European Offshore Wind Deployment Centre
Environmental Statement

Appendix 29.1: Information to Inform a Habitats Regulation Appraisal

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GENESIS

European Offshore Wind Deployment Centre

Information to Inform a Habitats Regulations Appraisal

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Prepared by:

Genesis Oil & Gas Consultants Ltd

6 Albyn Place, Aberdeen, AB10 1YH

Tel. +44 (0) 1224 615100, Fax. +44 (0)1224 615111

www.genesisoilandgas.com

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Contents

1 INTRODUCTION

The purpose of this document is to provide a summary of the information required to inform any possible Habitats Regulations Appraisal that may be required to be undertaken by the competent authority with respect to the proposed European Offshore Wind Deployment Centre (EOWDC) as required under the EU Habitats and Birds Directives.

The document aims to identify all qualifying species or habitats that, based on data collected at the proposed development site, have the potential to be impacted. A high level assessment on the risk of a possible adverse effect has been undertaken and a conclusion made on the level of risk to a qualifying species or habitat.

This assessment is based on site specific data collected from the surveys undertaken so far and, where appropriate, relevant data from other offshore wind farms. The aim of this assessment is to identify the species or habitats that may be required to be assessed by the competent authority as part of a Habitats Regulations Appraisal and potential future Appropriate Assessments and also consider the risk of a potential adverse effect occurring to the sites' qualifying species of habitats

This assessment takes into consideration comments received in response to the EOWDC Scoping Opinion request from SNH to Marine Scotland dated 29 September 2010 (SNH 2010) and further response from Marine Scotland to the *Assessment against the Habitats Regulations and cumulative impacts screening* (Genesis 2011; Marine Scotland 2011).

It is recognised that further bird and marine mammal data currently being collected may also be used to inform a future HRA. When the data become available it will be reviewed and used, if required, to update this document.

2 QUALIFYING SITES

Under Article 6 of the Habitats Directive and Regulation 45 of the Conservation (Natural Habitats etc) Regulations 1994 (as amended) the competent authority is required to assess whether or not a plan or programme will adversely affect the integrity of a Special Protection Area (SPA) or Special Area of Conservation (SAC).

There are a number of SPAs and SACs that have the potential to be impacted by the proposed offshore wind farm. The scope of this assessment is based on the Natura 2000 sites identified within the scoping document for which there is some evidence that the qualifying species could be present in the area of the proposed EOWDC and subsequent advice from SNH and Marine Scotland (SNH 2010; Marine Scotland 2011).

Special Protection Areas

Eleven SPAs have been identified as having qualifying species that have the potential to be impacted by the proposed offshore wind farm and an assessment has been made for each of the species cited against the site's Conservation Objectives (Appendix A). The assessment is based on whether the species is at risk of:

Collision – The risk of collision depends on a number of variables, in particular species specific near and far field avoidance rates, flight heights, speed of flight, frequency of

movements in or near to the turbines as well as the size and location of the turbines themselves. Additional factors such as weather and species' behaviour can also affect the risk of collision.

Displacement – Evidence from existing offshore wind farms have identified that some species of seabird may avoid entering wind farms and therefore be displaced from areas that they would otherwise utilise. The level of displacement is very species specific and the duration of displacement may vary across species, with some species avoiding wind farms immediately post-construction and returning to the area after a period of time and other species showing little or no evidence of returning to the wind farm area post construction. Displacement from an area may cause reduced foraging areas, increasing inter and intra specific competition and consequently lowering survival rates. Secondary impacts such as reducing prey availability, i.e. less fish in an area during construction, may also cause displacement as birds forage elsewhere for food.

Barrier effects – In order to avoid flying through wind farms many species have been recorded flying around or over them and consequently may have to fly further than prior to the construction of the wind farm. This increase in flying distance may cause an increase in energy expenditure, which could have a detrimental effect on the fitness of the individual and reduce survival or fecundity rates. This is of particular concern should there be regular, daily, movements around a wind farm, i.e. to and from foraging or roosting areas.

In-combination impacts – in-combination impacts are assessed under the Conservation (Natural Habitats & c.) Regulations 1994 (as amended). Impacts include those arising from existing and reasonably foreseeable activities including:

- Shipping
- Fishing
- Aggregates
- Dredging
- Oil and gas installations
- Renewables

In-combination impacts relates specifically to those from other plans or projects on European Sites.

Special Areas of Conservation

Eight SACs have been identified that have qualifying species or habitats that may have the potential to be impacted by the proposed development. This assessment has considered each of the species or habitats cited for each site and their Conservation Objectives. The assessment is based on potential risks arising from:

Habitat disturbance – The qualifying habitats may be sensitive to physical impacts arising from the proposed offshore wind farm, in particular direct physical impacts caused by construction or less direct impacts caused by reduced or increased sediment loads.

Displacement – Species listed within the relevant SACs may be impacted by noise or other activities that may cause an increase in mortality, temporary injury, or displacement away from the area.

The following assessment attempts to assess the potential impacts arising from the proposed EOWDC against the qualifying species and habitats. For species or habitats where no potential for a likely significant effect has been identified no further assessment has been undertaken.

3 PROJECT DESCRIPTION

A detailed description of the proposed EOWDC project is presented in Chapter 3 of the Environmental Statement.

The proposed development is approximately 2 km from the coastline at its closest point in Aberdeen Bay (Figure 3-1). The total area of the turbine layout is 4.3 km^2 within the lease boundary area of 20 km^2. Water depth ranges from between 20 m and 30 m Lowest Astronomical Tide (LAT). The key project characteristic are presented in Table 3-1.

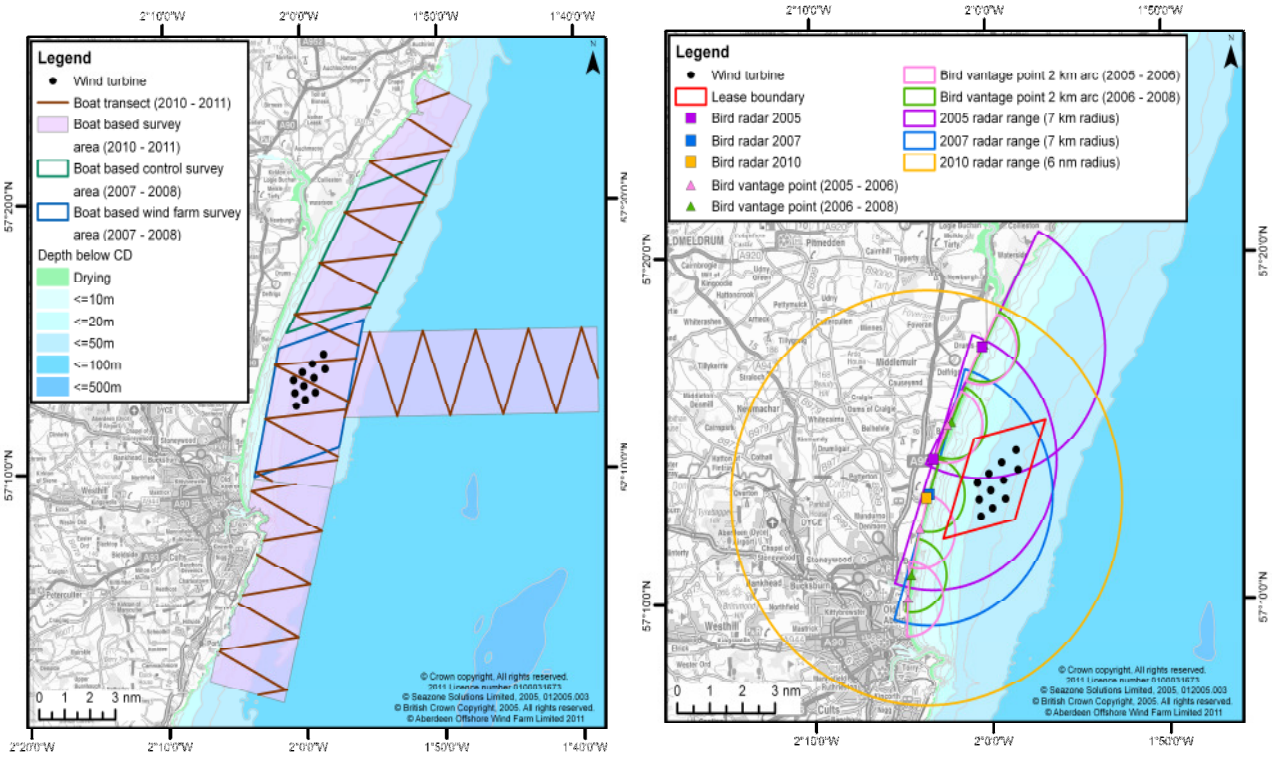

Figure 3-1: Location of proposed EOWDC and bird and marine mammal surveys undertaken

It is proposed that the project may be constructed in two phases. The actual deployment of wind turbines is at this stage not known and the numbers deployed in 2013 and 2014 are variable but for the purposes of the EOWDC assessment, the following has been assumed for the phasing

2013 - 4 wind turbines installed
2014 - 7 wind turbines installed

Table 3-1: key project characteristics

Key Project Characteristics	
Maximum Capacity	100 MW
Maximum Number of Wind Turbines	11
Lease Boundary Area	20 km^2
Distance to Shore	2 km
Water Depth Across Wind Turbine Locations	20 – 30 m
Individual Wind Turbine Capacity	4 to 10 MW
Maximum Rotor Diameter above LAT	150 m
Maximum Hub Height above LAT	120 m
Maximum Tip Height above LAT	195 m
Minimum Clearance Above Sea Level	22 m
Indicative Spacing between Wind Turbines	Between 790 m and 1,050 m
Foundation Types	Potential foundations include monopiles, jackets, tripods, gravity base structure, suction caisson/ buckets
Inter-array Cables	Maximum number of 12. Total length of 13 km.
Export Cables	Maximum number of 4 will run from the wind turbine array back to Mean High Water Spring (MHWS) Total length of 26 km

4 SCOPE OF ASSESSMENT

Likely species present

Which species of bird are known to occur or are likely to occur in the area of the proposed development?

In order to undertake this initial step a review has been undertaken of the site specific data collected at the proposed EOWDC location in Aberdeen Bay from both land and boat based surveys since 2005 and aerial surveys undertaken by the JNCC in 2005 and 2006.

Boat based survey data were used from surveys undertaken between January 2007 and July 2008 and reported in a number of reports:

- Monthly survey reports for February 2007 – April 2008
- 6-month interim report for February 2007 – July 2007
- 1st year survey report for February 2007 – January 2008
- Bird boat survey raw data for February 2007 – July 2008

Land based surveys from four vantage points across Aberdeen Bay were undertaken between April 2006 and March 2008. The surveys provided good coverage for the near-shore waters particularly areas inaccessible by boat due to shallow water depth. A number of reports presenting the results of the Vantage Point (VP) surveys have been produced:

- Monthly survey reports for April 2007 – March 2008.
- Six-month reports completed for
    - April –September 2006
    - October 2006 – March 2007
    - April – September 2007
    - October 2007 – March 2008
- VP data for March 2005 – October 2005.
- VP data for April 2006 – March 2008.

Radar Surveys have been undertaken on three occasions from two sites within Aberdeen Bay between 2005 and 2010. A total of ten days of radar surveys were undertaken in 2005 and fifteen in 2007 and further five days in 2010.

In April 2005 a study using both s-band and x-band radar was undertaken at two locations within Aberdeen Bay: Drums and East Hatton. A further fifteen day study in April 2007 was undertaken at Blackdog, just south of Drums. In 2010 a further survey was undertaken during April aimed to focus efforts on recording pink-footed goose migration. The study also recorded all other species observed during the study.

In addition to surveys undertaken specifically to obtain information relevant to the proposed project other ornithological surveys have been undertaken in Aberdeen Bay, the results from which have been used in this report. In particular, the results of three aerial bird surveys

undertaken by the JNCC between December 2005 and May 2006. It is recognised that there are other potential sources of data including local bird reports or Wetland Bird Survey (WeBS) counts (Calbrade *et al.* 2010; NESBR). For the purposes of this assessment these data sources have been used for reference purposes. Species recorded in Aberdeen Bay from site specific surveys are presented in (Table 4-1).

For further detailed information on the species recorded within Aberdeen Bay the Ornithological Baseline and Impact Assessment should be referred to (Appendix 10.1 to the Environmental Statement).

Potential sensitivity to offshore wind farms

There are a number of publications presenting the likely sensitivity of bird species to offshore wind farms (e.g. Zucco *et al.* 2006; RSPB 2010) and there is general agreement between the various publications as to the main potential risks to birds and individual species sensitivities from wind farms. For the purposes of this assessment the report published by the RSPB in 2010 has been used to provide the relevant information on species' sensitivities. For species that were not included in the RSPB publication a score has been given based on existing data from offshore wind farms, e.g. Pettersson (2005); Petersen *et al*. (2006).

The potential sensitivities to wind farm developments based on the review by Langston (2010) and other offshore wind farm developments are presented in Table 4-1 for the species recorded in Aberdeen Bay from site specific surveys,.

Table 4-1: Species recorded in Aberdeen Bay from site specific surveys and their potential vulnerability

Vulnerability to wind farm development	Collision.	Displacement	Barrier	Habitat/Prey	Feature of SPA with potential for interaction with site? (Y/N)	Use of site (breeding, wintering, passage)
Whooper swan	***	*	*	-	Y	P
Mute swan	High	Low	Low	-	N	B/W/P
Pink-footed goose	**	**	*	-	Y	P
Greylag goose	**	**	*	-	Y	P
Barnacle goose	**	**	*	-	Y	P
Brent goose	**	**	*	-	N	P
Shelduck	Mod	Low	Low	-	Y	P
Eurasian Wigeon	Mod	Low	Low	-	Y	P
Eurasian Teal	Mod	Low	Low	-	Y	P
Mallard	Mod	Low	Low	-	Y	B/W/P
Tufted duck	Mod	Low	Low	-	N	B/W/P
Common eider	*	*	**	**	Y	B/W
Long-tailed duck	*	**	**	**	N	W
Common scoter	*	**	**	**	N	W/P
Velvet scoter	*	**	**	**	N	W/P
Common goldeneye	*	*	**	**	N	W/P
Red-breasted merganser	*	*	**	**	N	W/P
Red-throated diver	*	***	**	**	N	W/P
Black-throated diver	*	***	**	**	N	W/P
Great northern diver	*	***	**	**	N	W/P
Northern Fulmar	*	*	*	**	Y	B/W
Manx shearwater	*	*		**	N	P

Vulnerability to wind farm development	Collision.	Displacement	Barrier	Habitat/Prey	Feature of SPA with potential for interaction with site? (Y/N)	Use of site (breeding, wintering, passage)
Sooty shearwater	*	*		**	N	P
European storm petrel	*	*	-	**	N	P
Gannet	**	*	*	*	Y	B/W/P
Cormorant	**	*	**	**	Y	B/W
European Shag	*	**	**	**	Y	B/W
Grey heron	High	Low	Low	-	N	B/W/P
Oystercatcher	Mod	Low	Low	-	Y	B/W/P
Ringed plover	Mod	Low	Low	-	N	B/W/P
Golden plover	Mod	Low	Low	-	N	P
Lapwing	Mod	Low	Low	-	Y	B/W/P
Knot	Mod	Low	Low	-	N	P
Sanderling	Mod	Low	Low	-	N	W/P
Dunlin	Mod	Low	Low	-	N	P
Black-tailed godwit	Mod	Low	Low	-	N	P
Bar-tailed godwit	Mod	Low	Low	-	N	W/P
Redshank	Mod	Low	Low	-	Y	B/W/P
Whimbrel	Mod	Low	Low	-	N	P
Curlew	Mod	Low	Low	-	N	B/W/P
Turnstone	Mod	Low	Low	-	N	W/P
Pomarine skua	**	*	*	*	N	P
Arctic skua	**	*	*	*	N	P
Long-tailed skua	**	*	*	*	N	P
Great skua	**	*	*	*	N	P
Glaucous gull	Mod	Low	Low	Low	N	W
Little gull	*	*	*	*	N	P

Vulnerability to wind farm development	Collision.	Displacement	Barrier	Habitat/Prey	Feature of SPA with potential for interaction with site? (Y/N)	Use of site (breeding, wintering, passage)
Black-headed gull	*	*	*	*	N	B/W/P
Sabine's gull					N	P
Common gull	*	*	*	*	N	B/W/P
Lesser black-backed gull	**	*	*	*	Y	B
Herring gull	**	*	*	*	Y	B/W/P
Great black-backed gull	**	*	*	*	N	B/W
Kittiwake	**	*	*	*	Y	B/W
Little tern	**	*	*	*	Y	B
Sandwich tern	**	*	*	**	Y	B
Common tern	**	*	*	**	Y	B
Arctic tern	**	*	*	**	Y	B
Guillemot	*	**	**	**	Y	B/W
Razorbill	*	**	**	**	Y	B/W
Black guillemot	*	**	**	**	N	B/W
Puffin	*	**	**	**	Y	B
Little auk	*	**	**	**	N	W/P

Note – *** = high sensitivity, ** = moderate sensitivity, * = low sensitivity (Langston 2010).

High/mod/low designations have been made based on published data from offshore wind farms either for that particular species or similar 'sister' species.

5 SPAS

There is no clear guidance on how to define the extent and scope of a seabird population that could potentially be impacted by a proposed offshore wind farm. King *et al*. (2009) suggests that regional populations should be the Round 2 strategic areas (Renewable Energy Zones) or the Round 3 zones. However, as the proposed EOWDC is not in such an area there is no clear guidance as to how to identify the regional population for this assessment.

The scope of the review undertaken for this document was based on all coastal SPAs between Troup, Pennan and Lions Heads SPA, on the Moray Firth and the Forth Islands SPA to the south; covering approximately 300 km of coastline. This covers a greater length shoreline than any of the Round 2 Renewable Energy Zones and a significant proportion of eastern Scotland's coastline. Consequently, it covers an area greater than suggested as guidance within the COWRIE report (King *et al*. 2009); therefore ensuring that a representative area is covered.

All coastal or near coastal SPAs were identified using information from the SNH and JNCC websites (JNCC 2011, SNH 2011). A total of 11 SPAs have been identified as having qualifying species that are at potential risk of an adverse effect from the proposed project (Figure 5-1).

:

- Buchan Ness to Collieston SPA
- Fair Isle SPA
- Firth of Forth SPA
- Firth of Tay & Eden Estuary SPA
- Forth Islands SPA
- Fowlsheugh SPA
- Loch of Skene SPA
- Loch of Strathbeg SPA
- Montrose Basin SPA
- Troup, Pennan and Lion's Heads SPA
- Ythan Estuary, Sands of Forvie and Miekle Loch SPA

Further details on each of the SPAs including their qualifying species and Conservation Objectives are presented in Appendix A. Not all those species listed within the site designations have been recorded within the area of the proposed EOWDC and consequently not all qualifying species are at risk of a potential impact.

Table 5-1 links the species that have been recorded within the proposed EOWDC area (Table 4-1) with the relevant SPAs (Appendix A). In addition, the table presents the distance each SPA is from the proposed EOWDC and the population of each species at the time of designation and when available, more recent populations.

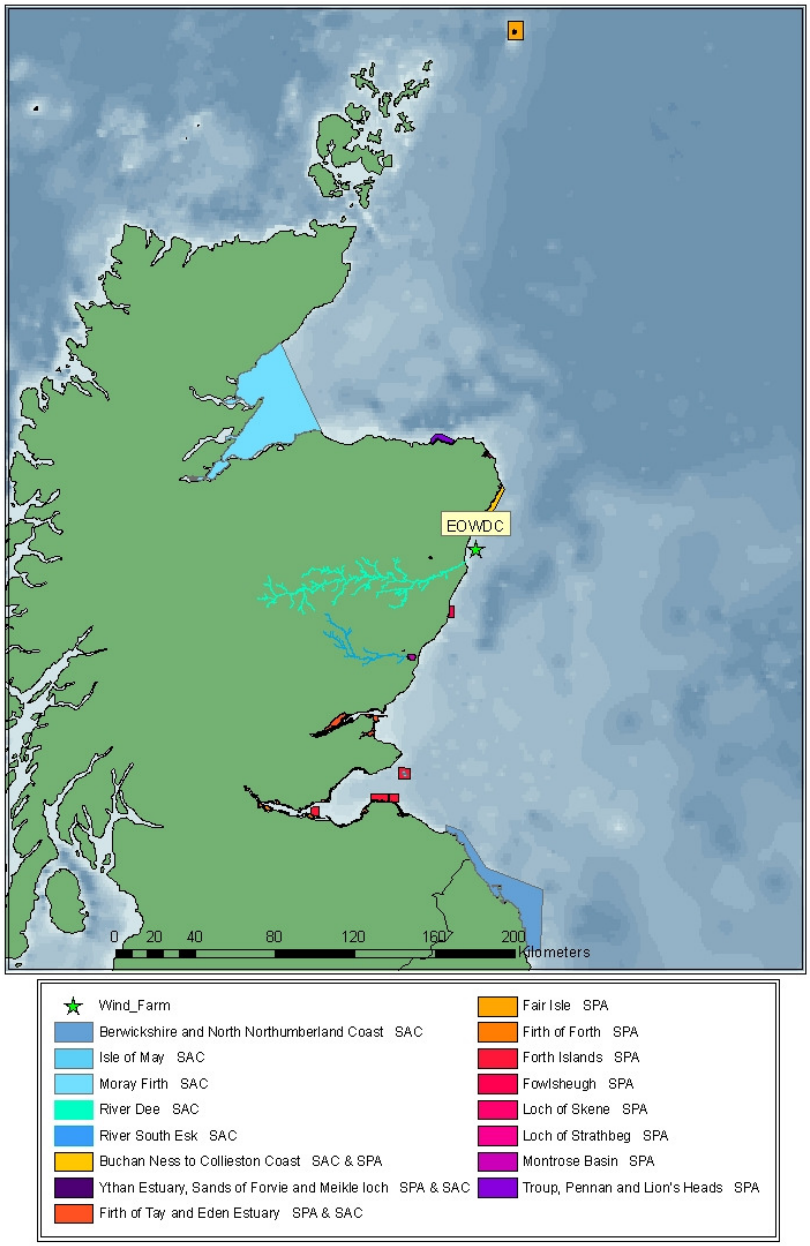

Figure 5-1: Designated sites scoped in to the HRA

Source JNCC 2011. http://jncc.defra.gov.uk/page-4

Table 5-1: Qualifying species recorded from surveys and potential linkage with Special Protection Area

Species	Site name	Distance from site (km)	Qualifying feature	Popⁿ of SPA	
				Designation or SPA review	Most recent
Whooper swan	Loch of Strathbeg	47.6	3.3% of GB wintering popⁿ	183	333 (1)
Pink footed goose	Ythan Estuary	7.2	7.7% of GB Wintering popⁿ	17,213	16,300 (1)
	Firth of Forth	134	5.5% of GB wintering popⁿ	12,400	4,463 (1)
	Firth of Tay & Eden	96	1.7% of GB wintering popⁿ	3,769	2,704 (1)
	Loch of Strathbeg	47.6	17.7% of GB Wintering popⁿ	39,924	53,454 (1)
	Montrose Basin	61	14.1% of GB Wintering popⁿ.	31,622	38,911 (4)
Greylag goose	Loch of Skene	21	Migratory species	10,840	790 (3)
	Loch of Strathbeg	47.6	3.3% of GB Wintering popⁿ	3,325	580 (3)
	Montrose Basin	61	1.1% GB Wintering popⁿ	1,080	275 (4)
	Firth of Tay & Eden Estuary	96	1.0% of GB Wintering popⁿ	1,200	2,640 (3)
Barnacle goose	Loch of Strathbeg	47.6	1.9% of GB wintering popⁿ	226	726 (1)
Shelduck	Montrose Basin	61	Waterfowl assemblage	-	988 (4)
	Firth of Forth	134	1.2% of NW European popⁿ	3,586	3,166 (1)
	Forth of Tay & Eden	96	Waterfowl assemblage	-	1,114 (1)
Teal	Loch of Strathbeg	47.6	Waterfowl assemblage	-	504 (3)
Wigeon	Montrose Basin	61	Waterfowl assemblage	-	3,944 (1)
	Firth of Forth	134	Waterfowl assemblage	2,139	2,139 (1)

Species	Site name	Distance from site (km)	Qualifying feature	Pop[n] of SPA	
				Designation or SPA review	Most recent
Mallard	Firth of Forth	134	Waterfowl assemblage	-	2546 (5)
Common eider	Ythan Estuary	7.2	Waterfowl assemblage	-	3,688 (1)
	Montrose Basin	61	Waterfowl assemblage	-	1,983 (4)
	Firth of Tay & Eden	96	Waterfowl assemblage	-	4,378 (1)
	Firth of Forth	134	Waterfowl assemblage	9,400	5,188 (1)
Long tailed duck	Firth of Forth	134	Waterfowl assemblage	1,045	215 (1)
	Firth Tay and Eden	96	Waterfowl assemblage	-	204 (1)
Common scoter	Firth of Forth	134	Waterfowl assemblage	-	635
	Firth of Tay & Eden	96	Waterfowl assemblage	-	-
Velvet scoter	Firth of Forth	134	Waterfowl assemblage	2,880	731 (1)
	Firth of Tay & Eden	96	Waterfowl assemblage	-	326 (1)
Common Goldeneye	Firth of Forth	134	Waterfowl assemblage	-	581 (1)
	Firth of Tay & Eden Estuary	96	Waterfowl assemblage		255 (1)
Red-breasted merganser	Firth of Forth	134	Waterfowl assemblage	670	410 (1)
Red throated diver	Firth of Forth	134	1.8% of GB pop[n]	88	317 (1)
Fulmar	Buchan Ness – Collieston	9.5	Waterfowl assemblage	1,765 prs	1,370 (3)
	Fowlsheugh	31.1	Waterfowl assemblage	1,170 prs	246 (3)
	Forth Islands	124.4	Waterfowl assemblage	1,600 prs	402 (3)

Species	Site name	Distance from site (km)	Qualifying feature	Pop[n] of SPA	
				Designation or SPA review	Most recent
	Troup, Pennan and Lion's Head	74.3	Waterfowl assemblage	4,400 prs	636 (3)
Gannet	Forth Islands	124.4	13.1% of N. Atlantic breeding pop[n]	34,400 prs	48,065 prs (2)
	Fair Isle	260	0.6% of GB pop[n]	1,166 prs	3,582 AoN (2)
Cormorant	Forth Islands	124.4	Waterfowl assemblage	200 prs	198 prs (2)
	Forth Islands	124.4	Wintering assemblage	682	-
	Firth of Tay & Eden Estuary	96	Wintering assemblage	230	-
European shag	Buchan Ness – Collieston	9.5	Waterfowl assemblage	1,045 prs	331 prs (3)
	Forth Islands	124.4	2.3% of biogeographical pop[n]	2,887 prs	480 prs
Great crested grebe	Firth of Forth	134	7% of GB wintering pop[n]	720	-
Curlew	Firth of Forth	134	2% of GB pop[n]	1,928	3,939 (1)
Oystercatcher	Montrose Basin	61	Waterfowl assemblages	-	1,385 (4)
	Firth of Tay & Eden Estuary	96	Waterfowl assemblage	-	-
	Firth of Forth	134	Waterfowl assemblage	2,368	7,638 (1)
Golden plover	Firth of Forth	134	Waterfowl assemblage	2,970	-
Lapwing	Ythan Estuary	7.2	Waterfowl assemblage	-	6,269 (3)
	Firth of Forth	134	Waterfowl assemblages	4,184	-
Sanderling	Firth Tay & Eden	96	Waterfowl assemblages	-	277 (1)
Ringed plover	Firth of Forth	134	Waterfowl assemblage	328	471 (1)

Species	Site name	Distance from site (km)	Qualifying feature	Pop[n] of SPA	
				Designation or SPA review	Most recent
Turnstone	Firth of Forth	134	1% of western Palearctic pop[n]	1,286	853 (1)
Redshank	Ythan Estuary	7.2	Waterfowl assemblage		2,471 (1)
	Firth of Forth	134	Waterfowl assemblage	3,700	5,111 (1)
	Firth of Tay & Eden Estuary	96	2.5% of wintering pop[n]	1,800	1,162 (1)
	Montrose Basin	61	1.5% of wintering pop[n]	2,259	1,951 (4)
Lesser black backed gull	Forth Islands	124.4	2.4% of west European pop[n].	2,920 prs	2,779 (2)
Herring gull	Buchan Ness – Collieston	9.5	Waterfowl assemblage	4,292 prs	3,079 (3)
	Fowlsheugh	31.1	Waterfowl assemblage	3,190 prs	122 (2)
	Forth Islands	124.4	Waterfowl assemblage	6,600 prs	2,968
	Troup, Pennan and Lion's Head	74.3	Waterfowl assemblage	4,200 prs	1,597 (3)
Kittiwake	Buchan Ness – Collieston	9.5	Waterfowl assemblage	30,452 prs	12,542 (2)
	Fowlsheugh	31.1	1.1% of East Atlantic Breeding pop[n]	34,870 prs	11,140 (2)
	Forth Islands	124.4	Waterfowl assemblage	8,400 prs	2,316 (2)
	Troup, Pennan and Lion's Head	74.3	Waterfowl assemblage	-	14,896 (3)
Little tern	Ythan Estuary	7.2	1.7% of GB Breeding pop[n].	41 prs	36 prs -(3)
	Firth of Tay and Eden Estuary	96	1% of GB Breeding pop[n]	25 prs	0 prs -(3)
Sandwich tern	Ythan Estuary	7.2	4.3% of GB Breeding pop[n]	600 prs	645 AoN
	Loch of Strathbeg	47.6	3.8% of GB Breeding pop[n]	530 prs	1-2 AoN

Species	Site name	Distance from site (km)	Qualifying feature	Pop[n] of SPA	
				Designation or SPA review	Most recent
	Firth of Forth	134	3.8% of GB passage	1,617	-
	Forth Islands	124.4	0.2% of GB Breeding pop[n]	22 prs	0
Common tern	Ythan Estuary	7.2	2.2% of GB Breeding pop[n]	265 prs	6 prs
	Forth Islands	124.4	6.5% of GB Breeding pop[n]	800 prs	378 prs [2]
Arctic tern	Forth Islands	124.4	1.2% of GB Breeding pop[n]	540 prs	908 prs [-2]
Guillemot	Buchan Ness – Collieston	9.5	Waterfowl assemblage	8,640 prs	19,296
	Fowlsheugh	31.1	1.8% of East Atlantic Breeding pop[n].	40,140 prs	50,566
	Troup, Pennan and Lion's Head	74.3	1.3% of East Atlantic Breeding pop[n].	29,902 prs	16,325
	Forth Islands	124.4	Waterfowl assemblage	16,000 prs	2,550
Razorbill	Buchan Ness to Collieston	9.5	Waterfowl assemblage		4,179
	Fowlsheugh	31.1	Waterfowl assemblage	5,800	4,632
	Forth Islands	124.4	Waterfowl assemblage	1,400 prs	3,464
	Troup, Pennan and Lion's Head	74.3	Waterfowl assemblage	-	-
Puffin	Forth Islands	124.4	2.3% of breeding pop[n].	21,000 prs	58,867 AoN

1 = Calbrade, *et al.* 2010, 2 = BTO 2011, 3 = JNCC 2011, 4 = Montrose Basin 2011, 5 = SNH 2011

Potential for in-combination impacts

The consideration of potential in-combination impacts is of key importance when undertaking a Habitats Regulations Appraisal.

