4 Biological Environment

4.1 Designated Sites

4.1.1 Introduction

4.1.1.1 This chapter provides an overview of the statutory and non-statutory protected sites within the vicinity of the Project, or which could be potentially affected by the Project. These designated sites are protected under European Directives and / or UK / Scottish legislation. Additional non–statutory designated sites are also considered.

4.1.1.2 The locations of relevant designated sites are illustrated in Figures 4.1-1, 4.1-2 and 4.1-3 in Volume 6 a. Information on each designated site, including its reason for designation / classification, is given in Table 4.4-1 to Table 4.1-4 below. The sites are ordered in terms of Environmental Impact Assessment (EIA) topic, i.e. Marine Mammals, Ornithology, Fish & Shellfish Ecology, and Terrestrial Ecology. Where the same sites are subject to multiple designations that protect the same conservation interests, designation information is not repeated and only one table entry is provided.

4.1.2 International Designations

Ramsar Sites

4.1.2.1 Ramsar sites are designated under the Convention of Wetlands of International Importance. The Convention was adopted in Ramsar, Iran in 1971 and ratified by the UK Government in 1976. Ramsar sites protect wetlands that are of international significance in terms of their ecology, botany, zoology, limnology or hydrology. The initial emphasis was on selecting sites of importance to waterbirds, though greater attention has increasingly been given to non–bird features.

4.1.2.2 All Ramsar sites in Scotland are also either Special Protection Areas (SPAs) or Special Areas of Conservation (SACs) (Natura 2000 sites), and many are also Sites of Special Scientific Interest (SSSIs), although the boundaries of the different designations are not always exactly the same.

4.1.2.3 Assessments of the likely significant effects of the Project on Ramsar sites (and their protected features) have been set out in the following chapters:

- Ornithology (Chapters 7.4, 10.4 and 14.4); and
- Terrestrial Ecology (Chapters 10.6 and 14.6).

4.1.3 European Designations

Special Protection Areas and Special Areas of Conservation

4.1.3.1 SPAs are areas classified under Article 4 of Directive 79/409/EEC on the Conservation of Wild Birds (the Birds Directive). The Directive requires member states to designate SPAs in order to protect rare and vulnerable birds (as listed on Annex I of the Directive) and regularly occurring migratory species.

4.1.3.2 Assessments of the likely significant effects of the Project on SPAs (and their protected features) have been set out in the following chapters:

- Ornithology (Chapters 7.4, 10.4 and 14.4); and
- Terrestrial Ecology (Chapters 10.6 and 14.6).

4.1.3.3 SACs are areas designated under Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive). SACs are selected for a number of habitats and species, both terrestrial and marine, which are listed in the Habitats Directive.

4.1.3.4 Assessments of the likely significant effects of the Project on the SACs have been set out in:

- Fish and Shellfish (Chapters 7.2, 10.2 and 14.2);
- Marine Mammals (Chapters 7.3, 10.3 and 14.3); and
- Terrestrial Ecology (Chapters 10.6 and 14.6).

4.1.3.5 In Scotland, the Habitats Directive and Birds Directive are transposed into national law in the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), and in respect of consents granted under the Electricity Act 1989 in the Conservation of Habitats and Species Regulations 2010. The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 apply to offshore marine areas beyond 12 nm. The Directive requires member states to maintain or restore European protected habitats and species listed in the Annexes at a favourable conservation status and to designate and monitor areas (SACs and SPAs) which are outstanding habitats and species listed in Annexes.

4.1.4 National Designations

Sites of Special Scientific Interest (SSSIs)

4.1.4.1 Sites of Special Scientific Interest (SSSIs) are areas of special interest for their wildlife, geology and landforms and are notified under the Wildlife and Countryside Act 1981(as amended by the Nature Conservation (Scotland) 2004 Act). SSSIs are afforded a level of protection against damaging activities in order to preserve their natural heritage interests, whilst allowing traditional land use to continue. Any potentially damaging operations must be authorised by Scottish Natural Heritage (SNH).

4.1.4.2 Assessments of the likely significant effects of the Project on the SSSIs have been set out in the following chapters:

- Fish and Shellfish Ecology (Chapters 7.2, 10.2 and 14.2);
- Marine Mammals (Chapters 7.3, 10.3 and 14.3);
- Ornithology (Chapters 7.4, 10.4 and 14.4); and
- Terrestrial Ecology (Chapters 10.6 and 14.6).

National Nature Reserves

4.1.4.3 National Nature Reserves (NNRs) are areas of land set aside for nature, where the main purpose of management is the conservation of habitats and species of national and international significance.

4.1.4.4 NNRs are designated under the National Parks and Access to the Countryside Act 1949 or the Wildlife and Countryside Act 1981. Nearly all are SSSIs and most are also part of the network of European Natura 2000 sites.

4.1.4.5 Assessments of the likely significant effects of the Project on NNRs have been set out in:

- Terrestrial Ecology (Chapters 10.6 and 14.6).

4.1.5 Regional / Local Designations

Local Nature Reserves

4.1.5.1 Local Nature Reserves (LNRs) are areas of at least locally important natural heritage, designated and managed by local authorities. Local authorities select and designate local nature reserves using their powers under Section 21 of the National Parks and Access to the Countryside Act 1949 (as amended). LNRs may gain protection through also being SSSIs or Natura 2000 sites.

4.1.5.2 Assessments of the likely significant effects of the Project on LNRs have been set out in:

- Terrestrial Ecology (Chapters 10.6 and 14.6).

4.1.6 Future Statutory Designations

4.1.6.1 The UK has signed up to international agreements such as the Convention on Biological Diversity and the OSPAR Convention, which aim to establish an 'ecologically coherent network of Marine Protected Areas (MPAs)' by 2012. In Scotland, this will require the future designation of a number of new 'nature conservation' MPAs in order to protect nationally important marine biodiversity and geodiveristy features. The identification of future MPAs is ongoing, with search locations identified and recommendations for MPAs expected to reach Scottish Parliament by the end of 2012.

4.1.6.2 At present in the Moray Firth region, there are no recommendations for new MPAs with which the Project could interact.

4.1.7 Non–Statutory Designations

4.1.7.1 In addition to the above statutory designated sites, potential impacts on non–statutory reserves have also been considered where relevant within this Environmental Statement (ES).

Royal Society for the Protection of Birds Reserves.

4.1.7.2 The key Royal Society for the Protection of Birds (RSPB) reserves that have been considered in the assessment are Troup Head, Loch of Strathbeg, Hoy, Copinsay, Sumburgh Head, Mousa, and Fetlar reserves. Each of these sites is an SPA and / or SSSI, and are covered in the assessment of these sites in the following chapters:

- Terrestrial Ecology (Chapters 10.6 and 14.6); and
- Ornithology (Chapters 7.4, 10.4 and 14.4).

Scottish Wildlife Trust Reserves

4.1.7.3 The key Scottish Wildlife Trust (SWT) reserve that has been considered in the assessment is Longhaven Cliffs. Assessments of the likely significant effects of the Project on Longhaven Cliffs SWT Reserve have been set out in the following chapters:

- Terrestrial Ecology (Chapters 10.6 and 14.6).

Local Nature Conservation Sites

4.1.7.4 Local nature conservation sites (LNCS) are a non–statutory designation given by local authorities to areas of locally important nature and landscapes. The main purpose of LNCS is to flag–up to planners and developers where there are natural features of some merit. In this way, it gives planners and developers early indication of sensitive sites and opportunities for enhancing the local environment.

4.1.7.5 LNCS is the term now used to refer to a variety of non–statutory sites, including, Wildlife Site (WS), Site of Importance for Nature Conservation (SINC), and Regionally Important Geological / Geomorphological Site (RIGS).

4.1.7.6 Assessments of the likely significant effects of the Project on LNCS have been set out in the following chapters:

- Terrestrial Ecology (Chapters 10.6 and 14.6).

Table 4.1-1 Summary of Major Nature Conservation Designations (with Biological Features) Potentially Affected by the Project by EIA Discipline – Ornithology

Site	Status	Area (ha)	Main Conservation Interest	EIA Receptors	Relevant Assessment
East Caithness Cliffs	SPA, SSSIs	11,690.92	The sea cliffs that comprise East Caithness Cliffs SPA regularly support populations of European importance of a variety of seabird species. Notified interest features: Fulmar, shag, cormorant, peregrine, kittiwake, herring gull, great black–backed gull, guillemot, razorbill, puffin, seabird assemblage.	Fulmar, kittiwake, guillemot, razorbill, puffin, seabird assemblage	Offshore generating station and offshore transmission infrastructure
North Caithness Cliffs	SPA, SSSIs, RSPB reserve	14,621.14	North Caithness Cliffs SPA is of special nature conservation importance for supporting large populations of breeding seabirds. Dunnet Head is an RSPB reserve. Notified interest features: razorbill, peregrine, puffin, fulmar, kittiwake, guillemot, seabird assemblage.	Razorbill, puffin, fulmar, kittiwake, guillemot, seabird assemblage	Offshore generating station and offshore transmission infrastructure
Troup, Pennan and Lion's Heads	SPA, RSPB reserve	3,367.21	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. Troup Head is an RSPB reserve. Notified interest features: razorbill, fulmar, herring gull, kittiwake, guillemot, seabird assemblage.	Fulmar, kittiwake, guillemot, seabird assemblage	Offshore generating station and offshore transmission infrastructure
Pentland Firth Islands	SPA, SSSI	170.51	The Pentland Firth Islands are located between the Orkney Islands and the mainland coast of north–east Scotland. Notified interest features: Arctic tern.	Arctic tern	Offshore generating station
Hoy	SPA, SSSI, RSPB reserve	18,122.17	Hoy SPA is of special nature conservation importance for supporting large populations of breeding seabirds. Notified interest features: great skua, peregrine, puffin, fulmar, red–throated diver, great black–backed gull, kittiwake, Arctic skua, guillemot, seabird assemblage.	Puffin, fulmar, kittiwake, guillemot, seabird assemblage	Offshore generating station and offshore transmission infrastructure
Copinsay	SPA, SSSI, RSPB reserve	3,607.7	Copinsay SPA regularly supports in excess of 20,000 breeding seabirds. Notified interest features: fulmar, great black–backed gull, kittiwake, guillemot, seabird assemblage.	Fulmar, kittiwake, seabird assemblage	Offshore generating station and offshore transmission infrastructure
Loch of Strathbeg	SPA, SSSI, Ramsar, RSPB reserve	615.94	Loch of Strathbeg SPA is a site of International importance comprising a shallow freshwater loch with surrounding wetland, dune and grassland communities. It provides wintering habitat for a number of important wetland bird species, particularly wildfowl.	SPA: Greylag goose, pink–footed goose, whooper swan, barnacle goose, waterfowl assemblage.	Offshore generating station and onshore infrastructure

Site	Status	Area (ha)	Main Conservation Interest	EIA Receptors	Relevant Assessment
Loch of Strathbeg	SPA, SSSI, Ramsar, RSPB reserve	615.94	SPA Notified interest feature: Eurasian teal, greylag goose, pink–footed goose, whooper swan, sandwich tern, barnacle goose, waterfowl assemblage. SSSI notified interest features: breeding bird assemblage, eutrophic loch, fen meadow, open water transition fen, wintering pink–footed goose, whooper swan, greylag goose, goldeneye, goosander, mute swan, pochard, tufted duck and wigeon.	SSSI: breeding bird assemblage, eutrophic loch, fen meadow, open water transition fen, wintering pink–footed goose, whooper swan, greylag goose, goldeneye, goosander, mute swan, pochard, tufted duck and wigeon	Offshore generating station and onshore infrastructure
Auskerry	SPA, SSSI.	101.97	Auskerry is a small, uninhabited low–lying island situated 5 km south of Stronsay in the Orkney Islands of northern Scotland. Notified interest features: Arctic tern, storm petrel.	Arctic tern	Offshore generating station
Calf of Eday	SPA, SSSI	2,668.91	Calf of Eday SPA supports large colonies of breeding seabirds. Notified interest features: fulmar, great black–backed gull, cormorant, kittiwake, guillemot, seabird assemblage.	Fulmar, seabird assemblage	Offshore generating station
Rousay	SPA, SSSI	5,483.37	Rousay SPA consists of areas of maritime heath and grassland, and seacliffs. Notified interest features: fulmar, kittiwake, Arctic tern, Arctic skua, guillemot, seabird assemblage.	Fulmar, seabird assemblage	Offshore generating station
West Westray	SPA, SSSI	3,781.29	West Westray SPA is an 8 km stretch of sea cliffs, together with adjacent grassland and heathland, along the west coast of the island of Westray in Orkney. The cliffs support large colonies of breeding auks and kittiwakes while the grassland and heathland areas support breeding colonies of skuas and terns. Notified interest features: razorbill, fulmar, kittiwake, Arctic skua, Arctic tern, guillemot, seabird assemblage.	Fulmar, seabird assemblage	Offshore generating station
Papa Westray	SPA, SSSI, RSPB reserve	245.71	Papa Westray is a small island lying close to Westray in the northern Orkney islands in Scotland. Notified interest features: Arctic tern, Arctic skua. The SSSI and RSPB reserve is North Hill.	Arctic tern	Offshore generating station

Site	Status	Area (ha)	Main Conservation Interest	EIA Receptors	Relevant Assessment
Sule Skerry and Sule Stack	SPA, SSSI	3,890.55	The SPA comprises two uninhabited islands and supports European important populations of seabirds. Notified interest features: gannet, guillemot, Leach's petrel, puffin, shag, storm petrel, seabird assemblage.	Gannet	Offshore generating station
Fair Isle	SPA, SSSI	6,824.4	Fair Isle SPA supports internationally important populations of breeding seabirds on its cliffs and maritime heath and grassland. Notified interest features: gannet, Arctic skua, Arctic tern, Fair Isle wren, fulmar, great skua, guillemot, kittiwake, puffin, razorbill, shag, seabird assemblage.	Gannet	Offshore generating station
North Rona and Sula Sgeir	SPA, SSSI	6,850.58	The uninhabited islands of North Rona and Sula Sgeir, together with several outlying rocky islets and adjacent waters, lie 65 km north of Lewis. The coastlines of both islands consist mainly of cliffs except for two low–lying peninsulas on North Rona. Notified interest features: gannet, fulmar, great black–backed gull, guillemot, kittiwake, Leach's petrel, puffin, razorbill, storm petrel, seabird assemblage.	Gannet	Offshore generating station
Sumburgh Head	SPA, SSSI, RSPB reserve	39.04	Sumburgh Head is located at the most southern tip of the Shetland mainland in northern Scotland. Notified interest feature: Arctic tern	Arctic tern	Offshore generating station
Mousa	SPA, SSSI, RSPB reserve	197.98	Mousa is a small island located off the east coast of the south part of the Shetland mainland in northern Scotland. Notified interest feature: Arctic tern	Arctic tern	Offshore generating station
Noss	SPA, SSSI	3,338.34	Noss SPA is an offshore island lying 5 km east of Lerwick, Shetland. It supports breeding seabirds on cliffs and also on inland heathlands and grasslands. Notified interest features: gannet, fulmar, great skua, guillemot, kittiwake, puffin, seabird assemblage.	Gannet	Offshore generating station
Foula	SPA, SSSI	1,323.31	Foula is the most westerly of the Shetland Islands, which are situated to the north of the Scottish mainland and Orkney. Notified interest feature: Arctic tern	Arctic tern	Offshore generating station
Papa Stour	SPA, SSSI	569.03	Papa Stour lies on the west coast of mainland Shetland in northern Scotland. Notified interest feature: Arctic tern	Arctic tern	Offshore generating station

