate to sub-Saharan Africa and/or Iberia during the non-breeding season. Spring migration occurs during late March and April, and autumn migration during July (Wernham *et al.,* 2002).

12.143. The vast majority of the Icelandic population of black-tailed godwits either winters in or migrates across the British Isles. Spring migration occurs from mid-April to early May (Gunnarsson *et al*., 2006) and autumn migration sees birds returning to the UK in July and August, where they congregate in large moulting flocks before dispersing to wintering sites elsewhere in Britain, Ireland or continental Europe (Wernham *et al*., 2002). These post-moult movements see individuals crossing the southern North Sea, Irish Sea and English Channel in autumn and early winter, returning in early spring (Wright *et al.,* 2012).

12.144. The migration model estimated that five black-tailed godwits breeding in the UK would pass through the Turbine Area during both the spring and autumn migration periods (Table 12.16). This accounts for 4.81% of the Great Britain and Ireland breeding population and 0.003% of the flyway breeding population. During the non-breeding season, the migration model estimated that 932 black-tailed godwits visiting the UK would pass through the Turbine Area during either the spring or autumn migration periods (Table 12.16). This accounts for 1.64% of the Great Britain and Ireland non-breeding population and 1.86% of the non-breeding flyway population.

12.145. As black-tailed godwits are a feature of the Solent and Southampton Water SPA and Poole Harbour SPA their non-impact specific value is **very high**. Their general sensitivity to collision risk is **high** (Table 12.6), therefore, the overall site-specific sensitivity for black-tailed godwit is **very high**.

Bar-tailed godwit

12.146. Bar-tailed godwits wintering in the UK migrate from breeding populations in Scandinavia and Russia (Wernham *et al*., 2002). Almost the entire Britain and Ireland population (54,280 individuals) take migration routes across the North Sea, with some birds continuing on to Ireland (16,280 individuals) or crossing the English Channel (low thousands), whilst others remain in Britain throughout the winter.

12.147. Migration occurs mainly between July and September and individuals return to breeding grounds in February and March. Large numbers stage at sites in the Wadden Sea, suggesting that migration routes are probably concentrated on paths to this area from key wintering sites (Wright *et al.,* 2012).

12.148. The migration model estimated that no bar-tailed godwits would pass through the Turbine Area during either the spring or autumn migration periods (Table 12.16).

12.149. As bar-tailed godwit are linked to several SPAs in the UK, and these birds may migrate through the Turbine Area their non-impact specific value is **very high**. Their general sensitivity to collision risk is **high** (see Table 12.6), therefore, the overall site-specific sensitivity for bar-tailed godwit is **very high**.

Nightjar

12.150. Nightjars are summer visitors to the UK, with the entire population migrating into the UK from the south in spring, and returning in autumn. Breeding nightjars are an interest feature of the New Forest SPA (300 pairs) and the Dorset Heathlands SPA (386 pairs), which are a minimum of approximately 22 km and 16 km respectively from the Turbine Area. Nightjars are also a feature of the more distant East Devon Heaths SPA (83 pairs), which is a minimum of approximately 107 km from the Turbine Area.

12.151. Observations and ringing recoveries have revealed only the basics of seasonal movements. However, birds are known to spend the winter months in eastern and southern Africa and autumn migration seems to be on a broad southerly front across Western Europe and North Africa, with more easterly populations heading south-east across the Middle East (Wernham *et al.,* 2002). It is likely that the majority of migration is concentrated in the English Channel and southern North Sea, especially given that the species' UK range is concentrated in south and east England. However, nightjars do occur in other parts of the country, so it is likely that a small number of birds migrate across other parts of UK waters (Wright *et al.,* 2012).

12.152. Migration from the breeding grounds begins from late July onwards, with most birds leaving in late August and September. Some birds have been recorded in Britain as late as October or November. Birds return north or north-east from March onwards and arrive at their breeding grounds in late April and May (Wernham *et al.,* 2002). Assuming an equal sex ratio, it can be assumed that 9,200 birds cross the English Channel and southern North Sea in spring en-route to UK breeding sites, and that these would be supplemented by juvenile birds in autumn (Wright *et al.,* 2012).

12.153. The migration model estimated that 482 nightjars would pass through the Turbine Area during both the spring and autumn migration periods. This accounts for 5.24% of the UK population (of 9,200 breeding individuals) and 0.05% of the flyway (international) population.

12.154. As nightjars are a feature of the Solent and Southampton Water SPA and Poole Harbour SPA their non-impact specific value is **very high**. Their general sensitivity to collision risk is **high** (Table 12.6), therefore, the overall site-specific sensitivity for nightjar is **very high**.

12.155. Following the Nightjar workshop on the 20/06/2013, an update to the modelling work presented here has been agreed with NE. This work is on-going and will be reported within the forthcoming ES for the Project.

Impact Assessment

12.156. The following sections describe the potential impacts of the construction, O&M and decommissioning phases of the Project on the ornithological receptors using or flying through the study area. The assessment considers all species identified in the baseline and agreed through the consultation and survey programme undertaken for this assessment (refer to 'Scope of the Assessment').

12.157. All potential impacts are assessed in accordance with the assessment methodology guidelines described (refer to 'Impact Assessment Methodology') and also in conjunction with the design parameters specified for the Realistic Worst Case Scenario ('RWCS') outlined within Table 12.17 below.

Realistic worst case scenario

Table 12.17 Rochdale envelope parameters relevant to the offshore ornithology impact assessment

Potential effect	Realistic worst case scenario	Rationale
Construction		
Disturbance and Displacement from increased vessel activity	Maximum number of heavy vessel movements over total construction period is estimated as 1,141 comprising approximately: ➢ 3 x Foundation installation vessels (400 vessel movements); ➢ 3 x Wind turbine installation vessels (200 vessel movements); ➢ 2 x Substation installation vessels (18 vessel movements); ➢ 2 x Inter array cable laying vessels (100 vessel movements); ➢ 1 x Export cable laying vessel (18 vessel movements); ➢ 1 x Meteorological Mast ('met mast') Installation vessels (5 vessel movements); ➢ 1 x Scour protection vessel (400 vessel movements). Maximum number of light vessel movements over total construction period is 6,300 comprising: ➢ 300 towing and anchoring vessels movements; ➢ 2,500 crew transfer vessel movements; ➢ 2,500 commissioning vessel movements; ➢ 1,000 guard vessel movements.	Maximum estimated number of vessel movements required to cause greatest displacement to birds on site. This assumes a maximum construction schedule of 24 hours a day, 7 days a week for a maximum construction period of 4.5 years. However, this would not be the case, as construction will be intermittent, with periods of downtime. Maximum number of heavy vessel movements per year: 253 assuming a 4.5 year construction period. Maximum number of light vessel movements per year: 1400 assuming a 4.5 year construction period.

Table 12.17 Rochdale envelope parameters relevant to the offshore ornithology impact assessment

Potential effect	Realistic worst case scenario	Rationale
Disturbance and displacement from piling noise.	Monopiles Foundations: Maximum of 109 x monopile turbine foundations comprising maximum of 108 x 8 m diameter monopiles for turbines and maximum of 1 x 4 m diameter monopiles for met mast. Spaceframe foundations used within monopile exclusion zone. Maximum (peak) hammer energy of 1,800 kJ per monopile foundation. Maximum of 2 monopiles being installed simultaneously. Maximum average active piling for one monopile foundation is 4 hours over a 24 hour installation period.	Monopile foundations have the largest pile diameter and require the greatest peak hammer energy (blow force) for installation (1,800 kJ), generating the greatest levels (intensity) of noise. Gravity base structures ('GBS') and suction caisson foundations do not require percussive piling. Monopile foundations only used outside the exclusion zone.
	Pin piles Foundations: Maximum of 221 x 3.5 m diameter space frame foundations, each with 4 x 3.5 pin piles for turbines comprising: maximum of 218 x space frame foundations for turbines and a maximum of 3 x space frame foundations for offshore substation ('OSP'). Maximum of 1 x 4 m monopile for met mast. Maximum (peak) hammer energy of 1,400 kJ per space frame foundation. Maximum of two space frame foundations installed at a time, with two pin piles being installed simultaneously at locations on opposite boundaries and with one pin pile installed followed by a second on completion of the first. Maximum of 4 pin piles installed at two locations over 4 hours. Maximum active piling for each space frame foundation is 8 hours over a 48 hour installation period.	Space frame foundations require the greatest number of piles (4 per foundation) generating the maximum piling activity (duration) across the construction timescale, compared to monopile foundations. GBS and suction caissons: no piling required. Space frame foundations are used across the total Turbine Area.

Table 12.17 Rochdale envelope parameters relevant to the offshore ornithology impact assessment

Potential effect	Realistic worst case scenario	Rationale
Indirect effects as a result of displacement of prey species.	Disturbance/displacement of prey species from piling noise (intensity): Foundations: Maximum of 108 x 8 m diameter monopile for turbine foundations and maximum of 1 x4 m diameter monopiles for met mast. Spaceframe foundations used within monopile exclusion zone. Maximum (peak) hammer energy of 1,800 kJ per monopile foundation. Maximum of 2 monopiles being installed simultaneously. Maximum piling duration of one monopile is 4 hours over a 24 hour installation period.	Monopile foundations have the largest pile diameter and require the greatest peak hammer energy (blow force) for installation (1,800 kJ), generating the greatest levels (intensity) of noise. GBS and suction caissons foundations do not require percussive piling. Monopile foundations only used outside the exclusion zone.
	Disturbance/displacement of prey species from piling noise (duration): Foundations: Maximum of 221 x 3.5 m diameter space frame foundations, each with 4 x 3.5 pin piles for turbines comprising: maximum of 218 x space frame foundations for turbines and a maximum of 3 x space frame foundations for OSP. Maximum of 1 x 4 m diameter monopile for met mast. Maximum (peak) hammer energy of 1,400 kJ per space frame foundations. Maximum of two space frame foundations installed at a time, with two pin piles being installed simultaneously at locations on opposite boundaries and with one pin pile installed followed by a second on completion of the first. Maximum of 4 pin piles installed at two locations over 4 hours. Maximum active piling for each apace frame foundation is 8 hours over a 48 hour installation period.	Space frame foundations require the greatest number of piles (4 per foundation) generating the maximum piling activity (duration) across the construction timescale, compared to monopile foundations. GBS and suction caissons: no piling required. Space frame foundations are used across the total site.

Table 12.17 Rochdale envelope parameters relevant to the offshore ornithology impact assessment

Potential effect	Realistic worst case scenario	Rationale
	Disturbance/displacement from increased suspended sediment concentration. Foundations: Maximum of 221 x GBS comprising: 218 x 37.5 m diameter GBS for turbines, 3 x 45 m diameter GBS for OSP and 1 x 4 m diameter monopile for met mast.	GBS have the largest footprint of any foundation option and require greatest extent of bed preparation prior to installation compared to other foundation options (e.g. monopile foundations).
	Disturbance and displacement from inter-array cable laying activities: Inter-array cables: Maximum of 296 km associated with turbine foundations and 10 km back-up connections. Inter-substation cables: Maximum of 70 km of inter-substation cabling with a two circuit inter-connection (Maximum of 35 km for a single cable connection).	Maximum length of inter-array cabling required and installed based upon the use of 5 MW turbines. Maximum length of inter-substation cabling required and installed based upon maximum of 3 x OSPs. Other development options result in reduced length of cable required and reduction in disturbance activities.
	Disturbance and displacement from export cable laying activities: Maximum length of 210 km export cable, based upon maximum of 6 x 132 kV export cables (35 km each). Installation of up to a maximum of 50% of export cable length to be installed via jetting technique in combination with other cable laying techniques.	132 kV solution requires a greater number of export cables than other voltages assessed (e.g. 275 kV). Other cable solutions require reduced number of cables and reduction in disturbance activities.
Operation and maintenance		
Collision risk	Maximum of 218 x 5 MW turbines, with minimum spacing of 756 m x 1008 m between turbines.	Collision risk modelling shows that 218 x 5 MW turbines have largest collision impact risk. Other development options provide a reduced density of turbines with a smaller swept volume ratio per MW installed capacity.

Table 12.17 Rochdale envelope parameters relevant to the offshore ornithology impact assessment		
Potential effect	Realistic worst case scenario	Rationale
Barrier effects	Maximum offshore project area of 175 km^2 with maximum of 218 x 5 MW turbines, with a minimum spacing of 756 m x 1008 m between turbines. Maximum of 3 x OSP, including foundations and super structure. Maximum of 1 x met mast including foundation and tower.	Maximum density of turbines and structures across the offshore project area, which maximises the potential barrier to foraging grounds and migration routes for bird species. Other development options result in reduced number and density of turbines.
Disturbance and displacement from offshore infrastructure	Maximum project area of 175 km^2 with maximum of 218 x 5 MW turbines, with a minimum spacing of 756 m x 1008 m between turbines. Maximum of 3 x OSP, including foundations and super structure. Maximum of 1 met mast including foundation and tower.	Maximum density of turbines and structures across the offshore project area, which maximises the potential for avoidance and displacement. Other development options represent a smaller total area occupied and reduced density of turbines. Assessment assumes 100% displacement from site.
Disturbance and displacement from increased vessel and helicopter activity	Maximum level of vessel activity across the project area through scheduled and unscheduled maintenance and inspection visits. Maximum of 218 x turbines, 3 x OSP and 1 x met mast requiring maintenance and inspection. Maximum of 5 service vessels making 1,000 vessel movements per annum for scheduled and unscheduled maintenance. Maximum of 12 helicopter movements per annum for scheduled and unscheduled maintenance.	Maximum number of turbines, offshore substations and met mast requiring maintenance and inspection which maximises the potential for disturbance to bird species. Other development options result in reduced number of turbines and structures, and therefore a reduced number of planned visits required and reduced planned vessel movements.