Having identified the species of seabird occurring within the proposed EOWDC area and the relevant SPAs for which the species may be a qualifying feature the next step is identify the potential for in-combination impacts.

EC Guidance (EC 2000) advises that '*when determining likely significant effects, the combination of other plans or projects should also be considered to take account of cumulative impacts. It would seem appropriate to restrict the combination provision to other plans or projects, which have been actually proposed*.

Guidance produced by COWRIE (King, *et al*. 2009) proposes that assessments should include:

- Projects that have been consented but which are yet to be constructed.
- Projects for which an application has been made,
- Projects that are reasonably foreseeable – i.e. those for which an application has yet to be made but where such application is known to be imminent.

Activities identified that may cause a potential in-combination impact include:

- Shipping
- Fishing
- Aggregates
- Dredging
- Oil and Gas
- Renewable Energy

Shipping and Fishing

Impacts from exisiting shipping and fishing activities are 'unregulated' activities, in that they do not require a specific permit before being undertaken. They are ongoing and impacts arising from them are reflected in the baseline environmental data. Currently, approximately 16,000 vessel movements take place in and out of Aberdeen harbour each year and there are no known planned increases in either shipping of fishing in the area. EC Guidance indicates that completed plans and projects are excluded from assessment requirements of Article 6(3) unless the continuing effects on the site point to a pattern of progressive loss of site integrity, which is not the case in the area of the proposed development with regards to either shipping or fishing activities. Consequently, they have not been considered as part of any in-combination impact assessment (EC 2000).

Aggregates

There are no aggregate activities in the vicinty of the proposed EOWDC.

Dredging

There are no dredging deposit sites within Aberdeen Bay. Dredging associated with Aberdeen Harbour can occasionally occur, although it is infrequent. There are currently plans to undertake dredging in Aberdeen Harbour during 2012. This will be completed prior

to any proposed construction activites associated with the proposed EOWDC. Consequenlty, there will no in-combiantion impacts associated with dredging.

Oil and Gas

Aside from shipping activites associated with the oil and gas industry there are are no oil and gas acitivities in the wider Aberdeen Bay area.

Renewable Energy Projects

There are currently five proposed offshore wind farms in the Firth of Forth and Moray Firth. The Beatrice and Moray Firth Offshore Wind Farms are in the Moray Firth; approximately 150 km away and Neart na Gaiothe and Inch Cape and Firth of Forth are in the Firth of Forth, approximately 70 km to the south of the proposed EOWDC (Table 5-2 Figure 3-1). There is currenlty one operational demonstrator project in the Moary Firth, the Beatrice Demonstrator.

Table 5-2: Proposed offshore wind energy projects that may have potential in-combination impacts

Name of development	Developer	MW	Possible / Actual number of Turbines	Project timeframe construction
The Beatrice Demonstrator	Joint Venture Talisman and Scottish and Southern Energy	10	2	Installed operational
The Moray Firth Eastern Development	Moray Offshore Renewables Ltd	1,300	67	Construction starts 2015
The Moray Firth Western Development			Not yet known	Unknown >2015 (EIA commences 2013)
Beatrice	Sea Energy Renewables Ltd & Scottish and Southern Energy	920	184	2014
Firth of Forth: Phase 1	SeaGreen	1,075	215	2015
Firth of Forth: Phase 2		1,435	287	Unknown >2015
Firth of Forth: Phase 3		955	191	Unknown >2015
Neart na Gaoithe	Mainstream Renewable Power	420	130	2014
Inch Cape	SeaEnergy	905	181	2015

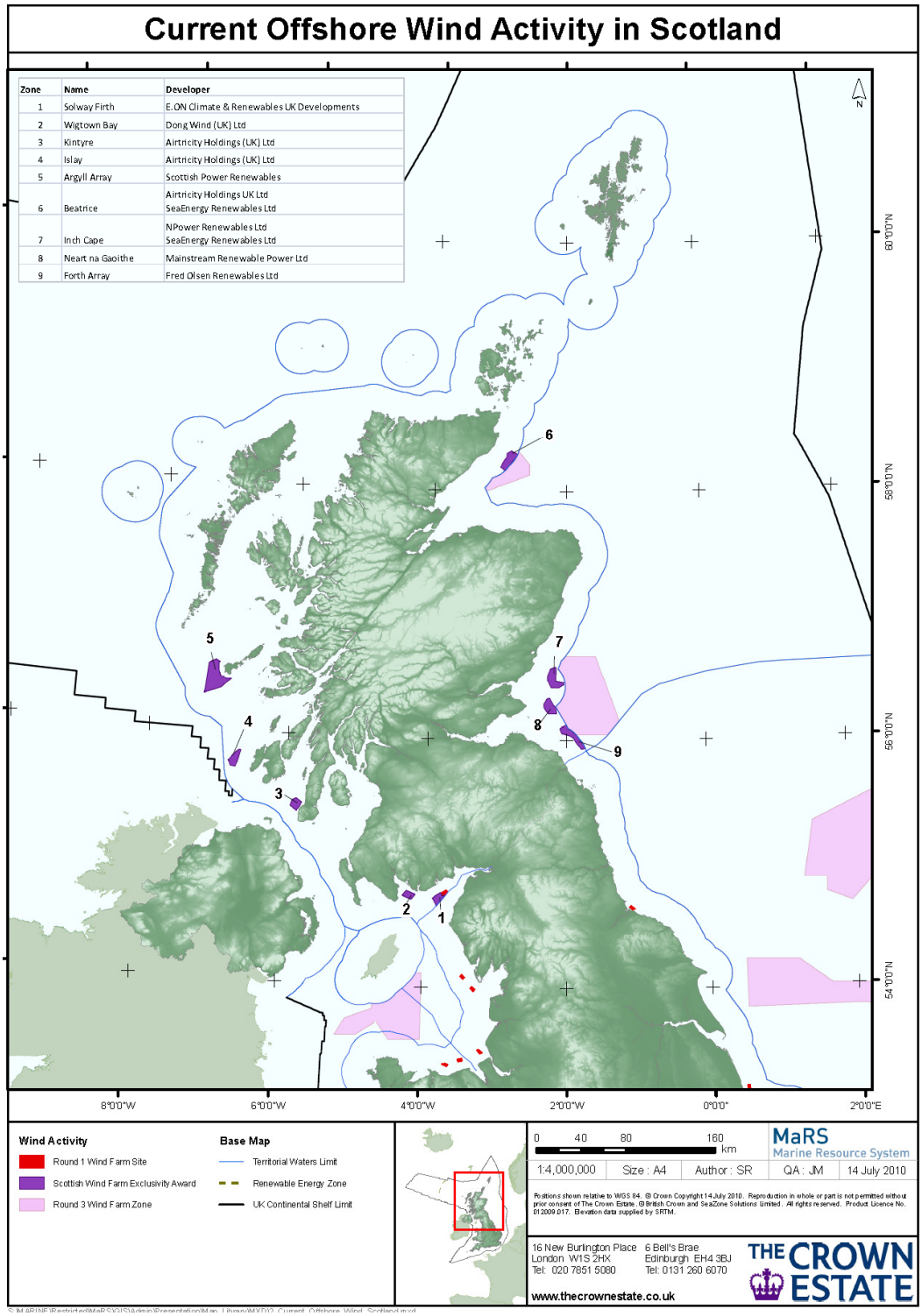

Figure 5-2: Map showing the nine initial proposed offshore wind farms in Scottish Territorial Waters

Based on the known foraging ranges of breeding seabirds occuring in the proposed EOWDC (Roos 2010, Thaxter *et al.* 2010) it has been identifed that there is the potential for an in-combination impact on the following plans or projects (Table 5-2):

- Beatrice Demonstrator Project (operational),
- The Beatrice Offshore Wind Farm (proposed),
- The Moray Firth Offshore Wind Farm (proposed),
- Inch Cape Offshore Wind farm (proposed),
- Firth of Forth Offshore Wind Farm (proposed),
- Neart na Gaoithe Offshore Wind Farm (proposed).

In order to undertake an in-combination impact assessment it is necessary to know details of the proposed plans. Currently, apart from an approximate number of turbines there is little information for any of the proposed developments and no data are available on the location or type of turbines planned to be installed nor, importantly, are there any survey data available to identify which species of bird may be present at each of the sites and in what numbers. Consequently, it is not possible to undertake a detailed in-combination impact assessment that includes the proposed renewable energy developments.

Identifying potential for interaction

Having identified the relevant SPAs and qualifying species an assessment has been undertaken to identify which species have the potential to interact with the proposed EOWDC either alone or in-combination with other plans or projects (Table 5-3). For breeding species the assessment is based on the maximum reported foraging ranges for each species and where more than one distance is available the greatest distance has been selected (Roos 2010, Thaxter *et al*. 2010). For non-breeding birds that are listed as qualifying species for an SPA they are all considered to be at potential risk but the level of significance is based on the number of birds recorded within the proposed development area and their behaviour.

Table 5-3: Breeding seabirds associated with a relevant SPA for which potential impacts could occur either alone or in-combination

Breeding bird species known to frequent area of development	Known foraging range from breeding colony (km)		Potential overlap with SPA colony	Distance from proposed EOWDC (km)	Potential overlap with proposed EOWDC (based on max foraging distance)	Potential overlap with other offshore wind farms and proposed EOWDC
	Max	Mean Max $^{-1}$				
Common eider	100	38.33	Ythan Estuary	7.2	Y	No
			Montrose Basin	61	Y	Firth of Forth, Neart na Gaoithe, Inch Cape
			Firth of Tay & Eden Estuary	96	Y	Firth of Forth, Neart na Gaoithe, Inch Cape
			Firth of Forth SPA	134	N	No
Fulmar	664	311	Buchan Ness – Collieston,	9.5	Y	Moray Firth, Firth of Forth, Beatrice, Neart na Gaoithe, Inch Cape
			Fowlsheugh	31.1	Y	Moray Firth, Firth of Forth, Beatrice, Neart na Gaoithe, Inch Cape
			Forth Islands	124.4	Y	Moray Firth, Firth of Forth, Beatrice, Neart na Gaoithe, Inch Cape
			Troup, Pennan and Lions Head	74.3	Y	Moray Firth, Firth of Forth, Beatrice, Neart na Gaoithe, Inch Cape
			Orkney, Shetland, West coast of Scotland, North Sea	>260	Y	All UK offshore wind farms
Gannet	640	308	Forth Islands	124.4	Y	Moray Firth, Firth of Forth, Beatrice, Neart na Gaoithe, Inch Cape. All North Sea offshore wind farms

Breeding bird species known to frequent area of development	Known foraging range from breeding colony (km)		Potential overlap with SPA colony	Distance from proposed EOWDC (km)	Potential overlap with proposed EOWDC (based on max foraging distance)	Potential overlap with other offshore wind farms and proposed EOWDC
	Max	Mean Max $^{-1}$				
			Fair Isle	260	Y	Moray Firth, Firth of Forth, Beatrice, Neart na Gaoithe, Inch Cape. All North Sea offshore wind farms North of the Wash
Cormorant	35	25	Forth Islands	124.4	N	No
European Shag	17	16	Buchan Ness to Collieston	9.5	Y	No
			Forth Islands	124.4	N	No
Lesser black-backed gull	180	132	Forth Islands	124.4	Y	Firth of Forth, Neart na Gaoithe, Inch Cape
Herring gull	92	61	Buchan Ness to Collieston	9.5	Y	No
			Fowlsheugh	31.1	Y	Firth of Forth, Neart na Gaoithe, Inch Cape
			Forth Islands	124.4	N	No
Kittiwake	83	66	Buchan Ness to Collieston	9.5	Y	No
			Fowlsheugh	31.1	Y	Firth of Forth
			Forth Islands	124.4	N	No
			Troup, Pennan and Lions Head	74.3	Y	Moray Firth, Beatrice

Breeding bird species known to frequent area of development	Known foraging range from breeding colony (km)		Potential overlap with SPA colony	Distance from proposed EOWDC (km)	Potential overlap with proposed EOWDC (based on max foraging distance)	Potential overlap with other offshore wind farms and proposed EOWDC
	Max	Mean Max $^{-1}$				
Little tern	11	6	Ythan	7.2	Y	No
			Firth of Tay and Eden Estuary	96	N	No
Sandwich tern	70	42	Ythan	7.2	Y	No
			Loch of Strathbeg	47.6	Y	No
Common tern	37	34	Ythan	7.2	Y	No
			Forth Islands	124.4	N	No
Arctic tern	25	12	Forth Islands	124.4	N	No
Guillemot	135	71	Buchan Ness – Collieston	9.5	Y	Firth of Forth, Neart na Gaoithe, Inch Cape
			Forth Islands	124.4	Y	Firth of Forth, Neart na Gaoithe, Inch Cape
			Fowlsheugh	31.1	Y	Firth of Forth, Neart na Gaoithe, Inch Cape
			Troup, Pennan and Lions Head	74.3	Y	Moray Firth, Beatrice
Razorbill	150	31	Buchan Ness – Collieston	9.5	Y	Firth of Forth, Neart na Gaoithe, Inch Cape
			Fowlsheugh	31.1	Y	Firth of Forth, Neart na Gaoithe, Inch Cape

Breeding bird species known to frequent area of development	Known foraging range from breeding colony (km)		Potential overlap with SPA colony	Distance from proposed EOWDC (km)	Potential overlap with proposed EOWDC (based on max foraging distance)	Potential overlap with other offshore wind farms and proposed EOWDC
	Max	Mean Max [-1]				
			Forth Islands	124.4	Y	Firth of Forth, Neart na Gaoithe, Inch Cape
			Troup, Pennan and Lions Head	74.3	Y	Moray Firth, Beatrice
Puffin	200	86	Forth Islands	124.4	Y	Firth of Forth, Neart na Gaoithe, Inch Cape

[1] - Mean Max is the mean foraging distance based on the maximum foraging distances reported from various studies

Based on the above screening assessment, species identified as having a likely potential for an interaction with the proposed EOWDC are further considered in the high level screen assessment in Section **Error! Reference source not found.**. The information presented is a summary of that presented for each species in the Ornithological Baseline and Impact Assessment (Appendix 10.1 of the Environmental Statement) and this should be used in conjunction with the summarised information presented here to further inform any possible future Habitats Regulations Appraisal.

6 SCREENING ASSESSMENT

Whooper swan		Loch of Strathbeg
Population	SPA	203 individuals representing up to 3.7% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6)
	Recent population	333 individuals
Data	Aerial surveys	None
	Boat based (WF)	No sightings
	VP Surveys (Abdn Bay)	No sightings
	Radar	Five at Drums 28 October 2005.
Impact	Collision risk	One sighting of five birds below 20 m. Whooper swans are known to fly at turbine height.
	Displacement	No
	Barrier effect	Unknown
Evidence base	Site specific	Very few whooper swans recorded at proposed EOWDC
	Generic	Good data on flight height and direction from tagging studies (e.g. Griffen, Rees & Hughes 2010)
Evidence of potential impact	No	No evidence from existing wind farms of impacts but there is recognised to be potential risk of collisions.
Potential to assess	Yes	
Risk	Low	Very few recorded sightings at proposed location.
Further assessment	**No**	

Pink-footed goose		Ythan Estuary, Sands of Forvie and Meikle Loch	Montrose Basin	Loch of Strathbeg	Firth of Forth	Forth of Tay & Eden
Population	SPA	17,213 ind	31,622 ind	39,924 ind	12,400 ind	3,769
	Recent population	16,300 (07/08)	*c.*38,911 (08/09)	53,454 (08/09)	3,220 (08/09)	2,704 (08/09)
Data	Aerial surveys	No data				
	Boat based (WF)	No definite sightings				
	VP Surveys (Abdn Bay)	5.8 (birds per hour Oct – Mar 2006). A total of 646 were recorded from all sites Oct – Mar 08.				
	Radar	858 at Drums. Four sightings of 102 birds between 11 & 26th April 2007; 90 in April 2010.				
Impact	Collision risk	Flight height – of the 858 recorded at Drums, all were flying between 44 m and 60 m in October 2008. 90 birds in April 2007 were below 30 m.				
	Displacement	No				
	Barrier effect	Geese fly over or around wind farms.				
Evidence base	Site specific	Little evidence of significant usage of the site. Radar data has not recorded significant geese movements in April or October. Between half and 100% were recorded flying above 25 m.				
	Generic	Flight height data from R1 & R2 wind farms. Collision Risk Modelling, PVA by SNH and DECC				
Evidence of potential impact	No	No evidence of any impact on Geese species from either onshore or offshore wind farms. Barrow Offshore Wind Farm recorded avoidance behaviour (Petterson 2005; Petersen *et al.* 2006; Jensen 2006; BOW 2007)				
Potential to assess	Yes					
Risk	Low	Site specific data is limited but indicated high proportion at turbine height. Published data from other constructed wind farms indicating a very high avoidance rate and no impacts recorded.				
Further assessment	**Yes**					

Greylag goose		Loch of Skene	Montrose Basin	Firth of Tay & Eden Estuary	Loch of Strathbeg
Population	SPA	10,840 (5 year peak mean 1991/2 - 1995/6)	1,080	1,200	3,325
	Recent population	790 (2010). 5 year peak mean of 2,555 (03 – 08)	2,519 (Jan 2011)	2,640 08/09	580 (2007)
Data	Aerial surveys	No data			
	Boat based (WF)	No sightings			
	VP Surveys (Abdn Bay)	Peak average of 0.5 birds per hour (Oct 06 – Mar 07)			
	Radar	None reported			
Impact	Collision risk	Geese are very good at avoiding wind farms.			
	Displacement	No			
	Barrier effect	Geese fly either around or over wind farms. Minor barrier effect.			
Evidence base	Site specific	Few records with none from radar or boat based surveys.			
	Generic	Evidence that geese, including greylag geese, avoid wind turbines (e.g. Petterson 2005; Petersen *et al.* 2006; Jensen 2006; BOW 2007).			
Evidence of potential impact	No	No offshore wind farms have been shown to impact on geese.			
Potential to assess	Yes				
Risk	Low	Very few recorded sightings of greylag goose during either onshore or offshore surveys.			
Further assessment	**No**				

Barnacle goose		Loch of Strathbeg
Population	SPA	Article 4.2 - Waterfowl assemblage of at least 20,000 - Recorded as for all species as 95,000 individuals
	Recent population	121 (2008); 5 year peak mean 733 (03 – 08)
Data	Aerial surveys	No data
	Boat based (WF)	No sightings
	VP Surveys (Abdn Bay)	46 passed Balmedie (Oct 07 – Mar 08). 1,820 between April & September 2006
	Radar	281 observed at Easter Hatton. Mean flock size of 56.
Impact	Collision risk	All 281 observed barnacle geese were below 30 m in height.
	Displacement	No
	Barrier effect	Geese are known to fly around or over or between turbines.
Evidence base	Site specific	Evidence of passage occurring. Some data on flight heights.
	Generic	Data from Kalmar Sound and other offshore wind farms indicated high avoidance rates (e.g. Petterson 2005; Petersen *et al.* 2006; Jensen 2006; BOW 2007).
Evidence of potential impact	No	Geese have a very high avoidance rate. Relatively low numbers recorded at proposed EOWDC location.
Potential to assess	Yes	
Risk	Low	Published data from other constructed wind farms indicating a very high avoidance rate and no impacts recorded.
Further assessment	**No**	

Shelduck		Montrose Basin	Firth of Forth	Firth of Tay & Eden estuary
Population	SPA	Article 4.2 - Waterfowl assemblage of at least 20,000	3,586	Article 4.2 - Waterfowl assemblage of at least 20,000
	Recent population	988 (08/09)	3,166 (08/09)	1,114
Data	Aerial surveys	No data		
	Boat based (WF)	No Records		
	VP Surveys (Abdn Bay)	1 – 2 May 2007, Jan and March 2008,		
	Radar	No records		
Impact	Collision risk	Very low		
	Displacement	No		
	Barrier effect	No		
Evidence base	Site specific	Very few sightings		
	Generic	Wildfowl tend to fly around wind farms (Petterson 2005; Petersen *et al.* 2006).		
Evidence of potential impact	No	No evidence from existing wind farms of any impact on shelduck		
Potential to assess	Yes			
Risk	Low	Very low numbers recorded in proposed EWODC area. No evidence from other offshore wind farms of any impacts on shelduck.		
Further assessment	**No**			

Teal		Loch of Strathbeg
Population	SPA	Article 4.2 - Waterfowl assemblage of at least 20,000
	Recent population	504 (2007)
Data	Aerial surveys	No data
	Boat based (WF)	Two individuals
	VP Surveys (Abdn Bay)	27 pass Blackdog (Oct 07 – Mar 08)
	Radar	No records
Impact	Collision risk	One of the two teal recorded was between 25 – 200 metres
	Displacement	No
	Barrier effect	No
Evidence base	Site specific	Very few sightings
	Generic	Wildfowl tend to fly around wind farms (e.g. Petterson 2005; Petersen *et al.* 2006).
Evidence of potential impact	No	No evidence from existing wind farms of any impact on teal.
Potential to assess	Yes	
Risk	Low	Very low numbers recorded at proposed EOWDC area. No evidence from other offshore wind farms of any impacts on teal.
Further assessment	**No**	

Wigeon		Montrose Basin	Firth of Forth
Population	SPA	Article 4.2 - Waterfowl assemblage of at least 20,000	2,139
	Recent population	3,944 (08/09)	-
Data	Aerial surveys	No data	
	Boat based (WF)	1 April 2008	
	VP Surveys (Abdn Bay)	13 in March 2008	
	Radar	No data	
Impact	Collision risk	Very low	
	Displacement	No	
	Barrier effect	No	
Evidence base	Site specific	Very few sightings	
	Generic	Wildfowl tend to fly around wind farms (e.g. Petterson 2005; Petersen *et al.* 2006).	
Evidence of potential impact	No	No evidence from existing wind farms of any impact on wigeon.	
Potential to assess	Yes		
Risk	Low	Very low numbers recorded at proposed development area. No evidence from other offshore wind farms of any impacts on wigeon.	
Further assessment	**No**		

Common eider		Ythan Estuary, Sands of Forvie and Meikle Loch	Montrose Basin	Firth of Forth	Firth of Tay and Eden
Population	SPA	Article 4.2.	Article 4.2.	9,400	Article 4.2
	Recent population	3,688	1,983 (July 2010)	5,188	4,378
Data	Aerial surveys	JNCC data for Winter surveys in 2003, Dec 2005, Jan 2006 & May 2006 & summer surveys in 2006 both showed that extensive near-shore usage in waters <20 m. Peak count of 283 in May 2006.			
	Boat based (WF)	A total of 14 eider were recorded in the wind farm area from Feb 2007 – Mar 2008. With a max of 5 in April 2007. In the control area a total of 68 were recorded with a maximum of 26 in October 2007. Maximum counts of between 400 – 500 birds in August and September			
	VP Surveys (Abdn Bay)	877 recorded during VP surveys Oct 2007 to Mar 2008. An average of 8.1 per hour			
	Radar	Peak count of 680 common eider recorded October 2005, 0 – 4,000 m from shore.			
Impact	Collision risk	October 2005 – maximum flight height of 10 m from 680 sightings. All 835 in April 2007 were below 30 m. 98% of VP sightings were below 30 m.			
	Displacement	May be temporary displacement during construction but wind farm predominantly in waters > 20 m. Tuno Knob identified initial displacement followed by birds entering the wind farm.			
	Barrier effect	Evidence from Denmark and Sweden clearly indicate that common eider fly over or around wind turbines (e.g. Petterson 2005; Petersen *et al*. 2006).			
Evidence base	Site specific	The majority of common eider are within 500 m of the shore (>500 out 835 April 2007).			
	Generic	Flight height data from Denmark and Sweden shows common eiders fly predominantly below turbine height with very low collision risk. Evidence of barrier effect as common eider fly around turbines.			
Evidence of potential impact	Yes	Possible evidence of short-term displacement. No evidence of collision risk. Potential barrier effect.			
Potential to assess	Yes				
Risk	Low	Relatively few common eider recorded within proposed EOWDC area and evidence of very low collision risk. Possible displacement may occur.			
Further assessment	**Yes**	Due to significant numbers in wider area.			