Site	Status	Area (ha)	Main Conservation Interest	EIA Receptors	Relevant Assessment
Fetlar	SPA, SSSI, RSPB reserve	2,594.91	Fetlar is one of the northernmost of the Shetland Islands in northern Scotland. Notified interest feature: Arctic tern	Arctic tern	Offshore generating station
Forth Islands	SPA, SSSI	9,796.98	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. Notified interest features: gannet, Arctic tern, common tern, cormorant, fulmar, guillemot, herring gull, kittiwake, lesser black–backed gull, puffin, razor bill, roseate tern, Sandwich tern, shag, seabird assemblage.	Gannet	Offshore generating station
Hermaness, Saxa Vord and Valla Field	SPA, SSSI	6,507.16	Hermaness, Saxa Vord and Valla Field Special Protection Area lies in the north–west corner of the island of Unst, Shetland, at the northernmost tip of Britain. It consists of 100 to 200 m high sea cliffs and adjoining areas of grassland, heath and blanket bog. Notified interest features: gannet, fulmar, great skua, guillemot, kittiwake, puffin, red–throated diver, shag, seabird assemblage.	Gannet	Offshore generating station
Rum	SPA, SSSI	46,716.21	Rum SPA includes the Inner Hebridean Island of Rum, which has a largely rocky coast with cliffs rising to 210 m, and adjacent coastal waters. Notified interest features: Manx shearwater, golden eagle, guillemot, kittiwake, red–throated diver, seabird assemblage.	Manx Shearwater	Offshore generating station

Table 4.1-2 Summary of Major Nature Conservation Designations (with Biological Features) Potentially Affected by the Project by EIA Discipline – Marine Mammals

Site	Status	Area (ha)	Main Conservation Interest	EIA Receptors	Relevant Assessment
Moray Firth	SAC	151,347.17	Notified interest features: Subtidal sandbanks, Bottlenose dolphin.	Bottlenose dolphin	Offshore generating station and transmission infrastructure
Dornoch Firth and Morrich More	SAC	8,700.53	Notified interest features: reefs, subtidal sandbanks, glasswort and other annuals colonising mud and sand, Atlantic salt meadows, estuaries, intertidal mudflats and sandflats, otter, common seal, coastal dune heathland, dunes with juniper thickets, lime–deficient dune heathland with crowberry, shifting dunes, dune grassland, humid dune slacks, shiftings dunes with marram grass.	Harbour (common seal)	Offshore generating station and transmission infrastructure

Table 4.1-3 Summary of Major Nature Conservation Designations (with Biological Features) Potentially Affected by the Project by EIA Discipline – Fish & Shellfish Ecology

Site	Status	Area (ha)	Main Conservation Interest	EIA Receptors	Relevant Assessment
Berriedale and Langwell Waters	SAC	57.54	Notified interest features: Atlantic salmon	Atlantic salmon	Offshore generating station and offshore transmission infrastructure
River Oykel	SAC	960.20	Notified interest features: Atlantic salmon, freshwater pearl mussel	Atlantic salmon, freshwater pearl mussel	Offshore generating station and transmission infrastructure
River Thurso	SAC	353.31	Notified interest features: Atlantic salmon	Atlantic salmon	Offshore generating station and transmission infrastructure
River Evelix*	SAC	20.17	Notified interest features: Freshwater pearl mussel	Freshwater pearl mussel	Offshore generating station and transmission infrastructure
River Moriston*	SAC	194.53	Notified interest features: Atlantic salmon, freshwater pearl mussel	Atlantic salmon, freshwater pearl mussel	Offshore generating station and transmission infrastructure
River Spey*	SAC	5,764.53	Notified interest features: sea lamprey, Atlantic salmon, otter, freshwater pearl mussel	Atlantic salmon, freshwater pearl mussel	Offshore generating station and transmission infrastructure

*Also relevant to Terrestrial Ecology

Table 4.1-4 Summary of Major Nature Conservation Designations (with Biological Features) Potentially Affected by the Project by EIA Discipline – Terrestrial Ecology

Site	Status	Area (ha)	Main Conservation Interest	EIA Receptors	Relevant Assessment
Rosehearty to Fraserburgh Coast	SSSI	135.75	Notified interest features: turnstone, purple sandpiper, curlew, eider.	Turnstone, purple sandpiper, curlew, eider	Transmission infrastructure
Rora Moss	SSSI	164.68	Notified interest feature: raised bog.	Raised bog	Transmission infrastructure
Buchan Ness to Collieston	SPA	5,400.94	Notified interest features: fulmar, guillemot, herring gull, kittiwake, shag, seabird assemblage.	Fulmar, guillemot, herring gull, kittiwake, shag, seabird assemblage	Transmission infrastructure
Buchan Ness to Colliestron	SAC	206.85	Notified interest feature: vegetated sea cliffs.	Vegetated sea cliffs	Transmission infrastructure
Bullers of Buchan Coast	SSSI	104.06	Notified interest features: breeding seabird colony, guillemot, kittiwake, shag, coastal geomorphology of Scotland, maritime cliff.	Breeding seabird colony, guillemot, kittiwake, shag, maritime cliff	Transmission infrastructure
Collieston to Whinnyfold Coast	SSSI	103.89	Notified interest features: breeding seabird colony, fulmar, guillemot, kittiwake, razorbill, sea wormwood.	Breeding seabird colony, fulmar, guillemot, kittiwake, razorbill	Transmission infrastructure
Waters of Philorth	LNR	18.77	Water of Philorth is a small scale estuarine environment including a small area of saltmarsh and sand spit. The sand dune system holds vegetation, saltmarsh and reedbeds which attract a variety of waders, wildfowl and seabirds.	Waders, wildfowl and seabirds	Transmission infrastructure
Longhaven Cliffs	SWT reserve	2.5 km coastal stretch	Scottish Wildlife Trust (SWT) reserve – seabird colony.	Seabird colony	Transmission infrastructure

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4.2 Benthic Ecology

4.2.1 Introduction

4.2.1.1 This chapter describes the subtidal benthic ecology of the three proposed wind farm sites (Telford, Stevenson and MacColl), and the associated offshore transmission infrastructure (OfTI) between the proposed wind farm sites and the location at which it makes landfall at Fraserburgh Beach. Specifically, it defines the seabed habitats and the macrobenthos, i.e. the fauna which are generally 1 mm in size or larger, that are associated with each habitat type. Flora (i.e. seaweeds) are not associated with the seabed within the boundaries of the three proposed sites because of the water depths, which are too great to permit sufficient light penetration for photosynthesis and only occur in relatively shallower waters along inshore sections of the export cable route. The information presented has been drawn from:

- Consultation with relevant statutory and non-statutory bodies;
- Desktop studies;
- A series of site specific benthic ecology field surveys; and
- Consideration of the relevant key legislative and planning information.

4.2.1.2 The methodologies, results and conclusions of the site specific field surveys for both the proposed wind farm sites and the export cable route are detailed in the following technical appendices:

- Technical Appendix 4.2 A (Benthic Ecology Characterisation Survey); and
- Technical Appendix 4.2 B (Benthic Ecology Characterisation Report).

4.2.1.3 Benthic ecology refers to the communities of fauna which live on or in seabed substrates and the relationships that they have with each other and with the physical environment. Fauna living on or over the seabed surface are typically referred to as epifauna whilst fauna living within the seabed (for example: as active burrowers or tube dwellers) are typically known as infauna. For the purposes of this chapter, both epifaunal and infaunal components are referred to as the benthos or the benthic ecology.

4.2.1.4 This baseline is used to inform assessment of the likely significant effects of the three proposed wind farms and the OfTI on benthic ecology which is presented in:

- Chapters 7.1, 10.1 and 14.1 (Benthic Ecology); and
- Chapter 12.1 (Whole Project Assessment).

4.2.1.5 The intertidal ecology at the proposed export cable landfall site at Fraserburgh Beach is described in Chapter 4.6 (Intertidal Ecology).

4.2.2 Consultations

4.2.2.1 A full account of consultation on the three proposed wind farms and transmission infrastructure is presented in Chapter 1.4 (Stakeholder Consultation). Table 4.2-1 below summarises the consultations undertaken to inform benthic ecology baseline data gathering and impact assessment.

Table 4.2-1 Summary of Consultations

Organisation	Summary of Consultation Response	MORL Approach
Marine Scotland (Responses relating to the survey specifications and survey findings)	• Agreement of site specific survey and analysis methodologies;	• Acceptance of agreed methodologies;
	• Agreement that coarse sediment habitats within the boundaries of the three wind farm sites do not constitute Annex I stony reef, based on the evidence acquired from site specific field survey.	• Acceptance of status of coarse sediment habitats.
Marine Scotland (Responses relating to the scoping opinion for both the wind farm sites and offshore transmission assets).	• Stated that the ES needs to show that the relevant wildlife legislation and guidance were taken into account;	• Agreement with comment;
	• Advocated minimisation of stabilisation material to minimise benthic impacts and consideration of using mattresses instead of rock as this offers the possibility of removal during decommissioning	• Agreement with comment
	• Considered that there is not a risk to the benthos from the accidental release of pollutants. This may be briefly discussed in the ES or scoped out;	• An Environmental Management Plan (EMP) would be in place to control use and storage of pollutants;
	• Required the entire cable route to be towed using a standard sled capable of video and stills images to ensure quantitative data are gathered on protected habitats, species and priority marine features. MSS require clarification on what is meant by 'epibenthic community assessment'; and	• Surveys have been conducted on the basis of previously agreed scope including video survey at pre-selected locations;
	• Advised that sediment samples be collected for both particle size and chemical analyses and that comparison of data with Scottish Interim Sediment Quality Guidelines should be made.	• Agreement with comment.
Scottish Environmental Protection Agency (SEPA) (Responses relating to the scoping opinion for both the wind farm sites and offshore transmission assets).	• Good working practice to be adopted to minimise habitat damage during the construction phase. This should be controlled through an environmental management plan;	• An EMP will be in place during the construction;
	• Advice on designated sites and protected species should be sought from SNH; and	• MORL have met with SNH, and other consultees, to discuss *Sabellaria spinulosa* reef during draft ES consultations;
	• SEPA recommend that the developers draw up and adopt a protocol to minimise risks of introducing marine invasive species.	• Acknowledged comment.
Scottish Natural Heritage (SNH) & Joint Nature Conservation Committee (JNCC) (Responses relating to the coping opinion for both the wind farm sites and offshore transmission assets).	• Recommend checks for Annex I habitats and Priority Marine Features as well as any Biodiversity Action Plan Habitats and species during survey work;	• Annex I habitats have been described and mapped during the field work;
	• Consideration of potential impacts on the cold water coral *Lophelia pertusa* will be required should the export cable cross the Southern Trench; and	• Five seabed video transects were conducted within the vicinity of the Southern Trench. No *Lophelia pertusa* was recorded;
	• Indirect cumulative effects on prey species, as a result of changes to benthic and pelagic ecology could be significant. Consideration of indirect effects will be required for natural heritage aspects.	• Cumulative effects on benthic and pelagic (fish) species have been addressed in Chapters 14.1 and 14.2 respectively.

Organisation	Summary of Consultation Response	MORL Response
Inshore Fisheries Group (Responses relating to the coping opinion for both the wind farm sites and offshore transmission assets).	• Thermal pollution of the seabed surrounding export cables should be added to the list of possible impacts;	• Effects of heat from operational cables on benthic ecology are addressed in Chapter 10.1;
	• Spat settlement of the King scallop and depositing of squid eggs on the seabed is dependent on the availability of hydroid and bryozoan communities and suitable biogenic material respectively. Any smothering of such communities and habitats at these stages has the potential to impact juvenile and egg survival;	• Effects of smothering on hydroid and bryozoan communities have been addressed in Chapter 7.1;
	• It is considered that thermal load of cabling can have a significant impact on the predator / prey balance within seabed communities and that this should be recognised in any cumulative impact assessment.	• Cumulative effects of heat from operational cables on benthic ecology are addressed in Chapter 14.1.
RSPB Scotland (Responses to draft ES and Technical Reports)	• Once disturbed, any benthic community assemblage is highly unlikely to return to the same community structure that was present initially: as communities are dynamic it is pointless to expect simple bounce back;	• The assessment has been based on biotopes to accommodate natural variability;
	• Should these developments be consented, we would expect to see comprehensive monitoring programmes which include good reference sites and use BACI approaches;	• Acknowledged
	• Comments on the sampling scheme including the potential for mis-representing bio-diversity and for missing key ecosystem components and associated quality of the assessments. Comments raised on potential impacts of disturbed sediments that should be included within the assessment. Comments raised on additional information requirements in Technical Appendices (Volume 8) and greater clarity regarding derivation of biotope boundaries.	• The sampling scheme sufficiently represents key ecosystem components. Impacts of disturbed sediments on benthic ecology have been addressed in Chapter 7.1. Technical Appendix 4.2 A clarifies the derivation of biotope boundaries within the three proposed wind farm sites.
Marine Scotland (MS) (Responses to draft ES)	• Comment on the deposition of sediment to 5.1 m which is considered to be a significant amount and thus would result in a significant, localised impact;	• The extent of the effect is highly localised so impact significance falls within the "minor" classification as discussed in Chapter 7.1;
	• The developer should consider that the change in benthic species diversity as a result of creating artificial reef from the rock armour / scour protection and the turbine structures themselves may constitute a significant impact. These communities are likely to be very different to the natural occurring communities that are indigenous to the site;	• New substrates will be colonised by [sessile epifauna] species already naturally present at Smith Bank on cobble habitats to the north west of the site (see Technical Appendix 4.2 A). Colonising communities are therefore not likely to be very different to those which are indigenous to the site;
	• Comment on raising the significance of potential impacts of non-indigenous species (NIS) from minor to moderate;	• The significance of potential impacts of NIS has been raised from minor to moderate (Chapter 7.1) in light of regulator concern;
	• The Annex 1 stony reef and *Sabellaria spinulosa* reef are protected habitats; theoretically no trenching or disturbance that has a damaging effect on these habitats would be permitted under current legislation. Detrimental impact to an Annex 1 habitat would constitute an impact of major significance;	• The significance of this impact has been raised from moderate to major (Chapter 12.2);
	• The reduction of habitat and subsequent reduction in species diversity expected as a consequence of mattressing / rock dumping along the cable route etc. would constitute a negative impact. The developer should highlight this	• Addressed in Chapter 10.1.

Organisation	Summary of Consultation Response	MORL Response
Marine Scotland (MS) (Responses to draft ES) (continued)	• Due to the limited evidence supplied supporting claims that the Annex 1 habitats are patchy and not continuous we would recommend that it would be difficult to say that micro-siting of the cables would have only a minor impact. If the developer could provide sufficient supporting evidence for these claims then this impact may be reduced by mitigation but as the evidence stands this is difficult to claim; • The "change to the ambient sedimentary habitats to a more heterogeneous course, hard substrate" could be assessed as minor rather than not significant if the increase in species biodiversity is to the determent of indigenous species.	• The presentation shown at the draft ES consultee meeting on 18 / 04 / 12 showed current EIA acoustic and ground-truthing (video) data and demonstrated that it is already possible to classify and map reef and non – reef areas to facilitate micro-siting. MORL have already committed to pre-construction surveys to collect additional data to further inform cable micro-siting options.
Marine Scotland, SNH & JNCC (Draft ES consultation meeting 18/04/12),	• Presentation of acoustic and associated ground truthing video data and discussion on preliminary methods for the micro-siting of the export cables as mitigation for potential damage to protected *Sabellaria spinulosa* reef.	• MORL will undertake a pre-construction survey to support micro-siting of cables as mitigation.