Table 12.17 Rochdale envelope parameters relevant to the offshore ornithology impact assessment

Potential effect	Realistic worst case scenario	Rationale
Indirect effects due to habitat loss / change for key prey species	Foundations: Maximum of 221 x GBS comprising: 218 x 37.5 m diameter GBS for turbines, 3 x 45 m diameter GBS for OSP and 1 x 4 m diameter GBS for met mast. Scour protection applied to 30% of all foundations. 12.1.3 Maximum seabed take (foundations, scour and cable protection) = 422,847 m^2. Comprising 414,996 m^2 for turbine foundations, 7,434 m^2 for 3 x OSP foundations and 417 m^2 for x 4 m monopile foundation for met mast.	GBS have the largest footprint of any foundation option and occupy the greatest extent of seabed. Other foundation options result in reduced seabed occupancy (monopile and space frame foundations).
	Inter-array cables: Maximum of 296 km associated with turbine foundations and 10 km back-up connections. Maximum of 22.1 km inter-array cabling requiring cable protection (7 m width). Maximum 154,700 m^2 sea bed area take.	Maximum length of inter-array cabling and cable protection required occupying the greatest extent of seabed.
	Inter-substation cables: Maximum of 70 km of inter-substation cabling with a two circuit inter-connection (Maximum of 35 km for a single cable connection). Maximum of 5.4 km inter-substation cabling requiring cable protection (7 m width). Maximum 37,800 m^2 sea bed area take.	Maximum length of inter-substation cabling and cable protection required occupying the greatest extent of seabed.
Disorientation/attraction to wind farm structures	Maximum of 218 x turbines with full lighting options. Maximum of 3 x OSP with full lighting options. Maximum of 1 x met mast with full lighting options.	Maximum number of structures with full lighting options provides maximum potential for disorientation or attraction to wind farm structures. Other development options result in reduced number of turbines and structures and lighting requirements.

Table 12.17 Rochdale envelope parameters relevant to the offshore ornithology impact assessment

Potential effect	Realistic worst case scenario	Rationale
Decommissioning		
Disturbance and displacement from decommissioning activities	Removal of the maximum number structures above the seabed associated with the Project including: 218 x turbines (GBS, towers and nacelles), 3 x OSP (GBS and tower) and 1 x met mast (monopile and tower). Buried cables remain in situ. Maximum number of decommissioning vessels required. Maximum decommissioning programme.	Maximum number of structures results in maximum decommissioning activities, maximum vessel numbers and maximum levels of noise generated. Removal of piled foundation by cutting or abrasive techniques to below the seabed surface results in the maximum disturbance to noise sensitive receptors. Removal of GBS results in the maximum disturbance to seabed sediments. Other development options result in reduced numbers of structures removed and reduced area of seabed disturbance. A full decommissioning plan will be agreed with the relevant government department at the point of decommissioning. At present, decommissioning assumes removal of all structures above the sea bed.
Indirect effects due to habitat loss / change for key prey species	Removal of maximum number of structures above the seabed associated with the Project including: 218 x turbines (GBS and towers), 3 x OSP (GBS and super structure) and 1 x met mast (monopile and tower). Buried cables remain *in situ*.	Removal of maximum number of structures results in maximum loss / change in area of benthic habitat and associated fish communities. Removal of GBS results in the maximum habitat area loss /change. Other development options result in reduced area of habitat loss/change. A full decommissioning plan will be agreed with the relevant government department at the point of decommissioning. At present, decommissioning assumes removal of all structures above the sea bed.

Construction Phase

12.158. The construction phase of the Project has the potential to affect resident, breeding, wintering and migrating bird populations in the marine environment through disturbance / displacement of birds and their prey and habitat loss.

12.159. The offshore elements of the Project will take a maximum of four and a half years to construct. The construction phase will, therefore, coincide with a maximum of five bird breeding periods, five wintering periods and up to ten migration periods.

12.160. The construction phase will require the mobilisation of vessels and equipment and the installation of foundations, export cables and other infrastructure. These activities have the potential to disturb and displace birds from within the Turbine Area, offshore export cable route and adjacent areas. NE / JNCC interim guidance (NE / JNCC, 2012) suggests the effect should be considered to occur within the construction area and 2 km around it; except for seaducks and divers where 4 km is recommended. These activities also have the potential to cause habitat loss directly and indirectly, as a bird's access to the development site for the purposes of feeding, loafing and moulting could be reduced. The use of lighting could also attract (or repel) migrating birds and therefore affect migratory routes on a local scale.

12.161. Any effects from construction activity are considered to be medium-term, lasting only for the duration of construction activity. The exceptions to this are habitat loss and localised habitat change; these effects span both the construction and O&M phases of the development and are assessed simultaneously for both phases in this section.

Disturbance and Displacement

12.162. Direct disturbance of birds during the construction phase of a wind farm may occur due to vessel movements (moving to, from and within the Turbine Area), underwater and airborne noise from foundation installation and cable laying activities and the physical presence of vessels, installation equipment (e.g. cranes) and their crews. Any impacts resulting from disturbance and displacement from these activities are considered to be short-term, temporary and reversible in nature, as birds will return to areas once construction activities have ceased. Disturbance and displacement of birds during the construction phase is most likely to affect birds foraging or regularly commuting across the Turbine Area; birds on migration are unlikely to be affected as an individual would only have to make a very slight detour to avoid one or more of the small number of active work sites that would be present.

12.163. During the construction process a maximum of three turbine foundations (within the 175 km^2 Project site) can be worked on at any one time, however, it should be noted that the maximum number of foundations piled simultaneously is two (refer to RWCS). Similarly only three cable laying vessels (two inter-array cable laying vessels and one export cable laying vessel) will operate simultaneously. The level of disturbance at each work location will also differ dependent on the activities taking place (e.g. piling of each monopole foundation will last for approximately four hours in a 24 hour period, outside of these four hours other less disturbing works on the foundation will be taking place). The RWCS, outlined in Table 12.17, describes the elements of the Project considered within this assessment.

12.164. Indirect disturbance of birds may also occur during the construction phase. Indirect effects include those resulting from the production of underwater noise and the generation of suspended sediments that may alter the behaviour or availability of bird prey species. Underwater noise may cause fish and mobile invertebrates to avoid the construction area and also affect their physiology and behaviour. Suspended sediments may cause fish and mobile invertebrates to avoid the construction area and may smother and hide immobile benthic prey. These mechanisms result in less prey being available within the Turbine Area to foraging seabirds. Refer to Chapter 5, 'Physical Processes and Chapter 9 'Benthic Ecology' and 10 'Fish and Shellfish Ecology' for a more detailed account of sedimentation and impacts on benthic organisms and fish.

12.165. The potential generation of underwater noise was assessed in relation to that arising from piling operations, which includes the embedded mitigation of a soft start procedure. The potential generation of suspended sediments was assessed in relation to seabed preparation activities, drilling associated with foundation installation, inter-array cable installation and export cable installation.

12.166. The effects of noise on prey species of birds (refer to Chapter 10, 'Fish and Shellfish Ecology') recorded in the Turbine Area (e.g. shellfish and sprat

Sprattus sprattus) is predicted to be temporary and localised and **Not Significant** (a higher level of impact has been identified for certain species that are not major prey items of birds, however, this is not relevant to the assessment of indirect effects on birds and is not discussed further here). The extent of sediment generation and deposition from bed preparation activities, drilling associated with foundation installation, inter-array cable installation and export cable installation and their effects are predicted to be temporary and localised and **Not Significant.** Refer to Chapter 5 'Physical Processes', Chapter 9 'Benthic Ecology' and Chapter 10 'Fish and Shellfish Ecology' for more detailed accounts.

12.167. Some species are more susceptible to disturbance than others, for example gull species are not considered susceptible to disturbance, as they are often associated with fishing boats (e.g. Camphuysen, 1995, Hüppop and Wurm, 2000; Buckley, 2009) and have been noted in association with construction vessels at the Greater Gabbard offshore wind farm (GGOWL 2011) and close to active foundation piling activity at the Egmond aan Zee ('OWEZ') Wind Farm, where they showed no noticeable reactions to the works (Leopold and Camphuysen, 2007). However, in comparison species such as divers and scoter have been noted to avoid shipping by several kilometres (Mitschke *et al*., 2001 from Exo *et al*., 2003).

12.168. Thirteen key species have been considered within the assessment with regard to disturbance and displacement during construction. For these species non-impact specific values of between low and very high (see Table 12.4) were allotted and general sensitivity values (see Table 12.5) between very low and medium. This resulted in site-specific sensitivities of **very low** to **medium** for disturbance and displacement.

12.169. The magnitude of effect was determined as **negligible** for each species due to the temporary and localised nature of the construction works (i.e. a small number of working sites active at a given time in the 175 km^2 Turbine Area), the prescribed nature of the routes of boat traffic to and from the construction area and that no significant impacts were predicted to benthic and fish prey species (refer to Chapter 9, 'Benthic Ecology' and Chapter 10 'Fish and Shellfish Ecology'). The **negligible** impact significance results in the impacts being deemed **Not Significant** for any of the receptors. The predicted impact significance for each of the key seabird species is presented in Table 12.18.

Table 12.18 Summary of potential direct disturbance and displacement effects during construction

Species	Non-impact specific value	General disturbance/ displacement sensitivity	Site-specific sensitivity	Magnitude of effect	Impact significance
Fulmar	Low	Very low	Very low	Negligible	Negligible
Balearic shearwater	Medium	Low	Low	Negligible	Negligible
Gannet	Very high	Low	Medium	Negligible	Negligible
Kittiwake	Low	Low	Low	Negligible	Negligible
Mediterranean gull	Very high	Low	Medium	Negligible	Negligible
Lesser black-backed gull	Low	Low	Low	Negligible	Negligible
Great black-backed gull	Low	Low	Low	Negligible	Negligible
Herring gull	Medium	Low	Low	Negligible	Negligible
Sandwich tern	Very high	Low	Medium	Negligible	Negligible
Common tern	Very high	Low	Medium	Negligible	Negligible
Guillemot	Medium	Medium	Medium	Negligible	Negligible
Razorbill	Medium	Medium	Medium	Negligible	Negligible
Puffin	Low	Low	Low	Negligible	Negligible

Habitat Loss/change

12.170. Installation and anchoring of equipment and vessels to the seabed has the potential to result in both temporary and permanent displacement of benthic communities and the loss/change of the natural habitat found on the seabed. The presence of wind turbine foundations and ancillary structures will also result in the permanent loss of seabed habitat. In general terms the habitat lost to offshore wind farm developments typically equates to less than 1% of the total development footprint (Drewitt and Langston, 2006).

12.171. The level of habitat loss/change for the Project would increase over the construction period as more infrastructure (including turbine foundations and cable protection) is installed. Once complete the proposed infrastructure would occupy less than 0.5% of the Turbine Area – further areas within the immediate vicinity of the infrastructure will likely be temporarily lost due to deposition of sediments. The areas both permanently and temporarily lost would initially be largely void of both benthic and fish communities, thereby removing a proportion of the potential food resource for birds foraging in the Turbine Area. However, the area of seabed habitat lost is small and communities of benthic and fish species are likely to re-colonise habitats previously exposed to sedimentation, and/or take advantage of the provision of artificial structures.

12.172. Therefore the magnitude of effect for all species is predicted to be **negligible**; the impact significance is assessed as **negligible** which is deemed **Not Significant**. Chapter 10 'Fish and Shellfish Ecology' identified that the addition of sub-sea artificial structures would act as an artificial reef offering a potential refuge to fish from predators and commercial fishing activities and lead to a localised increase in benthic species that prefer hard substrates. The magnitude of this positive effect on fish populations (and hence the consequential potential for an increase in food resources for birds) was assessed as **low** and the impact was assessed as **Not Significant**.

12.173. A summary of the effects of potential habitat loss for each of the key species identified is provided in Table 12.19.

Table 12.19 Summary of potential direct habitat loss effects during construction

Species	Non-impact specific value	General sensitivity to direct habitat loss	Site-specific sensitivity	Magnitude of effect	Impact significance
Fulmar	Low	Low	Very low	Negligible	Negligible
Balearic shearwater	Medium	Low	Low	Negligible	Negligible
Gannet	Very high	Very Low	Low	Negligible	Negligible
Kittiwake	Low	Low	Low	Negligible	Negligible
Mediterranean gull	Very high	Low	Medium	Negligible	Negligible
Lesser black-backed gull	Low	Very Low	Low	Negligible	Negligible
Great black-backed gull	Low	Low	Low	Negligible	Negligible
Herring gull	Low	Very Low	Low	Negligible	Negligible
Sandwich tern	Very high	Medium	Very high	Negligible	Minor
Common tern	Very high	Medium	Very high	Negligible	Minor
Guillemot	Medium	Medium	Medium	Negligible	Negligible
Razorbill	Medium	Medium	Medium	Negligible	Negligible
Puffin	Low	Medium	Low	Negligible	Negligible

Operation and maintenance

12.174. The operation and maintenance of the Project has the potential to affect resident, breeding, wintering and migrating bird populations in the marine environment in a number of ways including:

- Disturbance/displacement of birds and their prey;
- Increased mortality rates through collision with turbine blades;

- Alteration of migratory and foraging movements (barrier effect).