Fulmar		Buchan Ness to Collieston Coast	Fowlsheugh	Forth Islands	Troup Pennan and Lion Head
Population	SPA	Article 4.2 - Waterfowl assemblage of at least 20,000	Article 4.2 - Waterfowl assemblage of at least 20,000.	Article 4.2 - Waterfowl assemblage of at least 20,000.	Article 4.2 - Waterfowl assemblage of at least 20,000.
	Recent population	1,370	246	Isle of May – 358 (2009 Bass Rock – 44 (2009)	636 (2007)
Data	Aerial surveys	No data			
	Boat based (WF)	In the wind farm peak count of 16 (Feb 2007). In the control area up to 45 peak count Dec 07.			
	VP Surveys (Aberdeen Bay)	Peak average of 9.5 birds per hour (Apr – Sep 2006).			
	Radar	Not reported.			
Impact	Collision risk	All 84 recorded sightings were below 15 m.			
	Displacement	No evidence of displacement.			
	Barrier effect	No data.			
Evidence base	Site specific	Eighteen months of boat data some flight height data available.			
	Generic	Few sightings from SNS wind farms showing no evidence of an effect.			
Evidence of potential impact	No	Relatively few records of fulmar at constructed offshore wind farms.			
Potential to assess	Yes				
Risk	Low	Low risk of collision due to low flight heights and relatively low numbers in the wind farm area.			
Further assessment	**No**				

Gannet		Forth Islands	Fair Isle
Population	SPA	34,400 pairs representing at least 13.1% of the breeding North Atlantic population (Count, as at 1994	1,166 nests
	Recent population	51,647 prs	3,582 (2009) nests
Data	Aerial surveys	No data	
	Boat based (WF)	In wind farm peak count 47 (August); 67 In the control area peak count was in August.	
	VP Surveys (Abdn Bay)	Peak of 120 birds per hour (July 2007).	
	Radar	110 recorded by radar in spring 2005. Peak numbers 3.0 km and 5 km from shore. 633 gannets were recorded in autumn 2007, most between 1.5 and 3.0 km from shore.	
Impact	Collision risk	17% of 347 recorded flights were between 25 m and 200 m; Up to 73% were >25 m at Drums (Oct 07 – Mar 08). Maximum height recorded using radar is 30 m.	
	Displacement	No	
	Barrier effect	Birds may fly around the wind farm.	
Evidence base	Site specific	Some boat based survey data.	
	Generic	Evidence of displacement from Horns Rev Offshore Wind Farm.	
Evidence of potential impact	Yes	Possible collision risk.	
Potential to assess	Yes	Based on flight height data and distribution.	
Risk	Medium	Frequently recorded and at rotor height.	
Further assessment	**Yes**		

Cormorant		Forth Islands
Population	SPA	200 prs - Article 4.2 - Waterfowl assemblage of at least 20,000
	Recent population	198 pairs
Data	Aerial surveys	No data
	Boat based (WF)	Peak of 17 in the wind farm area during October 2007; 20 in the control area during September 2007.
	VP Surveys (Abdn Bay)	Peak average of 4.2 birds per hour (Apr 06 – Sept 06)
	Radar	96 recorded during October 2005
Impact	Collision risk	All sightings from boat based surveys were below 25 m. 89 % of all flights at Nysted Offshore Wind Farm were below turbine height.
	Displacement	None reported
	Barrier effect	None reported
Evidence base	Site specific	Boat based data demonstrating birds are in water depths of <20 m.
	Generic	Evidence indicates very low collision risk and no displacement (Zucco *et al*. 2006).
Evidence of potential impact	No	None reported from offshore wind farms.
Potential to assess	Yes	
Risk	Low	Birds outwith wind farm area and low collision risk.
Further assessment	**No**	

European shag		Buchan Ness to Collieston Coast	Forth Islands
Population	SPA	Article 4.2 - Waterfowl assemblage of at least 20,000	2,887 pairs
	Recent population	331 (2007)	Isle of May – 465 (2009) Bass Rock – 15 (2009)
Data	Aerial surveys	No	
	Boat based (WF)	A total of 14 birds in total. *c* 5 within wind farm area	
	VP Surveys (Abdn Bay)	Peak of 3 birds per hour during April 2007 and an average peak of 0.9 birds per hour (Oct 06 – Mar 07).	
	Radar	14 records of 10 observations (spring 2007).	
Impact	Collision risk	No recorded flights above 25 m.	
	Displacement	Birds have been recorded near or in wind farms.	
	Barrier effect	Possible, due to regular flight movements. Not known if there is a barrier effect.	
Evidence base	Site specific	Few sightings, all near shore.	
	Generic	Uncommon at offshore wind farms. Little evidence available.	
Evidence of potential impact	No	Possible displacement or barrier.	
Potential to assess	Yes		
Risk	Low	Very low risk of collision and little or no evidence of displacement or barrier effects.	
Further assessment	**No**	Few sightings, nearshore low flying and no evidence of displacement.	

Oystercatcher		Montrose Basin
Population	SPA	Article 4.2 - Waterfowl assemblage of at least 20,000
	Recent population	1,766 (Feb 2010)
Data	Aerial surveys	No data
	Boat based (WF)	None recorded
	VP Surveys (Abdn Bay)	Up to 190 birds recorded during summer 2007. Peak movements along the coast of 3.1 birds/hr at the Don Mouth during the winter of 2006 & 2007.
	Radar	None
Impact	Collision risk	Few data available on flight heights. No evidence of concentrations or commuting routes across wind farm.
	Displacement	No
	Barrier effect	Waders have been recorded flying around wind farms.
Evidence base	Site specific	Little evidence of any usage of the site.
	Generic	Few nearshore wind farms have recorded oystercatcher behaviour and flight heights.
Evidence of potential impact	No	
Potential to assess	Yes	
Risk	Low	No evidence of any usage of the site or evidence of any regular passage.
Further assessment	**No**	

Lapwing		Ythan Estuary, Sands of Forvie and Meikle Loch
Population	SPA	Article 4.2 - Waterfowl assemblage of at least 20,000 - Recorded as a total of all species as 51,265
	Recent population	Peak numbers in Ythan in August with maximum of 6,269 in August 2006.
Data	Aerial surveys	No data
	Boat based (WF)	None recorded
	VP Surveys (Abdn Bay)	None recorded offshore.
	Radar	680 lapwing recorded October 2005. 835 birds in April 2007, 0 – 4.0 km from shore
Impact	Collision risk	Possible risk of collision. No evidence of any significant usage of the site.
	Displacement	No
	Barrier effect	May have barrier effect.
Evidence base	Site specific	Little evidence of any impacts to lapwing from offshore wind farms. Few records from Kalmar sound.
	Generic	Flight height data from Denmark and Sweden. Evidence of barrier effect.
Evidence of potential impact	No	Possible evidence of short-term displacement. No evidence of collision risk. Potential barrier effect. Few records from other offshore wind farms show majority fly below turbine height.
Potential to assess	Yes	
Risk	Low	Due to low numbers present offshore and those recorded from onshore being at Drums to the north of the proposed development and therefore at no risk of collision to and from the Ythan Estuary SPA.
Further assessment	**No**	

Redshank		Ythan Estuary, Sands of Forvie and Meikle Loch	Montrose Basin	Firth of Forth	Firth of Tay & Eden Estuary
Population	SPA	Article 4.2 - Waterfowl assemblage of at least 20,000 - Recorded as for all species as 51,265 individuals	Article 4.2 - Waterfowl assemblage of at least 20,000 ind.	Waterfowl assemblage	Waterfowl assemblage
	Recent population	1,497 in 2008; 5 year peak mean of 2,216 between 03 - 08	1,951 (Nov 2010)	5,111	1,162
Data	Aerial surveys	No data			
	Boat based (WF)	None recorded			
	VP Surveys (AbdnBay)	A total of 11 birds at the Donmouth (Oct 2007 – Mar 2008). Peak of 7 in Nov 2007.			
	Radar	None			
Impact	Collision risk	Few data available on flight heights. No evidence of concentrations or commuting routes across wind farm.			
	Displacement	No			
	Barrier effect	Waders have been recorded flying around wind farms.			
Evidence base	Site specific	Little evidence of any usage of the site.			
	Generic	Few nearshore wind farms have recorded redshank behaviour and flight heights.			
Evidence of potential impact	No				
Potential to assess	Yes				
Risk	Low	No evidence of any usage of the site or evidence of any regular passage. Very small numbers recorded.			
Further assessment	**No**				

Lesser black-backed gull		Forth Islands
Population	SPA	2,920 pairs representing at least 2.4% of the breeding Western Europe/Mediterranean/Western Africa population (Count, as at 1994)
	Recent population	2,779 apparently occupied nests
Data	Aerial surveys	No
	Boat based (WF)	Only two sightings in the wind farm area during June.
	VP Surveys (Abdn Bay)	Peak average of 2 birds per hour (Apr 06 – Sept 06).
	Radar	None reported.
Impact	Collision risk	Birds regularly fly at turbine height. Extensive data from other offshore wind farms.
	Displacement	No
	Barrier effect	No
Evidence base	Site specific	Small number of sightings.
	Generic	Data from other offshore wind farms.
Evidence of potential impact	Yes	Collision risk.
Potential to assess	Yes	
Risk	Low	Small numbers of gulls recorded in the area.
Further assessment	**No**	

Herring gull		Buchan Ness to Collieston Coast	Fowlsheugh	Forth Islands
Population	SPA	Article 4.2 - Waterfowl assemblage of at least 20,000	Article 4.2 - Waterfowl assemblage of at least 20,000	Article 4.2 - Waterfowl assemblage of at least 20,000
	Recent population	3,079 AoN (2007)	122 AoN (2008)	Isle of May 2,962 (2008) Bass Rock 169 (2004)
Data	Aerial surveys	No data		
	Boat based (WF)	Up to 456 July 2007; 417 June 2007 within wind farm survey area. Considerably fewer during other months.		
	VP Surveys (Aberdeen Bay)	7,737 herring gulls recorded between Oct 07 and Mar 08 with a peak average of 54 birds per hour (Oct 06 -Mar 07).		
	Radar	Gull sp only recorded. >10,000 recordings but no distance or height measurements		
Impact	Collision risk	>30% between 25m and 200m from boat based studies. >60% were between 30 & 150 metre flight height from VP studies.		
	Displacement	No evidence for displacement may be an attraction.		
	Barrier effect	No evidence of a barrier effect.		
Evidence base	Site specific	Eighteen months of boat based survey data.		
	Generic	Herring gulls frequently fly at rotor height but evidence indicates they have relatively high avoidance rates.		
Evidence of potential impact	Yes	Collision risk.		
Potential to assess	Yes	A common species at many offshore wind farms. Good flight height data.		
Risk	Medium	Frequently recorded within wind farm area at rotor height.		
Further assessment	**Yes**			

Kittiwake		Buchan Ness to Collieston Coast	Fowlsheugh	Forth Islands	Troup Pennan & Lion's Heads
Population	SPA	Article 4.2 - Waterfowl assemblage of at least 20,000	Article 4.2 - Waterfowl assemblage of at least 20,000	Article 4.2 - Waterfowl assemblage of at least 20,000	Article 4.2 - Waterfowl assemblage of at least 20,000
	Recent population	12,542 AoN [1] (2007)	11,140 prs in 2006	3,354 on Isle of May in 2008	14,896 AoN
Data	Aerial surveys	No data			
	Boat based (WF)	Maximum of 1,676 in July 2007 in WF and 663 in control area in July 2007.			
	VP Surveys (Abdn Bay)	Average of up 70 birds per hour Summer 2006. 1 per hour from October to March 2007.			
	Radar	None reported			
Impact	Collision risk	40% above 25 m.			
	Displacement	No			
	Barrier effect	No - Gulls tend not to avoid flying through wind farms.			
Evidence base	Site specific	Extensive usage of Aberdeen Bay but low usage of the site. Flight heights recorded.			
	Generic	Some evidence available from other sites.			
Evidence of impact	No	Possible collision risk.			
Potential to assess	Yes				
Risk	Low	Site regularly used. Potential risk of collision. Possible displacement.			
Further assessment	**Yes**				

[1] AoN = Apparently Occupied Nests

Little tern		Ythan Estuary, Sands of Forvie and Meikle Loch	Firth of Tay and Eden Estuary
Population	SPA	41 pairs	25 pairs
	Recent population	21 (2008) 36 (2009)	0 pairs
Data	Aerial surveys	None	
	Boat based (WF)	0	
	VP Surveys (Abdn Bay)	0.1 (birds per hour)	
Impact source	Collision risk	Flight height – 3 - 8 m at Scroby Sands Offshore Wind Farm.	
	Displacement	There is no evidence of displacement of little terns.	
Evidence base	Site specific	No little terns recorded within wind farm location.	
	Generic	Scroby Sands Offshore Wind Farm monitoring report (ECON 2006; ECON 2008).	
Evidence of potential impact	No	Possible collision risk but none reported from Scroby Sands Offshore Wind Farm (e.g. ECON 2006)	
Potential to assess	Yes		
Risk	Low	None recorded within wind farm location. Evidence from other sites show low flight height and low likelihood of foraging offshore. Although possible evidence of prey displacement (ECON 2006; ECON 2008)	
Further assessment	**Yes**		

Sandwich tern		Ythan Estuary, Sands of Forvie and Meikle Loch	Loch of Strathbeg	Forth Islands	Firth of Forth
Population	SPA	600 pairs	530 pairs	22 pairs	1,617 ind (passage)
	Recent population	0 (1993 & 1994) peak of 1,802 pairs in 1987; mean 517pairs over 20 years. 645 AoN 2009	0 – No breeding since 2000. 1 pr in 2010	0 in 2007	-
Data	Aerial surveys	No data			
	Boat based (WF)	43 birds between May & July 2007			
	VP Surveys (Abdn Bay)	Up to 300 birds per hour in August 2007			
Impact	Collision risk	Flight height –all recorded flights below 25 m, 16 were between 15 & 25 m.			
	Displacement	Little evidence that Sandwich terns avoid flying through wind farms (e.g. Evaraert & Stienen 2006).			
Evidence base	Site specific	Boat based data indicates low usage of the site compared to elsewhere. 4% of flights at rotor height from boat based surveys. Vantage Point surveys recorded 44% of flight heights at rotor height Nearly all sightings in waters of *c* 10 m and less than 20 m.			
	Generic	Flight height data available from Humber, Kentish Flats, Sheringham Shoal, London Array, Docking Shoal, Race Bank Offshore Wind Farms. Collision risk data from Zeebrugge Offshore Wind Farm. Overall 12% recorded at rotor height			
Evidence of potential impact	Yes	Although site specific data indicates predominantly low flight heights below probable turbine height, data from other wind farms identify potential collision risk.			
Potential to assess	Yes				
Risk	Medium	Based on site specific data the risk is low but data from elsewhere identify probable collision risk.			
Further assessment	**Yes**				

Common tern		Ythan Estuary, Sands of Forvie and Meikle Loch	Forth Islands
Population	SPA population	265 prs	800 prs
	Recent data	6 (2004), 0 (2005), 6 (2006),	378 AoN
Data	Aerial surveys	None	
	Boat based (WF)	55 peak monthly count (July 2007).	
	VP Surveys (Abdn Bay)	16.7 (birds per hr)	
	Radar surveys	14 common terns at Blackdog in April 2007.	
Impact source	Collision risk	Flight height – 14% above 25 m. Up to 23 % between 15 m and 25 m. Other wind farms reported 11% at rotor height.	
	Displacement	Common terns are not known to be displaced	
Evidence base	Site specific	All sightings within the wind farm footprint are in waters of <20 m. To the north they occur further offshore. 21 common terns were recorded 'on the sea' in the wind farm area during July 2007.	
	Generic	Flight heights available at Humber, Kentish Flats, Sheringham Shoal, London Array Offshore Wind Farms.	
Evidence of potential impact	Yes	Collision risk data from Zeebrugge indicates potential collision risk (e.g. Evaraert & Stienen 2006).	
Potential to assess	Yes		
Risk	Medium	Relatively high numbers recorded in wider wind farm area. However evidence shows that majority fly below turbine heights.	
Further assessment	**Yes**		

Arctic tern		Forth Islands
Population	SPA population	540 prs
	Recent data	908 prs
Data	Aerial surveys	None
	Boat based (WF)	3 Arctic terns in July 2007
	VP Surveys (Abdn Bay)	Peak of 150 birds per hour at Drums July 2008, In 2007 a peak of 10 birds per hour
	Radar surveys	None recorded
Impact source	Collision risk	Flight height – none above 25 m. Elsewhere 24% recorded at rotor height
	Displacement	Arctic terns are not known to be displaced
Evidence base	Site specific	Few sightings within proposed EOWDC area. The majority of sightings to the north.
	Generic	Flight heights available at Humber, Kentish Flats, Sheringham Shoal, London Array Offshore Wind Farms. 24% reported as being at rotor height.
Evidence of potential impact	Yes	Collision risk data from Zeebrugge indicates potential collision risk for Terns (e.g. Evaraert & Stienen 2006).
Potential to assess	Yes	
Risk	Low	Low numbers recorded and relevant SPA 124 km away
Further assessment	No	

Guillemot		Buchan Ness to Collieston Coast	Fowlsheugh	Troup, Pennan and Lion's head	Forth Islands
Population	SPA	Article 4.2	Article 4.2	Article 4.2	Article 4.
	Recent population	19,296 ind. in 2007	50,566 ind. in 2009	16,325 ind. in 2007	2,550 individuals in 2009
Data	Aerial surveys	No			
	Boat based (WF)	Maximum of 1,165 in July 2007 in EOWDC and 2,419 in control area (July 2007). Widespread.			
	VP Surveys (Abdn Bay)	Up to 250 birds per hour in March 2007; Average of 59 birds per hour (Apr 2006 – Sept 2006). Ave of 24 per hour (Oct 2006 – Mar 2007).			
	Radar	259 sightings in 2005. Peak numbers between 4 km & 4.5 km during the spring and 2.0 – 2.5 km during autumn.			
Impact	Collision risk	One out of 243 recorded flights was above 25 m. VP surveys – 98 % below 30 m (Oct – Mar 08).			
	Displacement	Possible. No significant effect reported from North Hoyle Offshore Wind Farm or Kentish Flats (Gill *et al*. 2008). Reported increase in avoidance at Horns Rev Offshore Wind Farm.			
	Barrier effect	Some evidence that guillemots detour.			
Evidence base	Site specific	Extensive usage of the site. No specific concentrations recorded in the site.			
	Generic	Evidence from Horns Rev and North Hoyle Offshore Wind Farm.			
Evidence of potential impact	Yes	Low risk of collision. Possible displacement.			
Potential to assess	Yes				
Risk	Low	Extensive usage of the site, possible evidence of displacement.			
Further assessment	**Yes**				

Razorbill		Buchan Ness to Collieston Coast	Fowlsheugh	Troup, Pennan & Lion's Heads	Forth Islands
Population	SPA	Article 4.2 - Waterfowl assemblage of at least 20,000	Article 4.2 - Waterfowl assemblage of at least 20,000	Article 4.2 - Waterfowl assemblage of at least 20,000	Article 4.2 - Waterfowl assemblage of at least 20,000
	Recent population	4,179 individuals in 2007	4,632 individuals in 2009	3,216 Ind	3,464 individuals in 2008
Data	Aerial surveys	No			
	Boat based (WF)	Peak count in wind farm area of 273 in August 2007; 112 in Nov 2007. Up to 378 in control area (August 2007)			
	VP Surveys (Abdn Bay)	Peak average of 1.5 birds per hour (Oct 06 – Mar 07); Peak of seven birds per hour in March 2006			
	Radar	Yes but data combined with guillemot.			
Impact	Collision risk	132 recorded flights all below 25 m.			
	Displacement	Possible			
	Barrier effect	Possible depending on flight line.			
Evidence base	Site specific	Boat based and VP data			
	Generic	Limited data from other offshore wind farms.			
Evidence of potential impact	Yes	No evidence of collision risk but possible displacement effect.			
Potential to assess	Yes				
Risk	Low	Relatively small numbers of birds widely distributed.			
Further assessment	**Yes**				

Puffin		Forth Islands
Population	SPA	21,000 pairs representing at least 2.3% of the breeding population (Count, as at 1992).
Data	Recent population	56,867 apparently occupied nests in 2009.
	Aerial surveys	None
Data	Boat based (WF)	In the wind farm area a peak count of 221 during August 2007 and 285 in the control area during September 2007. Most sightings were in water depths of greater than 20 metres.
	VP Surveys (Abdn Bay)	Peak average of 0.3 birds per hour (Apr 06 – Sept 06).
	Radar	One recorded in October 2005
Impact	Collision risk	Low
	Displacement	Possible – most sightings were in water depths of greater than 20 m.
	Barrier effect	Low
Evidence base	Site specific	One year of boat based data.
	Generic	None
Evidence of potential impact	No	Puffins have not been a species regularly recorded at offshore wind farms.
Potential to assess	Yes	
Risk	Low	Nearest SPA 124 km away. Relatively low numbers recorded and potential small area of displacement
Further assessment	No	

7 SPECIES ASSESSMENTS

Pink-footed goose

Pink-footed goose is a qualifying species for the Ythan Estuary, Sands of Forvie & Miekle Loch SPA, Loch of Strathbeg SPA and the Montrose Basin SPA. Further to the south it is also a qualifying species for Firth of Forth and Firth of Tay & Eden SPAs.

The Conservation Objectives for the SPAs are:

To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and

To ensure for the qualifying species that the following are maintained in the long term:

- *Population of the species as a viable component of the site.*
- *Distribution of the species within site.*
- *Distribution and extent of habitats supporting the species.*
- *Structure, function and supporting processes of habitats supporting the species.*
- *No significant disturbance of the species.*

Birds arrive from their breeding grounds in Iceland to North-east Scotland during September and October and the Loch of Strathbeg and the Miekle Loch are important roosting sites for the species. Pink-footed geese exhibit a high degree of site loyalty with up to 76 % of geese returning to the same roost between winters (Mitchell & Hearn 2004), although they can move in variable numbers to other wintering sites, e.g. in 2010 arriving autumn geese moved onwards to the Montrose Basin SPA where record numbers of approximately 65,000 were recorded. Following their arrival the majority of pink-footed geese continue south-west to Lancashire and then overland to Norfolk wintering in all three areas. Spring migration is more prolonged with peak numbers during the spring occurring during April.

The UK population of pink-footed geese has increased considerably since the 1950's with a UK wintering population of 302,774 in 2006 (WWT 2007). Peak numbers of pink-footed geese in North-east Scotland occur in October with a five year mean peak between 2003 and 2008 at the Loch of Strathbeg of 55,153 and a similar mean count of 15,515 on Meikle Loch (Holt *et al.* 2009).

7.1.1 Evidence of site usage

There have been no definite sightings of pink-footed geese within the proposed EOWDC area from boat based surveys, although a flock of 180 geese sp. were recorded from boat surveys in November 2007 may have been this species. Vantage Point (VP) surveys have recorded a total of 646 pink-footed geese and from radar studies a total of 858 individuals. Over half the geese were reported to be flying at rotor height, i.e. >25 m.

The coastal waters of Aberdeen Bay are therefore regularly used by pink-footed geese but in relatively lower numbers compared to onshore sites.

7.1.2 Evidence of potential impact

Evidence from data obtained for other offshore wind farms indicate that pink-footed geese regularly fly at rotor height. Observations from Walney Bird Observatory during 2005 and 2007 recorded between 33% and 58% of all sightings above 25 m. Further observations off

Lincolnshire recorded between 37% and 74% of pink-footed geese flying at rotor height. Consequently, pink footed geese could be at risk of collision.

Although studies undertaken in Sweden and Denmark do show Geese flying around wind turbines, there is no evidence that there will be any significant displacement or barrier effects (Petterson 2005).

7.1.3 Evidence of collision risk

Collision risk modelling has been undertaken based on a number of highly precautionary assumptions.

1. The total number of pink-footed geese passing through North-east Scotland each autumn is 340,000. This is based on the entire UK wintering population occurring in North-east Scotland, which is not thought to be the case, as some but an unknown number of geese will arrive directly into the north-west England from their breeding grounds in Iceland (WWT 2007).
2. All pink-footed geese migrate south across a front of up to 5 km offshore and 5 km inland and therefore over a 10 km wide front. The maximum width of the proposed development is 3.6 km and therefore intercepts 36% of the potential flight path. This is precautionary as site specific data indicates that the majority of geese fly within 1 km from shore and therefore do not interact with potential development. Furthermore ringing results indicate that a significant proportion of pink-footed geese fly south-west to north-west England which would lead them overland away from the proposed EOWDC. However, for the purposes of the collision risk modelling it assumed that 36% of the UK wintering population of pink-footed geese cross the proposed development area, i.e. 122,400 birds and that they pass through the site each autumn and spring, i.e. a total passage of 244,800 birds per year.
3. Those that do fly across the development area, 46% do so at turbine height and that there is no far field avoidance.
4. The same rate of passage occurs during the spring as it does during the autumn is also very precautionary as the numbers of pink-footed geese in the spring are always significantly lower than those in the autumn indicating that many pink-footed geese do not pass through the region during the spring migration.

Collision Risk Modelling has been undertaken on these precautionary assumptions using a range of avoidance rates: 98%, 99% and 99.5%.

Table 7-1: Number of pink-footed geese collisions at a range of avoidance rates

Collision probability	Avoidance rate (%)		
	98	99	99.5
8.4%	56	28	14

Based on the various very precautionary scenarios and using a precautionary avoidance rate of 99% as recommended by SNH, it is predicted that up to a 28 collisions per year may occur (Table 7-1).

The annual mortality rate for pink-footed goose is 13.7% (BTO 2011). Consequently, out of a population of 340,000 an annual mortality of 45,560 pink-footed geese may be predicted. Therefore, 1% of the baseline mortality is 4,556 birds per year.

Based on the results from the precautionary Collision Risk Modelling undertaken the number of pink-footed geese that may collide is lower than that which may cause concern of a potentially significant impact on pink-footed geese.

To assess whether there is the potential for an adverse effect on pink-footed geese as a qualifying species for the relevant regional SPAs the assessment is based on the 5 year peak mean counts as opposed to numbers published at the time of SPA citation as the populations of pink-footed geese have increased significantly since the SPA citations were originally made. It is also assumed that each SPA population is separate from each other and any collision impacts relate to birds only associated with that SPA.

This is unrealistic as the number of birds for which collision risk modelling has been undertaken is significantly greater than the numbers cited within site specific qualifying interests.

As the counts relate only to the autumn passage of geese the modelling is based on a similar rate of passage across each site in the spring.

Table 7-2: Predicted natural mortality rates of pink-footed geese at relevant SPAs

Site SPA	Population	Natural Mortality	1% of Natural Mortality
Ythan Estuary, Sands of Forvie and Meikle Loch	16,300	2,233	22
Loch of Strathbeg	53,454	7,323	73
Firth of Forth	3,220	441	4
Firth of Tay and Eden Estuary	2,704	370	4
Montrose Basin	38,911	5,330	53

Based on the above the results and the precautionary guidance threshold of a 1% increase in baseline mortality the results from the Collision Risk Modelling indicate that there is the potential for an adverse effect to occur should all potential collisions relate to geese associated with three of the SPAs.

Results from monitoring undertaken at constructed offshore wind farms indicate a very high level of avoidance of wind farms by Geese, including pink-footed geese. Monitoring undertaken at Barrow Offshore Wind Farm has demonstrated that the pink-footed geese flying at rotor height adjust their flight height and fly over the wind turbines. Less than 2 % remained at turbine height and those that did adjusted the flight lines to fly between the turbines. No collisions were observed (BOW 2007).

None of the 100,000 geese (brent, white-fronted and barnacle geese) recorded at Kalmar sound in Sweden collided with the Utrunden or Yttre Stengrund Wind Farms (Petterson 2005).

In total over 120,000 geese of eight species have been recorded from five constructed wind farms over a period of 12 years, during which time only one collision has been observed. The collision involved a brent goose recorded at Rønland Offshore Wind Farm in Denmark.

There is therefore strong evidence to suggest that geese, including pink-footed geese, have a very low collision risk. Furthermore the collision risk modelling is highly precautionary and the numbers predicted to collide are still relatively small compared to the population as a whole.

Further evidence to support the conclusions that the potential impacts from collision risk are minor come from Population Viability Analysis (PVA) undertaken on pink-footed geese which indicate that the pink-footed goose population may be able to withstand an increase in mortality (from whichever source) of 5,000 birds per year (Trinder *et al.* 2005). Further PVA commissioned by DECC to model the possible effects of additional mortality on the pink-footed goose population over a 25 year period indicated that there was a 2% chance of the pink-footed goose population decreasing to below 150,000 if, due to collisions, wind farms increase the annual mortality by more than 1,000 birds over and above current impacts, e.g. hunting. (Trinder 2008). Consequently, the possible additional increase in mortality of up to 28 birds per year will not cause an adverse effect..

Risk of an adverse collision effect - Low

7.1.4 Evidence of displacement

There is no evidence of any displacement effects on pink-footed geese from offshore wind farms.

Risk of an adverse displacement effect - Low

7.1.5 Evidence of barrier effect

Monitoring undertaken at Barrow Offshore Wind Farm identified pink-footed geese altering flight height to avoid the wind farm or flying between the turbines. Consequently, although pink-footed geese demonstrated avoidance behaviour there was no evidence of a significant barrier effect.