4.2.3 Baseline Characteristics

4.2.3.1 This chapter describes baseline benthic ecology characteristics within the Outer Moray Firth, and then within the Project study area that includes the proposed offshore wind farms and OfTI.

4.2.4 Desktop Studies

4.2.4.1 The Moray Firth is described as an "open system" being an integral part of the wider North Sea, thus having common environmental factors. Seabed sediments, considered as moderately to well sorted, fine to medium grained, with some shell, are described as relatively homogeneous. Predicted distributions of seabed habitats derived from the Mapping European Seabed Habitat (MESH) project (www.searchmesh.net) (Figure 4.2.1, Volume 6 a) identifies five principal habitat types in the area:

- Circalittoral and deep coarse sediments;
- Circalittoral fine sand or circalittoral muddy sand;
- Deep circalittoral sand;
- Deep circalittoral mud; and
- Infralittoral coarse sediment.

4.2.4.2 The sediments of Smith Bank comprise coarse and medium sands. Coarser sediments are generally associated with shallower areas whilst finer grained sediments occur in deeper water areas. The levels of silt / clay in shallow water areas (up to 40 m) were found to be consistently low across survey area (< 2.5 %) although these increased to 5 % in depths of between 40 and 50 m. Sediment in deeper water areas (> 50 m) contained silt / clay levels of between 5 and 15 %. Organic matter content of the sediments was related to the silt / clay content and ranged between 0.07 % and 2.54 %.

4.2.4.3 Annelida (segmented worms) dominate benthic communities at Smith Bank, comprising 40 % of total species variety. Molluscs are also typically well represented (30 % of total diversity) together with crustaceans (20 %), miscellaneous taxa (10 %) and echinoderms (5 %). There is a rich and diverse faunal community characterised by the polychaetes *Spiophanes bombyx, Pholoe baltica,* cirratulids, *Scoloplos armiger, Nephtys* spp., *Spio filicornis, Lumbrineris* spp., *Diplocirrus glaucus* and *Goniada maculata,* bivalves *Cochlodesma praetenue, Tellina* (*Fabulina*) *fabula, Abra prismatica, Crenella decussata, Gari fervensis* and amphipods *Bathyporeia* spp. and *Urothoe elegans.* Talisman similarly identified a rich and diverse community here following investigations supporting the

Beatrice Wind Farm Demonstrator Project. Conspicuous sediment species observed during the Talisman study included the polychaetes *Chaetozone setosa, L. gracilis* and *Exogone hebes* together with the amphipods *U. elegans, Ampelisca tenuicornis* and *Bathyporeia* spp., the bivalve *T. fabula* and the pea urchin *Echinocyamus pusillus*. Essile epibenthic communities (i.e. groups of animals attaching to the surface of seabed substrata) were characterised by sponges, the erect bryozoan *Flustra foliacea*, the anemone *Bolocera tuediae* and the crab *Hyas coarctatus*.

4.2.4.4 South of Smith Bank and in areas coincident with the offshore export cable route, the National Biodiversity Network interactive webGIS identifies circalittoral mud seabed with seapens extending across much of the southern half of the outer Moray Firth. The distribution of seapens around Scotland show both *Pennatula phosphorea* and *Virgularia mirabilis* at various locations in the Moray Firth. The cold water coral *Lophelia pertusa* has been recorded within the Southern Trench.

4.2.4.5 Assemblages of more mobile epifaunal, such as crab, fish, shrimps and starfish include the common starfish *Asterias rubens*, burrowing starfish *Astropecten irregularis* and sea urchins *Echinus* spp., crustaceans (e.g. *Crangon allmanni*, *Pagurus bernhardus, Anapagurus laevis* and *H. coarctatus*) and the gastropod *Neptunea antiqua*. Historic scientific and commercial trawls also identified a typical regional assemblage of demersal fish comprising whiting (*Merlangius merlangus*), dab (*Limanda limanda*), haddock (*Melanogrammus aeglefinus*), lemon sole (*Microstomus kitt*), plaice (*Pleuronectes platessa*), grey gurnard (*Eutrigla gurnardus*), herring (*Clupea harengus*) and long rough dab (*Hippoglossoides platessoides*) (for more details on fish communities please refer to Chapter 4.3 (Fish and Shellfish Ecology) and Chapter 5.1 (Commercial Fisheries).

4.2.5 Site Specific Surveys

4.2.5.1 Baseline benthic ecological data, against which the following assessment is made, was collected during a site specific seabed sampling survey employing seabed video, sediment grab and trawl sampling techniques. Sampling locations were carefully chosen based on prior knowledge of seabed conditions, gained via geophysical seabed survey, to ensure all habitat types and features were represented. An analysis of seabed samples was undertaken in accredited laboratories following industry standard procedures. All survey specifications, sample and data analytical methods received prior approval from Marine Scotland. The site survey and following impact assessment was conducted by EMU Limited (EMU), who have over 15 years of benthic ecological survey and assessment experience. This includes previous survey and assessment work in support of a number of offshore wind farm developments in UK waters. Full details of the conduct of the survey, data analyses and benthic ecological interpretations are provided in Technical Appendix 4.2 A and 4.2 B.

4.2.5.2 There has been little historic seabed sampling within the boundaries of the three proposed wind farm sites although other adjacent areas of the Smith Bank and the Outer Moray Firth have been more extensively investigated. Specifically the benthic ecology of the Beatrice Oilfield and the Beatrice Demonstrator Project has been well studied as part of the initial development and subsequent environmental monitoring.

4.2.5.3 Two separate site specific surveys have been undertaken to improve understanding of the benthic ecology of the three proposed wind farm sites and offshore transmission infrastructure study area. These surveys are summarised in Table 4.2-2 below.

4.2.5.4 A further intertidal benthic ecology survey was also conducted and is discussed further in Chapter 4.6 (Intertidal Ecology). In addition, a sandeel survey was conducted across the entire Round 3 Zone; the results of this survey are discussed in Chapter 4.3 (Fish and Shellfish Ecology).

Table 4.2-2 Summary of Survey Activities

Survey Area	Methods Used	Date
Survey 1 – The three proposed wind farm sites (Telford, Stevenson and MacColl) plus a small number of survey stations outside of the wind farm boundaries	• Seabed sampling • Video surveillance • Scientific trawling	October 2010
Survey 2 – Export cable route	• Seabed video surveillance • Seabed sampling	July 2011

4.2.5.5 Survey areas and specifications, sample analyses and data analyses were agreed with Marine Scotland prior to mobilisation. Sampling locations for the three proposed wind farm sites were selected on the basis of previously gathered geophysical data and on predicted effect types to ensure adequate sampling of all seabed habitat types expected in the wind farm and OfTI study area. Sampling locations along the export cable route were selected on the basis of the broad-scale habitat mapping data derived from the MESH project, as mentioned above (see Figure 4.2-1, Volume 6 a). All video, grab and trawl sample locations are presented in Figure 4.2-2 Volume 6 a. The following briefly describes the conduct and findings of each of these surveys.

Survey 1 – Proposed Telford, Stevenson and MacColl Sites

Methodology

4.2.5.6 Seabed video footage and quantitative sediment samples were attempted at 88 stations, ten of which were also sampled for sediment contaminants for comparison with standard guideline levels. Three of the sample stations were placed beyond the range of predicted primary and secondary effects of the development, to act as reference locations for subsequent monitoring campaigns.

4.2.5.7 The seabed video footage provided information on the different seabed habitats present as well as the communities of animals living on and above the seabed surface. The collection of sediment samples provided quantitative data on the different groups of animals living on and within these different seabed habitats, as well as supplying detailed information on the types and distributions of sediment habitats present.

4.2.5.8 Video data at all 88 stations were collected. In addition, grab samples were successfully collected at all stations with the exception of station 20 where the very coarse and hard nature of the seabed preclude sampling using the grab techniques. A further five sample stations (stations 18, 21, 22, 50, 66) only returned low volumes and contained insufficient material to permit sub-sampling for particle size distribution (PSD) analysis. The total number of grab samples collected was therefore 87 samples for macrofaunal analysis and 82 samples for PSD analysis.

4.2.5.9 To assess larger, more mobile assemblages such as crab, prawns and fish, 21 scientific 2 m beam trawl samples were also collected. Samples were again located to provide sufficient coverage of predicted habitat and impact types. One reference trawl was also collected. Illustrative photographs of all the sampling equipment used are presented in Plate 4.2-1 below.

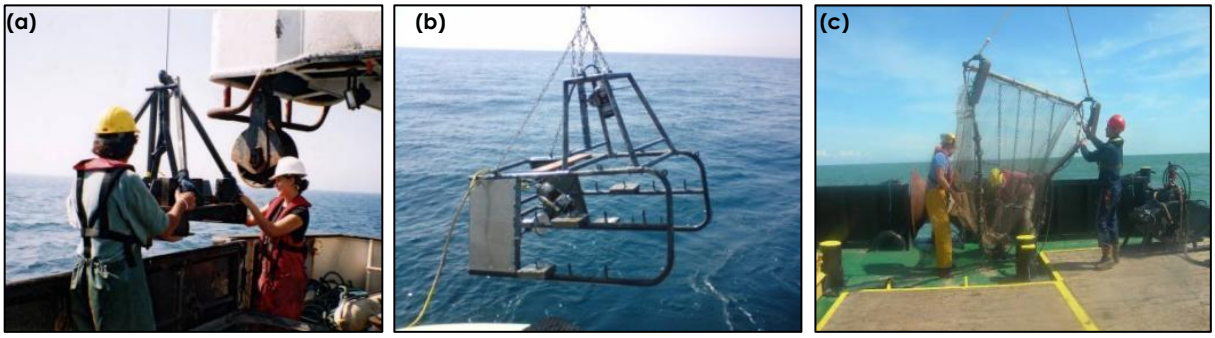


Plate 4.2-1 Sampling Equipment Including (a) Quantitative Seabed (Grab) Sampler, (b) Seabed Video Equipment and Frame and (c) 2 m Scientific Beam Trawl

4.2.5.10 Samples collected by the grab and trawl were transferred to specialist laboratories for determination of macrofaunal content (animals > 1 mm in size), PSD, loss on ignition and sediment chemistry. Data drawn from the laboratory work were subjected to a number of industry standard univariate and multivariate statistical analyses, drawn from the PRIMER package of statistical routines to investigate benthic community structure and potential relationships with physical environmental factors.

4.2.5.11 Finally, the different seabed habitats and communities found were classified using the BioScribe database according to the UK Marine Classification System v 4.05 and mapped.

Results

4.2.5.12 The results of the sampling and analyses were consistent with those of previous studies and showed that dominant seabed sediment habitat type was slightly gravelly sand with patches of shelly gravelly sand, sandy gravel and gravel (see examples in Plate 4.2-2). Levels of silt and clay in seabed sediments were generally low (< 3 %) across the three proposed wind farm sites with slight increases (up to 4 to 5 %) in deeper water areas. Levels of sediment contaminants were below relevant guideline values. The distribution of the seabed sediment types is shown in Figure 4.2-3, Volume 6 a.

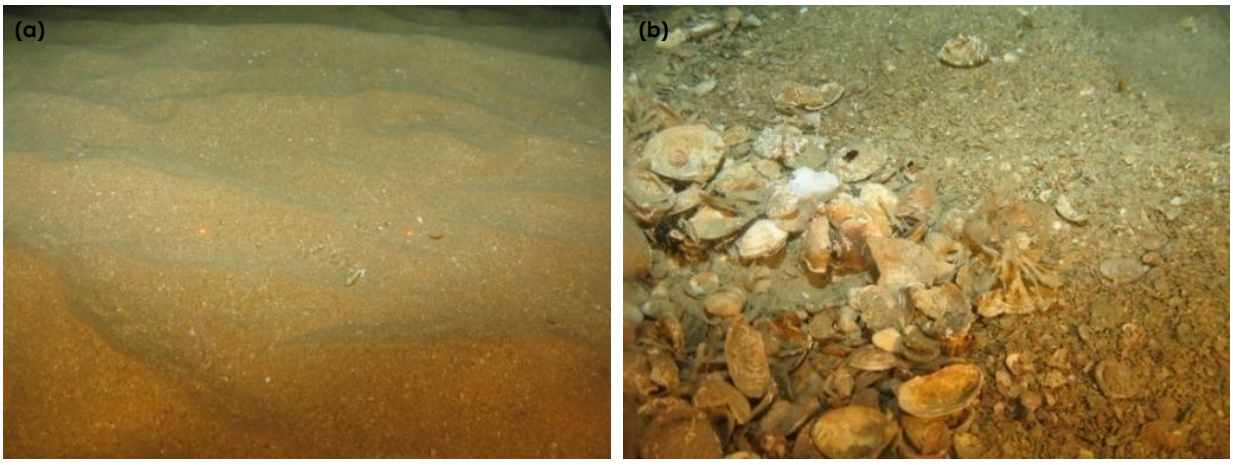


Plate 4.2-2 Example Seabed Photographs Showing Typical Sediment Types within Three Proposed Wind Farm Areas Including (a) Slightly Gravelly Sand with (b) Patches Of Coarser More Mixed Shelly Gravelly Sand

4.2.5.13 The benthic communities associated with these seabed habitat types were found to be rich and diverse and were characterised by polychaete worms (e.g. *S. bombyx, Notomastus spp. Lumbrineris gracilis* and *Chone sp.*), the burrowing urchin (*Echinocyamus. pusillus*) and the bivalve *Cochlodesma praetenue*. Other commonly recorded species

included the calcareous tube dwelling keel worm (*Pomatoceros triqueter*), soft corals, barnacles, sea firs (hydroids) and sea mats (bryozoans) which were found attached to the surfaces of gravel, stones and shell fragments. Plate 4.2-3 below presents examples of the principal characterising benthic species. Correlation with measured physical parameters, via the BIOENV statistical procedure, showed that benthic communities were most influenced by depth and sediment types.

Spiophanes bombyx *Cochlodesma praetenue* *Pomatoceros triqueter*

Plate 4.2-3 Typical Sediment Fauna Found within the boundaries of the Three Proposed Wind Farm Areas

4.2.5.14 Larger and more mobile species caught within the scientific trawls included:

- Queen scallops *Aequipecten opercularis*;
- Starfish *Asterias rubens*;
- Spider crabs *Macropodia sp*;
- Pogge *Agonus cataphractus*;
- Harbour crab *Liocarcinus depurator*;
- Hermit crabs *Parguridae;*
- Dragonet *Callionymus lyra*;
- Dab *Limanda limanda*;
- Plaice *Pleuronectes platessa*;
- Thick back sole *Microcheirus variegates*;
- Lemon sole *Microstomus kitt*; and
- Urchins *Echinoidea*.

4.2.5.15 Sandeels, including *Ammodytes* spp., *Hyperoplus lanceolatus* and *Gymnammodytes semisquamatus,* were recorded infrequently within the beam trawl although this method is generally regarded as inadequate for the sampling of these species. Where present, they were generally caught over clean, coarse sand sediments consistent with their known habitat preference. Chapter 4.3 (Fish and Shellfish Ecology) provides further information on the distribution of sandeels throughout the MORL Zone.