12.175. The greatest impacts associated with the Project are those arising during its operational life, as they will last at least 25 years across the Turbine Area and buffer. Therefore, with respect to this Project they are considered to be long-term, although ultimately reversible.

Direct Disturbance and Displacement

12.176. The presence of wind turbines has the potential to directly disturb and displace birds from within and around the proposed Turbine Area. This indirect habitat loss would reduce the area available 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.

12.177. 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). As offshore wind farms are a new feature in the marine environment, there is limited evidence as to the disturbance and displacement effects of the operational infrastructure.

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

12.179. There are a number of different measures used to determine bird displacement from areas of sea in response to activities associated with an offshore wind farm. Furness and Wade (2012), for example, use of 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. Moreover, these authors recognise that displacement may contribute to individual birds experiencing fitness consequences, which at an extreme level could lead to the mortality of individuals.

12.180. Both the presence of the infrastructure and the O&M activities associated with the Project has 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.

12.181. The methodology presented in the NE/JNCC joint Interim Advice Note (NE/JNCC, 2012) recommends a matrix is presented for each key species showing population losses at differing rates of displacement and mortality. This assessment uses the range of predicted losses, in association with the available scientific evidence to quantify the potential losses associated with the Project. These losses are then placed in the context of international, national and regional population estimates to determine the magnitude of effect.

12.182. The assessment of O&M disturbance and displacement does not consider those birds on migration. This is because birds are most at risk from the effects of displacement when they are resident (e.g. during the breeding season or wintering season) and any displacement of migrating individuals is captured by an assessment of barrier effects.

12.183. Following installation of the offshore cable, the required O&M activities may have short-term and localised disturbance and displacement impacts on birds using the Turbine Area. However, disturbance from O&M activities will be temporary and localised, and is unlikely to result in detectable effects at either the local or regional population level. Therefore no impact 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 and other infrastructure.

Disturbance and Displacement Screening

12.184. 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 12.20). The species identified as 'at risk' were then assessed within each biological period, within which an effect was most likely to occur (e.g. guillemot is assessed during both the breeding and wintering periods due to regionally important numbers being present in both). Any species with a low or very low site-specific sensitivity, or recorded only in very small numbers within the Turbine Area, was screened out of further assessment. As described above, any effects from displacement during the migration periods are covered through an assessment of the barrier effect, which is discussed in the following sections.

12.185. Table 12.20 presents the general sensitivity to disturbance and displacement for each species (refer to 'Assessment Methodology', alongside displacement rates taken from a monitoring report for OWEZ (Krijgsveld *et al.*, 2011). As few auks were recorded at OWEZ, data was used from the Robin Rigg offshore wind farm (Walls *et al.*, 2013) for this species group, as the sample sizes made it more statistically robust.

Table 12.20 Disturbance and displacement screening

Species	Non-impact specific value	General disturbance / displacement sensitivity	Macro avoidance rate or displacement rate	Biological period for peak numbers	Site-specific sensitivity
Fulmar	Low	Very low	28%	Spring Migration	Very low (Screened out)
Balearic shearwater	Medium	Low	n/a	n/a	Low (Screened out)
Gannet	Very high	Low	64%	Breeding	Medium (Screened in – as recorded in reasonable numbers and macro avoidance rate is high)
Kittiwake	Low	Low	18%	Winter / Spring Migration	Low (Screened out)
Mediterranean gull	Very high	Low	18%	Breeding (very low numbers)	Medium (Screened out as recorded in low numbers and macro avoidance rate is low)
Lesser black-backed gull	Low	Low	18%		Low (Screened out)
Great black-backed gull	Low	Low	18%		Low (Screened out)
Herring gull	Low	Low	18%		Low (Screened out)
Guillemot	Medium	Medium	30%	Breeding / Wintering	Medium (Screened in as recorded in regionally important numbers)

Table 12.20 Disturbance and displacement screening

Razorbill	Medium	Medium	30%	Wintering	Medium (Screened in as recorded in regionally important numbers)
Puffin	Low	Low	30%	Spring Migration	Low (Screened out)

Gannet

12.186. Gannets show a low level of general sensitivity to ship and helicopter traffic (Garthe and Hüppop, 2004, Furness and Wade, 2012); however a detailed study (Krijgsveld *et al*., 2011) using radar and visual observations to monitor the post-construction effects of the OWEZ established that 64% of gannets avoided entering the wind farm (macro-avoidance).

12.187. Table 12.21 shows a displacement matrix for gannet of percentage displacement rates at 10% intervals (0% - 100%), the rows highlighted are for displacement rates of 60% and 70%, as the OWEZ data suggests the actual rate lies between these two figures. Gannet has not been recorded in regionally important numbers within the Turbine Area during any biologically relevant period, but as a cited interest feature of the Alderney West Coast and Burhou Islands Ramsar site it is considered to have a very high non-impact specific value. As a result of their **low** species-specific sensitivity and a **very high** non-impact specific value, the site-specific sensitivity to disturbance and displacement for gannet is considered to be **medium**.

12.188. In line with the guidance (NE / JNCC, 2012) the displacement matrix (Table 12.21) completed for gannets during the breeding period is based on the entire population estimated to be present in the Turbine Area and all areas within 2 km of the boundary. The inclusion of all birds within the 2 km buffer, to determine the total number of birds subject to displacement, is precautionary, as the avoidance rate is likely, in reality, to fall with distance from the Turbine Area.

Table 12.21 Number of gannets lost to the population due to displacement (based on breeding period population of 167 for Turbine Area and 2 km buffer)

	Mortality Rates (%)											
Displacement 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	1	2	2
10	0	0	2	3	5	7	8	10	12	13	15	17
20	0	0	3	7	10	13	17	20	23	27	30	33
30	0	1	5	10	15	20	25	30	35	40	45	50
40	0	1	7	13	20	27	33	40	47	53	60	67
50	0	1	8	17	25	33	42	50	58	67	75	84
60	0	1	10	20	30	40	50	60	70	80	90	100
70	0	1	12	23	35	47	58	70	82	94	105	117
80	0	1	13	27	40	53	67	80	94	107	120	134
90	0	2	15	30	45	60	75	90	105	120	135	150
100	0	2	17	33	50	67	84	100	117	134	150	167

Table Notes:

- Green shaded cells highlight the most likely displacement range of 60% to 70% as appropriate from the evidence base.
- Pink Shaded cells represent the most likely range of mortality associated with displaced birds (between 1% and 10%) during the breeding period.

12.189. Based on 60-70% displacement and a 0-100% mortality rate, the number of individual gannets lost to the population has been estimated (Table 12.21). As it is not possible to provide a definitive mortality rate associated with displacement for any seabird, the approach taken for the Project has been to assess the losses for mortality rates between 1% and 10%, against the baseline mortality rate at the regional population level during the period when birds are resident.

12.190. The estimated number of gannets subject to mortality during the breeding period is between 10 and 12 individuals (this is based upon a mortality rate of 10% applied to the 60%-70% of birds displaced from the Turbine Area and 2 km buffer). The regional population of gannets during the breeding season is estimated at 55,700 individuals (including adults, juveniles and immature birds), with a baseline mortality rate of 8.1% (Robinson, 2009), which equates to the loss of 4,512 individuals per annum from this population. The loss of an additional 12 individuals to the population as a result of being displaced by the Project represents a 0.27% increase relative to the current regional mortality rate or an increase in baseline mortality from 8.1% to 8.12% (see Table 12.22). Therefore the magnitude of effect at a regional level is considered to be **negligible**. During the breeding period the impact significance of disturbance/displacement for gannet is assessed as **negligible** which is considered **Not Significant**.

Table 12.22 Displaced gannets (60% - 70%) subject to mortality (1% to 10%) assessed against regional baseline mortality rates								
Species	Displacement rate (%)	Mortality rate (%)	Regional population	Baseline mortality rate (%)	No. birds subject to mortality	Baseline and Navitus Bay mortality rate (%)	Increase from baseline (5.4%) to baseline and Navitus Bay mortality rate	Increase in mortality relative to current mortality (%)
Gannet (breeding)	60% (minimum)	1% (minimum)	55,700	8.1% (4,512)	1	8.10%	0.00%	0.02%
	80% (maximum)	10% (maximum)			12	8.12%	0.02%	0.27%

Auks (Guillemot and Razorbill)

12.191. Both guillemots and razorbills are considered to have **medium** general sensitivities to disturbance and displacement, based on their sensitivity to ship and helicopter traffic in Garthe and Hüppop (2004) and Furness and Wade (2012). Guillemots have been recorded within the Turbine Area in regionally important numbers during the wintering, spring migration and breeding periods. Razorbills have been recorded in regionally important numbers during the wintering and spring migration periods only. Therefore, both guillemots and razorbills are considered to have a non-impact sensitivity of **medium**. This equates to both guillemot and razorbill being assigned site-specific sensitivities to disturbance and displacement of **medium**.

12.192. Although both species, like many seabirds, will move away from vessels and helicopters, there is no evidence that they will avoid operational wind turbines. Data from the OWEZ monitoring program showed relatively little displacement of auks from wind turbines. Guillemots were recorded swimming within the OWEZ site on several occasions, and razorbills were also found within the site, which underlines that, at the very least, there is less than 100% avoidance (Leopold *et al*., 2011). More recent studies in the Irish Sea, Solway Firth and southern North Sea comparing pre-construction and post-construction numbers of auks within offshore wind farms have found no evidence of displacement. Evidence from Thornton Bank and Bligh Bank (Vanerman *et al*. 2011) and North Hoyle (RWE, 2008) has shown no avoidance by auks from wind farms or within a buffer up to 3 km. Data presented in the first year of post-construction monitoring from Robin Rigg (Walls *et al*., 2013) showed minimal displacement of auks from within the wind farm footprint (density estimates suggested a displacement rate of 30%). For the purpose of this assessment, the study that provided the most robust data (that from the Robin Rigg offshore wind farm) has been used as the evidence base, for a reasonable displacement rate for both guillemot and razorbill.

12.193. In line with guidance (NE/JNCC, 2012) the population 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 populations of guillemots and razorbills within the Turbine Area and a 2 km buffer zone around the site only.

12.194. Each matrix displays displacement rates and mortality rates for guillemot and razorbill (Tables 12.23, 12.24 and 12.26). For the purpose of this assessment a displacement rate range of 20-40% is highlighted in each matrix, which is in line with Walls *et al*. (2013).

12.195. The levels of mortality considered within this assessment range between 0 and 10% in the breeding season and 0 – 1% during non-breeding periods. The mortality rates associated with disturbance/displacement during the breeding season are likely to be greater than those at other times as the foraging range is likely to be more tightly constrained by the presence of eggs or young.

Guillemot

12.196. The estimated number of guillemot subject to mortality during the breeding period (Table 12.23) is between 1 and 2 individuals using a 1% mortality rate for displaced birds and between 11 and 22 individuals using a mortality rate of 10% (using a 20% to 40% displacement rate). The maximum level of effect (22 birds) results in the baseline mortality rate increasing by 0.21% from 5.4% (based on Robinson, 2005 and Garthe and Hüppop, 2004) to 5.61%. Therefore the magnitude of effect is considered to be **negligible** at a regional level. The impact significance of disturbance/ displacement effects for guillemot during the breeding period is assessed as **negligible**, which is considered **Not Significant**.

12.197. The estimated number of guillemot subject to mortality during the wintering period (Table 12.24) is between 1 and 4 individuals using a 1% mortality rate for displaced birds (using a 20% to 40% displacement rate). The maximum level of effect (4 birds) results in the baseline mortality rate increasing by 0.02% from 5.4% to 5.42%. Therefore the magnitude of effect is considered to be **negligible** at a regional level. The impact significance of disturbance/displacement for guillemot during the wintering period is assessed as **negligible**, which is considered **Not Significant**.

Table 12.23 Guillemot displacement rates (based on breeding population of 547 for Turbine Area and 2 km buffer)

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	1	2	2	3	3	4	4	5	5
10	0	1	5	11	16	22	27	33	38	44	49	55
20	0	1	11	22	33	44	55	66	77	88	98	109
30	0	2	16	33	49	66	82	98	115	131	148	164
40	0	2	22	44	66	88	109	131	153	175	197	219
50	0	3	27	55	82	109	137	164	191	219	246	274
60	0	3	33	66	98	131	164	197	230	263	295	328
70	0	4	38	77	115	153	191	230	268	306	345	383
80	0	4	44	88	131	175	219	263	306	350	394	438
90	0	5	49	98	148	197	246	295	345	394	443	492
100	0	5	55	109	164	219	274	328	383	438	492	547

Table Notes:

- Green shaded cells highlight the most likely displacement range of 20% to 40% as appropriate from the evidence base.
- Pink Shaded cells represent the most likely range of mortality associated with displaced birds (between 1% and 10%) during the breeding period.