Risk of an adverse barrier effect – Low

7.1.6 Evidence of in-combination impact

There is the potential for an in-combination impact of pink-footed goose from other offshore developments that have previously been recognised as having a potential impact on pink-footed geese, particularly with respect to collision risk.

In-combination collision risk totals based on collision risk modelling are presented in Table 7-3. The collision risk modelling undertaken at the time was based on avoidance rates of 95, 99 and 99.5%. Based on an avoidance rate of 99%, a total of up to 167 pink-footed geese are predicted to be impacted from all the currently consented offshore wind farms.

Based on the total UK population of approximately 340,000 pink-footed geese and a 1% baseline mortality rate of 4,556 individuals per year the potential in-combination impacts are considered not to be adverse.

Further projects in the Firth of Forth and Moray Firth have the potential to cause an incremental increase in mortality rates. There are no data available on the likely numbers of pink-footed geese present within the proposed developments presented in Table 5-2. However, evidence from ringing indicate that the majority of pink-footed geese move south-west and are therefore unlikely to be recorded within the Firth of forth area in large numbers. However, the numbers likely to cross the Moray Firth are unknown. However, all evidence indicates that pink-footed geese avoid wind turbines and therefore it is believed that there is unlikely to be an adverse affect arising from collision risk.

Table 7-3: Predicted potential collision mortality for pink-footed geese.

Site	Avoidance rate		
	95%	**99 %**	**99.5 %**
Ormonde	77	15	8
Walney	6	1	<1
West of Duddon Sands	5	1	<1
Barrow	15	15	8
Docking Shoal		15	8
Humber Gateway		48	24
Lincs	171 - 262	34 – 52	17 – 26
Lynn & Inner Dowsing	100 - 165	20 – 33	10 – 17
Total	**374 - 530**	**149 – 167**	**69 – 85**

Risk of an adverse in-combination effect - Low

7.1.7 Conclusion

Taking into account data obtained from the proposed EOWDC and supported by published data from other sites it is concluded that the proposed EOWDC either alone or in-combination will not cause an adverse effect on the integrity of the relevant SPAs with regard to pink-footed goose.

Common eider

Common eider ducks are part of the qualifying assemblage under Article 4.2 of the Directive 2009/147/EC (codified 79/409/EEC) by regularly supporting at least 51,265 individual waterfowl (5 year peak mean 1991/2 - 1995/6) for the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, Montrose Basin SPA, Firth of Tay & Eden Estuary SPA, Firth of Forth SPA.

The Conservation Objectives for the SPAs are:

To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and

To ensure for the qualifying species that the following are maintained in the long term:

- *Population of the species as a viable component of the site.*
- *Distribution of the species within site.*
- *Distribution and extent of habitats supporting the species.*
- *Structure, function and supporting processes of habitats supporting the species.*
- *No significant disturbance of the species.*

Common eiders occur in the area throughout the year but most adults winter in the Firth of Forth and Tay estuary. First winter birds remain near the estuary (Baillie & Milne 1988). Peak numbers occur in the Ythan during May with maximum counts of up to 4,212 in 2004 and a five year peak mean of 3,333 individuals. Within Aberdeen Bay, peak counts of common eider occur in late summer when up to 6,003 were recorded in 2005 and the peak mean between 2003 and 2008 in Aberdeen Bay was 4,833. In the Montrose Basin peak counts of common eider occur during July with 1,983 in July 2010.

7.1.8 Evidence of site usage

Aberdeen Bay has the fourth largest population of common eider in the UK (Holt *et al*. 2009).

Site specific boat based surveys undertaken between February 2007 and January 2008 recorded a total of 68 individuals across both the control area and the proposed development area with a maximum of five within the wind farm area in April 2007. All but one of the sightings occurred in waters of less than 20 m. In contrast to the boat based surveys, common eider were frequently recorded from the four land based vantage point survey locations with a total of 877 recorded in flight between October 2007 and March 2008 and an overall average of 8.1 birds per hour flying past each point. Thus, indicating extensive near-shore coastal usage.

Figure 7-1 presents the eider distribution from boat based data collected between September and May. Few sightings were obtained from boat based surveys between June and September. The results indicate that eider occur infrequently within the proposed development area.

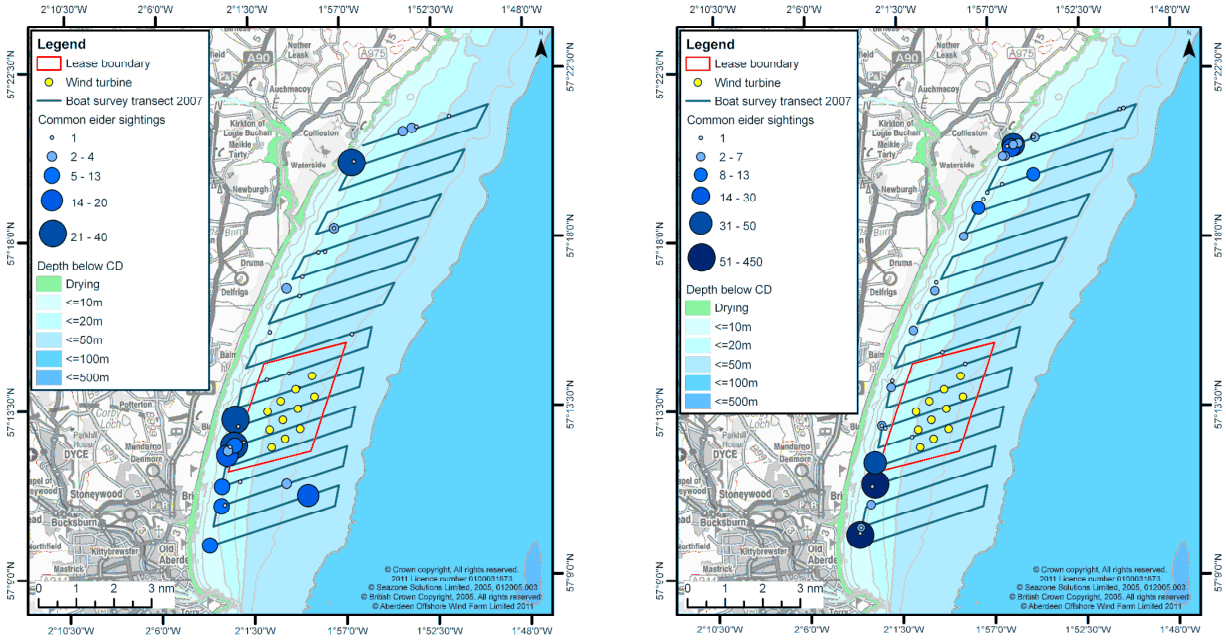

Figure 7-1: Common eider distribution in Aberdeen Bay September to May (all sightings).

Data from Denmark supports the evidence obtained from within Aberdeen Bay that common eider occur very infrequently in water depths of >20 m with less than 1 % of 36,700 records in the relatively deeper waters.

7.1.9 Evidence of collision risk

Evidence from data obtained for other offshore wind farms indicate that common eider fly predominantly below rotor height. Observations from Denmark indicate that more than 80 % of all common eider flights occur below 30 m (Kahlert *et al* 2000). Further evidence from Denmark and Sweden have demonstrated that Common eider duck have a very high avoidance rate with no collisions detected at Horns rev offshore wind farm that has an annual autumn passage of between 40,000 to 60,000 common eider per year (Petersen *et al* 2006). Similar avoidance rates were found at Kalmar Sound Offshore Wind Farm (Pettersson 2005). There is no evidence of a potential collision risk impact.

Risk of a significant effect - Low

7.1.10 Evidence of a displacement

Based on the results from the monitoring data, the worst-case scenario is that should displacement occur, that no eider will be within the proposed development area and there will be 80% displacement out to a distance of 1 km and a further 50% decrease in abundance out to 2 km from the wind farm.

Based on the peak density obtained from boat based surveys of 10.9 birds/km^2 during the winter period, should there be a total displacement of eider from within the proposed EOWDC area then it is predicted that up to 47 eider may be displaced during periods of peak density. Based on an 80% displacement out to 1 km (a total surface area of 12.3 km^2)

from the proposed development area then it is predicted that a total of 154 eider may be displaced with a further 44 out to 2 km should there be 20% displacement. Therefore, the maximum number of eider potentially displaced is up to 198 birds based on the highest densities recorded from any survey within Aberdeen Bay and at least some displacement out to 2 km.

Based on the estimated total of 198 potentially displaced eider out of a peak reported count of 3,500 eider at Blackdog, it is predicted that up to 6% of the eider within Aberdeen Bay may be displaced. However, the distribution of eider within Aberdeen Bay is clustered with peak numbers occurring at various sites across the bay during different seasons (Sohle *et al*. 2006). The area off Blackdog regularly records the peak counts of eider in Aberdeen Bay (NESBR) and should displacement occur a greater proportion of eider might be affected than is estimated using densities obtained from boat based surveys.

The Tuno Knob Offshore Wind Farm in Denmark is a relatively small wind farm of ten turbines in an area that holds up to 5,800 eider. Post-construction monitoring at Tuno Knob has indicated that the distribution of eider is closely related to their prey and although there may be some displacement immediately post-construction there is unlikely to be any significant displacement of eider from the proposed development area as long as their prey remain available (Guillemette *et al.* 1999). Evidence from studies undertaken at Nysted offshore wind farm have indicated that although there was an avoidance of the area during construction there was a subsequent increase of 48% within the wind farm area post-construction but a decrease in numbers out to 2 and 4 km (Zucco *et al.* 2006).

These two studies demonstrate that eiders do not avoid wind farms post-construction and their distribution is closely aligned to the availability of prey. The main prey items for eider are mussels (*mytilus edulus*). Evidence from constructed wind farms indicate that there is likely to be an increase in mussels around the base of turbines and that no significant impacts have been detected on mussels from the construction of wind farms. Consequently, there is unlikely to be a negative impact on prey availability for eiders within Aberdeen Bay.

Table 7-4: Calculations used to calculate potential displacement of eider

Calculations used for displacement	
Area	*Peak density of eider – 10.9 birds/km^2*
Area of EOWDC – 4.3 km^2	4.3 * 10.9 = 47
Area of EOWDC 1 km buffer – 12.3 km^2 @ 80%	(12.3 * 10.9)*0.8 = 107
Area of EOWDC 2 km buffer – 20.3 km^2 @ 20%	(20.3 * 10.9)*0.2 = 44
Total predicted displacement	47+107 + 44 = 198

7.1.11 Disturbance

Eiders may be disturbed by vessels both during the construction phase and during operations from maintenance vessels. Studies have indicated that there may be displacement from large vessels out to 1,000 m (Larsen & Laubek 2005).

During construction there may be a number of vessels operating within the area but they will likely be focussed around a single point where the turbine is being installed. Consequently, eider may be displaced from within 1 km radius of the installation; an area of 3 km^2. Based on the highest recorded density of 10.9 birds/km^2, it is therefore predicted that up to 33 eider may be displaced from the vicinity during construction. This equates to approximately 1% of the peak eider population within Aberdeen Bay based on the peak estimated figure of 3,500 individuals. The construction period will be of short duration and the impacts from construction vessels temporary. Displacement by service boats may diminish the re-population potential of the EOWDC. It is not known how many service vessels may be required but based on the scale of the proposed development there is unlikely to be frequently more than one vessel on any one occasion. The presence of the proposed development in the vicinity of the intensively used Aberdeen Harbour means that the potential increase of one vessel movement on a regular basis will not have any noticeable difference to the number of vessels already using Aberdeen Bay. Any specific displacement caused by the service or construction boats will be temporary as eiders will be able to move into the area once the vessels leave.

Risk of an adverse effect from displacement or disturbance - Low

7.1.12 Evidence of barrier effect

Evidence from Denmark and Sweden suggest that common eider fly around, rather than through, wind farms. Consequently, there will be an increase in energy expenditure. Research at the substantially larger Nysted Offshore Wind Farm comprising of 72 turbines calculated an increase of flight distance of 500 m caused by flying around the wind farm. The conclusions of the study were that such a flight would not have any adverse effect on migrating common eider.

There is no evidence of regular daily movements of eider within Aberdeen Bay to and from feeding or roosting areas. Should it occur with eider making daily movements from the Ythan Estuary to Aberdeen Bay to the south of the proposed development and the birds select to fly around the turbines up to 1 km away then they may incur an additional flight distance of up 3.2 km each way, or a total of 6.4 km. This may increase the daily energy expenditure to between 2.0 – 2.5% (Caldrow, Stillman & West 2007; Speakman, Gray & Furness 2009). This is a relatively small increase in daily energy expenditure and is unlikely to have an adverse effect on eiders in Aberdeen Bay.

The peak numbers of eider in Aberdeen Bay occur during July and August when the adult eider undergo a complete wing moult over a period of four weeks, during which time they become flightless. The daily energetic costs during this period increase but the birds remain within certain areas where they can forage and cannot undergo daily flight movements (Guillemette *et al.* 2007) Consequently, there is no incremental increase in daily energy expenditure due to the barrier effect during this period of higher energy expenditure.

Data obtained from two years of Vantage Point surveys did not detect any evidence to suggest that there are regular daily flights by eider across the proposed development area and so a regular barrier effect that may cause a long-term increase in daily energetic costs is not predicted. There is the potential for a relatively small *ad hoc* increase as birds move around the bay but as most movements are within 1 km of the coast regular barrier effects are unlikely.

Risk of a an adverse effect from barriers – Low

7.1.13 Evidence of in-combination impact

There is the potential for an in-combination effect with other shipping activities within Aberdeen Bay and the vessels associated with the proposed development. Currently there are up to 16,000 vessels per year using Aberdeen harbour and the incremental increase in vessel usage associated with the development, operation and decommissioning of the proposed EOWDC will be relatively small, particularly during the period of operation. Vessels associated with the proposed development will be no closer than 2 km from shore, the distance of the nearest turbine, and therefore unlikely to have an impact on the nearshore eider. There is no evidence of any potential in-combination effect from the proposed development and other offshore activities for common, particularly with respect to displacement/disturbance risk.

Risk of an adverse in-combination effect – Low

7.1.14 Conclusion

Taking into account data obtained from the proposed EOWDC and supported by published data from other sites it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SPAs with regard to common eider.

Gannet

Gannets occur as a qualifying species for the Forth Islands SPA with a breeding population of 44,000 pairs (Mitchell *et al.,* 2004).

The Bass Rock is approximately 130 km from the proposed EOWDC location. Data from tagged gannets at Bass Rock have recorded breeding gannets foraging up to 540 km from the colony with a mean distance of 230 km and consequently could occur within the proposed EOWDC area.

Elsewhere the nearest SPA with gannet as a qualifying species is Fair Isle which is located 260 km to the north of the proposed development. The foraging ranges from gannets from their breeding colonies means that Fair Isle and all the other SPA colonies are within range of the proposed development.

Troup Head is the closest gannetry to the proposed development located approximately 73 km to the north. This gannetry has increased in size over the last twenty years and now contains 1,810 nests (NESBR 2009). Being considerably closer than other existing colonies the Troup Head colony is likely to be the main source of gannets in Aberdeen Bay during the breeding season but gannet is not a qualifying species for the SPA and therefore not considered as part of this assessment.

7.1.15 Evidence of site usage

Gannets were recorded throughout Aberdeen Bay from boat based surveys with no areas identified as being of particular importance but with the majority of sightings in water depths of between 20 m and 50 m. Numbers of gannets recorded were lowest between November and March and highest during the breeding season from April to August when gannets were widespread throughout the area.

Boat based survey data recorded a peak count of 47 birds in the original wind farm survey area and 67 in the control area. Vantage Point surveys recorded up to 43 birds per hour between April and September 2006. The majority of sightings were greater than 1.5 km from shore with peak numbers between 3.0 and 3.5 km from the coast.

There is no evidence to suggest that the gannets recorded in Aberdeen Bay are those from either the Bass Rock or Fair Isle SPAs. However, the area is within the known foraging range of the species and it is likely that at least some of the gannets recorded are associated with the Bass Rock and other SPAs elsewhere.

7.1.16 Evidence of collision risk

Data obtained from both boat and land based observations indicate that between 18 % and 73 % of gannets fly greater than 25 m above the sea surface. Data from other UK offshore wind farm indicate a lower percentage at rotor height with between 6 % and 14 % of gannets flying greater than 20 m above sea surface. There have been relatively few constructed wind farms where gannets have been regularly recorded. Data from Horns Rev Offshore Wind Farm suggest that gannets do not fly through wind farms and therefore avoid the area. Consequently, the risk of collision is low. Out of a total of 1,144 gannets recorded at Horns Rev, no collisions were observed. Gannets have been reported as occurring within North Hoyle Offshore Wind Farm and no collisions have been reported.

Collision risk modelling undertaken for the proposed development based on a range of potential avoidance rates from 98%, 99% and 99.5% indicate that between 0.41 and 1.6 gannets per year may collide with the proposed development.

Based on the various scenarios and using a precautionary avoidance rate of 98% it is predicted that a total of 1.6 collisions per year may occur. The current SPA population in the region is 51,647 pairs.

The annual mortality rate for gannet is 8.1 % (BTO 2011). Consequently, out of a population of 51,647 pairs (103,294 adults) an annual mortality of 8,367 gannets may be predicted. Therefore, 1% of the baseline mortality is 84 birds per year, i.e. an increase in mortality rate of more than 84 birds per year caused by collisions may be considered significant.

For the two individual SPAs the increase in mortality that could cause an adverse effect is lower:

- Fair Isle SPA has a current population of 3,582 AoN (5,164 adults); therefore an annual mortality rate of 418 adults. 1% of baseline mortality is therefore 4 individuals.
- Forth Islands SPA has a current population of 51,647 AoN (103,294); therefore an annual mortality rate of 8,367 adults. 1% of baseline mortality is therefore 84 individuals.

The results from the collision risk modelling indicate that between 1 and 2 gannets per year may collide with the proposed development. This is lower than either of the baseline mortality rates used to indicate whether the potential impact is will have an adverse effect.

There is no evidence that gannets from Fair Isle occur within the region during the breeding season. Foraging activity will likely remain within the waters around Shetland and therefore it is not predicted that there will be any impact on gannets associated with the Fair Isle SPA during the breeding season.

Tagging data of birds from the Bass Rock colony indicates that they forage widely and are potentially at collision risk with the proposed development (Hamer *et al.* 2000). Based on the collision risk modelling undertaken, should all the potential collisions be of birds arising from the Bass Rock colony in the Forth SPA, 124 km away, then there will be a very small increase in the baseline mortality rate and below the level that may be of concern.

Evidence from existing offshore wind farms indicates that gannets avoid flying through wind farms and may have a significant far field avoidance rate; this behaviour will further reduce the risk of potential collision.

Consequently, based on the evidence available it is unlikely that there will be an adverse effect on gannets from either of the SPAs due to collision mortality.

Risk of an adverse effect from collision - Low

7.1.17 Evidence of displacement

Evidence from Horns Rev Offshore Wind Farm indicates that gannets will avoid entering the wind farm. Data from boat based surveys and Vantage Point surveys indicate that there are no areas of Aberdeen Bay that are preferentially used by gannets and consequently any gannets displaced from the footprint of the wind farm will be able to forage elsewhere and there is no evidence to suggest that the displacement will cause an adverse effect on

gannets using the area. Should avoidance occur, there will be a corresponding reduction in potential risk of collision.

There is the potential for displacement of prey species from the area during construction, should pile driving be undertaken. During this period it may be that gannets may be displaced from a wider area until such time their prey returns. Pile driving, should it occur, will be undertaken over a relatively short period of time and consequently the duration of potential displacement impact will also likely be relatively short and the area potentially impacted relatively small compared to the wider foraging ranges of Sandwich terns. Adult gannets are known to exhibit a great degree of flexibility in selection of prey, foraging locations and distances travelled. Consequently, they are adaptable to forage outwith the area during the period of potential impact (Hamer *et al.* 2007).

Risk of adverse effect from displacement – Low

7.1.18 Evidence of barrier effects

It is possible that the displacement of gannets from the proposed EOWDC area may cause a barrier effect. Evidence from Horns Rev Offshore Wind Farm indicates that gannets will fly around the wind farm area thus cause a potential increase in energetic costs. The predicted increase in distance travelled due to the presence of the wind farm is less than 500 m and consequently any additional increase in energetic expenditure will be negligible compared to the distance travelled to and from the breeding colonies.

Risk of an adverse effect from barrier – Low

7.1.19 Evidence of in-combination impact

The theoretical very large foraging range that gannets can fly suggest that any individual gannet may interact with a number of the proposed offshore wind farms in Scottish waters. Published data elsewhere indicates that gannets from colonies in Shetland or eastern England are unlikely to occur in Aberdeen Bay during the breeding season (Langston 2011), although they may occur during periods of passage.

Consequently, there is low potential for in-combination effects with respect to gannets from Fair Isle SPA or Bempton Cliffs SPA. However, there is evidence to suggest that the gannets from the Forth Island SPA may occur within the Aberdeen Bay area. Populations from this SPA may also interact with potential offshore wind farm developments currently proposed the Firth of Forth area, namely: Neart na Gaoithe, Inch Cape and Firth of Forth offshore wind farms. There is currently very limited information on the proposed developments as decisions on the location, scale and numbers of turbines are still to be decided. Based on the scoping reports it is currently predicted that there may be an additional 526 turbines within the Firth of Forth area (Table 7-5). Information on the use of these areas by gannets is limited with no published information currently available from on-going studies being undertaken for the proposed wind farms. It is therefore not possible to undertake an in-combination collision risk assessment based on collision risk modelling or an assessment on possible in-combination impacts arising from displacement or barrier effects.

Table 7-5: Predicted wind farms that may have an in-combination impact on gannets in the Firth of Forth

Project	Estimated no. of turbines	Area (km^2)	Predicted Application date
Inch Cape	181	151	2012
Neart Na Gaoithe	130	105	2012
Firth of Forth (phase I)	215	597	2013

There is a significant difference in scale between the proposed development and those planned elsewhere and it is a significantly greater distance from the Forth Islands SPA. Any potential incremental increase in mortality of between one and two birds per year arising from the proposed development will likely be very minor.

Collision Risk Modelling undertaken for Beatrice Offshore Wind Farm predicted a total of five gannets per year may collide with the Beatrice demonstrator project development based on a 98% avoidance rate (Talisman 2005). The additional mortality from the proposed development may increase this by one or two birds per year. There are two planned offshore wind farms within the Moray Firth that could potentially have an in-combination impact on the gannets at Troup head (Table 7-6). There is little information on the number or scale of turbines and there is no published information currently available from on-going studies being undertaken for the proposed wind farms. It is therefore not possible to undertake an in-combination collision risk assessment based on collision risk modelling or an assessment on possible in-combination effects from displacement or barrier impacts. The scale of the proposed development is significantly smaller than those proposed in the Moray Firth and consequently based on the current information on gannet distribution the scale of potential impact proportionally smaller.

Table 7-6: Predicted wind farms that may have an in-combination impact on gannets in the Moray Firth

Project	Estimated no. of turbines	Area (km^2)	Predicted Application date
Moray Firth (phase 1)	200	296	2012
Beatrice	184	131	2012

Risk of an adverse in-combination effect – Low

7.1.20 Conclusion

Taking into account data obtained from the proposed EOWDC and supported by published data from other sites it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SPAs with regard to gannet.

Herring gull

Herring gull are a qualifying species for the Buchan Ness to Collieston Coast SPA, Fowlsheugh SPA and Forth Islands SPA (Mitchell *et al.* 2004). The UK breeding population has undergone a significant decline in recent years although the exact reasons for this decline are unknown.

During the breeding season herring gulls remain largely coastal with maximum foraging ranges from the breeding colony of 54 km.

7.1.21 Evidence of site usage

The known foraging range of breeding herring gulls indicates that herring gulls from the Forth Islands SPA will not occur in Aberdeen Bay during the breeding season. Birds from Buchan Ness to Collieston SPA and Fowlsheugh SPA may use the area.

Data from boat based surveys indicate significant seasonal variability in the usage of the site. Greatest numbers occurred in the wind farm study area during June and July with a peak count of 456 birds in July 2007. Most sightings were in the south-west of the study area with relatively few within the proposed development area. Further data from vantage point counts recorded a mean peak count of 54 birds per hour passing the observation points and no significant difference in the number of birds was detected across all four vantage point sites suggesting a relatively uniform usage of the coastline across Aberdeen Bay. Herring gulls were the most frequently recorded species from vantage point surveys from between October 2006 and March 2007.

7.1.22 Evidence of potential collision risk

Herring gulls are one of the most frequently recorded species in Aberdeen Bay. The species regularly flies at the height of the turbines and shows no avoidance of wind farms, nor any displacement.

Evidence from site specific monitoring using boat based and land-based surveys and other data sources indicate that herring gulls are widespread and frequent within Aberdeen Bay and with a distinct seasonal peak during the summer months.

Results from collision risk modelling assessed the potential impact across a range of avoidance rates of between 98 and 99.5%. The results indicate that between 1.8 and 7.2 herring gulls may collide with the proposed EOWDC each year.

Based on the regional SPA population of herring gulls of 19,562 individuals, the annual mortality rate will be 2,347 individuals and therefore the 1% baseline mortality rate will be 235 birds per year. The results from the Collision Risk Modelling predict a total of up to seven herring gulls per year may collide with the turbines.

The Buchan Ness to Collieston Coast SPA lies approximately 9.5 km away from the proposed development and holds approximately 6,158 breeding herring gulls (Based on counts undertaken in 2007). The colony will therefore have an annual mortality of 739 birds. It is likely that many of herring gulls recorded within Aberdeen Bay during the breeding period are associated with this colony. The results from the collision risk modelling predict an annual mortality of 7 herring gulls per year indicating that there will not likely be an adverse effect on the population of herring gulls associated with the SPA based on the precautionary assumption that an increase of 1% above baseline mortality could be adverse,

i.e. more than 8 herring gulls a year collide with the turbines. However, the predicted mortality of 7 birds per year is close but it is based on a series of precautionary figures that assume the peak numbers recorded within the development area are constant throughout the year. It is therefore predicted that the number estimated to collide each year is precautionary as are the avoidance rates, which have been reported as being greater than 99% (Everaert & Kuijken 2007).

The Fowlsheugh SPA lies 31 km away from the proposed development and holds 122 breeding pairs of herring gull based on latest counts. Therefore, the annual mortality rate from this colony is 14 birds per year. Based on the results from the collision risk modelling it is concluded that if all the herring gulls at risk of collision are from Fowlsheugh then there is the potential for an adverse effect on the SPA population

The Forth Islands SPA is approximately 124 km away and holds 13,200 herring gulls. However, the SPA is too far away for breeding herring gulls from the SPA to occur regularly, if at all, within the proposed development area during the breeding season. Therefore, there will not be an adverse effect on the population of the Forth Islands SPA due to collision.

The collision risk modelling is based on the peak number of herring gulls recorded from any of the surveys. Whereas the number of birds present in the actual wind farm development area was lower. Consequently, the numbers used for the collision risk modelling are precautionary.

Risk of an adverse effect from collision – Low

7.1.23 Evidence of displacement

Evidence from existing offshore wind farms indicate that herring gulls may enter the wind farm. No evidence of any displacement has been recorded.

Risk of an adverse effect from displacement – Low

7.1.24 Evidence of barrier effects

There is no evidence of any barrier effect to herring gulls from offshore wind farms.

Risk of an adverse effect from barrier effects – Low

7.1.25 In-combination effects

There is a potential for an in-combination effect with herring gulls originating from the Fowlsheugh SPA with proposed plans for offshore wind farms in the Firth of Forth. There is limited information on the proposed projects and no information on the number of herring gulls present in the area. However, given the location of the proposed developments and the close proximity to coastlines that herring gulls frequent during the breeding season it is predicted that there will be relatively few herring gulls within the proposed Firth of Forth wind farm areas. Consequently, the risk of an adverse in-combination impact is predicted to be low.

7.1.26 Conclusion

Taking into account data obtained from the proposed EOWDC and supported by published data from other sites it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SPAs with regard to herring gull.