4.2.5.16 The seabed video data supported the findings of the grab sampling in terms of the distribution of sediment habitats and characterising fauna. It also confirmed the nature of the coarse sediments where grab sampling was unsuccessful and where no or very poor quality samples were collected. These areas were recorded within the Stevenson site and were dominated by very coarse gravel sediments with small cobbles and supported a typical suite of encrusting fauna such as *P. triqueter*, bryozoans (sea mats), hydroids (sea firs) as well as mobile sea urchins (*Echinus esculentus*) (see example in Plate 4.2-4 below). Previous assessment and liaison with Marine Scotland (EMU, 2011) confirmed that this habitat did not fulfil the criteria for an Annex I 'stony reef' so has no particular nature conservation status.

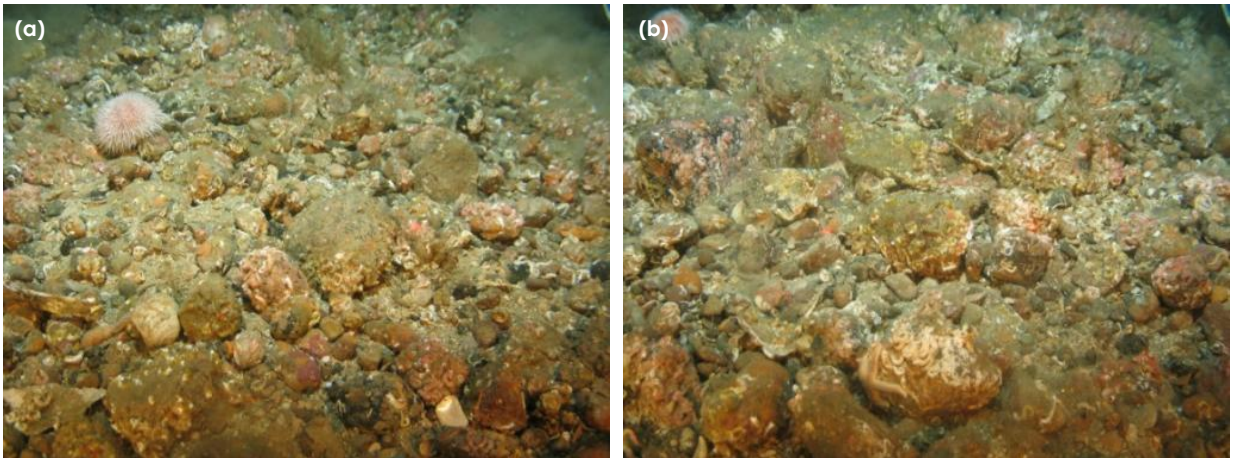


Plate 4.2-4 Examples of Coarse Sediment Habitats Within the Boundaries of the Stevenson Wind Farm Areas

4.2.5.17 Multivariate statistical classification and sorting techniques organised the grab faunal sample data into seven groups representing seven distinct communities. These faunal community groups and their associated sediment types were then compared with the Marine Habitat Classification using the BioScribe database to attribute each a biotope classification as summarised in Table 4.2-3 below. Coarse sediments for which poor quality or no grab data were collected were classified on the basis of the video data. The extents of each of the biotopes were then interpolated following interpretation of the boundaries of sediment acoustic regions and bathymetry shown on the geophysical data (Figure 4.2-4, Volume 6 a).

Table 4.2-3 Summary of Biotopes Identified Within and Around the Boundaries of the Three Proposed Wind Farm Sites

Group (No. Samples)	Biotope Classification	Representative Seabed Photograph	Description of Habitat and Community (Biotope)
a **(2 samples)**	SS.SMx.OMx. PoVen		Coarse sand and gravelly sand characterised by the polychaete *Glycera lapidum*, and the bivalve *Crenella decussata*.
b **(5 samples)**	SS.SCS.CC		Coarse gravel sediments supporting *calcareous tube worms, and urchins.*

Group (No. Samples)	Biotope Classification	Representative Seabed Photograph	Description of Habitat and Community (Biotope)
c **(22 samples)**	SS.SCS.CCS. MedLumVen		Mixed sand and gravel sediments characterised by the polychaetes *Chone* sp., *Notomastus* sp., *L. gracilis, Aonides paucibranchiata* and *Glycera lapidum*, the pea urchin *E. pusillus*, the amphipod *Atylus vedlomensis* and ribbon worms Nemertea.
d **(2 samples)**	SS.SCS.ICS. Glap		Coarser sand and sandy gravel sediments characterised by the polychaete *Glycera lapidum*, and the bivalve *Crenella decussata*.
e **(11 samples)**	SS.SSa.OSa. OfusAfil or SS.SSa.IMuSa. FfabMag		Slightly deeper water sand and slightly gravelly sand sediments with some silt / clay supporting polychaetes, acorn worms , ribbon worms and brittlestars .
f **(1 sample)**	SS.SCS.ICS. MoeVen		Comparatively shallower coarse sand supporting the bivalve *Morella spp. Moerella* spp. with venerid bivalves.
g **(45 samples)**	SS.SSa.CFiSa. EpusOborApri		Fine sand sediments characterised by polychaetes (*Ophelia borealis*), molluscs (*Cochlodesma praetenue* & *Crenella decussata*) and the urchin *Echinocyamus pusillus*.

4.2.5.18 The biotopes found included closely related circalittoral (deep water) and offshore sand biotopes typical of central and northern North Sea areas. Classifications matched well with the distribution of the broad-scale MESH habitats shown in Figure 4.2-1, Volume 6 a and with previous sample data. None of the habitats were considered to be geographically restricted or rare and were well represented within and around the study area.

4.2.5.19 The trawl and video data identified assemblages of larger and more mobile benthic species not normally collected using grab techniques. These included scallops *Aequipecten opercularis,* common starfish, *Asterias rubens*, pogge *Agonus cataphractus*, harbour crab *Liocarcinus depurator*, hermit crabs *Pagurus* spp. dragonet *Callionymus lyra,* whiting *Merlangius merlangus* and dab *Limanda limanda* as well as plaice *Pleuronectes platessa,* thick back sole *Microchirus variegatus* and lemon sole *Microstomus kitt*.

4.2.5.20 No rare or protected species with respect to the EC Habitats Directive 92/43/EEC and / or the Wildlife & Countryside Act 1981, were found within the boundaries of the three proposed wind farm sites. The following features of potential nature conservation interest were however, noted:

- The Icelandic cyprine or Ocean quahog, *Arctica islandica,* is on the OSPAR List of Threatened and / or Declining Species and Habitats (Region II – Greater North Sea) and the list of Scottish Priority Marine Features (PMF) but was only found singly as juveniles at only nine of the 88 stations. No adult *A. islandica* specimens were recorded during the survey;
- "Subtidal sands and gravels" is a UK Biodiversity Action Plan (UK BAP) priority habitat as a result of its importance for the conservation of biodiversity. It encompasses a range of near-shore and offshore habitats including a number of shallow and deeper water sand and fine sand biotopes corresponding to the classifications SS.SCS.ICS, SS.SCS.CCS, SS.SSa.IFiSa, SS.SSa.CFiSa and SS.SSa.OSa. These biotope types were recorded during the current site investigation;
- The coarse sand biotope, MoeVen, is listed as a PMF of the current Scottish draft list. This biotope was however, only found at one reference location and outside of the boundaries of the study area; and
- Sandeels (as sandeel complex *Ammodytes marinus, A. tobianus*) are also included within the Scottish draft PMF list. These species have an important functional role supporting many types of larger fish, seabirds and marine mammals as a food source and the results of the sandeel survey of the MORL Zone are discussed in further detail in Chapters 4.3 (Fish and Shellfish Ecology), 4.4 (Marine Mammals) and 4.5 (Ornithology).

4.2.5.21 Finally, levels of sediment contaminants were below guideline levels at all locations sampled.

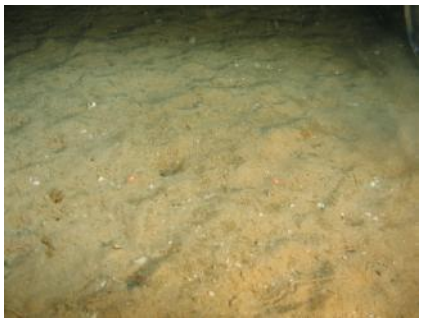
Survey 2 – Subtidal Survey of the Offshore Export Cable Route

4.2.5.22 In agreement with Marine Scotland, benthic ecological information for the OfTI study area was collected by digital seabed video and stills photography at 39 separate locations along the length of the proposed offshore export cable route. Video sample locations were distributed on the basis of MESH habitat data (Figure 4.2-1, Volume 6 a) so that all broad-scale seabed habitat types were covered. Figure 4.2-2, Volume 6 a shows the OfTI study area and location of the video samples. At each location, a minimum of five minutes of seabed video footage was collected, together with a minimum of five photographic stills as described in the specifications agreed with Marine Scotland. In areas of high habitat complexity or where a potentially sensitive feature was observed, the video deployment was extended, as described in the agreed specifications, to ensure collection of sufficient information to enable a good understanding of the nature and distribution of the habitats and the characterising epibenthic assemblages.

4.2.5.23 Seabed sampling was also attempted at 15 of the video locations for information of particle size distribution and levels of sediment contaminants. However, as a result of the presence of hard and /or coarse substrate, particularly over inshore areas, only nine samples were successfully recovered. Analysis of the samples for particle sizing and sediment chemistry was undertaken at accredited laboratories as described in Technical Appendix 4.2 A.

4.2.5.24 Matching of survey data with the Marine Habitat Classification system identified a total of 12 biotopes within the OfTI study area the distribution of which is shown in Figure 4.2-5, Volume 6 a. Table 4.2-4 below summarises the biotopes and characterising species found.

Table 4.2-4 Summary of Biotopes Identified Along the Export Cable Route

Habitat / Biotope Classification	Typical Species	Representative Seabed Image
Muddy sand with some areas of mixed sand and fine gravel (Sites 1 to 11) **SS.SSa.CMuSa** **SS.SMx.CMx**	Hydroids &bryozoans Paguridae, *Munida rugosa*, *Cancer pagurus*, *Buccinum undatum*.	
Muddy sand with burrowing megafauna. (Sites 12 to 14 and 17 to 24) **SS.SMu.CFiMu.SpnMeg**	Hydroid / Bryozoan *Virgularia mirabilis*, *Pennatula phosphorea*, *Lanice conchilega*, Paguridae, *Munida rugosa*, *Hippasteria phrygiana*, *Porania pulvillus*, *Asterias rubens*, *Echinus esculentus*.	
Coarse mixed sediments including boulders and bedrock outcrops. (Sites 15, 16, 25–35) **SS.SMx.CMx** **SS.SMx.CMx.FluHyd** **SS.SMx.CMx.OphMx** **SS.SCS.CCS**	Sponges, hydroids and bryozoans *Alcyonium digitatum*, *Urticina* sp., *Pomatoceros* sp. *Munida rugosa* Echinoderms.	
Bedrock, boulders with encrusting *Sabellaria spinulosa* and *S. spinulosa* reef overlaid with coarse mixed sediment and sand. (Site 36). **CR.MCR.CSab.Sspi**	Hydroid / Bryozoan *Alcyonium digitatum*, *Urticina* sp., *Sabellaria spinulosa*, *Munida rugosa*, *Cancer pagurus* Echinoderms.	

Habitat / Biotope Classification	Typical Species	Representative Seabed Image
Bedrock, boulders with cobbles. (Sites 37, 38, 39) **CR.MCR.EcCr.FaAlCr** **CR.MCR.EcCr.FaAlCr.Bri** **IR.MIR.KR (IR.MIR.KR.Lhyp.Pk)** **CR.MCR.EcCr.FaAlCr.Flu**	Hydroid / Bryozoan *Alcyonium digitatum,* *Urticina* sp., *Flustra foliacea,* *Asterias rubens,* *Ophiothrix fragilis,* *Ophiocomina nigra,* *Echinus esculentus,* Corallinaceae, *Laminaria* sp., Red and brown algal turf.	

Acoustic Data and Production of the Biotope Map for the OfTI Study Area

4.2.5.25 Side scan sonar (acoustic) data were provided after completion of the benthic video survey. These data showed a series of distinct boundaries between different sediment acoustic regions, such as changes in reflexivity, indicating the different harder and softer seabed types as well as changes between areas of apparent complexity (i.e. boulders and rock outcrop areas) and comparatively more featureless, homogeneous seabed areas. Overlay of these sediment acoustic regions with the biotope classifications and subsequent interpolation was then undertaken to indicate the distribution and extents of the biotopes present throughout the OfTI study area.

4.2.5.26 The resulting biotope map for the OfTI study area was then further overlaid with an interpretation as to the presence or likelihood of Annex I *Sabellaria spinulosa* and stony reef occurring. Areas of high potential are those where these reef features have been identified by the current survey and encompass adjacent areas where comparable seabed habitat conditions occur, as indicated by the available acoustic data. Low potential areas are those where reefs have not been identified but nonetheless may support these features based on the available acoustic data.

Distribution of the Biotopes within the OfTI Study Area

4.2.5.27 The study area was dominated by sedimentary seabed habitats including muddy sands, fine sandy mud and mixed sandy gravels. These areas are indicated in Figure 4.2-5, Volume 6 a by the SS.SSa.CMuSa, SS.SMu.CFiMu.SpnMeg and SS.SMx.CMx classifications respectively. These types of habitats supported little or no conspicuous epifauna with the exception of sparse growths of erect bryozoans and hydroids attached to patches of coarser material, together with mobile fauna including hermit crabs *Paguridae*, whelks *Buccinum undatum,* urchin *Echinus esculentus* and squat lobster *Munida rugosa*. Seapens *Pennatula phosphorea* and *Virgularia mirabilis* characterised large areas of fine sandy mud.

4.2.5.28 Further inshore, the seabed was dominated by comparatively coarser and more mixed sediment types, including areas of cobbles, boulders and exposed bedrock (SS.SCS.CCS, CR.MCR and IR.MIR). Overlying these coarser and rockier seabed habitat types were patches of clean, mobile fine sand in varying thicknesses creating a complex mosaic of biotopes in places. Sediment tolerant epifaunal communities (SS.SMx.CMx.FluHyd) dominated mixed sediment substrates whilst areas of more stable boulders and bedrock outcrops supported comparatively rich and diverse bryozoan and hydroid assemblages together with the soft coral *Alcyonium digitatum* and anemones *Metridium senile* and *Urticina felina* (CR.MCR.EcCr.FaAlCr and CR.MCR.EcCrFaAlCr.Bri). Along the offshore

export cable route dense populations of the epifaunal brittlestar *Ophiothrix fragilis* (SS.SMx.CMx.OphMx) colonised the upper surfaces of large cobbles and rocks.

4.2.5.29 Stable cobble and boulder beds and rock outcroppings also supported thick encrustations of the tube building Ross worm *Sabellaria spinulosa* (CR.MCR.CSab.Spi). These areas are likely to be moderately to strongly influenced by the movement of mobile / transient sands in suspension with which the Ross worm uses to construct and maintain its tubes. Such encrustations can promote benthic diversity and richness by stabilising seabed sediments and allowing colonisation by species which are comparatively less tolerant to disturbance. In places these encrustations were elevated from the seabed to form reef features as discussed further below.