Table 12.24 Guillemot displacement rates (based on wintering population of 986 for Turbine Area and 2 km buffer)

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	5	6	7	8	9	10
10	0	1	10	20	30	39	49	59	69	79	89	99
20	0	2	20	39	59	79	99	118	138	158	177	197
30	0	3	30	59	89	118	148	177	207	237	266	296
40	0	4	39	79	118	158	197	237	276	316	355	394
50	0	5	49	99	148	197	247	296	345	394	444	493
60	0	6	59	118	177	237	296	355	414	473	532	592
70	0	7	69	138	207	276	345	414	483	552	621	690
80	0	8	79	158	237	316	394	473	552	631	710	789
90	0	9	89	177	266	355	444	532	621	710	799	887
100	0	10	99	197	296	394	493	592	690	789	887	986

Table Notes:

- Green shaded cells highlight the most likely displacement range of 20% to 40% as appropriate from the evidence base.
- Pink Shaded cells represent the most likely range of mortality associated with displaced birds (1%) during the wintering period.

Table 12.25 Displaced population (20% - 40%) subject to mortality (1% to 10%) assessed against regional baseline mortality rates for guillemot

Species	Displacement rate (%)	Mortality rate (%)	Regional population	Baseline mortality rate (%)	No. birds subject to mortality	Baseline and Project mortality rate (%)	Increase from baseline (5.4%) to baseline and Project mortality rate	Increase in mortality relative to current mortality (%)
Guillemot (breeding)	20% (minimum)	1% (minimum)	10,434	5.4% (563)	1	5.41%	0.01%	0.18%
	40% (maximum)	10% (maximum)			22	5.61%	0.21%	3.90%
Guillemot (winter)	20% (minimum)	1% (minimum)	23,900	5.4% (1,291)	1	5.40%	0.00%	0.08%
	40% (maximum)	1% (maximum)			4	5.42%	0.02%	0.31%

Razorbill

12.198. The estimated number of razorbill subject to mortality during the wintering period (Table 12.26) is between 1 and 3 individuals using a 1% mortality rate for displaced birds (using a 20% to 40% displacement rate).

12.199. The maximum level of effect (3 birds) results in the baseline mortality rate increasing by 0.3% from 10% (based on Robinson 2005 and Garthe and Hüppop, 2004) to 10.3%.

12.200. Therefore the magnitude of effect is considered to be **negligible** at a regional level. The impact significance of disturbance/displacement effects for razorbill during the wintering period is assessed as **negligible**, which is considered **Not Significant**.

Table 12.26 Razorbill displacement rates (based on wintering population of 682 for Turbine Area and 2 km buffer)												
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	1	2	3	3	4	5	5	6	7
10	0	1	7	14	20	27	34	41	48	55	61	68
20	0	1	14	27	41	55	68	82	95	109	123	136
30	0	2	20	41	61	82	102	123	143	164	184	205
40	0	3	27	55	82	109	136	164	191	218	246	273
50	0	3	34	68	102	136	171	205	239	273	307	341
60	0	4	41	82	123	164	205	246	286	327	368	409
70	0	5	48	95	143	191	239	286	334	382	430	477
80	0	5	55	109	164	218	273	327	382	436	491	546
90	0	6	61	123	184	246	307	368	430	491	552	614
100	0	7	68	136	205	273	341	409	477	546	614	682

Table Notes:

- Green shaded cells highlight the most likely displacement range of 20% to 40% as appropriate from the evidence base.
- Pink Shaded cells represent the most likely range of mortality associated with displaced birds (1%) during the wintering period.

Table 12.27 Displaced population (20% - 40%) subject to mortality (1% to 10%) assessed against regional baseline mortality rates for razorbill

Species	Displacement rate (%)	Mortality rate (%)	Regional population	Baseline mortality rate (%)	No. birds subject to mortality	Baseline and Project mortality rate (%)	Increase from baseline (10%) to baseline and project mortality rate	Increase in mortality relative to current mortality (%)
Razorbill (Winter)	20% (minimum)	1% (minimum)	9,100	10.0% (910)	1	10.1%	0.01%	0.11%
	40% (maximum)	1% (maximum)			3	10.3%	0.03%	0.33%

Collision Risk

12.201. The Project presents a potential collision risk to birds which fly through the Turbine Area whilst foraging for food, commuting between breeding sites and foraging areas, or when on migration. The risk to birds arises from colliding with the wind turbine rotors and associated infrastructure resulting in injury or fatality.

12.202. Collision Risk Modelling (CRM) has been used in this assessment to estimate the risk to birds associated with the Project. CRM, using the Band model (Band, 2012), was used to produce predictions of mortality for particular species across set time periods (biological periods). The approach to CRM is summarised here for the purposes of assessment. Full details will be provided within Technical Reports submitted in support of the forthcoming ES for the Project.

12.203. The numbers of birds that are predicted to collide with the turbines per year have been compiled using the recognised and recommended techniques to provide collision rates for use in this assessment. It should be recognised that the estimates provided for all species are expected to be an overestimate of annual mortality rates. This is because of the precautionary assumptions that have been applied within the Band model (Band, 2012), for example, birds are assumed to encounter all turbines within the Turbine Area and the level of activity remains constant regardless of losses.

12.204. For the majority of the key seabirds the CRM is based upon the mean peak populations per month, derived from the surveys carried out between 2009 and 2011. The mean mortality rate estimates for each month have been summed according to the species-specific biological periods.

12.205. A number of seabird species not recorded in large numbers through the survey programme were identified as potential migrants through the Turbine Area (i.e. great skua, Arctic skua, common tern and Sandwich tern). Numbers of these species, and other migrant birds, passing through the Turbine Area were estimated using the Migropath model. The output of this model was then used within the CRM process.

Assessment of CRM Results

12.206. The magnitude of effect of collision mortality was assessed using the following process. Collision risk modelling for the worst case turbine array was carried out to produce predictions of the numbers of each species subject to mortality for the defined breeding, migration and wintering periods.

12.207. The seasonal mortality numbers were then compared to the relevant seasonal population mortality estimates for each species on an international, national and regional scale. A two stage process was used to quantify the magnitude of effect with respect to collision risk. The first stage was the calculation of the relative change (%) in the number of birds subject to mortality (titled in Tables 12.31 to 12.36 "Increase in mortality (number of individual birds) relative to current mortality (%)").

12.208. The second stage was the calculation of the baseline mortality without the Project, compared to the new baseline mortality that is predicted to occur after its construction (titled in Tables 12.31 to 12.36 "Predicted Baseline Mortality Rate with the addition of collision mortality from the Project (%)").

12.209. The result of this two stage process made it possible to create a set of quantified criteria from which to identify the scale of the magnitude of effect. Professional judgement was used to create a five point scale. The magnitude of effect is set out in Table 12.28.

Table 12.28 Identifying the magnitude of effect for collision risk

Magnitude	Measure of change
Negligible	<1% change in mortality relative to current mortality
Low	>1% change in mortality relative to current mortality; but <1 percentage point change in baseline mortality with the addition of the Project
Medium	>1% change in mortality relative to current mortality; and >1 to <5 percentage point change in baseline mortality with the addition of the Project
High	>1% change in mortality relative to current mortality; and >5 to <25% percentage point change in baseline mortality with the addition of the Project

Table 12.28 Identifying the magnitude of effect for collision risk

Very High	>1% change in mortality relative to current mortality; and >25 percentage point change in baseline mortality with the addition of the Project

CRM Results for Seabirds for the Project

12.210. The CRM results for the Project are presented in the following sections, full details of the collision risk modelling undertaken for each species will be provided within Technical Reports submitted in support of the forthcoming ES for the Project.

12.211. The species most likely to be at risk from collision are those that fly at a height that places them within PCH of the turbines and that are not displaced from entering a wind farm array in the first instance. Small and large gull species and fulmars are the most likely birds to continue to forage, migrate and generally fly through wind farms, due to their tolerance to mechanical infrastructure and habituation to man-made structures in general. This behaviour may put them at an increased risk of collision with turbines. Auks tend to fly close to the sea surface and, therefore, below the sweep of the turbine blades putting them at low risk of collision.

12.212. The Band model (Band, 2012) provides an estimate of the potential number of collisions of birds with the wind turbines. This estimate is based on the assumption that birds make no attempt to avoid collision. It is therefore necessary to apply an avoidance rate to the estimate to account for the likely degree of successful avoidance. An avoidance rate of 98% has been used in the assessment for all seabirds subject to CRM (Cook *et al*., 2012); with the exception of gannet where a 99% avoidance rate is considered more suitable (DECC, 2013). A range of avoidance rates (between 98 and 99.5%) are, however, provided for context.

12.213. Table 12.29 provides a summary of the estimated number of collisions annually for each species subject to CRM. Highlighted in red are the predicted annual number of collisions for each species at the avoidance rate considered most appropriate.

Table 12.29 Summary of annual mortality rates (number of individuals) for 98%, 99% and 99.5% avoidance rates for key seabirds

Avoidance rate	CRM value	Fulmar	Gannet	Kittiwake	Lesser Black-backed Gull	Herring Gull	Great Black-backed Gull
98%	Mean	**1**	375	**247**	**154**	**134**	**116**
99%	Mean	1	**187**	124	77	67	58
99.5%	Mean	0	94	62	39	34	29

12.214. Table 12.30 provides a summary of the increase in mortality (number of individual birds) relative to current mortality and the percentage baseline mortality for each key seabird species without the Project compared to the predicted baseline mortality after its construction. Where the magnitude of change in the predicted baseline mortality rate with the addition of collision mortality from the Project is greater than one percentage point this is highlighted in red.

Table 12.30 Summary of increase in mortality - number of individual birds - relative to current mortality (upper figure) and percentage point change in baseline mortality rates (lower figure) for key seabirds

	At international population scale	At national population scale	At regional population scale
Fulmar			
Spring	0.00% 2.8% to 2.8%	0.00% 2.8% to 2.8%	0.02% 2.8% to 2.8%
Breeding	0.00% 2.8% to 2.8%	0.00% 2.8% to 2.8%	0.22% 2.8% to 2.81%
Autumn	0.00% 2.8% to 2.8%	0.00% 2.8% to 2.8%	0.00% 2.8% to 2.8%
Winter	0.00% 2.8% to 2.8%	0.00% 2.8% to 2.8%	0.06% 2.8% to 2.80%
Gannet			
Spring	<0.01% 8.1% to 8.1%	0.01% 8.1% to 8.1%	0.06% 8.1% to 8.11%
Breeding	0.28% 8.1% to 8.12%	0.38% 8.1% to 8.13%	3.04% 8.1% to 8.35%
Autumn	0.08% 8.1% to 8.11%	0.10% 8.1% to 8.11%	1.14% 8.1% to 8.19%
Winter	0.02% 8.1% to 8.1%	0.03% 8.1% to 8.10%	0.23% 8.1% to 8.12%
Kittiwake			
Spring	0.01% 19% to 19%	0.04% 19% to 19.01%	0.37% 19% to 19.07%
Breeding	0.00% 19% to 19%	0.02% 19% to 19%	76.45% 19% to 33.53%
Autumn	0.00% 19% to 19%	0.01% 19% to 19%	0.12% 19% to 19.02%
Winter	0.04% 19% to 19%	0.10% 19% to 19.02%	2.14% 19% to 19.41%
Lesser Black-backed Gull			
Spring	0.02% 8.7% to 8.7%	0.06% 8.7% to 8.7%	0.10% 8.7% to 8.71%
Breeding	0.17% 8.7% to 8.71%	0.47% 8.7% to 8.74%	21.95% 8.7% to 10.61%
Autumn	0.10% 8.7% to 8.71%	0.28% 8.7% to 8.72%	0.49% 8.7% to 8.74%
Winter	0.00% 8.7% to 8.7%	0.00% 8.7% to 8.70%	0.00% 8.7% to 8.70%

Table 12.30 Summary of increase in mortality - number of individual birds - relative to current mortality (upper figure) and percentage point change in baseline mortality rates (lower figure) for key seabirds

Herring Gull			
Spring	0.01% 12% to 12%	0.03% 12% to 12%	0.58% 12% to 12.07%
Breeding	0.03% 12% to 12%	0.18% 12% to 12.2%	15.89% 12% to 13.91%
Autumn	0.00% 12% to 12%	0.02% 12% to 12%	0.39% 12% to 12.05%
Winter	0.08% 12% to 12.01%	0.06% 12% to 12.01%	1.25% 12% to 12.15%
Great Black-backed Gull			
Spring	0.23% 7% to 7.02%	1.49% 7% to 7.1%	8.45% 7% to 7.59%
Breeding	0.00% 7% to 7%	0.00% 7% to 7%	0.00% 7% to 7%
Autumn	0.27% 7% to 7.02%	1.77% 7% to 7.12%	10.06% 7% to 7.70%
Winter	0.13% 7% to 7.01%	0.72% 7% to 7.05%	3.36% 7% to 7.24%

12.215. An examination of Table 12.30 shows that for five of the six key seabird species the predicted increase in mortality (number of individual birds) relative to current mortality is greater than 1%. The five species are gannet, kittiwake, lesser black-backed gull, herring gull and great black-backed gull. The effect is at the regional level for all five of the species, but at the national level for only great black-backed gull during spring and autumn migration.