Kittiwake

Kittiwake is a qualifying species for Buchan Ness to Collieston Coast SPA, Fowlsheugh SPA Forth Islands SPA and Troup Pennan and Lion's Heads SPA as part of the waterbird assemblages under Article 4.2 of the Directive. Populations of kittiwakes at these colonies have decreased over recent years. The colony at Fowlsheugh was the largest and held 35,000 breeding pairs in 1992 but has decreased to below 12,000 pairs in 2006. The largest colony is now at Troup Pennan and Lion's Heads SPA where 14,896 pairs nest, followed by Buchan Ness to Collieston SPA that has 12,542 apparently occupied nests, i.e. 25,000 individuals.

The foraging ranges of kittiwakes from breeding colonies have been studied at the Isle of May and have indicated a maximum foraging range of 83 km. Consequently, birds from the Forth Islands will be unlikely to be foraging within the proposed development area during the breeding season. Kittiwakes from Collieston, Fowlsheugh and Troup, Pennan & Lions Heads SPA may occur within the proposed development area.

7.1.27 Evidence of site usage

Kittiwakes were recorded throughout Aberdeen Bay in highly seasonally variable numbers. During the winter periods very few kittiwakes were recorded. However during the breeding season kittiwakes were frequently recorded with estimated populations within the control area during this period of 1,676 birds and 663 birds in the proposed EOWDC development area. Peak densities of 33 birds/km^2 were recorded to the north of the proposed development during the summer months. Land-based observations also recorded peak numbers during the summer months with a peak in July. Of those for which flight height was recorded, 22% were greater than 25 m above the sea surface. The majority of sightings were between 1 – 3 km of the coast.

7.1.28 Evidence of collision risk

Collision risk modelling undertaken for the proposed EOWDC over a range of avoidance rates between 98 and 99.5% indicated that between 0.9 and 3.6 kittiwakes per year may collide.

Based on the regional SPA population of kittiwakes of 83,156 individuals, the annual mortality rate will be 4,989 individuals and therefore the 1% baseline mortality rate is 50 birds per year. The results from the collision risk modelling predict a total of four kittiwakes per year may collide with the wind turbines and therefore the proposed development will not have an adverse effect on the regional SPA population of kittwakes

The Buchan Ness to Collieston Coast SPA lies approximately 9.5 km away from the proposed development and holds approximately 25,000 breeding kittiwakes, based on the latest available counts in 2007. The colony will therefore have an annual mortality of 1,505 birds. It is likely that many of kittiwakes recorded within Aberdeen Bay during the breeding period are associated with this colony. The results from the collision risk modelling, which predict a mortality of four kittiwakes per year, indicates that there will not be an adverse effect on the population of kittiwakes associated with the SPA. This is based on the precautionary assumption that an increase of 1% above baseline mortality could be adverse, i.e. more than 15 kittiwakes a year collide with the turbines.

The Fowlsheugh SPA lies 31 km away from the proposed development and holds 11,140 breeding pairs of kittiwake based on latest counts. Therefore, the annual mortality rate from this colony is 1,337 birds per year. Based on the results from the collision risk modelling it is concluded that if all the kittiwakes at risk of collision are from Fowlsheugh then there is unlikely to be an adverse effect on the SPA population.

The Troup Pennan & Lion's Head SPA lies 74.3 km to the north of the proposed development and holds 29,792 breeding kittiwakes. The annual mortality is estimated to be 1,787 birds per year and consequently, based on a 1% of annual mortality threshold, an adverse effect on kittiwakes from this colony is not predicted.

The Forth Islands SPA is approximately 124 km to the south and holds 4,632 breeding kittiwakes. However, the maximum foraging range for kittiwakes reported is 83 km (Roos 2010) and therefore the SPA is outwith the maximum foraging range for breeding kittiwakes and therefore there will not be an adverse effect on the population due to collision.

Based on the results of the Collision Risk Modelling and the current regional and SPA populations, it is predicted that that the potential population affect caused by collision impacts with the proposed development on kittiwakes is negligible.

Risk of an adverse effect from collision – Low

7.1.29 Evidence of barrier effects

There is no evidence of any barrier effect to kittiwake from offshore wind farms.

Risk of an adverse effect from barrier impacts – Low

7.1.30 Evidence of displacement

There is no evidence of any displacement effect of kittiwakes from other constructed offshore wind farms.

Risk of an adverse effect from displacement – Low

7.1.31 In-combination effects

There is a potential for an in-combination effect with kittiwakes originating from the Fowlsheugh SPA with proposed plans for offshore wind farms in the Firth of Forth and those from Troup, Pennan and Lions Heads with proposed plans in the Moray Firth. There is limited information on the proposed projects and no information on the number of kittiwakes present in the area. However, as the potential incremental increase in mortality from the proposed development is less than four birds per year it is predicted that this will not have add significantly to the potential in-combination effect on the population. Consequently, the risk of an adverse in-combination impact arising from this development is predicted to be low.

Risk of an adverse effect from in-combination effects – Low

7.1.32 Conclusion

Taking into account data obtained from the proposed EOWDC and supported by published data from other sites it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SPAs with regard to kittiwake.

Little tern

Little tern is a qualifying species for the Ythan Estuary, Sands of Forvie and Meikle Loch SPA and held 36 breeding pairs in 2009 and Firth of Tay and Eden Estuary SPA.

Little terns no longer nest at the Firth of Tay and Eden Estuary SPA and therefore the site is not considered further in the assessment

They arrive from their West African wintering grounds from April onwards and depart in August and September. They feed on small fish, foraging in close in-shore waters.

The numbers nesting at Sands of Forvie varies considerably across years with many years having only a few pairs and others occasionally over 70 pairs nesting. The number of young fledged also varies considerably with most years producing only a few young due to predation and weather. During years where nests fail early on birds may leave the region by the end of June and early July but in years where nesting has been successful birds may remain in the area through to August or early September.

7.1.33 Evidence of site usage

Very few little terns were recorded from either the boat based or land-based surveys and none were recorded within the footprint of the proposed development area.

All sightings were within 2 km of the coast. Flight heights for those recorded were all below 30 m and typically little terns forage between 3 and 8 m above the sea surface.

7.1.34 Evidence of collision risk

No little terns were recorded within the proposed development area and flight heights of little terns are typically well below the turbine height (ECON 2006). Therefore, as little terns have not been recorded in the area and they fly predominantly below rotor height there is very little risk of collision

Risk of an adverse effect – Low

7.1.35 Evidence of displacement

Evidence from studies undertaken in Belgium and the UK has not shown any evidence of a displacement effect with some evidence of an increase in usage of a site following construction (ECON 2008). Consequently, it is predicted that there will be no displacement effects on little terns due to potential development.

Risk of an adverse effect – Low

7.1.36 Evidence Disturbance

Little terns forage on small fish often, young clupeids. Monitoring undertaken at Scroby Sands recorded a reduction in the availability of young herring following the construction of a wind farm by pile-driving and a subsequent breeding failure of little terns (ECON 2008). The little terns were able to compensate for the reduction in available prey by foraging further afield and changing prey items and there has not been any evidence of an overall population decline in the number of little terns in the area but the locations where the terns foraged and the sizes of colonies have varied.

The significance of any potential effect depends on the scale of displacement and its duration. It also depends on whether other suitable foraging areas can be located. Although these are difficult to predict any potential impacts upon prey are expected to be relatively short-term as they should affect only one or two breeding seasons depending on whether significant pile-driving takes place and whether construction is undertaken over one or two years. Following cessation of construction, it is predicted that new juvenile fish will be available the following season.

The numbers of little terns at the Sands of Forvie each year is highly variable as is their breeding success, with many years where they fail to produce many, if any, young consequently the integrity of the colony is unlikely to be effected by any reduction in breeding over a couple of years should it occur. Based on the available evidence, particularly the highly variable inter-annual breeding success and breeding population it is predicted that should pile-driving occur that there will not be any adverse effect on the integrity of the site with respect to breeding little terns.

Risk of adverse disturbance effect - Low

7.1.37 Evidence of barrier effects

As little terns forage predominantly within 2 km of the coast there will not be a barrier effect.

Risk of an adverse barrier effect – Low

7.1.38 In-combination effects

There are no other offshore developments that have the potential for an in-combination effect on little terns originating from the Ythan Estuary, Sands of Forvie and Miekle Loch SPA.

Risk of an adverse effect from in-combination effects – Low

7.1.39 Conclusion

Taking into account data obtained from the proposed EOWDC and supported by published data from other sites it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SPAs with regard to little tern.

Sandwich tern

Sandwich tern is a qualifying species for the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, Loch of Strathbeg SPA and Forth Islands SPA and Firth of Forth SPA.

The Ythan Estaury, Sands of Forvie and Meikle Loch SPA holds Scotland's largest breeding colony of Sandwich tern with a peak of 1,802 pairs in 1987 and an average of 517 pairs over the last 20 years. Recent counts of breeding birds at Sands of Forvie have been of 900 pairs in 2007, 670 in 2008 and 645 in 2009, indicating an ongoing and steady decline in the use of this site.

Sandwich terns have not bred at the Loch of Strathbeg SPA in recent years until 2010 when 1 pair nested.

The Firth of Forth SPA has a passage of Sandwich terns with up to 1,617 birds. It is not known which colonies these Sandwich terns originate from but are likely to be from a number of different colonies.

Birds return to their breeding grounds during April and remain in the area until the autumn. The number of terns breeding is highly variable and their success depends on the availability of suitable prey, predation and weather. Sandwich terns forage offshore for small fish species, particularly sandeels and clupeids. The distance that they forage varies depending on prey availability with distances of up to 67 km reported.

7.1.40 Evidence of site usage

The known foraging ranges of breeding Sandwich terns indicates that terns present within the wind farm study area may be associated with the Ythan Estuary, Sands of Forvie and Meikle Loch SPA.

Data from boat based surveys indicate very low usage of the wind farm study area with only five Sandwich terns recorded during May 2007. Elsewhere in Aberdeen Bay higher numbers were recorded particularly to the north, nearer to the Sands of Forvie breeding colony. Vantage point counts recorded relatively high numbers of Sandwich terns between April and September 2006 with an average of 25 birds per hour across all four vantage point sites. Evidence from boat based and vantage point surveys suggests that although there is extensive near shore usage of Aberdeen Bay there is relatively low usage of the proposed EOWDC location by Sandwich terns.

7.1.41 Evidence of collision risk

Collision risk modelling undertaken for Sandwich tern over a range of avoidance rates indicate a potential collision risk of between 0.1 and 0.4 birds per year.

Based on the regional SPA population of Sandwich tern of 645 breeding pairs the annual mortality rate will be 142 individuals and therefore the 1% baseline mortality rate is 1.4 birds per year. The results from the Collision Risk Modelling indicate less than 1 Sandwich tern will collide per year with the wind turbines.

Evidence from site specific monitoring using boat based and land-based surveys and other data sources indicate that relatively few Sandwich terns occur in area of the proposed development with nearly all sightings within 2 km of the coast and the majority within 1 km.

Data from existing offshore wind farms have reported relatively high number of collisions of sandwich tern with wind turbines (e.g. Everaert & Stienen 2006). However, they have also demonstrated high avoidance rates of greater than 99%. The number of collisions recorded has been largely due to the high number of transits made by the Sandwich terns at the sites. Site specific data indicates a low usage of the proposed development area and low numbers of transits across the site consequently a low risk of collision.

Based on the small numbers of sandwich terns recorded within the proposed development area and the relatively high avoidance rates reported for Sandwich terns, it is predicted that the risk of collision is low.

Risk of an adverse effect from collision – Low

7.1.42 Evidence of displacement

There is no evidence from offshore wind farms of any displacement effects on Sandwich terns.

Risk of an adverse effect from displacement - Low

7.1.43 Disturbance

Sandwich terns are not predicted to be impacted directly by disturbance from construction or operating vessels.

Sandwich terns feed predominantly on sandeels and clupeids (young herring) and should these prey species be impacted by construction activities in the vicinity of the proposed development then Sandwich terns may have to either forage more widely or find alternative prey. It is not possible to determine whether either possible impacts are potentially likely but Sandwich terns do forage widely in the coastal waters of Aberdeen Bay and appear not to occur in the EOWDC area so those that are effected may be able to relocate should there be a localised effect.

There is no evidence of an indirect impact on breeding Sandwich terns from other constructed offshore wind farms but there is the potential for a temporary effect on Sandwich terns should the construction of the proposed development cause a significant decline in the prey of Sandwich during the breeding season. If this effect occurs it is predicted that it would last no longer than the period of construction before fish numbers returns back to the population levels prior to construction.

Sandwich terns breeding success is highly variable across years with the population withstanding years with very low breeding success without having a significant effect on the colony size. Consequently should Sandwich terns be unsuccessful in breeding due to the potential displacement of prey then it is predicted that the effects will last no longer than the construction seasons and not have an adverse effect on the integrity of the site.

Risk of an adverse effect from disturbance impacts – Low

7.1.44 Evidence of barrier effects

There is no evidence of any barrier effect to Sandwich terns from offshore wind farms,

Risk of an adverse effect from barrier impacts – Low

7.1.45 In-combination effects

There are no other offshore developments that have the potential for an in-combination effect on Sandwich terns originating from the Ythan Estuary, Sands of Forvie and Miekle Loch SPA. Consequently, the risk of an adverse in-combination impact arising from the proposed EOWDC is predicted to be low.

Risk of an adverse effect from in-combination effects – Low

7.1.46 Conclusion

Taking into account data obtained from the proposed EOWDC and supported by published data from other sites it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SPAs with regard to Sandwich tern.

Common tern

Common tern is a qualifying species for the Ythan Estuary, Sands of Forvie and Meikle Loch SPA. At the time of designation the SPA held 2.2 % of the UK breeding population with 265 pairs. Since then the population has decreased with no more than 6 pairs since 2006. They are also a qualifying species for the Forth Islands SPA where up to 378 pairs nest

Birds return to their breeding grounds during April and remain in the area until the autumn. The number of terns breeding is highly variable and their success depends on the availability of suitable prey, predation and weather. Common terns forage offshore for small fish species, particularly sandeels and clupeids. The distance that they forage varies depending on prey availability with distances of up to 34 km reported.

7.1.47 Evidence of site usage

The known foraging range of breeding common tern indicates that terns present within the wind farm study area may be associated with the Ythan Estuary, Sands of Forvie and Meikle Loch SPA but not the Forth Islands SPA.

Data from boat based surveys indicate regular usage of the wind farm study area during the breeding season with up to 55 birds recorded during a boat based survey undertaken in July 2007. Vantage point counts recorded an average of 16.7 birds per hour across all four vantage point sites.

7.1.48 Evidence of collision risk

Boat based surveys recorded 14% of flights at rotor height

Collision risk modelling based on a range of avoidance rates of 98% 99% and 99.5% predicted between 0.8 and 3.5 common terns per year may be at risk of collision.

Based on the regional SPA population of 768 breeding adults, the annual mortality rate will be 77 individuals and therefore the 1% baseline mortality rate is less than one bird per year. The results from the Collision Risk Modelling predict a total of 3.5 common terns per year may collide with the wind turbines.

Six pairs of common tern nest on the Sands of Forvie and consequently any increase in adult mortality could have an adverse effect. The Sands of Forvie lies approximately 7.2 km away from the proposed development and therefore may be within the potential foraging range of breeding common terns, which although have been estimated to forage less than 25 km away from their nests are more likely to be within 4 – 6 km (Roos 2010).

A total of 378 pairs of common tern nest at the Firth of Forth, which lies approximately 124 km away and therefore outwith the maximum foraging range recorded for common terns.

The data used in the collision risk model is based on the peak counts recorded from anywhere within Aberdeen Bay from boat based surveys which were significantly greater than those within the wind farm area itself. Consequently, the number of birds predicted to be at risk of collision is precautionary. As is the avoidance rate used of 98%.

Data obtained from Zeebrugge, where common terns frequently pass across an array of turbines, have reported relatively high collision mortalities although very low collision probabilities of 0.1% for birds flying at rotor height and 0.007% for birds at all altitudes (Everaert & Stienen 2006). Consequently, the use of a 99% avoidance rate may be more

appropriate. Based on this, the number of potential collisions by common terns may be between one to two birds per year. Should one or more of the six breeding pairs from the Ythan Estuary, Forvie Sands and Meikle Loch SPA collide with the proposed EOWDC then the effect on the SPA population will be adverse. However, the relatively low usage of the site and the high avoidance rates makes this event unlikely and therefore the proposed development is not likely to have an adverse effect on the integrity of the site.

Risk of an adverse collision effect – Low

7.1.49 Evidence of displacement

Evidence from studies undertaken in Denmark where common terns were seen to enter operating wind farms indicates that there may be little or no displacement. Should displacement occur, site specific data indicates that common terns may forage elsewhere, particularly to the north where then numbers of common terns present were higher.

Risk of an adverse displacement effect – Low

7.1.50 Disturbance

Should the construction of the proposed development cause a reduction in the availability of prey to breeding terns then this may cause an adverse effect.

The location of nearest tern colonies and that more common terns were recorded to the north of the development area indicate that should there be a reduction of suitable prey in the vicinity of the proposed development than there are other areas where common terns may forage, e.g. in the Ythan Estuary. Any potential impact will likely last for no more than the one or two seasons as juvenile fish will be available as prey the following year.

The significance of any potential effect depends on the type of installation technique used the subsequent scale of disturbance and its duration. It also depends on whether other suitable foraging areas are available. Post construction monitoring undertaken at Kentish Flats did not record any reduction in the number of terns using the area and noted an increase in overall numbers (Gill *et al*. 2008).

Based on the results from site specific surveys indicating common terns can forage widely and evidence from studies undertaken at other constructed wind farms indicating that foraging with recently constructed wind farms can occur, it is predicted that there is unlikely to be an adverse effect from construction activities.

Risk of an adverse effect from disturbance - Low

7.1.51 Evidence of barrier effects

There is no evidence of any barrier effect to common terns from offshore wind farms.

Risk of an adverse barrier effect – Low

7.1.52 In-combination effects

There are no other offshore developments that have the potential for an in-combination effect on common terns originating from the Ythan Estuary, Sands of Forvie and Miekle Loch SPA. Consequently, the risk of an adverse in-combination impact arising from the proposed EOWDC is predicted to be low.

Risk of an adverse effect from in-combination impacts – Low

7.1.53 Conclusion

Taking into account data obtained from the proposed EOWDC and supported by published data from other sites it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SPAs with regard to common tern.

Guillemot

There are three guillemot colonies as part of SPA assemblages along the coast of North-east Scotland. Colonies of nearly 20,000 birds to the north of the wind farm area in the Buchan Ness to Collieston Coast SPA and 16,000 at Troup, Pennan and Lion's Heads SPA and a further 51,000 guillemots to the south of the proposed development at the Fowlsheugh SPA. Further south the Forth Islands SPA holds 16,000 birds.

7.1.54 Evidence of site usage

Guillemots were recorded widely across Aberdeen Bay from all surveys. Data from boat based surveys indicate that peak counts in the bay occur during the post-breeding period, particularly in July with more birds recorded within the control site than within the proposed EOWDC development area. Relatively high numbers remain within the area until November after which numbers of guillemots in the area decrease. Land based observations recorded peak numbers during April. Data from boat based surveys recorded guillemots widely across the surveyed areas and land-based observations recorded most guillemots from between 1.5 km and 4.5 km from the coast.

7.1.55 Evidence of collision risk

Collision risk modelling has been undertaken using a range of potential avoidance rates of 98%, 99% and 99.5%. The results from the modelling based on the highest densities recorded from any of the boat based surveys indicates that between 0.01 and 0.04 birds per year may collide with the proposed development.

Out of a peak regional population of 5,447 individuals an annual mortality of 294 guillemot, may be predicted. Therefore, 1% of the baseline mortality is 3 birds per year.

Based on the results from collision risk modelling, which predicts a total of 0.04 collision per year at a 98% avoidance rate, there will not be an adverse effect on the guillemot due to collisions.

The assessment against the relevant SPA populations indicates a very low risk of an adverse effect arising from collisions.

Based on the results from the collision risk modelling it is concluded that the potential effect from collision risk is negligible.

Risk of an adverse collision effect – Low

7.1.56 Barrier effect

Studies undertaken in Sweden and Denmark indicate that there is some potential for a barrier effect to occur with a reduced number of birds crossing the constructed wind farms.

During the breeding season it is predicted that there may be regular flights to and from colonies some of which will intersect the proposed development area. Should a barrier effect occur with guillemots from either Fowlsheugh or Buchan Ness to Collieston Coast SPAs making daily movements from one location to another around the proposed development area then they may incur an additional flight distance of up 3.2 km each way, or a total of 6.4 km. This may increase the daily energy expenditure to between 2.0 – 2.5% (Speakman, Gray & Furness 2009). Multiple flights will increase this expenditure.

The location and size of the proposed development is such that it will only occupy a relatively small zone through which birds may avoid flying. Regular daily movements by individual birds that could cause an incremental increase in distance of foraging flights on a daily basis is not predicted to occur, i.e. birds from colonies will forage over a wider area and will not need to detour around the proposed development on a regular daily basis.

Based on the above it is concluded that the potential incremental increases in foraging distances are unlikely to cause an adverse effect on guillemots.

Risk of an adverse barrier effect – Low

7.1.57 Evidence of displacement effect

The maximum number of guillemot potentially displaced has been calculated to be up to 1,355 birds based on the highest densities recorded from any survey within Aberdeen Bay and displacement out to 2 km. Based on the regional SPA population estimate of 88,737 guillemots then approximately 1.5% of the regional SPA population may be displaced.

Should there be a displacement effect there is no evidence to suggest that the loss of the area of the proposed development will be significant and that individuals displaced will not be able to find suitable foraging areas elsewhere. Therefore, there is no evidence to suggest that any displacement will have a negative impact on guillemots.

Post-construction monitoring undertaken at Horns Rev offshore wind farm has indicated that displacement of guillemots can occur. However, results from other operating wind farms have not shown a total displacement of guillemots. Guillemots have been recorded at the constructed Kentish Flats Offshore Wind Farm but in reduced numbers (Gill *et al.* 2008).

Based on the evidence from existing offshore wind farms it is predicted that the potential impact from displacement may be moderate but unlikely to have an adverse effect on the integrity of the relevant SPAs as displaced birds will not all die and will be able to relocate to other suitable sites.

Risk of an adverse displacement effect – Low

7.1.58 In-combination effects

Birds from the relevant SPAs may also occur in either proposed developments in the Moray Firth or the Firth of Forth.

The only data available is that from the Beatrice Demonstrator Project which recorded 19 guillemots over a period of 12 months pre-construction surveys indicating a relative low usage of the site by guillemots (Talisman 2005). The size, scale and exact locations of the Round 3 and those in Scottish Territorial Waters are currently not known and there are no data available to determine the number of guillemots that may be present in the planned development areas. Consequently, it is not possible to determine whether there will be an in-combination impact arising from the proposed plans. However, although the developments are within the potential foraging ranges of guillemots from a number of SPAs the, relatively far, distance the proposed development is from the other planned offshore wind farms and its relatively small scale reduces the risk of a potentially significant in-combination effects. Furthermore, the effects from displacement are such that it is predicted that displaced guillemots will not die and therefore, although there may be a proportion of birds displaced it is predicted that the potential impacts will not be adverse.

Risk of an adverse effect from in-combination impacts – Low

7.1.59 Conclusion

Taking into account data obtained from the proposed EOWDC and supported by published data from other sites it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SPAs with regard to guillemot.

Razorbill

There are four razorbill colonies as part of SPA assemblages that have the potential to be impacted by the proposed development. Buchan Ness to Collieston Coast SPA has 4,179 individuals, Fowlsheugh has 4,632 individuals, Forth Islands has 3,464 individuals and Troup, penan and Lion's Head has 3,216 razorbills.

7.1.60 Evidence of site usage

Razorbills were widely recorded across Aberdeen Bay from all surveys. Low numbers were present at the beginning of the year but increased from April onwards. Data from boat based surveys indicate peak counts in the bay between July and September but also a high count in October. Birds were recorded in relatively equal numbers across both the control site and the proposed EOWDC survey area. Land based observations recorded peak numbers during April and September.

Data from boat based surveys recorded razorbills widely across the surveyed areas and land based observations recorded most birds from between 2.0 km and 4.0 km from the coast.

All those recorded in flight were seen to be flying below 25 m.

7.1.61 Evidence of collision risk

No razorbills have been reported as flying at rotor height within Aberdeen Bay or from other wind farms and no reports of collisions by razorbills have been found. Consequently, it is concluded that the risk of a collision with a turbine is very small and that collision mortality will not cause an adverse effect to razorbills.

Risk of an adverse collision effect – Low

7.1.62 Barrier effect

During the breeding season it is predicted that there may be regular flights to and from colonies some of which will intersect the proposed development area. The distance razorbills forage varies depending upon the availability of suitable prey and at what stage during the breeding season they are. Should a barrier effect occur with razorbills from either Fowlsheugh or Buchan Ness to Collieston Coast SPAs making daily movements from one location to another around the proposed development area then they may incur an additional flight distance of up 3.2 km each way, or a total of 6.4 km. This may increase the daily energy expenditure to between 2.0 – 2.5% (Speakman, Gray & Furness 2009). More regular flights will increase energetic costs

The location and size of the proposed development is such that it will only occupy a relatively small zone through which birds may avoid flying. No significant concentrations of razorbills were recorded in the vicinity of the proposed development and therefore it is not considered to be a particularly favourable area for foraging. Regular daily movements by individual birds that could cause an incremental increase in distance of foraging flights on a daily basis is not predicted to occur, i.e. birds from colonies will forage over a wider area and will not need to detour around the proposed development on a regular daily basis.

Risk of an adverse barrier effect – Low

7.1.63 Evidence of displacement effect

Therefore, the maximum number of razorbill potentially displaced is up to 241 birds based on the highest densities recorded from any survey within Aberdeen Bay and displacement out to 2 km.

Based on the regional SPA population of 12,175 razorbills then approximately 1.9% of the regional population may be displaced.

Should there be a displacement effect there is no evidence to suggest that the loss of the area of the proposed development will be significant and that individuals displaced will not be able to find suitable foraging areas elsewhere.

Densities of razorbills within the area were not higher than elsewhere and consequently it is not thought that the proposed location is of particular importance, particularly as densities of razorbills tended to be higher to the north. There is no evidence to suggest that any displaced razorbills will not be able to relocate and no reason to suggest that those displaced will die. Consequently, it is predicted that there will not be an adverse effect on razorbills from displacement.

Risk of an adverse displacement effect – Low

7.1.64 In-combination effects

Birds from the relevant SPAs may also occur in either proposed developments in the Moray Firth or the Firth of Forth. There are no other additional activities within Aberdeen Bay that may cause in-combination impacts on razorbills.

The only data available is that from the Beatrice Demonstrator Project which recorded 1 razorbill over a period of 12 months pre-construction surveys (Talisman 2005). The size, scale and exact locations of the Round 3 and those in Scottish Territorial Waters are currently not known and there are no data available to determine the number of razorbills that may be present in the planned development areas. Consequently, it is not possible to determine whether there will be an in-combination impact arising from the proposed plans. However, although the developments are within the potential foraging ranges of razorbills from a number of SPAs the relatively far distance the proposed development is from the other planned offshore wind farms and it's relatively small scale reduces the risk of a potential in-combination effect.

Risk of an adverse effect from in-combination impacts – Low

7.1.65 Conclusion

Taking into account data obtained from the proposed EOWDC and supported by published data from other sites it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SPAs with regard to razorbill.

8 SAC'S

The scope of the review undertaken for this document was based on all coastal SACs in the wider region and advice received from SNH.

All coastal or near coastal SACs were identified using information from the SNH and JNCC websites (JNCC 2011, SNH 2011). A total of eight SACs have been identified as having qualifying species or habitats that are at potential risk of an adverse effect from the proposed project:

- Berwickshire and North Northumberland Coast SAC
- Buchan Ness to Collieston SAC
- Firth of Tay & Eden Estuary SAC
- Isle of May SAC
- Moray Firth SAC
- River Dee SAC
- River South Esk SAC
- Sands of Forvie SAC

Further details on each of the SACs including their qualifying species and Conservation Objectives are presented in Appendix B.