The Southern Trench

4.2.5.30 The Southern Trench is a distinct bathymetric feature comprising an enclosed seabed basin of at least 250 m deep 10 km north of the Fraserburgh coastline, which is traversed by the OfTI study area. A number of video transects were conducted within the trench to identify any specific habitats and communities associated with these distinct depth conditions.

4.2.5.31 The video data showed that the sea floor of the trench comprised gravelly shelly sand overlaid with a layer of fine silt (SS.SMx.CMx). Conspicuous species included hydroids and bryozoans, soft corals and hermit crabs together with various tube dwelling worms, crabs and starfish. In addition, growths of the tube worm *Salmacina* or *Filograna* were identified at one location. *Salmacina dysteri* and *Filograna implexa* are two separate species of tube building worm but current data are not sufficient to confirm species identity in this instance.

4.2.6 Features of Nature Conservation Importance Within the OfTI Study Area

4.2.6.1 The following describes benthic features of potential nature conservation importance identified within the study area.

- The SS.SMu.CFiMu.SpnMeg biotope covered large deeper offshore areas consistent with previous records. This biotope is a component of the "burrowed mud" Scottish draft PMF (see Table 4.2-4 above for example seabed photograph).

4.2.6.2 At places along the offshore export cable route in comparatively shallow and inshore waters encrustations of *Sabellaria spinulosa* grew erect from the seabed to match EC Habitats Directive Annex I *Sabellaria spinulosa* reef (classified as CR.MCR.CSab.Sspi describing *Sabellaria spinulosa* encrusted circalittoral rock). Plate 4.2-5 below shows an example of *S. spinulosa* reefs found during the site survey. *S. spinulosa* reef feature is listed under Annex I of the Habitats Directive (92/43/EEC) as biogenic reef and is a UK Biodiversity Action Plan (BAP) priority habitat.

Plate 4.2-5 Example Seabed Photograph of Potential *Sabellaria spinulosa* Reef Taken at Station 36

4.2.6.3 Along the nearshore section of the offshore export cable route, where it approaches Fraserburgh, the *S. spinulosa* reef identified was associated with cobbles, boulders and rock outcroppings and comprised a patchy network of thick, robust encrustations throughout the video transect.

- *Salmacina / Filograna* reef was found at station 25 (see Plate 4.2-6 below. This type of reef is constructed biogenically as a result of the growth of tightly packed tube worms. *Salmacina dysteri* and *Filograna implexa* are two separate species of tube building worm but current data are not sufficient to confirm species identity in this instance. Both species are Serpulids and members of the Family *Serpulidae*. Whilst these species are not mentioned specifically, Serpulid reefs are listed under Annex I of the EC Habitats Directive and, as with *Sabellaria spinulosa* above, are protected by a UK BAP. Serpulid aggregations are listed on the Scottish draft PMF list.

Plate 4.2-6 Example Photographs of the *Salmacina dysteri / Filograna implexa* Reefs Found at Station 25

- Areas of cobbles and rock outcroppings identified during the site specific study matched EC Habitats Directive Annex I stony and bedrock reef respectively (see Technical Appendix 4.2 B for method and criteria used for scoring resemblance). Both types of reef were found along offshore export cable route. Plate 4.2-7 shows example photographs of stony and bedrock reefs found along the cable route.

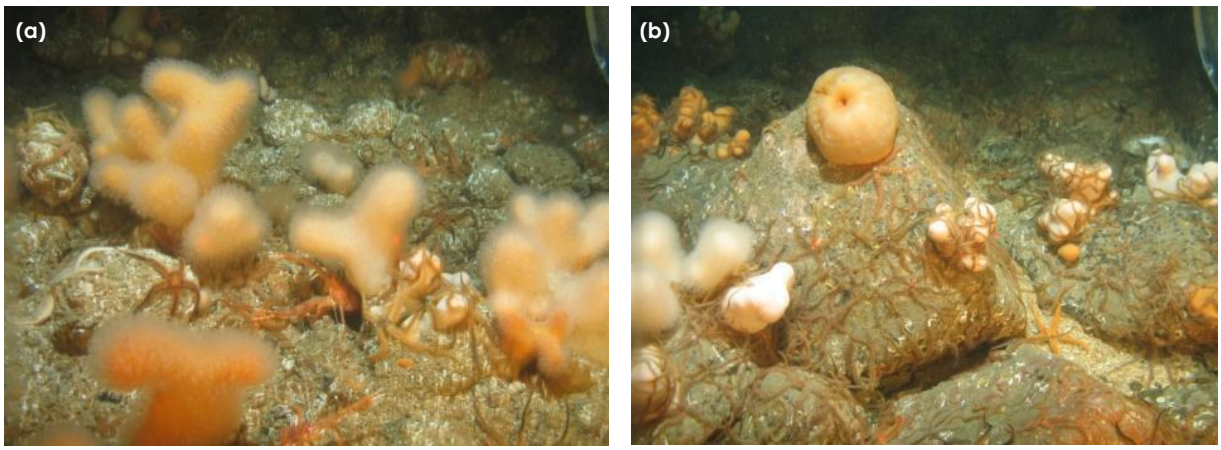


Plate 4.2-7 Example Seabed Photographs of (a) Bedrock Reef and (b) Stony Reef

4.2.6.4 Bedrock reefs included shallow water inshore rocky areas where there was sufficient light available to permit growth of algae. These areas were typically dominated by kelp together with a rich under-storey of red encrusting and foliose algae, hydroids, bryozoans, anemones and soft corals. Stony reefs comprised areas of cobbles and boulders and were generally found further offshore beyond the bedrock reefs. Here, light penetration was insufficient to support growths of algae. Instead, stony reef areas were dominated by bryozoans, hydroids and soft corals.

4.2.6.5 The acoustic and video data showed that biogenic reefs were patchy in their distribution suggesting that it is possible to micro-site export cables to *avoid sensitive features*. It is possible to lay power cables around quite intricate shapes, with the use of suitable 'installation aids' and this is discussed further in Chapter 10.1 (Benthic Ecology).

4.2.6.6 Finally, levels of sediment contaminants were found to be below standard guideline values and therefore were considered to be of no significance in terms of potential adverse effects on benthic ecology. Consequently, sediment contaminants have not been considered further in this assessment.

4.2.7 Individual Site Characteristics

4.2.7.1 Whilst the three individual proposed wind farm sites shared common seabed habitat types, each exhibited a unique mix of biotope types and may thus be considered to differ from one another in terms of their principal benthic ecological characteristics. Figure 4.2-4, Volume 6 a shows the distribution of benthic biotopes overlaid with the boundaries of the three proposed sites to illustrate the individual biotope characteristics of each site. Table 4.2-5 below presents a summary of the baseline benthic ecological characteristics for each of the three proposed wind farm developments.

Table 4.2-5 Baseline Benthic Ecological Characteristics of the Individual Wind Farm Sites

Individual Wind Farm Sites	Summary of baseline characteristics
Telford	The site is dominated by a homogenous circalittoral slightly gravelly fine sand supporting a typical range of infaunal polychaetes, molluscs and urchins and corresponding to the EpusOborApri biotope classification. The largely homogenous nature of the seabed habitat differed from the more mixed seabed types recorded within the Stevenson and MacColl sites. A low number of samples also correlated with the coarser sediment MedLumVen biotope classification, although this was comparatively unimportant in terms of spatial extent. Species diversity, abundance and biomass values in grab samples were comparatively low possibly reflecting the homogenous nature of the seabed. The principal biotope type within the Telford site was widely distributed throughout the development area and was represented in each of the proposed wind farm sites. The Telford site was also associated with a specific mobile epifauna as identified from the 2 m beam trawl samples including common starfish, hermit crab, queen scallop, spider crab and dab.
Stevenson	The Stevenson site shared comparable biotope attributes to the Telford site but uniquely comprised areas of coarse gravel and cobbles (see Plate 4.2-4 above as an example). Water depths were also generally less than those within the Telford and MacColl sites. The coarse substrates supported hydroid and bryozoan communities as well as other attaching animals such as barnacles and calcareous tube worm together with squat lobsters not found within the other proposed wind farm sites.
MacColl	In comparison with the Telford and Stevenson sites, MacColl was characterised by a mix of the principal sand and gravel sand biotope types discussed above but also included the Ofus.Afil biotope present in the comparatively deeper water areas present in this site. This biotope type included slightly gravelly sand and gravelly sand and comprised elevated levels of silt compared with the other two proposed wind farm sites. Typical fauna included sediment burrowing polychaetes, brittlestars and urchins. Given the specific water depth conditions within the MacColl site, this biotope type was almost exclusively found here. The MacColl site also supported 2 assemblages of mobile epifauna as recorded in the 2 m beam trawls. One assemblage appeared to be distributed over the comparatively more shallow waters to the west of the MacColl site and included common starfish, harbour crab, queen scallop edible urchin dab, pink shrimp and squat lobster. The second mobile epifaunal assemblage was distributed within the deeper water areas to the east of the MacColl site and included harbour crab, queen scallop, dragonet, spider crab and pogge.

4.2.8 Legislative and Planning Framework

4.2.8.1 The legislation and guidance which was taken into account in the benthic ecology assessment is summarised below:

- Council Directive 92/43/EEC on the Conservation of natural habitats and of fauna and flora (transposed into domestic legislation through the Conservation (Natural Habitats &c.) Regulations 1994, and Reg 86 of the Conservation of Habitats and Species Regulations 2010). The Offshore Marine Conservation (Natural Habitats &c.) Regulations 2007 (as amended 2010) extend the provisions of the Habitats Directive to offshore areas;
- Natural Environment and Rural Communities Act (2006) (provides for the publication of lists of nationally important habitats and species);
- Marine (Scotland) Act 2010 (provides for the publication of Priority Marine Features); and
- Wildlife and Countryside Act, 1981 (lists species of national nature conservation importance).

4.2.8.2 Specific guidance used in the preparation of both this chapter and its supporting field studies are provided below;

- DTLR (2002). Guidelines for the conduct of benthic studies at aggregate dredging site (now updated see Ware & Kenny, 2011);

- Cefas (2011). Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects;
- Johnston, C.M., Turnbull, C.G. and Tasker, M.L., 2002. Natura 2000 in UK Offshore Waters: Advice to support the implementation of the EC Habitats and Birds Directives in UK offshore waters [online]. *JNCC Report* No. 325, Joint Nature Conservation Committee, Peterborough; and
- MMO, JNCC, NE, CCW (2010). Guidance on the assessment of effects on the environment and cultural heritage from marine renewable developments.

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4.3 Fish and Shellfish Ecology

4.3.1 Introduction

4.3.1.1 This chapter describes the natural fish and shellfish resources relevant to MORLs three proposed wind farm sites (Telford, Stevenson and MacColl) and associated offshore transmission infrastructure (OfTI).

4.3.1.2 The study consisted of the following aspects:

- Consultation with relevant statutory and non–statutory bodies, including Marine Scotland Science, SNH, JNCC, RSPB and Moray and Pentland Firths Salmon Protection Group;
- Detailed desk study to establish the baseline conditions;
- Sandeel Distribution Surveys; and
- Consideration of the relevant key legislative and planning information.

4.3.1.3 For the purposes of the baseline assessment, four main aspects have been taken into account:

- Fish and shellfish species of commercial importance;
- Presence of spawning and nursery grounds;
- Key prey species to sea birds, marine mammals and fish; and
- Presence of species of conservation importance, including migratory species.

4.3.1.4 Certain species are relevant within more than one of the aspects listed above and, as a result, some repetition is to be expected.

4.3.1.5 The following technical appendices support this chapter and can be found as:

- Technical Appendices 4.2 A and B (Benthic Ecology Technical Report);
- Technical Appendix 4.3 A (Fish and Shellfish Ecology Technical Report);
- Technical Appendix 4.3 B (Salmon and Sea Trout Ecology and Fisheries Technical Report);
- Technical Appendix 4.3 C(Sandeel Distribution Survey); and
- Technical Appendix 4.3 D (Electromagnetic Fields Modelling).
- Technical Appendix 5.1 A (Commercial Fisheries Technical Report);

4.3.1.6 This baseline is used to inform the Fish and Shellfish ecology impact assessment described in the following chapters:

- Chapters 7.2, 10.2 and 14.2 (Fish and Shellfish Ecology); and
- Chapter 12.1 (Whole Project Assessment).

4.3.1.7 This baseline chapter is also used to inform the assessments for the following chapters:

- Chapters 4.2, 7.1, 10.1 and 14.1 (Benthic Ecology);
- Chapters 4.4, 7.3, 10.3 and 14.3 (Marine Mammals);
- Chapters 4.5, 7.4, 10.4 and 14.4 (Ornithology); and
- Chapters 5.1, 8.1, 11.1 and 15.1 (Commercial Fisheries).

4.3.2 Consultations

4.3.2.1 MORL has framed its assessment of likely significant effects on fish and shellfish populations through consultation with key stakeholders. Particular emphasis was placed on the effects on herring, cod and sandeel populations and diadromous species of conservation importance such as salmon, sea trout and European eel. In addition, potential effects on elasmobranchs and shellfish species including squid, *Nephrops*, scallops, lobsters and edible crabs, were also considered in the scoping responses.

4.3.2.2 Consultation was undertaken with the organisations and individuals listed in Table 4.3-1 and Table 4.3-2 below. Suggested inputs were included in the baseline and impact assessments where appropriate.