12.216. Table 12.30 also shows that for three species the predicted change in the baseline mortality rate is greater than 1% (highlighted in red). The three species are kittiwake, lesser black-backed gull and herring gull and the effect is at the regional level in the breeding season in all three instances.

12.217. Tables 12.31 to 12.36 present the full results for the key seabird species. The Tables are listed by the comparisons made to international, national and regional populations. Within each geographical comparison the results are presented for each biological period and information provided includes; baseline mortality, the relevant population estimate, the number of birds predicted to be subject to mortality, the predicted baseline mortality rate with the addition of collision mortality from the Project and the increase in mortality relative to current mortality.

Table 12.31 Seabird species annual mortality rates for collision risk compared to baseline international mortality rates (migration)

Species	Baseline mortality rate (%) (Robinson 2005)	International population (individuals)	Spring migration			Autumn migration		
			No. of birds subject to mortality from collisions (mean CRM value) for period	Predicted baseline mortality rate with the addition of collision mortality from the Project (%)	Increase in mortality (number of individual birds) relative to current mortality (%)	No. of birds subject to mortality from collisions (mean CRM value) for period	Predicted baseline mortality rate with the addition of collision mortality from the Project (%)	Increase in mortality (number of individual birds) relative to current mortality (%)
Fulmar	2.8	5,600,000	1	2.8	0.00	0	2.80	0.00
Gannet	8.1	600,000	2	8.1	<0.01	37	8.11	0.08
Kittiwake	19.0	4,200,000	59	19.0	0.01	19	19.00	0.00
Lesser black-backed gull	8.7	600,000	11	8.7	0.02	54	8.71	0.10
Herring Gull	12.0	1,520,000	10	12.0	0.01	7	12.00	0.00
Great black-backed gull	7.0	220,000	35	7.02	0.23	42	7.02	0.27

Table 12.32 Seabird species annual mortality rates for collision risk compared to baseline international mortality rates (breeding and winter seasons)

Species	Baseline mortality rate (%) (Robinson 2005)	International population (Individuals)	Breeding			Winter		
			No. of birds subject to mortality from collisions (mean CRM value) for period	Predicted baseline mortality rate with the addition of collision mortality from the Project (%)	Increase in mortality (number of individual birds) relative to current mortality (%)	No. of birds subject to mortality from collisions (mean CRM value) for period	Predicted baseline mortality rate with the addition of collision mortality from the Project (%)	Increase in mortality (number of individual birds) relative to current mortality (%)
Fulmar	2.8	5,600,000 (breeding) 5,600,000 (winter)	0	2.80	0.00	0	2.80	0.00
Gannet	8.1	600,000 (breeding) 600,000 (winter)	137	8.12	0.28	12	8.10	0.02
Kittiwake	19.0	4,200,000 (breeding) 2,000,000 (winter)	29	19.00	0.00	141	19.01	0.04
Lesser black-backed gull	8.7	600,000 (breeding) 550,000 (winter)	90	8.71	0.17	0	8.70	0.00
Herring gull	12.0	1,520,000 (breeding) 590,000 (winter)	61	12.00	0.03	57	12.01	0.08
Great black-backed gull	7.0	220,000 (breeding) 440,600 (winter)	0	7.00	0.00	39	7.01	0.13

Table 12.33 Seabird species annual mortality rates for collision risk compared to baseline national mortality rates (migration)

Species	Baseline mortality rate (%) (Robinson 2005)	National population (individuals)	Spring			Autumn		
			No. of birds subject to mortality from collisions (mean CRM value) for period	Predicted baseline mortality rate with the addition of collision mortality from the Project (%)	Increase in mortality (number of individual birds) relative to current mortality (%)	No. of birds subject to mortality from collisions (mean CRM value) for period	Predicted baseline mortality rate with the addition of collision mortality from the Project (%)	Increase in mortality (number of individual birds) relative to current mortality (%)
Fulmar	2.8	1,000000	1	2.80	0.00	0	2.80	0.00
Gannet	8.1	440,000	2	8.10	0.01	37	8.11	0.10
Kittiwake	19.0	760,000	59	19.01	0.04	19	19.00	0.01
Lesser Black-backed Gull	8.7	220,000	11	8.70	0.06	54	8.72	0.28
Herring Gull	12.0	280,000	10	12.00	0.03	7	12.00	0.02
Great black-backed Gull	7.0	34,000	35	7.10	1.49	42	7.12	1.77

Table 12.34 Seabird species annual mortality rates for collision risk compared to baseline national mortality rates (Breeding and Winter Seasons)

Species	Baseline mortality rate (%) (Robinson 2005)	National population (individuals)	Breeding			Winter		
			No. of birds subject to mortality from collisions (Mean CRM value) for period	Predicted baseline mortality rate with the addition of collision mortality from the Project (%)	Increase in mortality (number of individual birds) relative to current mortality (%)	No. of birds subject to mortality from collisions (Mean CRM value) for period	Predicted baseline mortality rate with the addition of collision mortality from the Project (%)	Increase in mortality (number of individual birds) relative to current mortality (%)
Fulmar	2.8	1,000,000 (breeding) 1,000,000 (winter)	0	2.80	0.00	0	2.80	0.00
Gannet	8.1	440,000 (breeding) 440,000 (winter)	137	8.13	0.38	12	8.10	0.03
Kittiwake	19.0	760,000 (breeding) 760,000 (winter)	29	19.00	0.02	141	19.02	0.10
Lesser black-backed gull	8.7	220,000 (breeding) 130,000 (winter)	90	8.74	0.47	0	8.70	0.00
Herring gull	12.0	280,000 (breeding) 740,000 (winter)	61	12.2	0.18	57	12.01	0.06
Great black-backed gull	7.0	34,000 (breeding) 77,000 (winter)	0	7.0	0.00	39	7.05	0.72

Table 12.35 Seabird species annual mortality rates for collision risk compared to baseline regional mortality rates (migration)

Species	Baseline mortality rate (%) (Robinson 2005)	Regional population (individuals)	Spring			Autumn		
			No. of birds subject to mortality from collisions (mean CRM value) for period	Predicted baseline mortality rate with the addition of collision mortality from the Project (%)	Increase in mortality (number of individual birds) relative to current mortality (%)	No. of birds subject to mortality from collisions (mean CRM value) for period	Predicted baseline mortality rate with the addition of collision mortality from the Project (%)	Increase in mortality (number of individual birds) relative to current mortality (%)
Fulmar	2.8	100,000	1	2.80	0.02	0	2.80	0.00
Gannet	8.1	40,000	2	8.11	0.06	37	8.19	1.14
Kittiwake	19.0	84,000	59	19.07	0.37	19	19.02	0.12
Lesser black-backed gull	8.7	125,000	11	8.71	0.10	54	8.74	0.49
Herring gull	12.0	14,000	10	12.07	0.58	7	12.05	0.39
Great black-backed gull	7.0	6,000	35	7.59	8.45	42	7.70	10.06

Table 12.36 Seabird species annual mortality rates for collision risk compared to baseline regional mortality rates (breeding and winter season)

Species	Baseline mortality rate (%) (Robinson 2005)	Regional population (individuals)	Breeding			Winter		
			No. of birds subject to mortality from collisions (mean CRM value) for period	Predicted baseline mortality rate with the addition of collision mortality from the Project (%)	Increase in mortality (number of individual birds) relative to current mortality (%)	No. of birds subject to mortality from collisions (mean CRM value) for period	Predicted baseline mortality rate with the addition of collision mortality from the Project (%)	Increase in mortality (number of individual birds) relative to current mortality (%)
Fulmar	2.8	7,500 (breeding) 6,500 (winter)	0	2.81	0.22	0	2.80	0.06
Gannet	8.1	55,700 (breeding) 63,800 (winter)	137	8.35	3.04	12	8.12	0.23
Kittiwake	19.0	200 (breeding) 34,700 (winter)	29	33.53	76.45	141	19.41	2.14
Lesser black-backed gull	8.7	4,700 (breeding) 11,600 (winter)	90	10.61	21.95	0	8.70	0.00
Herring gull	12.0	3,200 (breeding) 37,900 (winter)	61	13.91	15.89	57	12.15	1.25
Great black-backed gull	7.0	200 (breeding) 16,400 (winter)	0	7.00	0.00	39	7.24	3.36

Fulmar

12.218. Based on the flight manoeuvrability, flight altitude, the percentage of birds flying and nocturnal flight activity scores provided in Garthe and Hüppop (2004), combined with the SOSS rankings of perceived collision risk (Collier *et al.*, 2012) and collision risks in Langston (2010), fulmars are considered to have low general sensitivity to collision risk. As fulmars have both a **low** non-impact specific value and **low** general sensitivity to collision risk their site-specific sensitivity to collision risk is also **low**. Within the CRM, 0.55% of birds in flight were deemed to be at PCH, based on the survey data recorded.

12.219. The number of individuals predicted to be subject to mortality is one individual during the spring migration period and zero during the breeding, autumn migration and wintering periods. The mortality rate is not predicted to increase by one percentage point or more at the international, national and regional levels in any of the biological periods. Therefore, a **negligible** magnitude of effect is anticipated at all population levels and across all periods. The impact significance of collision risk for fulmar is assessed as **negligible** which is considered **Not Significant**.

Gannet

12.220. Based on the flight manoeuvrability, flight altitude, percentage flying and nocturnal flight activity scores in Garthe and Hüppop (2004), combined with the SOSS rankings of perceived collision risk (Collier *et al.*, 2012) and collision risks in Langston (2010), gannets are considered to have a medium general sensitivity to collision risk. As gannets have a **very high** non-impact specific value and a **medium** general sensitivity value their site-specific sensitivity to collision risk is considered to be **very high**. Within the CRM, 6.31% of birds in flight were deemed to be at PCH, based on the survey data recorded.

12.221. Gannets are found in the Turbine Area in the highest numbers during the breeding season (although not in numbers which exceed the regional 1% threshold for this period). The colonies on Ortac and Les Etacs in the Channel Islands, which are within the Alderney West Coast and Burhou Islands Ramsar site, are located within the mean maximum range of gannet of 229.4 ± 124.3 km (Thaxter *et al.*, 2012) from the Turbine Area. Therefore, it is possible that a proportion of the birds recorded during the breeding season could be foraging individuals from these colonies.

12.222. The number of individuals predicted to be subject to mortality during the breeding season is 137, which equates to an increase relative to current mortality of 0.28%, 0.38% or 3.04% at the international, national and regional population levels respectively. However, in no circumstance is the change in annual baseline mortality during any biological period approaching a one percentage point difference – the maximum increase is from the current 8.1% to 8.35% during the breeding period. As the breeding period for gannets (agreed for this assessment) includes the months of March to August, there will be a considerable amount of birds passing through the Turbine Area during this period that are moving to and from more northerly breeding colonies (Wernham *et al.*, 2004) or birds that are part of the wider non-breeding population. The predicted increase relative to current mortality for the regional breeding population is therefore likely to be a large over-estimate because it includes these non-breeding and passage birds.

12.223. Evidence of this occurring is only likely to be derived from tracking studies of non-breeding gannet over the spring, summer and autumn period. Prior to that information being obtained, professional judgement has to be relied upon and the assessment therefore carries a high level of uncertainty.

12.224. The magnitude of effects for gannet from collision risk during the breeding period will be of **negligible** to **low** at the national and regional level respectively. Due to the **very high** site-specific sensitivity of gannets this results in impact significance assessed as **minor** at the national level, which is considered **Not Significant**, and **moderate** at the regional level which is considered **Significant**. As discussed above, this is considered to be an over-estimate due to the presence of non-breeding and passage birds in the area during the March to August period.

12.225. The numbers of individuals predicted to collide during the wintering and spring migration are 12 and 2 birds respectively. This equates to increases of less than 1% relative to the international, national and regional baseline mortality rate. In addition, the change in annual baseline mortality is less than one percent. Such changes are considered to result in a **negligible** magnitude of effect at the international, national and regional levels. Impact significance is assessed as **minor**, which is considered **Not Significant**.

12.226. The number of gannets predicted to be subject to mortality during the autumn migration period is 37. During the autumn the increase of mortality, relative to the current baseline mortality is 0.08%, 0.1% or 1.14% relative to the international, national and regional population levels. The change in annual baseline mortality during the autumn migration period does not approach a one percentage point difference at any geographical level. The magnitude of effect is **negligible** at the international and national levels and low at the regional level. The impact significance assessed as **minor** at the international and national level and **moderate** at the regional level, which is considered **Significant**.

12.227. As described above the results are likely to be an over-estimate and carry a high level of uncertainty. Recent research on gannet colonies in the English Channel has provided a greater understanding of how this species may be affected by the Project. Therefore, further work is currently underway to fully quantify the potential for the Project to have detectable effects on the regional population of breeding gannets. The results of this work will be presented within the forthcoming ES submitted in support of the application for development consent.

Kittiwake

12.228. Based on the flight manoeuvrability, flight altitude, percentage flying and nocturnal flight activity scores in Garthe and Hüppop (2004), combined with the SOSS rankings of perceived collision risk (Collier *et al*., 2012) and collision risks in Langston (2010), kittiwakes are considered to have a **medium** general sensitivity to collision risk and a **low** site-specific sensitivity. Within the CRM 10.42% of birds in flight were deemed to be at PCH, based on the survey data recorded.