Annex I habitats – Embryonic shifting sand dunes - *Ammophila arenaria, Empetrum nigrum*		**Sands of Forvie SAC**
SAC		Embryonic shifting dunes, shifting dunes along the shoreline with *Ammophila arenaria*, decalcified fixed dunes with *Empetrum nigrum*, humid dune slacks
Data	Site surveys	None
Impact	Physical impact	None
Evidence base	Site specific	There will be no direct or indirect impacts from the construction or presence of the wind farm on the site.
	Generic	There is no published evidence to indicate either a direct or indirect impact on sand dune habitats from offshore wind farms.
Evidence of potential impact	None	
Potential to assess	Yes	Sediment modelling would confirm lack of any potential impact.
Risk	Low	Proposed offshore wind farm too far to impact on coastal processes at Sands of Forvie SAC.
Further assessment	No	

Large shallow inlets and bays, mudflats and sandflats reefs and submerged or partially submerged caves **Annex II species – grey seal**		**Berwickshire and North Northumberland Coast SAC**
SAC		Large shallow inlets and bays Mudflats and sandflats not covered by seawater at low tide Reefs Submerged or partially submerged sea caves Grey seal
Data	Site surveys	Boat based survey
Impact	Physical impact	None on qualifying habitats. Potential for noise impacts on grey seals
Evidence base	Site specific	There will be no direct or indirect impacts from the construction or presence of the wind farm on the site's qualifying habitats. Grey seals were present throughout the survey area during all the boat based survey months.
	Generic	There is published evidence to indicate that there is potential for an impact on grey seals arising from noise generated during piling operations.
Evidence of potential impact	Yes	Seals may avoid areas with high levels of sound
Potential to assess	Yes	Noise modelling and site specific data.
Risk	Low	
Further assessment	**Yes**	For grey seal only

Vegetated sea cliffs of the Atlantic and Baltic Coasts		Buchan Ness to Collieston SAC
SAC		The vegetated cliff slopes support a wide range of coastal vegetation types with an abundance of such local species as Scots lovage (*Ligusticum scoticum*) and roseroot (*Sedum rosea*). Maritime heath, acid peatland and brackish flushes also occur.
Data	Site surveys	None
Impact	Physical impact	None
Evidence base	Site specific	There will be no direct or indirect impacts from the construction or presence of the wind farm on the site.
	Generic	There is no published evidence to indicate either a direct or indirect impact on vegetated cliff slopes from offshore wind farms.
Evidence of potential impact	None	
Potential to assess	Yes	
Risk	Low	
Further assessment	No	No evidence to indicate any impact.

Estuaries, Sandbanks, Mudflats and Sandflats Annex II species – Common seal		**Forth of Tay & Eden Estuary SAC**
SAC		Mudflats and Sandflats not covered by seawater at low tide. Sandbanks which are slightly covered by seawater all the time Estuaries Common seal
Data	Site surveys	Boat based surveys
Impact	Physical impact	None on qualifying habitats Potential for noise impact on common seal
Evidence base	Site specific	There will be no direct or indirect impacts from the construction or presence of the wind farm on the qualifying habitats: mudflats, sandflats, sandbanks and estuaries. No common (harbour) seals were observed during the boat based surveys carried out during 2007-2008. In the four months of boat based surveys carried out during 2010-2011 there were 27 harbour seals observed.
	Generic	There is published evidence to indicate that there is potential for an impact on common seal arising from noise generated during piling operations.
Evidence of potential impact	Yes	Seals may avoid areas with high levels of sound
Potential to assess	Yes	Noise modelling and site specific data.
Risk	Low	
Further assessment	**Yes**	For common seal only

Bottlenose dolphin		**Moray Firth SAC**	
SAC			
Data	Species	Bottlenose dolphin	Sandbank
	Recent population	193 – 237 individuals	Sandbanks are at least 105 km away
		Bottlenose dolphin – Marine mammal surveys have indicated that bottlenose dolphins occur within the proposed EOWDC area. Previous studies have concluded that they occur off Aberdeen throughout the year with a slight increase in occurrence between November and May. Aberdeen harbour has been identified as an important feeding area for bottlenose dolphins, especially during the winter and spring when dolphins are most abundant. Their presence at this site has been linked to salmon migration up the river.	
Impact	Physical impact	Dolphins present within close proximity to the turbines during pile driving may be physically impacted. No physical impacts on Sandbank habitats *c*105 km away	
	Displacement effect	Dolphins may be displaced away from the area during the construction phase.	
Evidence base	Generic	Bottlenose dolphins from the Moray Firth SAC are known to occur in the area of the proposed EOWDC and as far south as St Andrews Bay. Impacts from noise from pile driving on porpoises have indicated that there is some temporary displacement as far as 21 km away and studies from seismic surveys indicate avoidance behaviour for a range of dolphin species.	
Evidence of potential impact	Yes	Possible displacement or disturbance effect from noise during construction activities.	
Potential to assess	Yes	Noise modelling.	
Risk	Moderate		
Further assessment	**Yes**		

Presence of Annex II species, Freshwater Pearl Mussel, Atlantic Salmon, Otter		**River Dee SAC**		
SAC				
Data		Freshwater Pearl Mussel	Atlantic Salmon	Otter
	Recent population	1.5 million	-	The population of otter in the Dee catchment is estimated at 40-50 adults.
Impact	Physical	Freshwater Pearl mussel - there will be no direct impacts on fresh water pearl mussel. Potential secondary impact if significant impact on salmon occurs. Atlantic salmon – Possible displacement effect during construction period. Otter – possible disturbance effect on otters from construction noise.		
	Noise			
Evidence base	Site specific	none		
	Generic	Freshwater Pearl Mussel – use Atlantic salmon as a host species for a winter before maturing. No evidence of any impacts on freshwater pearl mussels from offshore wind farms or other offshore activities. Atlantic Salmon – No evidence of displacement effects on Atlantic salmon from noise impacts. Otter – No evidence of any impact from pile driving from offshore wind farms. Mouth of the River Dee is Aberdeen Harbour and Aberdeen City therefore very low usage of the site. Any displacement, should it occur, will only be for the duration of pile driving. No likely significant effect.		
Evidence of potential impact	Yes	Possible displacement of Atlantic salmon effect during construction.		
Potential to assess	Yes			
Risk	Low	Duration of activities will be of a relatively short duration.		
Further assessment	**Yes**			

Presence of Annex II species, Freshwater Pearl Mussel, Atlantic Salmon		**River South Esk SAC**	
SAC			
Data	Species	Freshwater Pearl Mussel	Atlantic Salmon
	Recent population	Abundant in the River South Esk. The pearl mussel population is most abundant in the middle reaches of the river where they attain densities > 20 m^2	The South Esk supports a large, high-quality salmon *Salmo salar* population in a river draining a moderate-sized catchment on the east coast of Scotland.
Impact	Physical impact	Freshwater Pearl mussel - there will be no direct impacts on fresh water pearl mussel. Potential secondary impact if significant impact on salmon occurs. Atlantic salmon – Possible displacement effect during construction period.	
	Displacement effect		
Evidence base	Generic	Freshwater Pearl Mussel – use Atlantic salmon as a host species for a winter before maturing. No evidence of any impacts on freshwater pearl mussels from offshore wind farms or other offshore activities. Atlantic Salmon – No evidence of displacement effects on Atlantic salmon from noise impacts. Impacts from noise on other fish species (including Salmonids) have indicated that any displacement, should it occur, will be temporary and only for the duration of the pile driving. Fish return to the area. Recovery from temporary threshold shift should it occur may be within 48 hrs. Salmon may avoid the area during the construction period.	
Evidence of potential impact	Yes	Possible displacement effect during construction	
Potential to assess	Yes		
Risk	Low	Duration of activities will be of a relatively short duration.	
Further assessment	**Yes**		

Reefs **Annex II species – Common seal**		**Isle of May SAC**
SAC		Reefs Grey seal
Data	Site surveys	Boat based survey
Impact	Physical impact	None on qualifying habitat. Potential for noise impacts on grey seals
Evidence base	Site specific	There will be no direct or indirect impacts from the construction or presence of the wind farm on the site's qualifying habitats. Grey seals were present throughout the survey area during all the boat based survey months.
	Generic	There is published evidence to indicate that there is potential for an impact on grey seals arising from noise generated during piling operations.
Evidence of potential impact	Yes	Seals may avoid areas with high levels of sound
Potential to assess	Yes	Noise modelling and site specific data.
Risk	Low	
Further assessment	**Yes**	For grey seal only

Bottlenose dolphin

Further information on the distribution of bottlenose dolphins is presented within the is presented within the *Marine Mammal Impact Environmental Baseline* and *EIA technical report on Marine Mammals* prepared for the proposed EWODC Environmental Statement (Appendices 12.1 and 12.2 of the Environmental Statement). Bottlenose dolphins are known to occur regularly in the Aberdeen Bay area. Observations indicate they are present in the area throughout the year, with a peak occurrence during the winter and spring months (November-May), when they can be observed almost daily feeding at Aberdeen Harbour (Canning 2007; Stockin *et al*. 2006).

Analysis of cetacean distribution and habitat use along the Aberdeenshire coast, indicate that the entrance to the River Dee (Aberdeen Harbour) is an important feeding area for bottlenose dolphins, especially during the winter and spring when dolphins are most abundant (Canning 2007). The majority of sightings away from Aberdeen were of groups travelling while those sighted at Aberdeen generally exhibited foraging behaviours (Canning, 2007).

There were 200 bottlenose dolphins recorded during 62 observations both on and off effort during the boat based surveys carried out 2007-2008 (Figure 8-1). There were 10 observations of 58 bottlenose dolphins collected on effort that would have been available for distance analysis (if statistically feasible). The mean group size of all sightings both on and off effort was 5.2 individuals. The majority of sightings occurred during the spring months with sightings occurring throughout the year. A higher number of individuals were observed in the wind farm survey area in comparison to the control site.

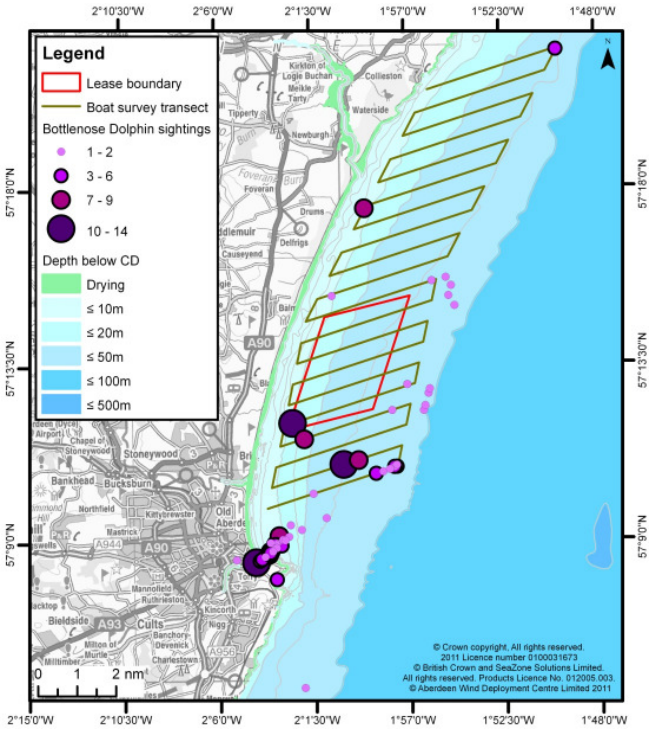

Figure 8-1: Bottlenose dolphins observed on and off effort during the 2007-2008 EOWDC boat surveys

8.1.1 Risk of physical impacts

Further detailed information on the potential impacts arising from the proposed development on bottlenose dolphins are presented in the EIA technical report on marine mammals (Appendix 12.2 of the Environmental Statement).

There is a risk of physical impacts on bottlenose dolphin from the proposed development, particularly during the construction phase when wind turbines may be pile driven into the seabed. Noise generated from pile driving has the potential to cause a range of effects ranging from mortality to permanent physical damage, temporary physical damage and disturbance or displacement.

Underwater sound modelling using the INSPIRE sound propagation model has been used to determine the potential range of underwater noise generated by installing a single 8.5 m diameter monopile. This is based on the worst-case scenario with respect to generation of underwater noise. The INSPIRE model uses a combination of loss caused by the spreading of the energy of the sound field (geometric loss) and loss caused by energy in the water column being absorbed in the underlying sea bed (absorption losses). This is used to estimate the likely transmission losses as the sound propagates away from the source; in this case impact piling. The model is therefore capable of estimating the effect of rapidly varying water depths that are commonly found in UK coastal waters.

For the assessment of physical injury to marine mammals the assessment applies a number of different impact criteria including those proposed by Parvin *et al*. (2007), and also the audiological impact criteria that have been developed by Southall *et al*. (2007).

Sound levels used in the assessment of physical impacts to determine potential adverse effect on Bottlenose dolphin are:

- lethal effect may occur in bottlenose dolphin where peak to peak levels exceed 240 dB re.1µPa
- physical injury may occur in bottlenose dolphin where peak to peak levels exceed 220 dB re.1µPa

The results from the underwater noise modelling undertaken at four wind turbines and the results from Turbine 11, the worst-case based on the piling of an 8.5 m diameter turbine are presented in Figure 8-2. The results from the modelling indicate that the lethal effect level (240 dB peak-peak) and the physical effect level (220 dB peak-peak) will be exceeded at 3 m and 60 m, respectively. As the environmental conditions are comparable for all the wind turbines; the modelling suggests that for physical impacts the anticipated ranges at which lethal effects and physical effects will be the same for all the wind turbine positions.

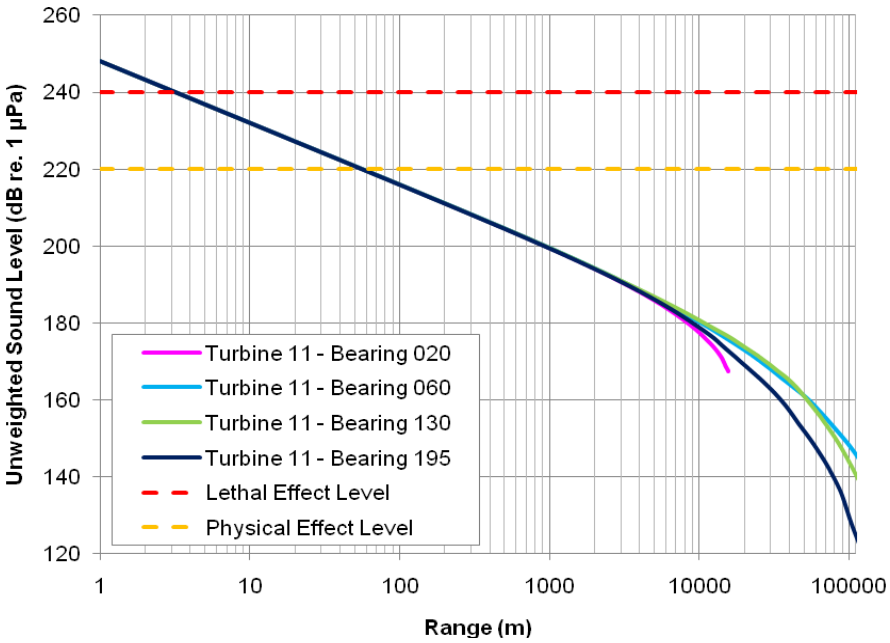

Figure 8-2: Graph showing the unweighted peak to peak noise level with range for the four transects extending from wind turbine 11

Although bottlenose dolphins frequently occur in Aberdeen Bay it is predicted that it is unlikely for a bottlenose dolphin to be within 3 m of the wind turbine during installation and therefore not at risk of mortality.

Hearing impairment in the form of a Temporary Threshold shift (TTS) in hearing may occur where a bottlenose dolphin is exposed to a levels of 130 dB_{ht} and Permanent Threshold Shift (PTS) may occur with repetitive exposure. M-weighted Sound Exposure Levels (dB re. 1 μPa^2s (M)) have also been used and TTS is predicted to occur at sound levels of 198 dB re 1 $\mu Pa^2/s$ (M_{hf}) (Table 8-1).

Table 8-1: Proposed auditory exposure criteria for bottlenose dolphin frequency specific hearing

Marine mammal group	Sound type	
	Single pulses	Multiple Pulses
Mid Frequency Cetaceans (i.e. bottlenose dolphin)		
Sound Pressure Level	230 dB re 1 µPa (peak)	230 dB re 1 µPa (peak)
Sound Exposure Level	198 dB re 1 $\mu Pa^2/s$ (M_{hf})	198 dB re 1 $\mu Pa^2/s$ (M_{hf})

The 130 dB_{ht} perceived level is used to indicate traumatic hearing damage over a very short exposure time of only a few pile strikes at most (Nedwell *et al.* 2007). Based on this measure it is predicted that there is the potential for traumatic hearing damage out to 290 m from sound source. However, when applying the criteria used by Southall it is predicted that

there is the potential for a permanent threshold shift out to 5 m from source or 7 m when based on the single pulse Sound Exposure Level (SEL) criteria which have taken consideration of the hearing capabilities of marine mammal function hearing groups (Southall *et al*. 2007).

Based on the above range of modelling results it is predicted that there is a potential for auditory injury, i.e. permanent threshold shift of between 5 m and 290 m from the sound source, depending on the criteria selected. For the purposes of this assessment the precautionary worst-case figure of 290 m has been used.

It is unlikely that bottlenose dolphin will be present in the vicinity of the proposed development during the period of construction at a range that could cause auditory injury.

As part of any potential future construction operations there will be a Marine Mammal Protection Plan developed in order to ensure that there is a minimal risk of potential impact on bottlenose dolphins arising from construction. As part of the Plan and likely industry standard Licence conditions there will be qualified and experienced marine mammal observers present during construction and the relevant JNCC guidelines will be followed. This will further minimise the potential risk of a bottlenose dolphin being present in the area during construction. Consequently, it is predicted that there will not be an adverse effect with respect to auditory injury on bottlenose dolphins arising from construction.

8.1.2 Risk of disturbance impacts

Similar modelling has been undertaken to assess the potential risk of disturbance to bottlenose dolphins from construction operations. Table 8-2 presents a comparison between the mean predicted dB_{ht} behavioural avoidance impact ranges and the mean M-weighted SEL behavioural avoidance impact ranges for bottlenose dolphin.

The impact ranges for dB_{ht} differ substantially from those predicted using the M-weighted SEL criteria. The ranges using the M-weighted SEL criteria are thought to be highly optimistic, and are in conflict with the limited amount of published information currently available. For instance, harbour porpoise have been found to avoid an area around similar pile driving operations out to a distance of 15 km (Tougaard *et al*. 2006). The most precautionary estimates for the extent of potential disturbance are that there is the potential for avoidance behaviour out to 8.5 km from the possible pile-driving operations.

The accumulated exposure to sound for marine mammals has also been assessed using the auditory injury criteria proposed by Southall *et al*. (2007). This has been done by calculating a standoff range for each marine mammal group, whereby it would safely be able to escape the affected area without receiving a damaging exposure to the sound. The results indicate that a bottlenose dolphin between 120 m and 820 m from the sound source may be impacted from a multiple sound source, i.e. repeated hammering of piles.

Table 8-2: Summary of impact ranges comparing the single pulse behavioural avoidance ranges predicted using the dB_{ht} criteria (Nedwell *et al*. 2007) and the M-weighted SEL approach (Southall *et al*. 2007)

dB_{ht} (Nedwell *et al*, 2007)		M-weighted SELs (Southall *et al*, 2007)	
Species	**Mean behavioural avoidance range (90 dB_{ht})**	**Equivalent M-weighting group**	**Mean behavioural avoidance range**
Bottlenose Dolphin	8.5 km	Mid Frequency Cetacean	120 m

The range at which potential adverse behavioural responses is up to 8.5 km for bottlenose dolphin. However, the behavioural effects are only expected to occur during the piling activities and as such are limited to a maximum time period of 24 hours per pile, although it is expected to take considerably less time than this. The piling of jacket structures is expected to require piles with smaller diameters and will take less time to install, although there will be a greater number of piles per platform. Any behavioural effects that occur to the bottlenose dolphin are expected to be reversible, in that their behaviour will no longer be changed when the piling activity has ceased. Furthermore, as bottlenose dolphins are present along the east coast of Scotland, it is predicted that the temporary displacement of animals from the Aberdeen Bay area will be mitigated by animals moving into other areas within their natural range albeit for a short period of time. Consequently, it is predicted that any potential behavioural responses will be of short duration and not significant.

Risk of an adverse effect– Low

8.1.3 In-combination effects

Bottlenose dolphins from the Moray Firth SAC also occur in the Tay and Firth of Forth area. And therefore there is a potential for an in-combination impact with developments in the Moray Firth and Firth of Forth.

Currently there are no known planned construction activities being undertaken at any of the Round 3 or Scottish Territorial Waters proposed offshore wind farms in 2013; the first year of potential construction planned for the EOWDC. However, there is potential for some construction to be undertaken in 2014 and this may overlap with construction of two other proposed developments in the Moray Firth and Firth of Forth (Table 5-2).

Should this occur then there may be a relatively short period of overlapping construction in 2014 during which time seven turbines may be installed at the proposed EOWDC. It is predicted that the installation of seven turbines will take place over a period of approximately seven days. Consequently, there will be a relatively short period when activities that could impact on bottlenose dolphins overlap. However, the two projects that have the potential to be constructing during the same period of seven days are both in excess of 100 km away and therefore the impacts arising from them, i.e. noise will not spatially overlap. There may be some displacement of bottlenose dolphins away from an area during the short period of time it will take to install up to seven turbines but this potential displacement is not

considered to be significant either alone or in-combination with the possible two other projects 100 km away.

Risk of an adverse effect from in-combination impacts – Low

8.1.4 Conclusion

Taking into account data obtained from the proposed EOWDC area and supported by published data from other sites, along with industry standard mitigation measures, it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SAC with regard to bottlenose dolphin.

The use of a soft start and marine mammal observers complying with the relevant JNCC guidance will reduce the risk of bottlenose dolphins being present within close proximity of the construction activities.

Grey and Common (harbour) seals

Further information on the distribution of both grey and common seals is presented within the *Marine Mammal Impact Environmental Baseline* and *EIA Technical Report on Marine Mammals* assessments prepared for the proposed EOWDC Environmental Statement (Appendices 12.1 and 12.2 of the Environmental Statement).

A total of 114 individual seals, of which a total of 44 were grey seals, 27 harbour seals and 37 were unidentified seals were observed during boat based surveys undertaken within Aberdeen Bay (Figure 8-3 and Figure 8-4).

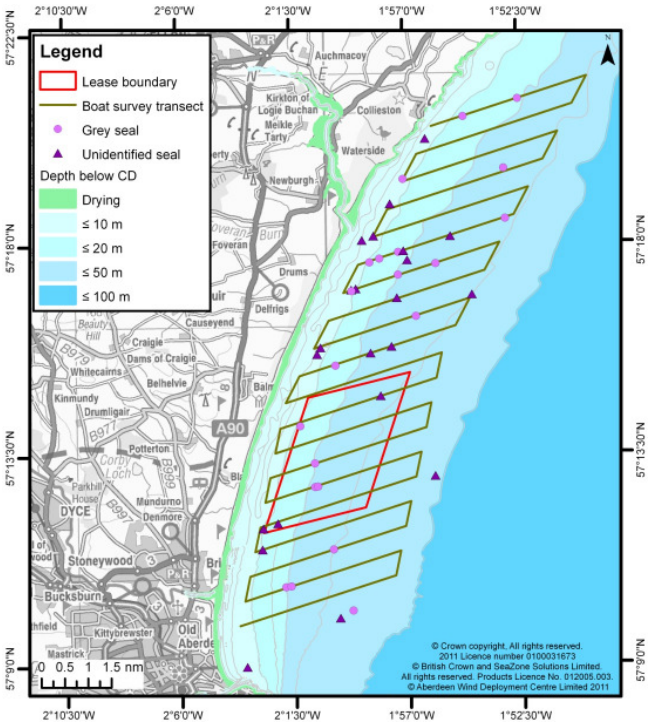

Figure 8-3: Grey and unidentified seals observed during the EOWDC boat based surveys during 2007-2008 (collected on and off-effort)

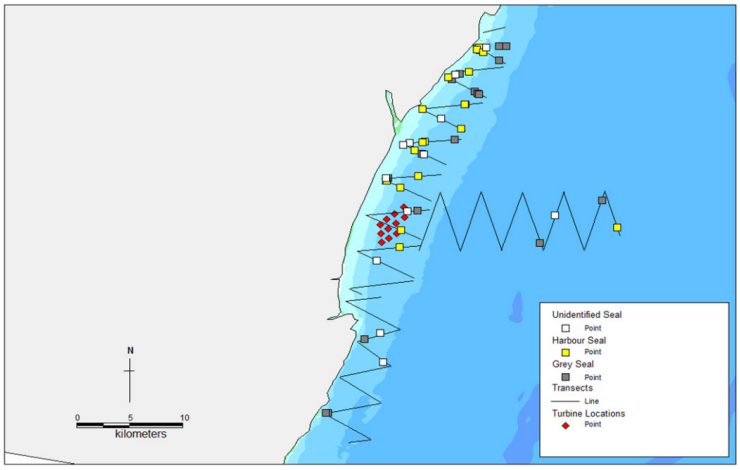

Figure 8-4: On-effort observations of seals along boat-based transects during August, September and November 2010, and January 2011.

Adult grey seals routinely move large distances. Grey seal movements have been studied in the North Sea using satellite-linked telemetry. In a study of animals at the Farne Islands and Abertay Sands, McConnell *et al.* (1999) found that movements were on two geographical scales: long and distant travel (up to 2,100 km away) to known haul-out sites; and local, repeated trips from haul-out sites to discrete offshore areas. Long-distance travel included visits to Orkney, Shetland, the Faroes, and far offshore into the Eastern Atlantic and the North Sea (Hammond *et al*. 2004). Recent telemetry studies have found that seals tagged as far south as the Farne Islands, Isle of May and Moray Firth have been found to enter the Pentland Firth area (SMRU 2011).

In 88% of trips to sea, individual grey seals returned to the same haul-out site from which they departed. The durations of these return trips were short (typically 2-3 days) and their destinations at sea were often localized areas characterized by a seabed of gravel/sand. This is the preferred burrowing habitat of sandeels, an important component of grey seal diet. The limited distance from a haul-out site of return trips (about 40 km) indicates that the seals were foraging within the coastal zone, rather than further offshore (Hammond *et al*., 2004).

The analysis of the seal telemetry data has shown that grey seals tagged in both the Isle of May SAC and Berwickshire and North Northumberland coast SAC appear to routinely travel past Aberdeen through the proposed location on the way to the Pentland Firth.

The radio-tracking of adult female common seals in the inner Moray Firth (1988, 1989, 1992) during the breeding season indicated that seals foraged up to 45 km from the haul-out site, but females with pups restricted their range markedly during the early part of the lactation period (Thompson *et al*. 1994).

Generally it has been thought that common seals forage relatively close inshore within a range of 60 km from their haul-out sites (Thompson *et al.* 1996). However, recent information on foraging movements and the distribution at sea of common seals has

highlighted greater travel distances, ranging from 10 km to 120 km, with a mean of 46 km (Hammond *et al*. 2004).

Data from satellite relay data loggers (SRDLs) have highlighted different foraging behaviour of common seals off south-east Scotland and around Orkney and Shetland. Off south-east Scotland, animals were found to be very faithful in their use of haul-out sites on land, and moderately site-faithful in the areas individuals used to forage. Duration of trips ranged from less than one day to 23 days, with a mean of 4.5 days. Foraging in the Moray Firth was mostly closer to the shore. Around Orkney and Shetland there are indications that seals tend to move between haul-outs sites within a 40 km radius of where they were captured with one animal hauling out as far as 200 km from where it was initially tagged. Foraging behaviour is also much more variable both in distance travelled and in the duration of trips. Most foraging trips are within 40 km of haul-outs but there are also longer distance trips to areas more than 200 km from haul-out sites (Hammond *et al*. 2004).

8.1.5 Risk of physical impacts

Further detailed information on the potential impacts arising from the proposed development on grey and common seals are presented in the EIA technical report on marine mammals (Appendix 12.2 of the Environmental Statement).

There is a risk of physical impacts on grey and common seals from the proposed development, particularly during the construction phase when wind turbines may be pile driven into the seabed. Noise generated from pile driving has the potential to cause a range of effects ranging from mortality to permanent physical damage, temporary physical damage and disturbance or displacement.