Table 4.3-1 List of Consultees

Organisation	Consultation Response	MORL Approach
Marine Scotland Science (MSS)	**Response Provided**. • Inputs into baseline information gathering; and • Inputs into impact assessment approach.	Included in Chapter 4.3, Technical Appendices 4.3 A and 4.3 B
	Principal Comments on Draft ES (excluding migratory fish): • Include average landing values in pounds (£); • Include *Arctica islandica* in the baseline; • Consider maintenance noise;	Addressed in Chapters 4.3 and 7.2
	• When considering 'Changes to fishing activity' the inter array cabling and cable route should also be considered as this may affect types of fishing that can occur and may exclude fishing on parts of the ground depending on whether / what cable protection systems are used rather than deep burial of the cables; • For assessment of habitat disturbance / loss on sandeels and herring, the proportion of suitable habitat that will be disturbed / lost should be taken into account;	Addressed in Chapter 10.2 and Chapter 14.2
	• We would recommend that the developer take a precautionary approach to the assessment of the potential of impact of construction noise on salmon and sea trout and change this to minor–moderate significance and probable;	Addressed in Chapter 7.2
	• Unless the developer can prove that cod are not present in / around the site, we would again recommend the developer re–assess the potential for impact of noise on cod to probable, especially as the impact has been considered of moderate–major significance. This could apply to both construction and operational noise;	Addressed in Chapter 7.2
	• There is a limited ability for sandeels to cope with loss of habitat or any other form of direct impact as they tend not to move from settled locations. Until locations of actual turbines can be given, it is difficult to see how the impact on sandeels can be assessed accurately. We would recommend that this impact be considered as minor–moderate significance and probable pending the results from the sandeel survey;	Addressed in Chapter 7.2

Organisation	Consultation Response	MORL Approach
Marine Scotland Science (MSS)	• Commercial fisheries should be included for assessment of cumulative impacts if displacement is likely to occur. Displacement and changes to fishing activity should not be classed as not significant if it has been stated that the potential for impact is dependent on the level of activity that is resumed. This implies an impact could occur and if fishing is displaced as a result, this could mean a moderate to major impact both on the fishers, who will have increased competition, and on the fishing grounds themselves as there may be increased fishing pressure on a smaller fishing area, resulting in increased pressure on the fishery / stock. For example: in terms of the scallop fishery, if the areas where the vessels are displaced to are a source for spawning, then this could result in a detrimental impact on the scallop stocks in the area	Addressed in Chapter 7.2
	Comments on Draft ES (migratory fish): • We note that the area around the Moray Firth contains a number of SACs for salmon and is probably an important area in terms of migration for salmon, sea trout and eels, with the potential to affect rivers that are of a great distance from the actual development;	Addressed in Chapter 7.2, Chapter 10.2 and Chapter 14.2
	• The likely impacts of EMFs are often assessed as probable, but minor and negative. The biological information on which this is based is very limited (as noted by the SNH commissioned review by Gill). As such, we do not consider that a confident assessment can be made. The developer should therefore identify that this assessment is associated with a low level of confidence;	Addressed in Chapter 7.2 and 10.2
	• The current understanding of EMF effects on diadromous fish is still relatively unknown. However, we note the current research by MSS in this area, which will improve the knowledge base in due course;	Addressed in Chapter 7.2, 10.2 and 14.2
	• The potential cumulative impacts of other developments on salmon and sea trout will be an important consideration. This is especially true for fish that migrate a long distance around the Scottish coast. The developer should also consider cumulative impacts associated with other developments including tidal turbine developments in the Pentland firth etc. The developer should note that there is substantial uncertainty in relation to cumulative effects;	Noted.
	• Given the substantial uncertainty associated with potential impacts on fish migration and consequences for individual rivers, the developer / MS LOT, may wish to consider the need to monitor fish movement through the area and / or the health of salmon populations.	Noted.
MSS sandeel specialists: Dr. Simon Greenstreet and Dr. Peter Wright.	**Response provided:** • Inputs into baseline information gathering and sandeel survey methodology.	Addressed in Chapter 4.3 and Technical Appendices 4.3 A and 4.3 C

Organisation	Consultation Response	MORL Approach
MSS herring specialist: Dr. Emma Hatfield, herring specialist	**Response provided:** • Inputs into baseline information gathering.	Addressed in Chapter 4.3 and Technical Appendix 4.3 A
Scottish Natural Heritage (SNH)	**Response provided:** • Inputs into baseline information gathering; and • Inputs into impact assessment approach.	Included in Chapter 4.3 and Technical Appendices 4.3 A and 4.3 B
	Comments on draft ES impact assessment (5th April 2012): • We note that impacts potentially arising from the cable route have not been addressed in detail, and it does not appear that offshore substation platforms have been addressed at all. It is not yet possible to categorically state that mitigation will not be required, and we recommend that the full range of possible mitigation measures is explored in the ES;	Addressed in Chapter 10.2
	• In respect of salmonids, the draft states that 'areas in the immediate vicinity of the rivers will not be affected (by noise) and hence fish will not be disturbed immediately prior to river entry or immediately after leaving the rivers…'. A significant area of the Moray Firth would however be affected by the 75 dB^{ht} (salmo salar) noise level, so possible impact on fish outside of the areas 'immediately' offshore should also be considered;	Addressed in Chapter 7.2
	• Other mitigation options besides soft–start piling should be considered – it is too early, and there is too little detail available with regard to the construction programme, to be able to categorically state, at this stage, that mitigation is not required;	Addressed in Chapters 7.2 and 10.2
	• We would find it helpful if sediment concentrations were mapped in order to consider possible impacts on fish (including Atlantic salmon migration to and from relevant SACs in the area);	Addressed in Chapter 7.2.
	• As we have previously advised, increases in suspended sediment concentrations cannot simply be dismissed as less than natural background conditions. It is important to consider seasonality and to understand that peaks in concentrations due to wind farm construction may occur at different times of year compared to natural peaks, and may coincide with periods of particular sensitivity in species' lifecycles. For example: the period of greatest sensitivity for herring is likely to be during, and subsequent to, their spawning in late Summer and Autumn. Peaks in the natural range of suspended sediment mostly occur over the Winter and therefore are less likely to coincide with herring spawning, whereas increased levels from wind farm construction might do and therefore need evaluation;	Addressed in Shapter 7.2 and Chapter 10.2

Organisation	Consultation Response	MORL Approach
Scottish Natural Heritage (SNH) (continued)	• We recommend presenting quantitative information on induced electric fields (iE) as well as on magnetic fields. It is thought that teleost fish show no response to iE fields < 6V / m, but that elasmobranchs can be sensitive to DC iE fields ranging from 0.5 – 1,000 BV / m (smaller range for AC);	Addressed in Chapter 7.2 and Chapter 10.2
	• With regard to diadromous fish, we consider it will be important to evaluate cable burial in shallower waters, where these fish could be expected to be in closer proximity to emitted EMF; • We note that potential impacts on sandeels will need to be re–assessed once the results of the sandeel survey are available.	Addressed in Chapter 7.2., Chapter 10.2 and Technical Appendix 4.3 D Addressed in Chapter 7.2, 10.2 and Technical Appendix 4.3 C
Joint Nature Conservation Committee (JNCC)	**Response provided:** • Inputs into baseline information gathering; and • Inputs into impact assessment approach.	Included in Chapter 7.2, 10.2 and 14.2 and Technical Appendices 4.3 A and 4.3 B
Royal Society for the Protection of Birds(RSPB)	**Comments on draft ES (29th February 2012):** We agree that impacts at the scale of the North Sea and even the Moray Firth are negligible but would suggest that, at the scale of the wind farm, they are potentially more severe than suggested. In particular, perturbation of seabed ecology is likely to have longer–lasting impacts if works go ahead in late Spring / early Summer in a year with calm weather, but this cannot be mitigated for such a large–scale project in a harsh physical environment. Nevertheless, within the timescale of the development, most of the localised effects of construction activity will have worn off. Whilst the creation of new habitat for new or different species is certain (e.g. artificial reef creation), a bigger impact on local fish stocks is likely to arise from the restriction of trawling among the towers. If trawlers are excluded there will be significant benefits to the environment that will more than offset construction damage.	Addressed in Chapters 7.2, 10.2 and 14.2.

4.3.2.3 In the case of salmon and sea trout, additional consultation was undertaken with District Salmon Fishery Boards (DSFBs), stakeholders and their representatives. The outputs of this are summarised in Table 4.3-2 below. The full consultation list is provided in Appendix 1.4 A.

Table 4.3-2 List of District Salmon Fishery Boards, Stakeholders and their Representatives Consulted

Organisation	Consultation Response	MORL Approach
Moray and Pentland Firths Salmon Protection Group (MPFSPG)	Inputs into baseline information gathering.	Taken into account in chapter 4.3
	Comments on draft ES impact assessment (10th April 2012): • We note that the initial scoping response to the developers from Marine Scotland Science strongly suggested that in order for an EIA to be fit for purpose, it should include detailed information on the utilisation of the development area by salmon and that if such information was lacking, a suitable monitoring strategy should be devised (as evidenced by the response outlined in Chapter 3 of your document). It is clear from the documents provided that neither of these two approaches will be adopted. We further note that Marine Scotland Science regard the monitoring undertaken at existing offshore developments such as Robin Rigg as yielding unsatisfactory results in respect of fish, therefore we find the proposed lack of meaningful monitoring in the present proposals equally unsatisfactory;	Taken into account in Chapter 7.2 and Chapter 10.2
	• It is currently difficult to give a reasoned opinion on the draft assessment as there is little detailed information provided on issues such as the actual likely size of the scheme, the type of devices to be deployed and the degree of confidence attached to the assessment of impacts. As an example, the assessment as it stands suggests that the loss of sandeel habitat due to the presence of the structures will be negative, of minor–moderate magnitude and to be probable–unlikely (i.e. confidence levels are 5–95 %). While we accept that some additional research will be undertaken in respect of sandeels in 2012, it is clear that the assessment as it stands is inherently weak;	Addressed in Chapters 4.3 and 7.2 and Technical Appendix 4.3 C.
	• Similarly, the assessment of construction noise on salmon and sea trout does not instil confidence, particularly as no mitigation is proposed to offset any potential effects. We note that the SNH commissioned report on the effects of electromagnetic fields and noise on fish, concludes that there is considerable uncertainty with regard to the findings of the research that has been undertaken so far and that more research is required. Given these levels of uncertainty, it is inappropriate to not fully utilise mitigation measures where they are available. Rather, we feel that a precautionary approach is advisable;	Addressed in Chapter 7.2.
	• The impact assessment has been formulated without fundamental knowledge of the usage, or otherwise, of the area by salmon and sea trout as well as other key species such as sandeel and, as such, it is difficult to be confident in its findings as currently presented. Additionally, the results of key research programmes such as the behaviour of salmonids in relation to electromagnetic fields are not yet available while other potential impacts such as noise still remain poorly understood. In terms of the proposed mitigation, the document explicitly states that no specific mitigation is proposed for salmon and sea trout. Thus the effects of construction activities on migrating smolts, a critical period during the life history of both salmon and sea	Addressed in Chapters 4.3 and 7.2 and Technical Appendix 4.3 C

Organisation	Consultation Response	MORL Approach
Moray and Pentland Firths Salmon Protection Group (MPFSPG) **(continued)**	trout, is apparently not considered to be worthy of mitigation despite the fact that potential measures are available in the form of the avoidance of sensitive activities during such crucial periods. There appears to be nothing in the document to suggest that there will be any effort to obtain baseline information in respect of salmon and sea trout movements, abundance, swimming depth, feeding behaviour etc. and without this any post construction monitoring in the wind farm area would be rendered extremely difficult. Whilst the results of the assessment, as they stand, appear to be in accordance with those previously published by the Scottish Government i.e. *Habitat Regulations Appraisal of Draft Plan for Offshore Wind Energy in Scotland Territorial Waters Appropriate Assessment Review* we view the contents of that document as deficient in a number of key aspects and to be subordinate to other work commissioned by Government agencies. There appears to remain a fundamental contradiction between the initial scoping advice from Marine Scotland Science and the sensitivity that has been assigned to the receptors in the aforementioned document published by the Scottish Government;	Addressed in Chapters 4.3 and 7.2 and Technical Appendix 4.3 C
	• In respect of the burying of cables as a mitigation for possible issues regarding electromagnetic fields it is considered vital that the document clearly states that as a mitigation, all cables will either be buried to a suitable depth or have a suitable material placed over them and that there will be no exceptions to this irrespective of any technical differences that may arise;	Addressed in Chapters 7.2 and 10.2 and Technical Appendix 4.3 D
	• The majority of the most likely significant effects have been identified. However, some aspects of the proposal, which are considered to be generally ecologically beneficial, such as the creation of physical structures facilitating an environment conducive to increased fish assemblages, may actually represent a new predation 'pinch point' for migrating smolts on what, given the lack of any evidence to the contrary, can only be considered a key migration route for salmon and a key feeding area for sea trout. Overall, the approach taken to the EIA appears to have ignored the scoping advice issued by Marine Scotland Science in regard to the baseline information on salmon and sea trout required. During discussions between our group and the representatives of the developers, the impression was given that the approach would be modified to assume that salmon and sea trout were present in the area, therefore the appropriate response would be to mitigate for any potential ill effects to the maximum degree practicable. We now see from the EIA that, with the exception of electromagnetic fields, there is no intention to mitigate even when measures such as the timing of sensitive works are available. It should be emphasised that if such an approach is adopted, DSFBs and Fishery Trusts will have no option but to assume that the entire run of salmon or sea trout from the river in question will use the area under development, and assess any application on that basis. It would appear that there is an over reliance on the published documentation from the Scottish Government, despite the fact that there are considerable uncertainties associated with the science underpinning that documentation. This reliance is further undermined by the suggestion that monitoring will only be undertaken in respect of a surrogate species.	Addressed in Chapter 7.2

Organisation	Consultation Response	MORL Approach
Moray and Pentland Firths Salmon Protection Group (MPFSPG) **(continued)**	Given that there are also other potential impacts that cannot be mitigated for, it appears that residual risk levels will largely be a function of the degree of utilisation of the proposed development area, and the behavioural patterns within that area, by salmon and sea trout.	Addressed in Chapter 7.2

4.3.3 Offshore Generating Station and Offshore Transmission Infrastructure Baseline Characteristics

Desktop Studies

4.3.3.1 The principal sources of information used to establish a fish and shellfish ecology baseline were as follows:

- MSS publications;
- International Council for the Exploration of the Sea (ICES) publications;
- Marine Management Organisation (MMO) Landings Data by ICES rectangle for the period 2000 to 2009;
- CEFAS publications;
- Fisheries Sensitivity Maps in British Waters (Coull *et al.,* 1998);
- Mapping spawning and nursery areas of species to be considered in Marine Protected Areas (Marine Conservation Zones). Report No 1 (Ellis *et al.,* 2010);
- Results of benthic surveys undertaken in the area (EMU 2011); and
- Other relevant research publications.

4.3.3.2 ICES statistical rectangles are the smallest spatial unit used for the collation of fisheries statistics by the European Commission (EC) and Member States. The boundaries of ICES rectangles align to 1˚ of longitude and 30' of latitude, and are large in relation to the three proposed wind farm sites, which represents approx. 9.1 % of the area of the ICES rectangle within which it is located (rectangle no 45E7). In addition, fishing activity is rarely evenly distributed throughout the area of a rectangle. The analysis of the fisheries statistics provided below should therefore be taken in the context of the spatial limitations of the dataset.

4.3.3.3 Furthermore, whilst landings data provide a good indication of the commercial species present by ICES rectangle, in some cases their relative abundance and importance may be misrepresented as a result of factors, such as: low quota allocations, fisheries closures, changes in demand, etc. In addition, the presence and distribution of fish and shellfish species are dependent on a number of biological and environmental factors that interact with each other in direct and indirect ways, and are subject to seasonal and annual variations.

4.3.3.4 The assessment of the three proposed wind farm sites and the OfTI as a potential spawning and nursery ground has primarily been undertaken using the charts provided in Coull *et al.,* (1998) and Ellis *et al.,* (2010). It should be noted that although these are useful sources to identify broad spawning and nursery grounds they do not allow for definition of exact grounds. Where available, alternative publications have been used to help define the extension of the grounds on a site specific basis (see Technical Appendix 4.3 A).

4.3.3.5 It is recognised that there are gaps in the understanding of the distribution, behaviour and ecology of certain species. This is particularly evident for a number of migratory species and species of conservation importance (i.e. sea lamprey, European eel, salmon and sea trout) for which little is known in relation to their migration routes and the use that they make of Scottish coastal areas.

4.3.4 Study Areas

4.3.4.1 Three study areas have been defined for the assessment of the natural fish and shellfish resources are shown in Figure 4.3-1, Volume 6 a:

- A study area specific to the three proposed wind farm sites (ICES rectangle 45E7) (Wind Farm Specific Study Area);
- A study area specific to the OfTI (ICES rectangles 45E7, 44E7 and 44E8) (OfTI Specific Study Area); and
- A regional study area (ICES rectangle 45E7, where the three proposed wind farm sites and part of the OfTI are located, and all adjacent rectangles).