12.229. There are very few breeding colonies of kittiwakes along the English south coast, generally reflecting a shortage of suitable breeding cliff sites (Stroud *et al*., 2001); low densities of birds are however, commonly found offshore during this period (Stone *et al.*, 1995). The only breeding colonies located within the mean maximum foraging range of 60 km (Thaxter *et al.*, 2012) from the Turbine Area are those in Dorset, which hold approximately 230 individuals (Mitchell *et al*., 2004). Therefore, many of the birds observed within the Turbine Area are likely to be non-breeding individuals, either passing through on passage (i.e. late spring or early autumn migrants) or birds that have not matured enough to begin breeding and are not strongly associated with any particular breeding colony. Taking this into account, it should be recognised that the majority of the population found within the Turbine Area during the breeding season is unlikely to constitute birds from local breeding colonies and as such will form part of the wider national and international populations. Therefore the collision risk assessment for kittiwake is based on the national and international breeding populations only.

12.230. The number of individuals predicted to be subject to mortality is 29 birds during the breeding season, which leads to an increase of 0.02% and 0% relative to the current mortality at a national and international level during this period. In addition, the change in annual baseline mortality during the breeding season, at a national and international level does not approach a one percentage point difference. The magnitude of the effect is therefore considered to be **negligible**. At both the national and international level the impact significance of collision risk for kittiwake is assessed as **negligible** which is considered **Not Significant**.

12.231. During both migration periods the predicted increase relative to the baseline mortality rate is less than 1% relative to the regional, national and international mortality. Therefore the magnitude of effect is assessed as **negligible** and the impact significance is assessed as **negligible,** which is considered **Not Significant**.

Lesser black-backed gull

12.232. Based on the flight manoeuvrability, flight altitude, percentage flying and nocturnal flight activity scores in Garthe and Hüppop (2004), combined with the SOSS rankings of perceived collision risk (Collier *et al*., 2012) and collision risks in Langston (2010), lesser black-backed gulls are considered to have a **medium** general sensitivity to collision risk; they have a **low** non-impact specific value and therefore their site-specific sensitivity to collision risk is considered to be **low**. Within the CRM 20.71% of birds in flight were deemed to be at PCH, based on the survey data recorded.

12.233. The number of individuals predicted to be subject to mortality is 90 birds during the breeding season, which leads to an increase of 0.17% or 0.47% relative to the current mortality at the international and national levels during this period. Neither the change in annual baseline mortality at the national nor international level results in an increase of more than 1 percentage point. The magnitude of effect, at the international and national levels, is therefore assessed as **negligible**. The impact significance is also assessed as **negligible** which is considered **Not Significant**.

12.234. At the regional level the magnitude of effect is considered to be **medium**, based on Table 12.28, as the relative increase in baseline mortality is 21.95% or a 1.91% change in the annual baseline mortality. The medium magnitude of effect and low site-sensitivity to collision risk suggest that an impact significance of **minor** is appropriate. However, relatively low numbers of lesser black-backed gulls breed along the English south coast, and with the species having a largely northerly and westerly breeding distribution (Wernham *et al.*, 2002), this partially explains the very low densities (below regional importance) recorded within the Turbine Area during the summer months. Therefore, the birds found within the Turbine Area during the breeding period may be more likely to be non-breeding individuals or birds on passage and therefore may be more likely to form the part of the wider national or even international population. This suggests that the increases in baseline mortality predicted for the regional breeding population are likely to be over-estimates.

12.235. No lesser black-backed gulls were recorded within the Turbine Area during the wintering period. Therefore, no impacts on this species due to collision are predicted during this biological period.

12.236. Lesser black-backed gulls which breed in the UK were thought to be largely sedentary, generally moving inland to reservoirs during the winter (Stone *et al.* 1995), though it has been known that a portion of the UK population migrate south to areas around the Bay of Biscay and North Africa (Brown and Grice, 2005). However, recent data from a DECC GPS tagging study of lesser black-backed gulls breeding at Orford Ness, conducted by the BTO (Ross-Smith 2012), provides detailed routes for a small number of individuals from that colony, with five of the six tagged birds migrating to Spain and Morocco during the winter (Thaxter *et al.* 2011). These birds moved south across the English Channel, with some birds passing near to, or within the vicinity of the Turbine Area (Ross-Smith 2012).

12.237. The numbers of individuals predicted to be subject to mortality on migration are 11 lesser black-backed gulls during spring and 54 during autumn. Lesser black-backed gull numbers within the Turbine Area were highest during the autumn migration period, although numbers did not exceed those required for regional importance. The increase relative to the baseline mortality rate is less than 1% during both the spring and autumn migration periods at the international, national and regional levels. The magnitude of effect is therefore assessed as **negligible**. This, combined with site specific sensitivity, results in an impact significance assessed as **negligible**, which is considered **Not Significant**.

Herring gull

12.238. Based on the flight manoeuvrability, flight altitude, percentage flying and nocturnal flight activity scores in Garthe and Hüppop (2004), combined with the SOSS rankings of perceived collision risk (Collier *et al*., 2012) and collision risks in Langston (2010), herring gulls are considered to have a **medium** general sensitivity to collision risk and a non-impact specific value of **medium**. The site-specific sensitivity of herring gull to collision risk is considered to be **medium**. Within the CRM 18.75% of birds in flight were deemed to be at PCH, based on the survey data recorded.

12.239. The number of individuals predicted to be subject to mortality is 57 birds during the wintering period, which leads to an increase of 1.25%, 0.06% and 0.08% relative to the baseline mortality rates at the regional, national and international levels. The increase to the current baseline mortality rate is less than 1% during the wintering period at all geographical scales. Such increases would potentially lead to a **low** magnitude of effect at the regional level and **negligible** at the national and international level. These predictions result in an impact significance assessed as **minor** (regional) to **negligible** (national and international), which is assessed as **Not Significant**.

12.240. The number of individuals predicted to be subject to mortality during the spring and autumn migration periods is 10 and seven birds respectively. The increase relative to current mortality and the increase relative to baseline mortality is below 1% at all geographical scales. Therefore the magnitude of effect on the migratory population of herring gulls is assessed as **negligible** at all levels. This combined with site-specific sensitivity results in an impact significance assessed as **negligible**, which is considered **Not Significant**.

12.241. The number of individuals predicted to be subject to mortality is 61 during the breeding period. This leads to an increase relative to the baseline mortality rate of 0.18% or 0.03% at a national and international level during this period. However, at the regional level, this would lead to an increase of 15.89% relative to the current mortality during this period. The increase relative to the baseline mortality rate at the regional level is 1.91%. This change is considered to have a **medium** magnitude of effect, resulting in an impact significance assessed as **minor** at the regional level.

12.242. However, herring gulls were only recorded in the Turbine Area in one month (June 2010) from a possible ten months that were surveyed during the breeding seasons. Therefore, it is clear from the survey data that the Turbine Area is not used regularly as a foraging location by individuals based at local breeding colonies. The birds recorded during the breeding season are likely to represent birds migrating or dispersing. With consideration of the survey data it is more appropriate to assess the risk from collision mortality against the national and international population only during the breeding season. The magnitude of effect at this level is assessed as **negligible** and the impact significance is therefore, also assessed as **negligible**, which is considered **Not Significant**.

Great black-backed gull

12.243. Based on the flight manoeuvrability, flight altitude, percentage flying and nocturnal flight activity scores in Garthe and Hüppop (2004), combined with the SOSS rankings of perceived collision risk (Collier *et al*., 2012) and collision risks in Langston (2010), great black-backed gulls are considered to have a **medium** general sensitivity to collision risk. This species has a non-impact specific value of **low** and therefore, their site-specific sensitivity to collision risk is considered to be **low**. Within the CRM 37.93% of birds in flight were deemed to be at PCH, based on the survey data recorded.

12.244. The number of individuals predicted to be subject to mortality is 39 during the wintering period. The increase relative to the current mortality rates is predicted to be less than 1% at the international and national levels during the wintering periods. The increase relative to the baseline mortality rate is also less than 1% at the international and national levels. This change results in a magnitude of effect assessed as **negligible** and therefore the impact significance is also assessed as **negligible** which is considered **Not Significant**.

12.245. The number of individuals predicted to be lost over-winter represents an increase of 3.36% relative to the current regional mortality rate. Although the increase relative to the baseline mortality rate is less than 1%. This is considered to represent a **low** magnitude of effect with regards to the regional wintering population, this combined with species sensitivity results in an impact significance assessed as **negligible** which is considered **Not Significant**.

12.246. No great black-backed gulls were recorded within the Turbine Area during the breeding period. Therefore, no impacts on this species due to collision are predicted during this biological period.

12.247. The number of individuals predicted to be subject to mortality is 35 during the spring migration period. Great black-backed gull numbers within the Turbine Area were highest during the spring migration period, although numbers did not exceed those required for regional importance. The increase relative to current mortality rates is 8.45%, 1.49% or 0.23% during the spring at the regional, national and international levels, respectively. The increase relative to the baseline mortality rate is less than 1% during the spring migration period and at all geographical levels. The change is considered to have a **low** magnitude of effect at the regional and national levels. This results in an impact significance assessed as **negligible** which is considered **Not Significant**.

12.248. The number of individuals predicted to be subject to mortality is 42 during the autumn migration period. Great black-backed gull numbers did not exceed those required for regional importance. The increase relative to current mortality rates is 10.06%, 1.77% or 0.27% during the autumn at the regional, national and international levels, respectively. The increase relative to the baseline mortality rate is less than 1% during the autumn migration period and at all geographical levels. The change is considered to have a **low** magnitude of effect at the regional and national levels. This results in an impact significance of **negligible** which is considered **Not Significant**.

Summary of CRM predictions for the key seabirds

12.249. A summary of the collision risk effects during the operational phase of the proposed Navitus Bay Wind Park for each of the key seabird species is presented in Table 12.37.

Table 12.37 Summary of collision risk effects during operations on seabirds

Species	Non-impact specific value	General collision risk sensitivity	Site-specific sensitivity	Impact magnitude	Predicted significance
Fulmar	Low	Low	Low	Negligible	Negligible
Gannet	Very high	Medium	Very high	Low to negligible	Moderate to negligible
Kittiwake	Low	Medium	Low	Negligible	Negligible
Lesser black-backed gull	Low	Medium	Low	Medium to negligible	Minor to negligible
Herring gull	Medium	Medium	Medium	Low - negligible	Minor to negligible
Great black-backed gull	Low	Medium	Low	Low - negligible	Negligible

CRM Results for Migrant birds

12.250. A summary of the CRM undertaken for migrant birds is provided here for the purposes of assessment. Full details of the collision risk modelling for each migrant species will be presented within Technical Reports, submitted in support of the ES for the Project.

12.251. A number of waders, wildfowl and one near-passerine (nightjar) species not recorded in significant numbers (or at all) through the survey programme were identified as potential migrants through the Turbine Area. Birds were identified using the SOSS 05 (Wright *et al.*, 2012) report that assessed the risk of offshore wind farm developments to migratory birds designated as features of UK SPAs (and other Annex I species). Following this exercise ten species were selected and modelled through the APEM Migropath detailed migration model. The predicted number of birds subject to mortality for different avoidance rates is presented within Table 12.38. Also presented is the modelling of four migrant seabirds including, Great skua, Arctic skua, Sandwich tern and Common tern. These were subject to a modelling approach following an interrogation of the survey data (refer to 'Scope of Assessment'.

12.252. The predicted annual mortality for each species has been assessed relative to the current mortality and in comparison to population estimates for each species at an international and national scale only (Table 12.39 and 12.40). No assessment at the regional scale has been undertaken as the modelling approach focuses on populations within SPA designations throughout the UK. This comparison allows for the magnitude of effect to be estimated for each population and therefore an overall level of impact significance to be defined.