Underwater sound modelling based on the installation of an 8.5 m diameter monopile

For the assessment of physical injury to marine mammals a number of different impact criteria including those proposed by Parvin *et al*. (2007), and also the audiological impact criteria that have been developed by Southall *et al*. (2007) have been used.

Sound levels used in the assessment of physical impacts to determine potential adverse effect on grey and common seal are:

- lethal effect may occur in seals where peak to peak levels exceed 240 dB re.1µPa
- physical injury may occur in seals where peak to peak levels exceed 220 dB re.1µPa

The results from the underwater noise modelling undertaken based on the worst-case scenario from piling an 8.5 m diameter turbine indicate that the lethal effect level (240 dB peak-peak) and the physical effect level (220 dB peak-peak) will be exceeded at 3 m and 60 m, respectively.

Although both grey and common seals frequently occur in Aberdeen Bay it is predicted that it is unlikely that they will be within 3 m of the wind turbine during installation and therefore not at risk of mortality. However, it is recognised that seals may be curious and therefore may approach the proposed construction activities closer than other marine mammals. The use of a soft start and marine mammal observers complying with the relevant JNCC guidance will reduce the risk of a seal being present within close proximity of the construction activities.

The nearest SAC for grey seal is the Isle of May SAC which is approximately 119 km to the south and the Berwick and Northumberland Coast SAC which is approximately 150 km from the proposed development. The nearest SAC for which common seal is a qualifying species is the Forth of Tay & Eden Estuary SAC which lies 96 Km to the south. Although there may be some passage of seals between this SAC and others in the Pentland Firth the number of either grey or common seals present in Aberdeen Bay from these sites during the relatively short period of construction is predicted to be low, particularly noting that grey seals return from foraging trips to the same haul out site on 88% of occasions and that common seals are not known to undertake regular foraging trips of greater than 60 km and are therefore unlikely to be regularly present in Aberdeen Bay.

Based on the modelling results it is predicted that there is a potential for auditory injury, i.e. permanent threshold shift of between 5 m and 130 m from the sound source, depending on the criteria selected. For the purposes of this assessment the precautionary worst-case figure of 130 m has been used.

The accumulated exposure to sound for marine mammals has been assessed using the auditory injury criteria proposed by Southall *et al*. (2007). This has been done by calculating a standoff range for each marine mammal group, whereby it would safely be able to escape the affected area without receiving a damaging exposure to the sound. The results indicate that a seal between 190 m and 3,600 m from the sound source may be impacted from a multiple sound source, i.e. repeated piling hammers.

It is expected that the perceived loudness of the piling activity will cause the marine mammal to exhibit an aversive behavioural reaction, with the animal moving from the area before the onset of any auditory injury can occur.

There is a risk to individual marine mammals that are exposed to high sound levels in the immediate vicinity of the piling operation, given that marine mammals may be subject to sound levels that are capable of causing physical impacts, including both auditory and non-auditory impacts. Animals would have to be present within the immediate area of the pile driver to be at risk of physical effects and it is considered the risk of marine mammals receiving sound levels capable of causing their death is remote.

8.1.6 Risk of disturbance impacts

Similar modelling has been undertaken to assess the potential risk of disturbance to grey and common seals from construction operations. Table 8-2 presents a comparison between the mean predicted dB_{ht} behavioural avoidance impact ranges and the mean M-weighted SEL behavioural avoidance impact ranges for bottlenose dolphin.

The impact ranges for dB_{ht} differ substantially from those predicted using the M-weighted SEL criteria. The ranges using the M-weighted SEL criteria are thought to be highly optimistic, and are in conflict with the limited amount of published information currently available. For instance, harbour porpoise have been found to avoid an area around similar pile driving operations out to a distance of 15 km (Tougaard *et al*. 2006). The most precautionary estimates for the extent of potential disturbance are that there is the potential for avoidance behaviour out to 8.5 km from the possible pile-driving operations.

The accumulated exposure to sound for marine mammals has also been assessed using the auditory injury criteria proposed by Southall *et al*. (2007). This has been done by calculating a standoff range for each marine mammal group, whereby it would safely be able to escape the affected area without receiving a damaging exposure to the sound. The results indicate that a bottlenose dolphin between 120 m and 820 m from the sound source may be impacted from a multiple sound source, i.e. repeated hammering of piles.

Table 8-3: Summary of impact ranges for common seals comparing the single pulse behavioural avoidance ranges predicted using the dB_{ht} criteria (Nedwell *et al*. 2007) and the M-weighted SEL approach (Southall *et al*. 2007)

dB_{ht} (Nedwell *et al*, 2007)		M-weighted SELs (Southall *et al*, 2007)	
Species	**Mean behavioural avoidance range (90 dB_{ht})**	**Equivalent M-weighting group**	**Mean behavioural avoidance range**
Common seal	9.6 km	Pinnipeds in water	1.6 km

The range at which potential adverse behavioural responses to common seals is up to 9.6 km and it is predicted that it will be the very similar for grey seals. The behavioural effects are only expected to occur during the piling activities and as such are limited to a maximum time period of 24 hours per pile; although it is expected to take considerably less time than this. Any behavioural effects that occur to the Seals are expected to be reversible, in that their behaviour will no longer be changed when the piling activity has ceased. Furthermore, as the seals that may be present are from SACs to the south of the proposed development area and any individuals present in Aberdeen Bay from the qualify sites are likely to be in transit and not resident, the potential displacement away from Aberdeen Bay will be temporary. It is therefore predicted that individuals in transit will not remain in the area of potential disturbance. Consequently, it is predicted that any potential behavioural responses will be of short duration and not significant.

Risk of an adverse effect– Low

8.1.7 In-combination effects

Grey seals from the Isle of May SAC and the Berwick and Northumberland SAC are likely to occur in areas of other potential offshore renewable projects, particularly in the Firth of Forth where there are currently three proposed offshore wind farms. Therefore, there is a potential for an in-combination impact with developments in the Moray Firth.

Based on results from tagging studies, common seals from the Firth of Tay and Eden Estuary are not predicted to occur regularly in the vicinity of the proposed EOWDC and therefore not at risk of an adverse in-combination effect in relation to the proposed development.

Currently there are no known planned construction activities being undertaken at any of the Round 3 or Scottish Territorial Waters proposed offshore wind farms in 2013; the first year of potential construction planned for the EOWDC. However, there is potential for some

construction to be undertaken in 2014 and this may overlap with construction of one of the Firth of Forth development, Neart na Gaoithe (Table 5-2).

Should this occur then there may be a relatively short period of overlapping construction in 2014 during which time seven turbines may be installed over a period of approximately seven days at the proposed EOWDC. Consequently, there will be a relatively short period when activities that could impact on seals overlap. However, the proposed Neart Na Gaoithe development is in excess of 100 km from the proposed EOWDC site and therefore the impacts arising from them, i.e. noise will not spatially overlap. There may be some displacement of grey and common seals away from the area during the short period of time it will take to install up to seven turbines but this potential displacement is not considered to be significant either alone or in-combination with a possible other project 100 km away.

Risk of an adverse effect from in-combination impacts – Low

8.1.8 Conclusion

Taking into account data obtained from the proposed EOWDC and supported by published data from other sites along with industry standard mitigation measures it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SACs with regard to grey seal or common seal.

Atlantic Salmon

The Atlantic salmon is a qualifying species for the River Dee SAC and River South Esk SAC.

Further information on the Atlantic salmon is presented within the *Salmon and Sea Trout Ecology and Fisheries Baseline Assessment* and the *Salmon and Sea trout Impact Assessment* sections of the EIA (Appendices 22.1 and 22.2 of the Environmental Statement).

Atlantic salmon have complex lifecycles during which they spend a proportion of their lives in both freshwater and saltwater.

Young salmon remain in the rivers where they hatched for up to four or five years, although in Scottish rivers two or three years is more usual. Approximately 75% of smolt (young salmon) caught in the River Dee are 2 years old with the rest being mainly 3 years old. They migrate down river to the sea between April and June where they remain for at least one year but usually two or three, before returning back up river, usually in the spring, to spawn, after which the majority of adult salmon die.

When salmon leave the rivers they do so together in shoals leaving the rivers rapidly. The exact migration routes of Salmon from Scottish rivers are not precisely known but they are known to occur in the north-west Atlantic and around West Greenland and the Faroes. The fish swim rapidly at a rate of between 7 – 30 km per day near to the sea surface and can rapidly travel over long distances.

Although salmon may return to the rivers throughout the year with no specific migration period, Multi Sea Winter (MSW) salmon start returning to the rivers in late winter and early spring and continue through to end of May or early June. All the salmon caught in the River Dee during this period are MSW salmon. Summer salmon occur from May onwards and have spent two winters at sea. They, along with grilse (one year old salmon), occur in highest numbers from between July and October. Returning salmon do not delay entry into the rivers and move into them as long as the river conditions are suitable. It is thought that returning salmon migrate along the coasts before entering their rivers.

A review paper by Malcolm *et al.* (2010), suggests a range of potential migratory routes for salmon in Scottish coastal waters, primarily using the results of adult fish tagging studies and the spatial distribution of tag returns from adult fish tagged as smolts as they left Scottish rivers.

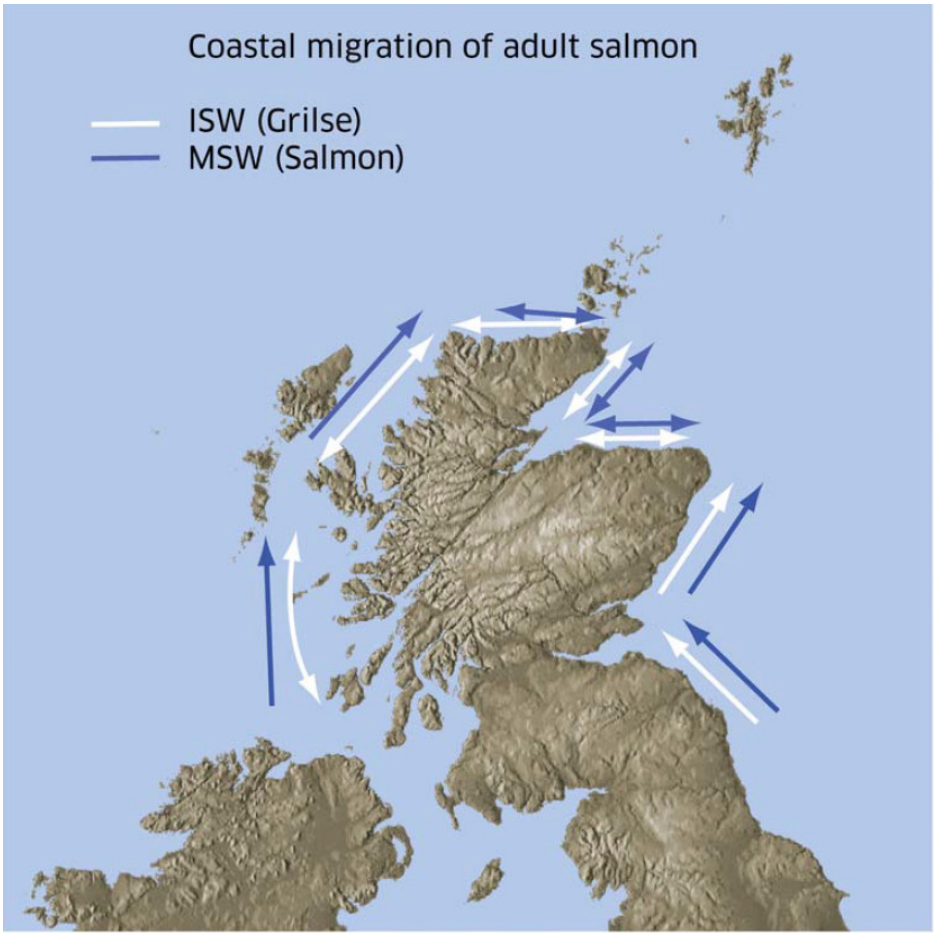

Figure 8-5: Predicted routes of Scottish Atlantic salmon (Malcolm *et al.* 2010)

Salmon entering the River South Esk SAC and River Dee SAC do so from a southerly direction and leave the rivers moving north.

8.1.9 Risk of physical impacts from noise

Potential adverse effects could arise from noise generated during the construction, operation and decommissioning phases of the proposed development. In particular, during the construction period where, should piling occur, the highest noise levels will arise.

Noise modelling undertaken for the proposed EOWDC predict that should piling of 8.5 m diameter piles take place, there is the potential for traumatic hearing damage to Atlantic salmon (based on 130 dB_{ht}) at distances of 20 m or less from the piling operations.

The results from noise modelling undertaken indicate that lethal effects on Atlantic salmon from pile driving associated with the proposed development will only occur out to 3 m from the source. Physical hearing damage may occur out to 20 m or less. Based on the very close range at which salmon are predicted to be required to be in order for there to be a risk of a physical impact and the low numbers of salmon that would occur within the small spatial area along with the relatively short duration possible pile-driving may occur, it is predicted

that there will not be any adverse effect on the Atlantic salmon associated with either the River Dee SAC or River South Esk SAC.

8.1.10 Risk of behavioural impacts from noise

Modelling undertaken based on the piling of 8.5 m diameter piles indicates that there is the potential for a strong behavioural reaction out to between 3.6 km and 4.7 km from the construction activities based on a threshold of 90 dB_{ht} and that at levels of 75 dBht up to 85% of salmon may react to noise. The results from the noise modelling undertaken are presented in Figure 8-6.

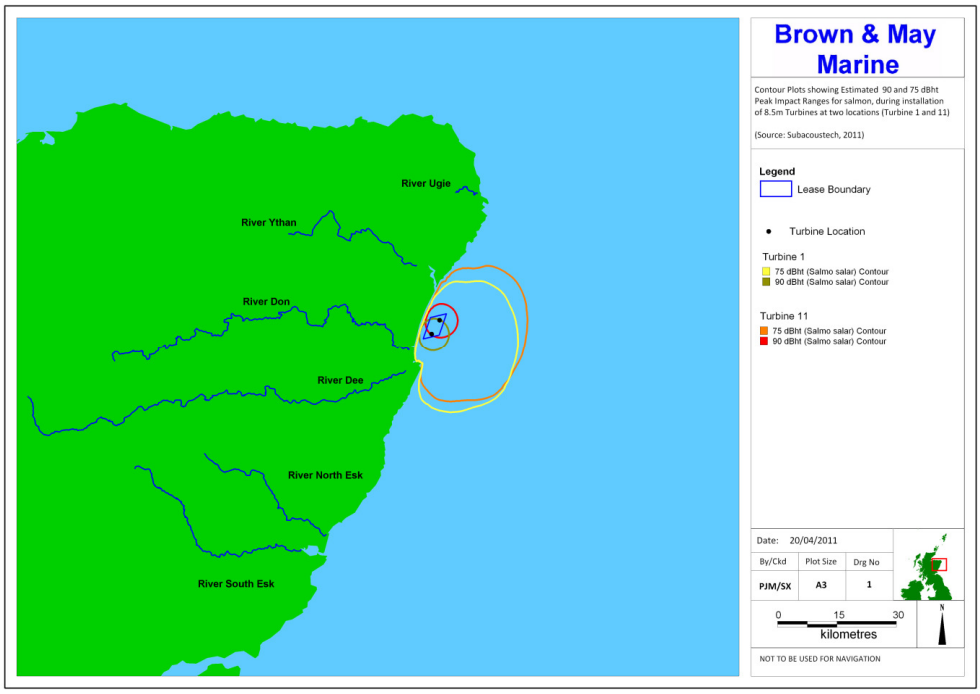

Figure 8-6: Contour Plots showing Estimated 90 and 75dB_{ht} *(Salmo salar)* peak impact ranges during installation of 8.5 m diameter wind turbines at two locations (Turbine 1 and 11)

Salmon are considered to be poor at detecting sounds within the water column although they may be able to detect substrate borne sounds (Gill and Bartlett, 2010).

Salmon smolts and post smolts leaving the SACs do so rapidly, leaving the rivers between April and June and most likely move northwards towards north-west Atlantic, Greenland and the Faroes and unlike returning adults do not necessarily follow the coastlines. Therefore, there is the potential for salmon leaving the relevant SACs to occur within the vicinity of the proposed development. However, the number of salmon smolts and post smolts likely to be in the area of potential impact at any one time is predicted to be low as they depart the rivers over a period of months. The consequences to those that could be affected may mean that

either they delay their departure from the rivers for the relatively short period of time during construction, or they may detour around the sound source during the period of migration. The scale of any detour is very small compared to the distances travelled during migration. It is therefore predicted that any behavioural responses arising from construction of the proposed development will not have an adverse effect.

Adult salmon returning to the River South Esk will be unlikely to be impacted by construction activities associated with the proposed development as they return to the river from the south and therefore outwith any zone of potential effect. Salmon returning to the River Dee SAC may be impacted as there is a potential overlap with sound sources that could cause behavioural responses and the River Dee SAC. There are predicted to be potentially two behavioural responses that may occur. Returning Atlantic salmon may delay their entry into the river during piling activities or they may ignore the sound source and enter the river without delay. Should they delay their entry into the River Dee SAC then it will for the duration of piling operations which are predicted to last no longer than 24 hrs per wind turbine and therefore of relatively short duration. Atlantic salmon are known to naturally delay entry into rivers until suitable conditions occur so a delay would not likely have an impact on the salmon.

There is no evidence from other offshore wind farms that operational noise has any adverse effect on fish species, with no decreases in the numbers of fish present within turbine arrays during the operational period of a wind farm. Studies undertaken on Atlantic salmon indicate that although salmon can detect operational turbines at a distance of 0.4 km and 0.5 km behavioural responses only occurred 4 m and then only at high wind speeds (above 30 m/s) (Walhberg & Westerberg 2005).

Based on the above it is predicted that the potential noise impacts arising from the proposed project will not have an adverse effect on the Atlantic salmon associated with the River Dee SAC or River South Esk SAC

Risk of an adverse effect– Low

8.1.11 Risk of impacts from increased sediments

Construction activities such as cable laying, piling and rock placement have potential to result in temporary sediment re-suspension increasing turbidity.

Suspended sediment concentrations within Aberdeen Bay range from 0.1 to 43.1 mg/l with an average of 20.7 mg/l. Sediment modelling has indicated that following construction there is the potential for a sediment plume to occur with a maximum concentration of 35mg/l extending from Aberdeen Harbour to approximately 3 km south of the River Ythan.

Salmon can be affected by high sediment loads, which if high enough can be lethal or at lower levels cause behavioural changes. Lethal sediment loads typically range from between hundreds and thousands mg/l, whilst sub-lethal effects may occur at lower levels, ranging from tens to hundreds mg/l depending on species specific tolerance. Salmon are considered tolerant of relatively high sediment loads with behavioural changes occurring at between 60 to 180 mg/l and therefore unlikely to be affected by the potentially increased loads arising during construction period. The duration of any impact will be short and, should it occur, only arise during the period of construction, which is predicted to be less than 24 hours per turbine. It is therefore predicted that there is unlikely to be an adverse

effect arising from the proposed development on Atlantic salmon due to possible short-term increased in turbidity.

8.1.12 Risk of impacts from Electromagnetic Fields

The magnetic fields anticipated to be produced by the AC cables associated with the proposed EOWDC are small (1.5 µT) in comparison to the Earth's magnetic field (approximately 50 µT). Atlantic salmon are expected to perceive these magnetic fields as new localised additions to the heterogeneous pattern of geomagnetic anomalies already occurring naturally and anthropogenically in the sea (MS 2011).

The location of the proposed development, to the north of the River Dee SAC and River South Esk SAC means that returning salmon from the south will not be impacted by any potential EMF arising from the proposed development.

Salmon leaving the SACs may pass across the cables and therefore detect an electromagnetic field. However, studies undertaken on chum salmon and other fish species have not been able to detect any effects from magnetic fields on them (OSPAR 2008). Consequently, it is predicted that there will not be an adverse effect on Atlantic salmon from electromagnetic fields.

Risk of an adverse effect– Low

8.1.13 In-combination effects

Atlantic salmon from the relevant SACs may also occur in either the proposed developments in the Moray Firth or the Firth of Forth.

Currently, there are no known planned construction activities being undertaken at any of the Round 3 or Scottish Territorial Waters proposed offshore wind farms in 2013, the first year of potential construction planned for the proposed EOWDC. There is potential for some construction to be undertaken in 2014 and this may overlap with construction of two other proposed developments (Table 5-2).

Should this occur then there may be a relatively short period of overlapping construction in 2014 during which seven turbines may be installed at the proposed EOWDC. The relatively short duration of any overlapping activities and that the projects are both in excess of 100 km away, it is predicted that should there be any in-combination effects they will not cause an adverse effect on the Atlantic salmon associated with the River Dee and River South Esk SACs.

Risk of an adverse effect from in-combination impacts – Low

8.1.14 Conclusion

Taking into account data obtained from the proposed EOWDC area and supported by published data from other sites it is concluded that the proposed development either alone or in-combination will not cause an adverse effect on the integrity of the relevant SACs with regard to Atlantic Salmon. Consultation with the Regulator, statutory advisors and relevant stakeholders will take place once detailed construction information is available to identify any practical, robust and appropriate mitigation measures that may further reduce any risk.

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Freshwater Pearl Mussel

The Freshwater Pearl Mussel is a qualifying species for the River Dee SAC and the River South Esk SAC.

The freshwater pearl mussel is dependent on salmonid fish during the larval stage of their life cycle, during which time they attach themselves onto the gills of salmon or sea trout until the following summer when they drop off onto the river bed. There is therefore a theoretical possibility that, should there be any significant displacement of salmon or sea trout from their spawning rivers, there could be an adverse effect on the freshwater pearl mussel. As indicated above, it is concluded that any potential effect, either alone or in-combination on Atlantic salmon would, should one occur, be localised, of short duration and only likely to affect a small number of individuals. The same conclusions are made with respect to sea trout.

It is therefore predicted that there will not be any adverse effects on the host species from the proposed development. Consequently, it is anticipated that there will not be any impact on the freshwater pearl mussel.

Risk of an adverse effect – Low

9 CONCLUSIONS

Based on data obtained from the proposed EOWDC area and supported by published data from other sites, it is considered that sufficient information is available to enable a Habitats Regulations Appraisal to be undertaken should it be required. It is concluded that the proposed EOWDC will not cause, on its own or in-combination, an adverse effect on the integrity of the relevant European Sites. Agreed mitigation measures will further reduce the risk of any potential impact. An agreed monitoring programme to be prepared in consultation with the Regulator and advisors will further ensure that the conclusions made are valid.

10 REFERENCES

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11 APPENDIX A

Site	Buchan Ness to Collieston Coast (including marine extension) SPA
Area	Area: 5,400.94 ha
Site description	Buchan Ness to Collieston Coast SPA is a stretch of south-east facing cliff in Aberdeenshire, Scotland. The 15 km stretch of cliffs, formed of granite, quartzite and other rocks, runs south of Peterhead, broken only by the sandy beach of Cruden Bay. The varied coastal vegetation on the ledges and the cliff tops includes maritime heath, grassland and brackish flushes. The boundary of the SPA follows the boundaries of Bullers of Buchan Coast SSSI and Collieston to Whinnyfold Coast SSSI, and the seaward extension extends approximately 2 km into the marine environment to include the seabed, water column and surface.
Qualifying Interest	Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 95,000 seabirds including nationally important populations of the following species: Black-legged kittiwake *Rissa tridactyla* (30,452 pairs, 6.2% of the GB population), Common guillemot *Uria aalge* (8,640 pairs, 1.2% of GB population), Herring gull *Larus argentatus* (4,292 pairs, 2.7% of the GB population), European shag *Phalacrocorax aristotelis* (1,045 pairs, 2.7% of the GB population) Northern fulmar *Fulmarus glacialis* (1,765 pairs, 0.3% of the GB population).
Conservation Objectives	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site. • Distribution of the species within site. • Distribution and extent of habitats supporting the species. • Structure, function and supporting processes of habitats supporting the species. • No significant disturbance of the species. Qualifying Species: Fulmar (*Fulmarus glacialis*) Guillemot (*Uria aalge*) Herring gull (*Larus argentatus*) Kittiwake (*Rissa tridactyla*) Shag (*Phalacrocorax aristotelis*)* Seabird assemblage

Site	Fair Isle SPA
Area	6,824.40 ha
Site description	Fair Isle is an Old Red Sandstone island, the most southerly of the Shetland group, lying halfway between Mainland and Orkney. It has a rocky, cliff coastline with adjacent coastal waters, heather moorland, acidic grassland, maritime grassland and crofting in-bye. The boundary of Fair Isle SPA is coincident with Fair Isle SSSI. The seaward extension extends approximately 2 km into the marine environment to include the seabed, water column and surface.
Qualifying Interest	Fair Isle SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: Fair Isle wren *Troglodytes troglodytes fridariensis* (33 territorial males, 100% of the GB population) Arctic tern *Sterna paradisaea* (1100 pairs, 1% of the GB population). Fair Isle SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: Common guillemot *Uria aalge* (32,300 individuals, 1.4% of the north Atlantic biogeographic population). Fair Isle SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 180,000 seabirds including nationally important populations of the following species: Atlantic puffin *Fratercula arctica* (23,000 individuals, 2% of the GB population) Razorbill *Alca torda* (3,400 individuals, 2% of the GB population), Black-legged kittiwake *Rissa tridactyla* (18,160 pairs, 4% of the GB population), Great skua *Stercorarius skua* (110 pairs, 1% of the GB population), Arctic skua *Stercorarius parasiticus* (110 pairs, 3% of the GB population) European shag *Phalocrocorax aristotelis* (1,100 pairs, 3% of the GB population) Northern gannet *Morus bassanus* (1,166 pairs, 0.6% of the GB population), Northern fulmar *Fulmaris glacialis* (35,210 pairs, 7% of the GB population) Common guillemot *Uria aalge* (32,300 individuals, 3% of the GB population) Arctic tern *Sterna paradisaea* (1,100 pairs).
Conservation Objectives	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site. • Distribution of the species within site. • Distribution and extent of habitats supporting the species. • Structure, function and supporting processes of habitats supporting the species. • No significant disturbance of the species. Qualifying Species:

	Arctic skua (*Stercorarius parasiticus)* Arctic tern (*Sterna paradisaea)* Fair Isle wren (*Troglodytes troglodytes fridariensis)* Fulmar (*Fulmarus glacialis)* Gannet (*Morus bassanus*) Great skua (*Stercorarius skua*) Guillemot (*Uria aalge)* Kittiwake (*Rissa tridactyla)* Puffin (*Fratercula arctica)* Razorbill (*Alca torda)* Shag (*Phalocrocorax aristotelis)** Seabird assemblage
Note – Relevant qualifying interests are for gannet only as advised by SNH (SNH 2010).	