4.3.4.2 The geographical scope described above takes into account fisheries statistics, which are collated by ICES rectangle. In some instances (i.e. species with spawning and nursery grounds) wider areas have been considered for assessment. In the case of diadromous migratory species, given the uncertainties in relation to migratory pathways (Malcolm *et al*., 2010), the geographical scope of assessment has been based on the proximity of the three proposed wind farm sites and offshore export cable(s) to rivers, taking special account of those which are designated Special Areas of Conservation and also providing a national context (see Technical Appendix 4.3 A and 4.3 B). Rivers designated as SACs in the Moray Firth and the wider area are shown in Figure 4.3-1, Volume 6 a together with the study areas.

4.3.5 Commercial Species

4.3.5.1 The Moray Firth supports a number of commercial fish and shellfish species. An indication of the relative importance of these in the regional study area is given in Figure 4.3-2, Volume 6 a, based on annual average (2000 to 2009) landings weights (tonnes) by species and ICES rectangle (MMO 2010). A description of the ecology and behaviour of the principal commercial fish and shellfish species is given in Technical Appendix 4.3 A.

4.3.5.2 The relative contribution of different species to the total landings weights varies depending on the ICES rectangle under consideration. *Nephrops,* for example, are of greatest importance in the southern (44E6, 44E7 and 44E8) and eastern (46E8 and 45E8) rectangles. Haddock accounts for a relatively high percentage of the total landings in the majority of rectangles, although the highest landings by weight for this species are recorded in the eastern rectangles of the regional study area. In the case of king scallops, landings values by weight are particularly high in the local study area and in adjacent rectangles 46E7, 45E6 and 44E6. Elasmobranch species (sharks and rays) constitute a small percentage of the landings weights, both in the local and regional study area, being included under the category "other" in Figure 4.3-2, Volume 6 a.

4.3.5.3 The annual average landings weights (2000 to 2009) by species in the local study area are shown in Table 4.3-3 and Table 4.3-4 below for fish and shellfish species respectively. Haddock, herring, monks and whiting account for the majority of the fish landings whilst the principal shellfish species landed are king scallops, *Nephrops*, edible crab and squid.

Table 4.3-3 Annual Average Landings Weights (2000 to 2009) of Principal Commercial Fish Species in ICES Rectangle 45E7 (Wind Farm Specific Study Area) (MMO 2010)

Common Name	Latin Name	Average (2000 to 2009) Landings Weight (t)	Average (2000 to 2009) Landings Value (£)	Percentage of Total Fish Landings Weight (45E7)	Percentage of Total Landings Weight (All Fish and Shellfish Species Combined) (45E7)
Haddock	*Melanogrammus aeglefinus*	280.6	204,153.6	64.9 %	25.0 %
Monks or Anglers	*Lophius piscatorius / L. budegassa*	43.1	113,426.6	10.0 %	3.8 %
Herring	*Clupea harengus*	39.1	6,907.6	9.0 %	3.5 %
Whiting	*Merlangius merlangus*	16.4	9,121.2	3.8 %	1.5 %
Cod	*Gadus morhua*	12.4	19,847.6	2.9 %	1.1 %
Horse Mackerel	*Trachurus trachurus*	8.2	2,453.4	1.9 %	0.7 %
Megrim	*Lepidorhombus whiffiagonis*	7.3	12,415.3	1.7 %	0.6 %
Plaice	*Pleuronectes platessa*	6.7	4,263.4	1.5 %	0.6 %
Witch	*Glyptocephalus cynoglossus*	2.8	2,647.1	0.7 %	0.3 %
Spurdog	*Squalus acanthias*	2.3	2,368.7	0.5 %	0.2 %
Hake	*Merluccius merluccius*	2.0	2,148.3	0.5 %	0.2 %
Skates and Rays	–	1.8	1,255.9	0.4 %	0.2 %
Ling	*Molva molva*	1.8	1,873.9	0.4 %	0.2 %
Lemon Sole	*Microstomus kitt*	1.6	2,960.0	0.4 %	0.1 %
Saithe	*Pollachius virens*	1.4	934.3	0.3 %	0.1 %
Other	–	5.1	6,229.3	1.2 %	0.5 %

Table 4.3-4 Annual Average Landings Weights (2000 to 2009) of Principal Commercial Shellfish Species in ICES Rectangles 45E7 (Wind Farm Specific Study Area) (MMO 2010)

Common Name	Latin Name	Average (2000 to 2009) Landings Weight (t)	Average (2000 to 2009) Landings Value (£)	Percentage of Total Shellfish Landings Weight (45E7)	Percentage of Total Landings Weight (all fish and shellfish species combined) (45E7)
King Scallops	*Pecten maximus*	539.0	957,355.2	78.1 %	48.0 %
Nephrops	*Nephrops norvegicus*	106.7	236,890.0	15.5 %	9.5 %
Squid	*Loligo forbesi*	40.2	87,849.6	5.8 %	3.6 %
Edible Crab	*Cancer pagurus*	2.5	2,999.2	0.4 %	0.2 %
Queen Scallops	*Aequipecten opercularis*	1.2	1,033.2	0.2 %	0.1 %
Velvet Crab	*Necora puber*	0.3	459.5	< 0.1 %	< 0.1 %
Octopus	–	0.1	55.4	< 0.1 %	< 0.1 %
Whelks	*Buccinum undatum*	< 0.1	46.6	< 0.1 %	< 0.1 %
Green Crab	*Carcinus maenas*	< 0.1	39.8	< 0.1 %	< 0.1 %
Lobsters	*Homarus gammarus*	< 0.1	538.8	< 0.1 %	< 0.01 %
Mixed Crabs	–	< 0.1	58.5	< 0.01 %	< 0.01 %
Periwinkles	*Littorina littorea*	< 0.1	22.6	< 0.01 %	< 0.01 %
Pink Shrimp	*Pandalus montagui*	< 0.01	1.3	< 0.01 %	< 0.01 %

4.3.5.4 The combined annual average weights (2000 to 2009) landed from the three ICES rectangles where the OfTI is located (44E7, 44E8 and 45E7) are given in Table 4.3-5 and Table 4.3-6 below, for fish and shellfish species respectively. Haddock and herring are the principal species landed by weight followed, to a lesser extent, by mackerel, monks, whiting and cod. The main shellfish species landed are *Nephrops,* king scallops and squid and to a lesser extent edible crab.

Table 4.3-5 Annual Average Landings Weights (2000 to 2009) of Principal Commercial Fish Species in the OfTI Specific Study Area (MMO 2010)

Common Names	Latin Names	Average (2000 to 2009) Landings Weight (t)	Average (2000 to 2009) Landings Value (£)	Percentage of Total fish Landings Weight in 44E7, 44E8 and 45E7	Percentage of Total Landings Weight (all species combined) in 44E7, 44E8 and 45E7
Haddock	*Melanogrammus aeglefinus*	1,543.1	1,004,096.3	44.2 %	25.4 %
Herring	*Clupea harengus*	1,147.1	232,306.9	32.8 %	18.9 %

Common Names	Latin Names	Average (2000 to 2009) Landings Weight (t)	Average (2000 to 2009) Landings Value (£)	Percentage of Total fish Landings Weight in 44E7, 44E8 and 45E7	Percentage of Total Landings Weight (all species combined) in 44E7, 44E8 and 45E7
Mackerel	*Scomber scombrus*	204.5	116,156.1	5.9 %	3.4 %
Monks or Anglers	*Lophius piscatorius / L. budegassa*	154.3	357,125.9	4.4 %	2.5 %
Whiting	*Merlangius merlangus*	121.1	71,976.9	3.5 %	2.0 %
Cod	*Gadus morhua*	103.5	143,184.8	3.0 %	1.7 %
Plaice	*Pleuronectes platessa*	53.9	31,307.7	1.5 %	0.9 %
Saithe	*Pollachius virens*	25.6	11,654.1	0.7 %	0.4 %
Lemon Sole	*Microstomus kitt*	20.1	37,912.9	0.6 %	0.3 %
Witch	*Glyptocephalus cynoglossus*	18.0	17,307.6	0.5 %	0.3 %
Skates and Rays	–	14.6	5,931.5	0.4 %	0.2 %
Ling	*Molva molva*	13.4	15,627.1	0.4 %	0.2 %
Megrim	*Lepidorhombus whiffiagonis*	12.7	22,372.0	0.4 %	0.2 %
Spurdog	*Squalus acanthias*	9.7	9,186.0	0.3 %	0.2 %
Horse Mackerel	*Trachurus trachurus*	8.2	2,453.4	0.2 %	0.1 %
Hake	*Merluccius merluccius*	6.8	7,389.4	0.2 %	0.1 %
Other	–	37.5	55,749.9	1.1 %	0.6 %

Table 4.3-6 Annual Average Landings Weights (2000 to 2009) of Principal Commercial Shellfish Species in the OfTI Specific Study Area (MMO 2010)

Common Name	Latin Name	Average (2000 to 2009) Landings Weight (t)	Average (2000 to 2009) Landings Value (£)	Percentage of Total Shellfish Landings Weight in 44E7, 44E8 and 45E7	Percentage of Total Landings Weight (all species combined) in 44E7, 44E8 and 45E7
Nephrops	*Nephrops norvegicus*	964.5	2,165,231.6	37.4 %	15.9 %
King Scallop	*Pecten maximus*	900.8	1,595,954.3	34.9 %	14.8 %

Common Name	Latin Name	Average (2000 to 2009) Landings Weight (t)	Average (2000 to 2009) Landings Value (£)	Percentage of Total Shellfish Landings Weight in 44E7, 44E8 and 45E7	Percentage of Total Landings Weight (all species combined) in 44E7, 44E8 and 45E7
Squid	*Loligo forbesi*	332.6	823,381.6	12.9 %	5.5 %
Edible Crab	*Cancer pagurus*	292.7	336,266.1	11.3 %	4.8 %
Velvet Crabs	*Necora puber*	48.2	71,016.0	1.9 %	0.8 %
Mussels	–	11.6	2,768.7	0.5 %	0.2 %
Lobsters	*Homarus gammarus*	7.3	75,562.7	0.3 %	0.1 %
Octopus	–	1.9	891.3	0.1 %	< 0.1 %
Queen Scallops	*Aequipecten opercularis*	1.5	1,517.9	0.1 %	< 0.1 %
Whelks	*Buccinum undatum*	1.0	376.3	0.0 %	< 0.1 %
Periwinkles	*Littorina littorea*	< 0.1	296.6	< 0.01 %	< 0.01 %
Green Crab	*Carcinus maenas*	< 0.1	57.5	< 0.01 %	< 0.01 %
Brown Shrimp	*Crangon crangon*	< 0.1	142.3	< 0.01 %	< 0.01 %
Other	–	17.9	22,396.2	0.7 %	0.3 %

4.3.6 *Spawning and Nursery Areas*

4.3.6.1 Spawning and nursery grounds have been defined for a number of species within and in the immediate vicinity of the three proposed wind farm sites and the OfTI. These are shown in Table 4.3-7 below, together with spawning times and intensity of spawning / nursery areas. Spawning times are given as provided in Coull *et al.,* (1998) and spawning / nursery grounds intensity as described in Ellis *et al.,* (2010). Where available, publications, data and information on the distribution of spawning and nursery grounds from alternative sources, have also been reviewed (Technical Appendix 4.3 A).

Table 4.3-7 Species with Spawning and Nursery Areas within / in Close Proximity to the EDA and Export Cable(s), and Spawning Times and Intensity (Coull *et al.,* 1998, Ellis *et al.,* 2010)

Species	Seasonality of Spawning (Intensity and Peak Spawning *)												Nursery (Intensity)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Cod		*	*										
Herring													
Lemon Sole													

Species	Seasonality of Spawning (Intensity and Peak Spawning *)												Nursery (Intensity)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Nephrops				*	*	*							
Plaice	*	*											
Sandeel													
Sprat					*	*							
Whiting													
Anglerfish	N / A												
Blue Whiting	N / A												
Haddock	N / A												
Hake	N / A												
Ling	N / A												
Mackerel	N / A												
Saithe	N / A												
Spotted Ray	N / A												
Spurdog	N / A												
Thornback Ray	N / A												

Colour Key: (red) = high Intensity Spawning / Nursery Ground, (yellow) = low Intensity Spawning / Nursery Ground, (green) = unknown Intensity, (*) = Peak Spawning

4.3.6.2 The distribution of spawning and nursery grounds in the Moray Firth and the wider area is illustrated in Figure 4.3-3 to Figure 4.3-12, Volume 6 a. Detailed information on the ecology and spawning behaviour of the species is given in Technical Appendix 4.3 A.

4.3.6.3 It should be noted that, in addition to the species listed above, king scallops may use areas relevant to the three proposed wind farm sites and the OfTI as a spawning and nursery ground. As suggested by fisheries data, scallops are widely distributed in the Moray Firth, including the area of the proposed wind farm sites and of the OfTI to a lesser extent. Similarly squid, a species also supporting important commercial fisheries, is known to spawn in the Moray Firth in inshore areas. Some degree of squid spawning may therefore also occur in the area of the OfTI and in the three proposed wind farm sites.

4.3.7 Key Prey Species

4.3.7.1 Sandeels, herring and sprat play a key role in the North Sea's food–web, being situated in a mid–trophic position. They are major predators of zooplankton and the principal prey of many top predators such as birds, marine mammals and piscivorous fish.

4.3.7.2 Sandeels are most commonly preyed upon when they are in transit to, or feeding in the water column. They are a key component of the diet of many birds (i.e. kittiwakes, razorbills, puffins and common terns), piscean predators such as herring, salmon, sea trout, cod, haddock and marine mammals such as grey seals, harbour porpoises and minke whales. A sandeel survey was undertaken by MORL for the purposes of investigating the distribution of sandeels across the three sites. Its findings are incorporated below and in Technical Appendix 4.3 C.

4.3.7.3 Herring is fed upon by a number of fish species (i.e. salmon, sea trout, whiting and cod), seabirds and a number of marine mammals such as harbour porpoises, bottlenose dolphins, grey seals and common seals. Similarly, sprat is also fed upon by a number of fish species, sea birds and marine mammals.

Sandeel Distribution Survey Results (30th January – 2nd March 2012)

4.3.7.4 Given the importance of sandeels as a prey species for a number of birds, mammals and fish species and the lack of site specific information on the distribution of sandeels in the area, a sandeel survey was commissioned by MORL to investigate the distribution of sandeels across the three proposed wind farm sites and the Western Development Area (WDA).

4.3.7.5 The methodology of the survey was designed in consultation with Marine Scotland. In addition, the dredges, steel bellies and nets were manufactured using the specifications obtained from a meeting held at Marine Scotland with their gear technician responsible for constructing the sandeel dredges used by Marine Scotland Science for their sandeel surveys.

4.3.7.6 The survey was undertaken during night hours between the end of January and the beginning of March, when the majority of sandeels were expected to be buried in the sediment. Two different techniques were employed: dredging and grabbing. Detailed information on the methodology and the findings of the survey are provided in Technical Appendix 4.3 C.

4.3.7.7 The total number of individuals caught during the survey by species and development area is given in Table 4.3-8 below. A total of 197 sandeels were caught in dredge tows carried out across the site, with the majority being caught in the WDA (143), followed by sandeels caught in MacColl (35), Stevenson (10) and Telford (9). Overall, the sandeel abundances found are considered to be low.

4.3.7.8 Three species of sandeels (*Ammodytidae spp*.) were caught during the survey:

- Raitt's sandeel (*Ammodytes marinus*);
- Smooth sandeel (Gymnammodytes semisquamatus); and
- Greater sandeel (Hyperoplus lanceolatus).