Table 12.38 Summary of mean, minimum and maximum annual collision mortality rates from for 98%, 99% and 99.5% avoidance rates for migrant species

Avoidance rate	Annual mortality rate from the Project (CRM Values)	Dark bellied –brent goose	Common scoter	Little egret	Avocet (breeding)	Avocet (non-breeding)	Golden plover (breeding)	Golden plover (non-breeding)	Grey plover	Knot	Black-tailed godwit (breeding)	Black-tailed godwit (non-breeding)	Bar-tailed godwit	Arctic skua	Great skua	Sandwich tern	Common tern	Nightjar
98%	**Mean**	0	0	2	0	0	4	0	2	1	0	2	0	0	0	0	1	1
	Minimum	0	0	2	0	0	4	0	2	1	0	2	0	-	-	-	-	1
	Maximum	0	0	2	0	0	4	0	2	1	0	2	0	-	-	-	-	1
99%	**Mean**	0	0	1	0	0	2	0	0	1	0	1	0	0	0	0	1	0
	Minimum	0	0	1	0	0	2	0	0	1	0	1	0	-	-	-	-	0
	Maximum	0	0	1	0	0	2	0	0	1	0	1	0	-	-	-	-	0
99.5%	**Mean**	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Minimum	0	0	0	0	0	1	0	0	0	0	0	0	-	-	-	-	0
	Maximum	0	0	0	0	0	1	0	0	0	0	0	0	-	-	-	-	0

Table 12.39 Migrant species annual collision mortality in comparison to international population level mortality (based on a worst case array and a 98% avoidance rate)

Species	Baseline mortality rate (%) (Robinson 2005)	International population (individuals)	Spring migration period			Autumn migration period		
			Mortality rate from the Project (mean CRM Value)	Predicted baseline mortality including the Project (%)	Increase relative to baseline mortality (%)	Mortality rate from the Project (mean CRM Value)	Predicted baseline mortality including the Project (%)	Increase relative to baseline mortality (%)
Dark-bellied brent goose	10.0	200,000	0	10.0	0.00	0	10.0	0.00
Common scoter	21.7	550,000	0	21.7	0.00	0	21.7	0.00
Little egret	28.8	125,000	1	28.8	0.00	2	28.8	0.00
Avocet (breeding)	22.0	73,000	0	22.0	0.00	0	22.0	0.00
Avocet (non-breeding	22.0	75,000	0	22.0	0.00	0*	22.0	0.00
Golden plover (breeding)	27.0	1,570,000	2	27.0	0.00	2	27.0	0.01
Golden plover (non-breeding)	27.0	1,574,166	0	27.0	0.00	0	27.0	0.00
Grey plover	14.0	250,000	0*	14.0	0.00	0*	14.0	0.00
Knot	15.9	450,000	1	15.9	0.00	1	15.9	0.00
Black-tailed godwit (breeding)	6.0	160,000	0	6.0	0.00	0	6.0	0.00
Black-tailed godwit (non-breeding)	6.0	57,000	1	6.0	0.03	1	6.0	0.03
Bar-tailed godwit	28.5	120,000	0	28.5	0.00	0	28.5	0.00
Great skua	11.2	48,000	0	11.2	0.00	0	11.2	0.00
Arctic skua	11.4	120,000	0	11.4	0.00	0	11.4	0.00
Sandwich tern	10.2	166,000	0	10.2	0.00	0	10.2	0.00
Common tern	10.0	160,000	0*	10.0	0.01	0*	10.0	0.01
Nightjar	30.0	940,000	0*	0.0	0.00	0*	0.0	0.00

Table Note: 0* = A species where the annual mortality rate has been rounded up to one bird for the assessment but the CRM predicted less than 0.5 birds per season. In this instance zero birds are predicted per season and the annual figure will be used for the purpose of assessment.

Table 12.40 Migrant species annual mortality in comparison to national population level mortality (based on a worst case array and a 98% avoidance rate)

Species	Baseline mortality rate (%) (Robinson 2005)	National population (individuals)	Spring migration period			Autumn migration period		
			Mortality rate from the Project (mean CRM Value)	Predicted baseline mortality including the Project (%)	Increase relative to baseline mortality (%)	Mortality rate from the Project (mean CRM Value)	Predicted baseline mortality including the Project (%)	Increase relative to baseline mortality (%)
Dark-bellied brent goose	10.0	91,000	0	10.00	0.00	0	10.00	0.00
Common scoter	21.7	123,190	0	21.70	0.00	0	21.70	0.00
Little egret	28.8	4,500	1	28.82	0.08	1	28.82	0.08
Avocet (breeding)	22.0	877	0	22.00	0.00	0	22.00	0.00
Avocet (non-breeding	22.0	7,500	0	22.00	0.00	0	22.00	0.00
Golden plover (breeding)	27.0	45,000	2	27.00	0.02	2	27.00	0.02
Golden plover (non-breeding)	27.0	566,700	0	27.00	0.00	0	27.00	0.00
Grey plover	14.0	49,315	0*	14.00	<0.01	0*	14.00	<0.01
Knot	15.9	338,970	1	15.90	0.00	1	15.90	0.00
Black-tailed godwit (breeding)	6.0	104	0	6.00	0.00	0	6.00	0.00
Black-tailed godwit (non-breeding)	6.0	56,880	1	6.00	0.03	1	6.00	0.03
Bar-tailed godwit	28.5	54,280	0	28.50	0.00	0	28.50	0.00
Great skua	11.2	19,268	0	11.20	0.00	0	11.20	0.00
Arctic skua	11.4	14,408	0	11.40	0.00	0	11.40	0.00
Sandwich tern	10.2	100,000	0	10.20	0.00	0	10.20	0.00
Common tern	10.0	100,000	0*	10.00	<0.01	0*	10.00	<0.01
Nightjar	30.0	9,200	0*	30.00	<0.01	0*	30.01	<0.01

Table Note: 0* = A species where the annual mortality rate has been rounded up to one bird for the assessment but the CRM predicted less than 0.5 birds per season. In this instance zero birds are predicted per season and the annual figure will be used for the purpose of assessment.

12.253. Of the fourteen migrant species assessed, seven are predicted to suffer zero collisions per annum (see table 12.38). These species were dark-bellied Brent goose, common scoter, avocet, bar-tailed godwit, Arctic skua, great skua and Sandwich tern. Therefore, for these species no impacts for the Project due to collision risk are predicted and they are not considered further within this assessment.

Common tern

12.254. Based on the flight manoeuvrability, flight altitude, the percentage of birds flying and nocturnal flight activity scores in Garthe and Hüppop (2004), combined with the SOSS rankings of perceived collision risk (Collier *et al*., 2012) and collision risks in Langston (2010), common terns are considered to have a **medium** general sensitivity to collision risk. They have a non-impact specific value of **very high** and therefore, their site-specific sensitivity to collision risk is considered to be **very high***.*

12.255. The Migropath model predicted that a total of 3,086 individuals potentially pass through the Turbine Area during each migration period. Within the CRM common tern were assumed to be flying at PCH for 12.7% of the time (Cook *et al.* 2011). The CRM predicts that one common tern will be subject to mortality in both the spring and autumn migration periods at the 98% avoidance rate (Tables 12.39 and 12.40). This results in an increase of 0.04% and 0.01%, relative to the baseline mortality rate, at the national and international population level respectively, during both the spring and autumn migration periods.

12.256. As a result, the magnitude of effect from collision is assessed as **negligible.** The impact significance is assessed as **minor,** which is considered **Not Significant** at both the international and national levels.

Little egret

12.257. No data on flight manoeuvrability, flight altitude, the percentage of birds flying and nocturnal flight activity scores are available for little egret in King *et al.* (2009), Garthe and Hüppop (2004), Maclean *et al.* (2009) or Wright *et al.* (2012). Therefore in order to provide a precautionary assessment, little egrets have been considered to have a **high** general sensitivity to collision risk based on professional opinion. They have a non-impact specific value of **very high** and therefore, their site-specific sensitivity to collision risk is considered to be **very high**.

12.258. Within the CRM it was assumed that little egret flies at PCH for 95% of the time (Wright *et al.* 2012). The predicted mean mortality rate at a 98% avoidance rate is of one bird during the spring and one bird during the autumn migration periods. This results in a near to zero percent increase (0.003%) relative to the baseline mortality rate at the international level and an increase of 0.08% at the national level for both the spring and autumn migration periods (Table 12.39 and Table 12.40*)*.

12.259. The predicted magnitude of effect from collision is assessed as **negligible**. The impact significance is assessed **minor,** which is considered **Not Significant** at both the national and international levels.

Golden plover

12.260. Based on the flight manoeuvrability, flight altitude, the percentage of birds flying and nocturnal flight activity scores in King *et al.* (2009), combined with the SOSS rankings of perceived collision risk (Collier *et al*., 2012), golden plovers are considered to have a **low** general sensitivity to collision risk; they have a non-impact specific value of **very high**. Therefore, their site-specific sensitivity to collision risk is considered to be **medium***.*

12.261. Within the CRM it was assumed that golden plovers fly at PCH for 75% of the time (Wright *et al.* 2012). The predicted mean mortality rate, at 98% avoidance rate, for the golden plovers that breed in the UK that potentially pass through the Turbine Area, is four birds in both the spring and autumn migration periods. This results in an increase of 0.02% relative to the baseline mortality rate at the national population level during both the spring and autumn migration periods and an increase of <0.01% relative to the baseline mortality rates at the international population level for both the spring and autumn migration periods.

12.262. The predicted magnitude of effect from collision is assessed as **negligible**. The impact significance is assessed as **negligible** which is considered **Not Significant** at both the international and national levels.

12.263. No non-breeding golden plovers potentially passing through the Turbine Area were predicted to suffer mortality from collision with turbines, at 98% avoidance rate, during the spring or autumn migration periods and therefore no impact is predicted.

Grey plover

12.264. Based on the flight manoeuvrability, flight altitude, the percentage of birds flying and nocturnal flight activity scores in King *et al.* (2009), combined with the SOSS rankings of perceived collision risk (Collier *et al*. 2012), grey plovers are considered to have a **low** general sensitivity to collision risk. They have a non-impact sensitivity of **very high** and therefore, their site-specific sensitivity to collision risk is considered to be **medium**.

12.265. Within the CRM it was assumed that grey plovers fly at PCH for 75% of the time (Wright *et al.* 2012). The predicted mean mortality rate at 98% avoidance rate for grey plover that could pass through the Turbine Area is one bird in both the spring and autumn migration periods. This results in an increase of <0.01% relative to the baseline mortality rate at the national and international population level, during both the spring and autumn migration periods (Tables 12.39 and 12.40). The predicted magnitude of effect from collisions is assessed as **negligible**. The impact significance is assessed as **negligible,** which is considered **Not Significant** at both the international and national levels.

Black-tailed godwit

12.266. Based on the flight manoeuvrability, flight altitude, the percentage of birds flying and nocturnal flight activity scores in King *et al.* (2009), black-tailed godwits are considered to have a **high** general sensitivity to collision risk. They have a non-impact specific value of **very high** and therefore, their site-specific sensitivity to collision risk is considered to be **very high**.

12.267. Within the CRM it was assumed that golden plovers fly at PCH for 75% of the time (Wright *et al.* 2012). No breeding black-tailed godwits that could pass through the Turbine Area will be subject to mortality, at 98% avoidance rate, during the spring or autumn migration periods and therefore no impacts are predicted.

12.268. The predicted mean mortality rate at 98% avoidance rate for the non-breeding black-tailed godwits, that visit the UK and could pass through the Turbine Area, is one bird in both the spring and autumn migration periods. This results in an increase of 0.03% relative to the baseline mortality rate at the national and international population level, during both the spring and autumn migration periods (Tables 12.39 and 12.40).

12.269. The magnitude of effect to collisions is assessed to be **negligible**. The impact significance is assessed as **minor** which is considered **Not Significant**.

Nightjar

12.270. Based on the flight manoeuvrability, flight altitude, the percentage of birds flying and nocturnal flight activity scores nightjar are considered to have a **high** general sensitivity to collision risk; they are a species of **very high** non-impact specific value. Therefore, their site-specific sensitivity to collision risk is considered to be **very high**.

12.271. The percentage time that nightjar fly at collision risk height is unknown and therefore a range of PCH was used within the assessment: 5%, 25% and 50%. The results predict only one collision (using 50% PCH) for spring and one for autumn. The magnitude of effect is therefore assessed as **negligible**. The impact significance is assessed as **minor** which is considered **Not Significant**.

12.272. Table 12.41 provides a summary of the collision risk assessment for migrant birds.

Table 12.41 Summary of collision risk effects during operations on migrants

Species	Non-impact specific value	General collision risk sensitivity	Site-specific sensitivity	Magnitude of effect	Predicted impact significance
Dark-bellied brent goose	Very high	Medium	Very high	None – no collisions	No impact
Common scoter	Very high	Low	Medium	None – no collisions	No impact
Little egret	Very high	High	Very high	Negligible	Minor
Avocet	Very high	High	Very high	None – no collisions	No impact
Golden plover	Very high	Low	Medium	Negligible	Negligible
Grey plover	Very high	Low	Medium	Negligible	Negligible
Knot	Very high	Low	Medium	Negligible	Negligible

Table 12.41 Summary of collision risk effects during operations on migrants					
Black-tailed godwit	Very high	High	Very High	Negligible	Minor
Bar-tailed godwit	Very high	High	Very High	None – no collisions	No impact
Great skua	Very high	Medium	Very High	None – no collisions	No impact
Arctic skua	Very high	Medium	Very High	None – no collisions	No impact
Sandwich tern	Very high	Medium	Very High	None – no collisions	No impact
Common tern	Very high	Medium	Very High	Negligible	Minor
Nightjar	Very high	High	Very High	Negligible	Minor

Barrier Effect

12.273. The presence of the Project could potentially create a barrier to bird migratory and foraging routes, and as a consequence, the Project has the potential to result in long-term changes to bird movements. It has been shown that some species (divers and scoters) avoid wind farms by making detours around turbine arrays which potentially increases their energy expenditure (Petersen, 2005; Petersen and Fox 2007) and potentially decreases survival chances. Such effects may have a greater impact on birds that regularly commute around a wind farm (e.g. birds heading to / from foraging grounds and roosting / nesting sites) than migrants that will only have to negotiate around a wind farm once per migratory period, or twice per annum, if flying the same return route (Speakman *et al*., 2009).

12.274. During the spring and autumn, the route taken by migrating individuals may change due to the barrier effect created by the turbines. Although migrating birds may have to increase their energy expenditure to circumvent the Turbine Area at a time when their energy budgets are typically restricted, this effect is likely to be small for one-off avoidances. Speakman *et al*. (2009) calculated that the costs of one-off avoidances during migration were small, accounting for less than 2% of available fat reserves. Therefore the impacts on birds that only potentially migrate (including seabirds on passage) through the Turbine Area can be considered negligible and these species can be scoped-out of detailed assessment.