Site	Firth of Forth SPA and Ramsar
Area	6,313.72 ha
Site description	The Firth of Forth SPA is a complex of estuarine and coastal habitats in south-east Scotland stretching east from Alloa to the coasts of Fife and East Lothian. The site includes extensive invertebrate-rich intertidal flats and rocky shores, areas of saltmarsh, lagoons and sand dune. The site is underpinned by the Firth of Forth SSSI.
Qualifying Interest	The Firth of Forth SPA qualifies under Article 4.1 by regularly supporting wintering populations (1993/94-97/98 winter peak means) of European importance of the Annex 1 species: Red-throated diver *Gavia stellata* (90 individuals; 2% of GB) Slavonian grebe *Podiceps auritus* (84; 2% of NW Europe, 21% of GB) Golden plover *Pluvialis apricaria* (2,949; 1% of GB) Bar-tailed godwit *Limosa lapponica* (1,974; 2% of Western Europe, 4% of GB). The site further qualifies under Article 4.1 by regularly supporting a post-breeding (passage) population of European importance of the Annex 1 species: Sandwich tern *Sterna sandvicensis* (1,617, 6% of GB, 1% of East Atlantic). The Firth of Forth SPA qualifies under Article 4.2 by regularly supporting wintering populations (1993/94-97/98 winter peak means) of both European and international importance of the migratory species: Pink-footed goose *Anser brachyrhynchus* (10,852; 6% of Icelandic/Greenlandic), Shelduck *Tadorna tadorna* (moulting flock of 4,509; 2% of NW European), Knot *Calidris canutus* (9,258; 3% of western European/Canadian), Redshank *Tringa totanus* (4,341; 3% of European/West African) Turnstone *Arenaria interpres* (860 individuals; 1% of European). The Firth of Forth SPA further qualifies under Article 4.2 by regularly supporting a wintering waterfowl assemblage of European importance: a 1992/93-96/97 winter peak mean of 95,000 waterfowl, comprising 45,000 wildfowl and 50,000 waders. This assemblage includes nationally important numbers of 15 migratory species: Great crested grebe *Podiceps cristatus* (720; 7% of GB), Cormorant *Phalacrocorax carbo* (682; 5% of GB), Scaup *Aythya marila* (437; 4% of GB), Eider *Somateria mollissima* (9,400; 13% of GB), Long-tailed duck *Clangula hyemalis* (1,045; 4% of GB), Common scoter *Melanitta nigra* (2,880; 8% of GB), Velvet scoter *M. fusca* (635; 21% of GB), Goldeneye *Bucephala clangula* (3,004; 18% of GB population), Red-breasted merganser *Mergus serrator* (670; 7% of GB), Oystercatcher *Haematopus ostralegus* (7,846; 2% of GB), Ringed plover *Charadrius hiaticula* (328; 1% of GB), Grey plover *Pluvialis squatarola* (724; 2% of GB), Dunlin *Calidris 122enelo* (9,514; 2% of GB), Curlew *Numenius arquata* (1,928; 2% of GB). The assemblage also includes large numbers of the following species:

	Wigeon *Anas penelope* (2,139 [1991/2-95/96]), Mallard *A. platyrhnchos* (2,564 [1991/2-95/96]) Lapwing *Vanellus vanellus* (4,148 [1991/2-95/96]).
Conservation Objectives	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site. • Distribution of the species within site. • Distribution and extent of habitats supporting the species. • Structure, function and supporting processes of habitats supporting the species. • No significant disturbance of the species. Qualifying Species: Bar-tailed godwit (*Limosa lapponica)* Common scoter *(Melanitta nigra)* Cormorant (*Phalacrocorax carbo)* Curlew (*Numenius arquata)** Dunlin (*Calidris alpina alpina)* Eider (*Somateria mollissima)* Golden plover (*Pluvialis apricaria)* Goldeneye (*Bucephala clangula)* Great crested grebe (*Podiceps cristatus)* Grey plover (*Pluvialis squatarola*) Knot (*Calidris canutus)* Lapwing (*Vanellus vanellus)* Long-tailed duck (*Clangula hyemalis)* Mallard (*Anas platyrhnchos)* Oystercatcher (*Haematopus ostralegus)* Pink-footed goose (*Anser brachyrhynchus)* Red-breasted merganser (*Mergus serrator)* Redshank (*Tringa totanus)* Red-throated diver (*Gavia stellata)* Ringed plover (*Charadrius hiaticula)* Sandwich tern (*Sterna sandvicensis)* Scaup (*Aythya marila)* Shelduck (*Tadorna tadorna)* Slavonian grebe (*Podiceps auritus)* Turnstone (*Arenaria interpres)* Velvet scoter (*Melanitta fusca)* Wigeon (*Anas penelope)** Waterfowl assemblage

Site	Firth of Tay & Eden Estuary SPA & Ramsar
Area	6,923.29 ha
Site description	The Firth of Tay & Eden Estuary SPA is a complex of estuarine and coastal habitats in eastern Scotland stretching from the mouth of the River Earn in the inner Firth of Tay east to Barry Sands on the Angus coast and St Andrews on the Fife Coast. The site includes extensive invertebrate-rich intertidal flats and areas of reedbed, saltmarsh and sand dune. The SPA is contained within the following SSSIs: Inner Tay Estuary, Monifieth Bay, Barry Links, Tayport-Tentsmuir Coast and Eden Estuary
Qualifying Interest	The Firth of Tay & Eden Estuary SPA qualifies under Article 4.1 of the Birds Directive by regularly supporting nationally important breeding populations of the Annex I species: Marsh harrier *Circus aeruginosus* (average of 4 females in 1992-96, 3% of British population) Little tern *Sterna albifrons* (average of 25 pairs between 1993 and 1997, 1% of British) Bar-tailed godwit *Limosa lapponica* (2,400, 5% of GB and 2% of Western European). The SPA qualifies under Article 4.2 by regularly supporting an internationally important wintering population of redshank *Tringa totanus* (1,800 individuals; 2% of GB and 1% of northwest European populations). The SPA qualifies under Article 4.2 by regularly supporting in winter over 20,000 waterfowl with a 1990/91-94/95 winter peak mean of 48,000 waterfowl, comprising 28,000 wildfowl and 20,000 waders. This assemblage includes internationally important wintering populations (1990/91-94/95 winter peak means) of: Pink-footed goose *Anser brachyrhynchus* (2,800; 1% of GB and Icelandic/Greenlandic populations) Greylag goose *A. anser* (1,200; 1% of GB and Icelandic populations) Nationally important wintering populations of: Cormorant *Phalacrocorax carbo* (230, 2% of GB) Shelduck *Tadorna tadorna* (1,200, 2% of GB) Eider *Somateria mollissima* (13,800, 18% of GB) Long-tailed duck *Clangula hyemalis* (560, 2% of GB) Common scoter *Melanitta nigra* (3,100; 9% of GB) Velvet scoter *Melanitta fusca* (730, 24% of GB), Goldeneye *Bucephala clangula* (230, 1% of GB) Red-breasted merganser *Mergus serrator* (470, 5% of GB) Goosander *Mergus merganser* (220, 2% of GB), Oystercatcher *Haematopus ostralegus* (5,100, 1% of GB), Grey plover *Pluvialis squatarola* (920, 2% of GB), Sanderling *Calidris alba* (220, 1% of GB), Dunlin *Calidris alpina* (5,200, 1% of GB) Black-tailed godwit *Limosa limosa* (150, 2% of GB)
Conservation Objectives	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying species that the following are maintained in the long term:

	Population of the species as a viable component of the site. Distribution of the species within site. Distribution and extent of habitats supporting the species. Structure, function and supporting processes of habitats supporting the species. No significant disturbance of the species. Qualifying Species: Bar-tailed godwit (*Limosa lapponica*) Black-tailed godwit (*Limosa limosa islandica)* Common scoter (*Melanitta nigra*) Cormorant (*Phalacrocorax carbo*) Dunlin (*Calidris alpina alpina)* Eider *(Somateria mollissima)* Goldeneye (*Bucephala clangula)* Goosander (*Mergus merganser*) Grey plover (*Pluvialis squatarola*) Greylag goose (*Anser anser*) Little tern (*Sterna albifrons*) Long-tailed duck (*Clangula hyemalis*) Marsh harrier (*Circus aeruginosus*) Oystercatcher (*Haematopus ostralegus*) Pink-footed goose (*Anser brachyrhynchus*) Red-breasted merganser (*Mergus serrator*) Redshank (*Tringa totanus*) Sanderling (*Calidris alba*) Shelduck (*Tadorna tadorna*) Velvet scoter (*Melanitta fusca*) Waterfowl assemblage

Site	Forth Islands SPA
Area	9,796.98 ha
Site description	Forth Islands SPA consists of a series of islands supporting the main seabird colonies in the Firth of Forth. The islands of Inchmickery, Isle of May, Fidra, The Lamb, Craigleith and Bass Rock were classified on 25 April 1990. The extension to the site, classified on the 13th February 2004 consists of the island of Long Craig, which supports the largest colony of roseate tern in Scotland. It is the most northerly of only six regular British colonies. The boundary of the Special Protection Area overlaps with the boundaries of the following SSSIs: Long Craig, Inchmickery, Forth Islands, Bass Rock and the Isle of May, and the seaward extension extends approximately 2 km into the marine environment to include the seabed, water column and surface
Qualifying Interest	Forth Islands SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: Arctic tern *Sterna paradisaea* (mean between 1992 and 1996 of 540 pairs, 1.2% of the GB population), Roseate tern *Sterna dougallii* (an average of 8 pairs, 1997 - 2001; 13% of GB population), Common tern *Sterna hirundo* (an average of 334 pairs, 1997-2001; 3% of GB population) Sandwich tern *Sterna sandvicensis* (an average of 440 pairs, 3% of GB). Forth Islands SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species; Northern gannet *Morus bassanus* (21,600 pairs, 8.2% of world biogeographic population), European shag *Phalacrocorax aristotelis* (2,400 pairs, 1.9% of N Europe biogeographic population), Lesser black-backed gull *Larus fuscus* (1,500 pairs, 1.2% of total *L.f. graellsii* biogeographic population) Atlantic puffin *Fratercula arctica* (14,000 pairs, 1.5% of total *F.a.grabae* biogeographic population). Forth Islands SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The site regularly supports 90,000 seabirds (three year mean, 1986 – 1988) including nationally important populations of the following species: Razorbill *Alca torda* (1,400 pairs, 1.4% of GB population) Common guillemot *Uria aalge* (16,000 pairs, 2.2% of GB population), Black-legged kittiwake *Rissa tridactyla* (8,400 pairs, 1.7% of GB population), Herring gull *Larus argentatus* (6,600 pairs, 4.1% of GB population), Great cormorant *Phalacrocorax carbo* (200 pairs, 2.8% of GB population), Northern gannet (21,600 pairs), Lesser black-backed gull (1,500 pairs), European shag (2,400 pairs), Atlantic puffin (14,000 pairs), Northern fulmar (798 pairs), Arctic tern (540 pairs), Common tern (334 pairs),

	Roseate tern (8 pairs) Sandwich tern (440 pairs)
Conservation Objectives	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site. • Distribution of the species within site. • Distribution and extent of habitats supporting the species. • Structure, function and supporting processes of habitats supporting the species. • No significant disturbance of the species. Qualifying Species: Arctic tern (Sterna paradisaea) Common tern (Sterna hirundo) Cormorant (Phalacrocorax carbo) Fulmar (Fulmarus glacialis) Gannet (Morus bassanus) Guillemot (Uria aalge) Herring gull (Larus argentatus) Kittiwake (Rissa tridactyla) Lesser black-backed gull (Larus fuscus) Puffin (Fratercula arctica) Razorbill (Alca torda) Roseate tern (Sterna dougallii) Sandwich tern (Sterna sandvicensis) Shag (Phalacrocorax aristotelis) Seabird assemblage

Site	Fowlsheugh (including marine extension) SPA
Area	Area: 1,303.54 Ha National Grid References: NO 879836 to NO 869782
Site description	Fowlsheugh SPA, located 4 km south of Stonehaven on the east coast of Aberdeenshire in north-east Scotland, is a 10.15 ha stretch of sheer cliffs, between 30 m and 60 m high, cut mostly from basalt and conglomerate rocks of Old Red Sandstone age. The boundary of the SPA overlaps with the boundaries of Fowlsheugh SSSI. The seaward extension extends 2 km into the marine environment and includes the seabed, water column and surface.
Qualifying Interest	Fowlsheugh SPA qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The colony regularly supports 145,000 seabirds. The colony further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: Common guillemot *Uria aalge* (56,450 individuals, 5% of GB population, 1.7% of Western European population), Black-legged kittiwake *Rissa tridactyla* (36,650 pairs, 7.5% of the GB population, 1.2 % of World population). The colony also regularly supports nationally important populations of: Razorbill *Alca torda* (5,800 individuals, 3.9% of the GB population). Northern fulmar *Fulmarus glacialis* (1,170 pairs, 0.2% of the GB population), Herring gull *Larus argentatus* (3,190 pairs, 2% of the GB population).
Conservation Objectives	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site • Distribution of the species within site • Distribution and extent of habitats supporting the species □ • Structure, function and supporting processes of habitats supporting the species □ • No significant disturbance of the species Qualifying Species: Fulmar (*Fulmarus glacialis*) Guillemot (*Uria aalge)* Herring gull (*Larus argentatus*) Kittiwake (*Rissa tridactyla)* Razorbill (*Alca torda*) Seabird assemblage

Site	Loch of Skene SPA & Ramsar
Area	120.89 ha
Site description	Loch of Skene is located about 15 km west of Aberdeen in Scotland. It is a shallow (<2 m deep) eutrophic lowland loch surrounded by fringing reedbeds and birch-willow carr. The loch supports an internationally important roost of: • Icelandic Greylag Goose *Anser anser*, • Icelandic Whooper Swan *Cygnus cygnus*. Both swans and geese feed away from the SPA on surrounding agricultural land during the day.
Qualifying Interest	This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive: Over winter: Whooper Swan *Cygnus cygnus,* 203 individuals representing up to 3.7% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6). This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: Over winter: Greylag Goose *Anser anser*, 10,840 individuals representing up to 10.8% of the wintering Iceland/UK/Ireland population (5 year peak mean 1991/2 - 1995/6).
Conservation Objectives	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site. • Distribution of the species within site. • Distribution and extent of habitats supporting the species. • Structure, function and supporting processes of habitats supporting the species. • No significant disturbance of the species. Qualifying Species: Greylag goose (*Anser anser*)

Site	Loch of Strathbeg SPA & Ramsar
Area	615.94 ha
Site description	The Loch of Strathbeg is located in north-eastern Scotland, in Aberdeenshire, inland from Rattray Head. It is a shallow, naturally eutrophic loch with adjoining reedbeds, freshwater marshes, and Alder *Alnus glutinosa* and willow *Salix* spp. carr. The calcareous dunes and dune slacks within the site are relatively undisturbed and contain a rich flora. The loch constitutes the largest dune slack pool in the UK (200 ha) and the largest waterbody in the north-east Scottish lowlands. It is separated from the sea by a 0.5-1 km wide dune system. The SPA provides wintering habitat for a number of important wetland bird species, particularly wildfowl (swans, geese and ducks), and is also an important staging area for migratory wildfowl from Scandinavia and Iceland/Greenland. In summer, coastal parts of the site are an important breeding area for Sandwich Tern *Sterna sandvicensis*, which feed outside the SPA in adjacent marine areas.
Qualifying Interest	This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive: During the breeding season: Sandwich Tern *Sterna sandvicensis*, 530 pairs representing up to 3.8% of the breeding population in Great Britain (5 year mean, 1993-1997). Over winter: Barnacle Goose *Branta leucopsis*, 226 individuals representing up to 1.9% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6). Whooper Swan *Cygnus cygnus,* 183 individuals representing up to 3.3% of the wintering population in Great Britain (5 year peak mean 1991/2 - 1995/6). This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: Over winter: Greylag Goose *Anser anser*, 3,325 individuals representing up to 3.3% of the wintering Iceland/UK/Ireland population (winter peak means). Pink-footed Goose *Anser brachyrhynchus*, 39,924 individuals representing up to 17.7% of the wintering Eastern Greenland/Iceland/UK population (5 year peak mean 1991/2 - 1995/6). Assemblage qualification: A wetland of international importance. The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl. Over winter: the area regularly supports 49,452 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Teal *Anas crecca*, Greylag Goose *Anser anser,* Pink-footed Goose *Anser brachyrhynchus*, Barnacle Goose *Branta leucopsis,* Whooper Swan *Cygnus cygnus*.
Conservation Objectives	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site. • Distribution of the species within site. • Distribution and extent of habitats supporting the species. • Structure, function and supporting processes of habitats supporting the species. • No significant disturbance of the species. Qualifying Species: Barnacle goose (*Branta leucopsis*)

	Greylag goose (*Anser anser)* Pink-footed goose (*Anser brachyrhynchus*) Sandwich tern (*Sterna sandvicensis)* Teal (*Anas crecca)* Whooper swan (*Cygnus cygnus)* Waterfowl assemblage

Site	Montrose Basin SPA & Ramsar
Area	984.61 ha
Site description	The Montrose Basin is located on the east coast of Scotland in Angus. It is an enclosed tidal basin fed by the River South Esk and contains areas of mud-flat, marsh and agricultural land, and Dun's Dish, a small eutrophic loch. It is a good natural example of an estuary, relatively unaffected by development, with high species diversity in the intertidal zone and supporting a large population of wintering waterbirds. The site is important for wintering populations of Iceland/Greenland Pink-footed Goose *Anser brachyrhynchus* and Icelandic Greylag Goose *Anser anser,* along with ducks and waders. The geese feed away from the SPA on surrounding agricultural land during the day.
Qualifying Interest	This site qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: Over winter: Greylag Goose *Anser anser,* 1,080 individuals representing at least 1.1% of the wintering Iceland/UK/Ireland population (5 year peak mean, 1987/8-1991/2). Knot *Calidris canutus*, 4,500 individuals representing at least 1.3% of the wintering Northeastern Canada/Greenland/Iceland/Northwestern Europe population (5 year peak mean 1991/2 - 1995/6). Pink-footed Goose *Anser brachyrhynchus*, 31,622 individuals representing at least 14.1% of the wintering Eastern Greenland/Iceland/UK population (5 year peak mean 1991/2 - 1995/6). Redshank *Tringa totanus*, 2,259 individuals representing at least 1.5% of the wintering Eastern Atlantic - wintering population (5 year peak mean 1991/2 - 1995/6) The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl: Over winter, the area regularly supports 54,917 individual waterfowl (5 year peak mean 1991/2 - 1995/6) including: Dunlin *Calidris alpina alpina*, Oystercatcher *Haematopus ostralegus*, Eider *Somateria mollissima*, Wigeon *Anas penelope*, Shelduck *Tadorna tadorna*, Redshank *Tringa totanus*, Knot *Calidris canutus*, Greylag Goose *Anser anser,* Pink-footed Goose *Anser brachyrhynchus*.
Conservation Objectives	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site. • Distribution of the species within site. • Distribution and extent of habitats supporting the species. • Structure, function and supporting processes of habitats supporting the species.

	• No significant disturbance of the species. Qualifying species: Dunlin (*Calidris alpina alpina*) Eider (*Somateria mollissima*) Greylag goose (*Anser anser*) Knot (*Calidris canutus*) Oystercatcher (*Haematopus ostralegus*) Pink-footed goose (*Anser brachyrhynchus*) Redshank (*Tringa totanus*) Shelduck (*Tadorna tadorna*) Wigeon (*Anas penelope*) Waterfowl assemblage

Site	Troup, Pennan and Lion's Heads SPA
Area	3,367 ha
Site description	The Troup, Pennan and Lion's Heads Special Protection Area is a 9 km stretch of sea cliffs along the Aberdeenshire coast. The cliffs support large colonies of breeding seabirds. The boundary of the Special Protection Area overlaps with the boundary of Gamrie and Pennan coast SSSI and the seaward extension extends approximately 2 km into the marine environment to include the seabed, water column and surface.
Qualifying Interest	The site qualifies under Article 4.2 by regularly supporting over 20,000 individual breeding seabirds. In 1995 the site supported about 150,000 individual seabirds of 9 species. The site qualifies further under Article 4.2 by regularly supporting internationally important breeding populations of the migratory species: Black-legged kittiwake *Rissa tridactyla* (31,600 pairs in 1995; 6% of the British population and 1% of the total population of the sub-species *R. t. tridactyla*). Common guillemot *Uria aalge* (44,600 individuals in 1995; 4% of the British and 1% of total population of the sub-species *U. a. aalge* and *U. a. albionis*). In addition to the species mentioned above, the assemblage of breeding seabirds includes the regularly occurring migratory species Northern fulmar *Fulmarus glacialis* (4,400 pairs), Herring gull *Larus argentatus* (4,200 pairs; 2% of the British breeding population). Razorbill *Alca torda* (4,800 individuals). All figures in brackets are estimates for 1995.
Conservation Objectives	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site. • Distribution of the species within site. • Distribution and extent of habitats supporting the species. • Structure, function and supporting processes of habitats supporting the species. • No significant disturbance of the species. Qualifying Species: Fulmar (*Fulmarus glacialis)* Guillemot (*Uria aalge*) Herring gull (*Larus argentatus)* Kittiwake (*Rissa tridactyla*) Razorbill (*Alca torda)** Seabird assemblage

Site	Ythan Estuary, Sands of Forvie and Meikle Loch SPA & Ramsar
Area	1016.24 ha
Site description	Ythan Estuary, Sands of Forvie and Meikle Loch are located north of Aberdeen on the east coast of Scotland. The site comprises the long, narrow estuary of the River Ythan and Meikle Loch. At its mouth, the river splits an extensive area of sand dunes with the Forveran Links on the west bank and the Sands of Forvie dune system on the east bank. Extensive mud-flats in the upper reaches of the estuary are replaced by coarser gravels with Mussel *Mytilus edulis* beds closer to the sea. The margins of the estuary are varied, with areas of saltmarsh, reedbed and poor fen. Meikle Loch is an important roost site for geese, which feed away from the SPA on surrounding farmland in winter. It is a eutrophic loch supporting limited aquatic vegetation. In summer the coastal habitats of the dunes and estuary provide an important breeding site for three species of tern, whilst in winter the estuary holds large numbers of waders, ducks and geese.
Qualifying Interest	This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive: During the breeding season: Common Tern *Sterna hirundo*, 265 pairs representing up to 2.2% of the breeding population in Great Britain (Count, as at early 1990s). Little Tern *Sterna albifrons*, 41 pairs representing up to 1.7% of the breeding population in Great Britain (Count, as at early 1990s). Sandwich Tern *Sterna sandvicensis*, 600 pairs representing up to 4.3% of the breeding population in Great Britain (Seabird Census Register). This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: Over winter; Pink-footed Goose *Anser brachyrhynchus*, 17,213 individuals representing up to 7.7% of the wintering Eastern Greenland/Iceland/UK population (winter peak means). The area qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl. Over winter, the area regularly supports 51,265 individual waterfowl (5 year peak mean 1991/2 – 1995/6) including: Redshank *Tringa totanus*, Lapwing *Vanellus vanellus*, Eider *Somateria mollissima*, Pink-footed Goose *Anser brachyrhynchus*.
Conservation Objectives	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and To ensure for the qualifying species that the following are maintained in the long term: • Population of the species as a viable component of the site. • Distribution of the species within site. • Distribution and extent of habitats supporting the species. • Structure, function and supporting processes of habitats supporting the species. • No significant disturbance of the species. Qualifying Species:

	Common tern (*Sterna hirundo*) Eider (*Somateria mollissima*) Lapwing (*Vanellus vanellus*) Little tern (*Sterna albifrons*) Pink-footed goose (*Anser brachyrhynchus*) Redshank (*Tringa totanus*) Sandwich tern (*Sterna sandvicensis*) Waterfowl assemblage

12 APPENDIX B

Site	Berwickshire and North Northumberland Coast SAC
Area	60545.5 ha
Qualifying Interest	Grey seal Large shallow inlets and bays Mudflats and sandflats not covered by seawater at low tide Reefs Submerged or partially submerged sea caves
Conservation Objectives	To avoid deterioration of the qualifying habitats (listed below) thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying habitat that the following are maintained in the long term: • Extent of the habitat on site • Distribution of the habitat within site • Structure and function of the habitat • Processes supporting the habitat • Distribution of typical species of the habitat • Viability of typical species as components of the habitat • No significant disturbance of typical species of the habitat Qualifying Habitats Large shallow inlets and bays Mudflats and sandflats not covered by seawater at low tide Reefs Submerged or partially submerged sea caves. To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying species that the following are maintained in the long term: Population of the species as a viable component of the site Distribution of the species within site Distribution and extent of habitats supporting the species Structure, function and supporting processes of habitats supporting the species No significant disturbance of the species Qualifying Species: • Grey seal

Site	Buchan Ness to Collieston SAC
Area	207.52 ha
Qualifying Interest	Vegetated sea cliffs of the Atlantic and Baltic coasts Vegetated sea cliffs
Conservation Objectives	To avoid deterioration of the qualifying habitat (listed below) thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying habitat that the following are maintained in the long term: • Extent of the habitat on site • Distribution of the habitat within site • Structure and function of the habitat • Processes supporting the habitat • Distribution of typical species of the habitat • Viability of typical species as components of the habitat • No significant disturbance of typical species of the habitat Qualifying Habitat Vegetated Sea Cliffs

Site	Firth of Tay and Eden Estuary SAC
Area	15,412.13 ha
Qualifying Interest	Estuaries, Sandbanks, Mudflats and Sandflats Annex II species – Common seal
Conservation Objectives	To avoid deterioration of the qualifying habitats (listed below) thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying habitats that the following are maintained in the long term: Extent of the habitat on site Distribution of the habitat within site Structure and function of the habitat Processes supporting the habitat Distribution of typical species of the habitat Viability of typical species as components of the habitat No significant disturbance of typical species of the habitat Qualifying Habitats: • Estuaries • Intertidal mudflats and sandflats • Subtidal sandbanks To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying species that the following are maintained in the long term: Population of the species as a viable component of the site Distribution of the species within site Distribution and extent of habitats supporting the species Structure, function and supporting processes of habitats supporting the species No significant disturbance of the species Qualifying Species: • Common seal

Site	Isle of May SAC
Area	357.75 ha
Qualifying Interest	Grey seal Reefs
Conservation Objectives	To avoid deterioration of the qualifying habitats (listed below) thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying habitats that the following are maintained in the long term: Extent of the habitat on site Distribution of the habitat within site Structure and function of the habitat Processes supporting the habitat Distribution of typical species of the habitat Viability of typical species as components of the habitat No significant disturbance of typical species of the habitat Qualifying Habitats: • Reefs To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying species that the following are maintained in the long term: Population of the species as a viable component of the site Distribution of the species within site Distribution and extent of habitats supporting the species Structure, function and supporting processes of habitats supporting the species No significant disturbance of the species Qualifying Species: • Grey seal

Site	Moray Firth SAC
Area	151,347 ha
Site description	
Qualifying Interest	Sandbanks which are slightly covered by sea water all the time: Subtidal sandbanks Bottlenose dolphin *Tursiops truncatus*
Conservation Objectives	To avoid deterioration of the qualifying habitat (listed below) thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying habitat that the following are maintained in the long term: • Extent of the habitat on site • Distribution of the habitat within site • Structure and function of the habitat • Processes supporting the habitat • Distribution of typical species of the habitat • Viability of typical species as components of the habitat • No significant disturbance of typical species of the habitat Qualifying Habitat Subtidal sandbanks To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying species that the following are established then maintained in the long term: • Population of the species as a viable component of the site • Distribution of the species within site • Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats supporting the species • No significant disturbance of the species Qualifying Species Bottlenose dolphin

Site	River Dee SAC
Area	
Site description	2,446.82 ha
Qualifying Interest	Otter *Lutra lutra* Freshwater pearl mussel *Margaritifera margaritifera* Atlantic salmon *Salmo salar*
Conservation Objectives	To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying species that the following are maintained in the long term: • Population of the species, including range of genetic types for salmon, as a viable component of the site • Distribution of the species within site □ Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats supporting the species □ No significant disturbance of the species • Distribution and viability of freshwater pearl mussel host species • Structure, function and supporting processes of habitats supporting • freshwater pearl mussel host species Qualifying species Atlantic salmon • Freshwater pearl mussel Otter

Site	River South Esk SAC
Area	478.62 ha
Qualifying Interest	Freshwater pearl mussel *Margaritifera margaritifera* Atlantic salmon *Salmo salar*
Conservation Objectives	Conservation Objectives for River South Esk Special Area of Conservation To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying species that the following are maintained in the long term: Population of the species, including range of genetic types for salmon, as a viable component of the site • Distribution of the species within site • Distribution and extent of habitats supporting the species • Structure, function and supporting processes of habitats • supporting the species • No significant disturbance of the species • Distribution and viability of freshwater pearl mussel host species • Structure, function and supporting processes of habitats supporting freshwater pearl mussel host species Qualifying Habitats: Atlantic salmon Freshwater pearl mussel

Site	Sands of Forvie SAC
Area	734 ha
Site description	
Qualifying Interest	Decalcified fixed dunes with Empetrum nigrum* Lime-deficient dune heathland with crowberry Embryonic shifting dunes Shifting dunes Humid dune slacks Humid dune slacks Shifting dunes along the shoreline with Ammophila arenaria (“white dunes”) Shifting dunes with marram
Conservation Objectives	Conservation Objectives for Sands of Forvie Special Area of Conservation To avoid deterioration of the qualifying habitats (listed below) thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying habitats that the following are maintained in the long term: • Extent of the habitat on site • Distribution of the habitat within site • Structure and function of the habitat • Processes supporting the habitat • Distribution of typical species of the habitat • Viability of typical species as components of the habitat No significant disturbance of typical species of the habitat. Qualifying Habitats: • Humid dune slacks Lime-deficient dune heathland with crowberry* Shifting dunes Shifting dunes with marram