12.275. Several species of seabirds could be susceptible to the barrier effect, outside of passage movements, if the presence of wind turbines prevented access to foraging grounds or made the journey to or from the foraging grounds more energetically expensive. Fulmar, kittiwake, lesser black-backed gull, herring gull, greater black-backed gull, common tern and sandwich tern were all noted within the Turbine Area outside of the passage period. All of these species are considered to have a **very low** or **low** general sensitivity to barrier effects (Maclean *et al*., 2009) and are generally tolerant of the presence of operational wind turbines. Therefore the magnitude of effect for these species is assessed as **negligible**. The impact significance of the barrier effect for all of these species is assessed as **negligible** which is considered **Not Significant**.

12.276. Other species recorded during the survey period namely gannet, Mediterranean gull, guillemot, razorbill and puffin, have either general sensitivity or site specific sensitivity values of **medium** or above. These species are considered individually below.

Gannet

12.277. Gannets are considered to have a **medium** general sensitivity to barrier effects based on a combination of the sensitivities given in Maclean *et al.* (2009) and professional opinion. They have a non-impact specific value of **very high** and therefore the site-specific sensitivity to barrier effects for gannet is considered to be **very high**.

12.278. Data from the OWEZ monitoring program showed that seabirds, including gannets, strongly avoided the turbine area (Krijgsveld *et al.*, 2010 and 2011; Leopold *et al.*, 2011). Post-construction data from the Horns Rev wind park reported a similar result with gannets noted in lower than expected numbers (Petersen *et al.*, 2004). Given the large foraging range of gannets (mean maximum range of 229 ± 124 km from a colony reported by Thaxter *et al.*, 2012), any increases in energy expenditure associated with close-range avoidance of the Turbine Area are considered unlikely to be significant and hence the magnitude of effect is considered to be **negligible**. The impact significance from a barrier effect for gannet is assessed as **minor** which is considered **Not Significant**.

Mediterranean gull

12.279. Mediterranean gulls are considered to have a **low** general sensitivity to barrier effects (Maclean *et al.* 2009) and have a non-impact specific value of **very high**. Therefore their site-specific sensitivity to the barrier effect is considered to be **medium**.

12.280. The Turbine Area is located 18.68 km from the Solent and Southampton Water SPA and just under 20 km from the Poole Harbour SPA at its closet point (two areas known to support breeding Mediterranean gulls). The estimated mean maximum foraging range for Mediterranean gulls is 20 km (Thaxter *et al.*, 2012). As the majority of the Turbine Area is located outside of the maximum foraging range of this species and the estimated numbers of Mediterranean gulls present within the Turbine Area during the breeding season did not exceed that required for regional importance, the magnitude of effect is predicted to be **negligible**. The impact significance from a barrier effect for Mediterranean gull is assessed as **negligible** which is considered **Not Significant**.

Guillemot

12.281. Guillemots are considered to have **medium** general sensitivity to barrier effects. As guillemots are found within the Turbine Area in regionally important numbers during the breeding and winter seasons they are considered have a **medium** non-impact specific value. Therefore their site-specific sensitivity to the barrier effect is considered to be **medium**.

12.282. The Turbine Area is within the mean maximum foraging range of 84.2 ± 50.1 km (Thaxter *et al.*, 2012) of the nearest guillemot breeding colonies on the Dorset and Isle of Wight coastlines. However, it must be noted that the foraging data that contributed to the mean-max foraging range for guillemot involved large to very large colonies further north in the UK, where foraging pressure is much higher in close proximity to the nesting cliffs, hence birds need to fly further to find food resources (Ashmole 1963). As there are, at most, 500 pairs of guillemots nesting on the cliffs of Durlston Head (Dorset) and Main Bench (Isle of Wight) combined, it is likely that these birds forage over shorter distances due to the presence of fewer guillemots and other pursuit-diving species competing in the near shore area making local food depletion undetectable (Gaston *et al*. 2007) during the breeding season.

12.283. McLean *et al* (2009) suggest that during the breeding season the barrier effect can cause an impact where a development is between a colony and foraging areas with regionally important numbers. However, although regionally important guillemot numbers were located within the Turbine Area during the breeding season, the site-specific surveys found no clusters of this species, suggesting that it does not form a foraging area of great importance to them during this period. It is also unclear as to whether birds will avoid entering the site, as evidence from post-construction monitoring surveys is inconclusive. Thornton Bank and Bligh Bank (Vannerman *et al.*, 2010) and North Hoyle (RWE, 2008) have shown no avoidance from the wind farm footprint, with some increases in numbers found during their studies. However, the first annual report from the Robin Rigg offshore wind farm (Walls *et al*., 2013) suggested that 30% of auks were displaced from the wind farm site. The barrier effect is unlikely to reduce the foraging efficiency of large numbers of guillemots suggesting that the magnitude of effect is low. The impact significance is from a barrier effect for guillemot is assessed as **minor** which is considered **Not Significant**.

12.284. Guillemots disperse widely during the winter period with a general drift away from breeding colonies. As guillemots do not appear to move to specific wintering grounds, the potential for barrier effects to act at this time is **negligible** and no significant impacts are anticipated.

Razorbill

12.285. Razorbills are considered to have **medium** general sensitivity to the barrier effect. Although razorbills do breed in small numbers along the south coast they are not found within the Turbine Area in regionally important numbers during the breeding season. This is most likely a reflection of the very small numbers that breed on Durlston Head, approximately 10 pairs in 2009 (Lane, 2011). Regionally important numbers have, however been recorded within the Turbine Area in winter and the non-impact specific value for razorbill is therefore considered to be **medium**.

12.286. The nearest breeding colonies of razorbill are on the Dorset coastline, as it is uncertain whether birds still breed at Main Bench on the Isle of Wight (Hunnybun, 2011). Although the Turbine Area is within the mean maximum foraging range of 48.5 ± 35.0 km (Thaxter *et al.*, 2012) of these colonies, the potential for a barrier effect to be of significance during the breeding season is minimal given the very small numbers of birds present.

12.287. Regionally important numbers of razorbills were estimated to be present within the Turbine Area during the winter. However, razorbills are generally dispersive rather than migratory in nature and are unlikely to be making established point to point migration journeys. The general drift away from breeding colonies suggests that the potential for a barrier effect to act on this species is reduced (i.e. there are no specific areas to which birds are moving). Therefore, barrier effects are unlikely to occur during the wintering period and the magnitude of effect is considered to be **negligible**. The impact significance of a barrier effect for razorbills is assessed as **negligible** which is considered **Not Significant**.

Puffin

12.288. Puffins are considered to be of **low** non-impact specific value as they were not recorded in regionally important numbers in any biological period. However, they are considered have a **medium** generally sensitive to the barrier effect and therefore their site-specific sensitivity to the barrier effect is considered to be **low**.

12.289. As the numbers of puffin breeding along the Dorset and Hampshire coastlines are small (approximately 5 pairs – Lane 2011) the potential for the barrier effect to operate is small, as individuals are unlikely to be competing between each other for resources. Therefore, the magnitude of effect is assessed as **negligible**. The impact significance of a barrier effect to puffin is assessed as **negligible** which is considered **Not Significant**.

12.290. Table 12.42 provides a summary of the barrier effect assessment for seabirds.

Table 12.42 Summary of barrier effect during operations on seabirds

Species	Non-impact specific value	General barrier effect sensitivity	Site-specific sensitivity	Impact magnitude	Predicted significance
Fulmar	Low	Low	Low	Negligible	Negligible
Balearic shearwater	Medium	Low	Low	Negligible	Negligible
Gannet	Very high	Medium	Very high	Negligible	Minor
Great skua	Very high	Low	Medium	Negligible	Negligible
Arctic skua	Very high	Low	Medium	Negligible	Negligible
Kittiwake	Low	Low	Low	Negligible	Negligible
Mediterranean gull	Very high	Low	Medium	Negligible	Negligible
Lesser black-backed gull	Low	Low	Low	Negligible	Negligible
Great black-backed gull	Low	Low	Low	Negligible	Negligible
Herring gull	Medium	Low	Low	Negligible	Negligible
Sandwich tern	Very high	Very low	Low	Negligible	Negligible
Common tern	Very high	Very low	Low	Negligible	Negligible
Guillemot	Medium	Medium	Medium	Low	Minor
Razorbill	Medium	Medium	Medium	Negligible	Negligible
Puffin	Low	Medium	Low	Negligible	Negligible

Decommissioning phase

12.291. Any effects generated during the decommissioning phase of the project are expected to be similar or of reduced magnitude to those generated during the construction phase, as certain activities such as piling will not be required. This is because it will generally involve a reverse of the construction phase through the removal of structures and materials installed, while cables are anticipated to remain buried in-situ.

12.292. Potential impacts predicted during the decommissioning phase include those associated with disturbance and displacement and habitat loss or change. Disturbance and displacement is likely to occur due to the presence of working vessels and crews and the movement and noise associated with these. Habitat loss will occur as structures will be removed that may have formed habitat to a variety of marine life over the 25 year O&M phase.

12.293. As no offshore wind farms have been decommissioned, it is anticipated that any future activities will be programmed in close consultation with NE, to allow any future guidance and best practice to be incorporated to minimise any potential impacts.

12.294. Any impacts generated during the decommissioning phase of the project are expected to be similar, but likely of reduced magnitude than those generated during the construction phase; therefore the magnitude of effect is predicted to be **negligible**. The impact significance of effects during decommissioning is assessed as **negligible** which is considered **Not Significant.**

12.6 Potential Mitigation

12.295. During the construction, operation and decommissioning phase of the Project no significant impacts are identified for the majority of potential effects assessed and therefore, no additional mitigation is identified.

12.296. However, during the O&M phase of the Project a potential significant impact has been identified for gannet in relation to collision risk at the regional level. No significant effects are identified at the national or international level and the change in annual baseline mortality does not approach a one percentage point difference.

12.297. The assessment is considered to carry a high level of uncertainty and is likely to be a large over estimate as the predicted increases include non-breeding passage birds. Recent research on gannet from colonies in the English Channel has provided a greater understanding of how this species may be affected by the Project. Therefore, further work is currently underway to further quantify the potential for the Project to have detectable effects on the regional population of breeding gannets. The results of this work will be presented within the forthcoming ES submitted in support of the application for development consent.

12.298. Mitigation measures are being identified in discussion with relevant statutory consultees which will seek to minimise predicted impacts.

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Glossary

TERM	DEFINITION
Aerial survey	Surveys undertaken using high definition cameras mounted on a plane.
Band model	A collision risk model developed by Dr. Band and advocated by Natural England and other SNCBs.
Barrier effect	The potential for infrastructure (in this case wind turbines) to severe links between important areas used by individual birds (e.g. between foraging and breeding grounds). The barrier effect is a type of displacement.
Biological period	The time when birds in the UK are mostly breeding (approximately considered to be April through July for most birds)
Birds of Conservation Concern	'Birds of Conservation Concern' is a publication that provides lists (red and amber) for bird species that are present in the UK. Species are entered on the list if they meet certain criteria (such as 50% decline in population in last 25 years).
Boat-basedBoat based surveys	Surveys undertaken by human surveyors from the deck of a boat which meets certain criteria (as defined in survey guidance).
Embedded mitigation	Mitigation that is incorporated into the project design to avoid or minimise the impact on habitats or species.
Geolocators	A device that can be fitted to a bird to track its movements over a given time period. Location is determined by recording light levels.
k-selected species	Species with long life expectancy, large body size and low productivity.
Migrant birds	Those birds that move from winter quarters to breeding areas (or vice versa).
Migropath model	A model developed by APEM to predict the number of passes of migratory birds through a given area (in this instance the Turbine Area).
r-selected species	Species with high fecundity, small body size, early onset maturity, short generation time and ability to disperse offspring widely. These species predominate in unstable or unpredictable environments.

Abbreviations

TERM	DEFINITION
BoCC	Birds of Conservation Concern
BTO	British Trust of Ornithology
CIEEM	Chartered Institute of Ecology and Environmental Management
CRM	Collision Risk Modelling
CroW	Countryside and Rights of Way Act
CSC	Christchurch Sailing Club
DCC	Dorset County Council
DWT	Dorset Wildlife Trust
GBS	Gravity Base Structures
GIS	Geographical Information System
HRA	Habitat Regulations Assessment
IEMA	Chartered Institute of Environmental Management and Assessment
IPC	Infrastructure Planning Committee
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
MLW	Mean Low Water
MPC	Milford Parish Council
NE	Natural England
NPS	National Policy Statement

TERM	DEFINITION
O&M	Operation and Maintenance
OSP	Offshore Substation Platform
OWEZ	Offshore Windpark Egmond ann Zee
PCH	Potential Collision Height
RSBP	Royal Society for the Protection of Birds
RWCS	Realistic Worst Case Scenario
SNCB	Statutory Nature Conservation Bodies
SNH	Scottish National Heritage
SOSS	Strategic Ornithological Support Services
SPA	Special Protection Areas
SSSI	Site of Special Scientific Interest
VLR	Vertical Look Radar
WCA	Wildlife and Countryside Act
WeBS	Wetland Bird Survey
WWT	Wildfowl and Wetlands Trust