4.3.7.9 Raitt's sandeel was the most abundant species caught during the survey, accounting for 89.8 % of the total sandeel catch, with the majority (78.5 %) being caught within the WDA. The highest number of Raitt's sandeel was recorded at station SD060, where 40 individuals were caught. Smooth sandeel were most prevalent in MacColl (12 individuals caught), whilst greater sandeel were only caught in low numbers in Stevenson (one individual) and the WDA (one individual).

4.3.7.10 Table 4.3-8 below shows the total number of individual caught, the species and the site in which they were caught.

Table 4.3-8 Total Numbers of Individuals Caught by Species and Development Site

Sandeel Species		Number of Individuals Caught				Total
Common Name	Latin Name	MacColl	Stevenson	Telford	WDA	
Raitt's sandeel	*Ammodytes marinus*	23	7	8	139	177
Smooth sandeel	*Gymnammodytes semisquamatus*	12	2	1	3	18
Greater sandeel	*Hyperoplus lanceolatus*	0	1	0	1	2
Total		35	10	9	143	197

4.3.7.11 The results of the sediment sample analysis indicate a preference for sediments with a high proportion of coarse sands and a low proportion of silt and fine sands. The distribution of sandeel abundances across the site together with seabed sediment types as defined by the British Geological Survey (BGS) data is shown in Figure 4.3-13, Volume 6 a. Highest sandeel abundances were caught in the north eastern section of the Western Development Zone and to a lesser extent in the western section of MacColl. Overall, the distribution of sandeels appears to be patchy, with the majority being caught in areas characterised by a sandy substrate (sand, sandy gravel, gravelly sand, sandy gravel).

4.3.7.12 It should be noted that zero catch rates should not be taken as an indication of unsuitable sandeel habitat. Sandeel distribution is extremely patchy and even the most suitable habitats often render zero–catch samples. If it is assumed that the population is below the area's carrying capacity, it is unlikely that all of the most suitable habitat will be fully occupied by sandeels (Greenstreet, 2007).

4.3.7.13 The relatively low sandeel abundances found in the survey suggest that within the three proposed wind farm sites there are not extensive areas supporting important sandeel populations. It should also be noted, that areas considered to potentially constitute suitable habitat for sandeels (sand, slightly gravelly sand, gravelly sand and sandy gravel) are widespread throughout the Moray Firth.

4.3.8 Species of Conservation Importance

4.3.8.1 A number of species of conservation importance have been identified as potentially present in areas relevant to the three proposed wind farm sites and the OfTI. These include diadromous migratory species, (those using the marine and freshwater environments during their life cycle) elasmobranchs (sharks and rays) and commercial fish species.

4.3.8.2 Diadromous migratory species potentially present in the Moray Firth Area are given in Table 4.3-9 below, together with their conservation status. The qualifying status of species considered for selection of river SACs in the Moray Firth and the wider area is given in Table 4.3-10 below. A description of the ecology and distribution of diadromous species of conservation importance is provided in Technical Appendix 4.3 A with the exception of salmon and sea trout, for which their ecology and fisheries are described separately in Technical Appendix 4.3 B. Designated sites relevant to the proposed wind farms and the OfTI are discussed in Chapter 4.1 (Designated Sites).

Table 4.3-9 Diadromous Migratory Species of Conservation Importance

Common Name	Scientific Name	Conservation Status								
		OSPAR	IUCN Red List	Bern Convention	Habitats Directive	The Wildlife & Countryside Act 1981	The Conservation (Natural Habitats, &c.) Regulations 1994	UK BAP species	Scottish Priority Marine Feature (PMF)	The Nature Conservation (Scotland) Act 2004
European Eel	*Anguilla anguilla*	✓	Critically endangered	–	–	–	–	✓	✓	–
Allis Shad	*Alosa alosa*	✓	Least concern	✓	✓	✓	✓	✓	–	–
Twaite Shad	*Alosa fallax*	–	Least concern	✓	✓	✓	✓	✓	–	–
Sea Lamprey	*Petromyzon marinus*	✓	Least concern	✓	✓	–	–	✓	✓	–
River Lamprey	*Lampetra fluviatilis*	–	Least concern	✓	✓	–	✓	✓	✓	–
Smelt	*Osmerus eperlanus*	–	Least concern	–	–	–	–	✓	✓*	–
Salmon	*Salmo salar*	✓	Lower Risk / least concern	✓	✓	–	✓	✓	✓	–
Sea Trout	*Salmo trutta*	–	Least concern	–	–	–	–	✓	✓	–
(*)= Due to be added to SNH PMF list (MS communication, 20/10/2011)										

4.3.8.3 It should be noted that salmon and sea lamprey are primary reasons and qualifying features for selection of a number of SAC rivers in the Moray Firth.

4.3.8.4 In addition, the freshwater pearl mussel is a primary reason for SAC selection. The life cycle of this species is closely linked to that of Atlantic salmon and concerns have been raised that impacts on Atlantic salmon may result in indirect effects on this species. Freshwater pearl mussel surveys have been carried out in the area of the onshore cable route. The results of these are provided in Chapter 4.7 (Terrestrial Ecology).

Table 4.3-10 Qualifying Status of Species of Conservation Importance in SAC Rivers (JNCC 2011)

SAC Rivers	Primary reason for SAC site selection	Qualifying feature for SAC site selection
Berriedale and Langwell Waters	Atlantic salmon	N / A
River Borgie	Freshwater pearl mussel	Atlantic salmon, otter
River Dee	Freshwater pearl mussel, Atlantic salmon, otter	N / A
River Evelix	Freshwater pearl mussel	N / A

SAC Rivers	Primary reason for SAC site selection	Qualifying feature for SAC site selection
River Moriston	Freshwater pearl mussel	Atlantic salmon
River Naver	Freshwater pearl mussel, Atlantic salmon	N / A
River Oykel	Freshwater pearl mussel	Atlantic salmon
River Spey	Freshwater pearl mussel, sea lamprey, Atlantic salmon, otter	N / A
River Thurso	Atlantic salmon	N / A

4.3.8.5 Elasmobranch species (sharks and rays) with conservation status and / or declining stocks, potentially using areas relevant to the three proposed wind farm sites, are given in Table 4.3-11 below.. Their distribution and ecology in the Moray Firth are described in Technical Appendix 4.3 A.

4.3.8.6 Sharks and rays have slow growth rates and low reproductive output compared to other species groups. This results in slow rates of stock increase and low resilience to fishing mortality. Directed fisheries have caused stock collapse for many species, although at present, mortality in mixed–species and by–catch fisheries seems to be a more important threat.

Table 4.3-11 Principal Elasmobranch Species with Conservation Status Recorded in the Moray Firth

Common Name	Latin Name	MMO Landings Data	Recorded in the Moray Firth (Ellis et al., 2005)	Conservation Status						
				OSPAR	IUCN Red List	The Wildlife & Countryside Act 1981	The Conservation (Natural Habitats, &c.) Regulations 1994	UK BAP species	Scottish Priority Marine Feature (PMF)	The Nature Conservation (Scotland) Act 2004
Sharks										
Basking Shark	*Cetorhinus maximus*	–	–	✓	Vulnerable	✓	–	✓	✓	✓
Blue Shark	*Prionace glauca*	–	–	–	Near threatened	–	–	✓	–	–
Gulper Shark	*Centrophorus granulosus*	✓	–	✓	Vulnerable	–	–	✓	–	–
Leafscale Gulper Shark	*Centrophorus squamosus*	✓	–	✓	Vulnerable	–	–	✓	–	–
Porbeagle	*Lamna nasus*	–	–	✓	Vulnerable	–	–	✓	–	–
Portuguese Dogfish	*Centroscymnus coelolepis*	✓	–	✓	Near threatened	–	–	✓	–	–
Sailfin Roughshark	*Oxynotus paradoxus*	✓	–	–	Data deficient	–	–	–	–	–
Spurdog	*Squalus acanthias*	✓	✓	✓	Vulnerable	–	–	✓	✓	–
Tope	*Galeorhinus galeus*	✓	–	–	Vulnerable	–	–	✓	–	–
Skates and Rays										
Common Skate	*Dipturus batis*	✓	✓	✓	Critically endangered	–	–	✓	✓	–
Long–Nosed Skate	*Dipturus oxyrinchus*	✓	–	–	Near threatened	–	–	–	–	–
Sandy Ray	*Leucoraja circularis*	–	–	–	Vulnerable	–	–	✓	–	–
Spotted Ray	*Raja montagui*	–	✓	✓	Least concern	–	–	–	–	–
Thornback Ray	*Raja clavata*	✓	✓	✓	Near Threatened	–	–	–	–	–
White Skate	*Rostroraja alba*	✓	–	✓	Endangered	–	–	✓	–	–

4.3.8.7 Further to the above, there are a number of other fish species with conservation status in the Moray Firth Area. The majority of these are commercially exploited in the Moray Firth having been recorded in landings data (2000 to 2009) within the regional study area. These are given Table 4.3-12 below. In addition, Ocean quahog (Arctica islandica) is also known to be present in the Moray Firth. The species is listed in OSPARs list of threatened and / or declining species and habitats, and as Scottish Priority Marine Feature (PMF) (Chapter 4.1: Designated Sites).

Table 4.3-12 Conservation Status of Fish Species Recorded in Landings Data (2000 to 2009) Within the Regional Study Area

Common Name	Latin Name	Scottish Priority Marine Feature (PMF)	UK BAP Species	OSPAR	IUCN Red List
Anglerfish	*Lophius piscatorius*	✓ (juveniles)	✓	–	–
Atlantic Halibut	*Hippoglossus hippoglossus*	–	✓	–	Endangered
Atlantic Mackerel	*Scomber scombrus*	✓	✓	–	–
Black Scabbardfish	*Aphanopus carbo*	–	✓	–	–
Blue Ling	*Molva dypterygia*	–	✓	–	–
Cod	*Gadus morhua*	✓	✓	✓	Vulnerable
Greenland Halibut	*Reinhardtius hippoglossoides*	–	✓	–	–
Hake	*Merluccius merluccius*	–	✓	–	–
Herring	*Clupea harengus*	✓ (juveniles and spawning adults)	✓	–	Least concern
Horse Mackerel	*Trachurus trachurus*	–	✓	–	–
Ling	*Molva molva*	✓	✓	–	–
Plaice	*Pleuronectes platessa*	–	✓	–	Least concern
Roundnoise Grenadier	*Coryphaenoides rupestris*	–	✓	–	–
Saithe	*Pollachius virens*	✓ (juveniles)	–	–	–
Sandeels	*Ammodytes marinus*	✓	✓	–	–
	Ammodytes tobianus	✓	–	–	–
Whiting	*Merlangius merlangus*	✓ (juveniles)	✓	–	–

4.3.9 Individual Site Baseline Characteristics

4.3.9.1 Given the lack of detailed site specific information about the distribution and migratory pathways of a number of species and the spatial definition of spawning and nursery areas (Coull *et al.,* 1998; Ellis *et al.,* 2010) in the Moray Firth, it is not possible to describe each individual wind farm site (MacColl, Stevenson and Telford) separately in terms of fish assemblages. An exception to this is provided by the results of the sandeel survey, which indicate species distribution across the three sites.

4.3.9.2 A precautionary approach has therefore been taken for the purposes of this assessment, which considers fish and shellfish species to be evenly distributed across all three sites. In light of this, baseline characteristics are considered uniform across the three proposed wind farm sites.

Sandeel Surveys

4.3.9.3 As indicated by the results of the sandeel survey, the distribution of sandeels across the development sites is patchy, with the majority being caught in the north eastern section of the WDA and the western section of MacColl.

4.3.10 Legislative and Planning Framework

4.3.10.1 The following documents have provided guidance for the undertaking of the Fish and Shellfish Ecology baseline assessment:

- Strategic Environmental Assessment (SEA) of Draft Plan for Offshore Wind Energy in Scottish Territorial Waters: Volume I: Environmental Report (Marine Scotland 2010);
- UK Offshore Energy Strategic Environmental Assessment. Environmental Report (Department of Energy and Climate Change, 2011);
- Habitats Regulations Appraisal of Draft Plan for Offshore Wind Energy in Scottish Territorial Waters. Appropriate Assessment Information Review (Marine Scotland 2011);
- Centre for Environment, Fisheries and Aquaculture Science (CEFAS) Guidance Note for Environmental Impact Assessment in Respect of the FEPA and CPA Requirements (CEFAS 2004);
- Marine Scotland Science (MSS) Scoping Opinion;
- Scottish Natural Heritage (SNH) and Joint Nature Conservation Committee (JNCC) Scoping Advice (14.05.2010); and
- Institute of Ecology and Environmental Management (IEEM). Guidelines for Ecological Impact Assessment in Britain and Ireland (marine and coastal) (IEEM 2010).

4.3.11 References

Coull, K.A., Johnstone, R., and Rogers, S.I., (1998) Fisheries Sensitivity Maps in British Waters. UKOOA Ltd.

Ellis, J.R., A. Cruz–Martínez, B.D., Rackham and Rogers S.I., (2005) The Distribution of Chondrichthyan Fishes around the British Isles and Implications for Conservation. J. Northw. Atl. Fish. Sci., 35: 195–213. doi:10.2960 / J.v35.m485.

Ellis, J.R., Milligan, S., Readdy, L., South, A., Taylor, N. and Brown, M., (2010) Mapping spawning and nursery areas of species to be considered in Marine Protected Areas (Marine Conservation Zones).

Greenstreet, P. R., (2007) Variation in the abundance and distribution of sandeels and clupeids in the wee bankie / marr bank region of the north–western north sea over the period 1997 to 2003. Fisheries Research Services Internal Report No: 25/07.

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Malcolm, I.A., Godfrey,J., and Youngson, A.F., 2010. Review of migratory routes and behaviour of atlantic salmon, sea trout and European eel in Scotland's coastal environment: implications for the development of marine renewables. Scottish Marine and Freshwater Science Volume 1 No 14. ISSN: 2043–7722.

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The Conservation (Natural Habitats, &c.) Regulations 1994. Available online at http://www.legislation.gov.uk/uksi/1994/2716/contents/made. Accessed on 02/11/2011.

The Nature Conservation (Scotland) Act 2004. Available online at http://www.legislation.gov.uk/asp/2004/6/pdfs/asp_20040006_en.pdf. Accessed on 02/11/2011.

The Wildlife and Countryside Act 1981. Available online at http://www.legislation.gov.uk/ukpga/1981/69. Accessed on 02/11/2011.

UK BAP 2011. UK Biodiversity Action Plan Species List. Available online at www.ukbap.org.uk/. Accessed on 25/05/2011.

4.4 Marine Mammals

4.4.1 Introduction

4.4.1.1 The Moray Firth is an important area for marine mammals, with at least 14 species of cetacean being recorded in and around the Firth. In addition, populations of both grey and harbour seal are present within the Firth. The bottlenose dolphin and harbour seal populations are considered to be both nationally and internationally important, with Special Areas of Conservation (SACs) for both species designated within the inner waters (see Chapter 4.1: Designated Sites and Figure 4.4-1, Volume 6 a).

4.4.1.2 This chapter provides a summary of baseline marine mammal data for the Moray Firth, including the proposed development areas. The purpose is to provide a thorough review of marine mammal occurrence and behaviour to aid assessment of impacts related to the construction, operation and maintenance of the three proposed offshore wind farms and associated offshore transmission infrastructure (OfTI).

4.4.1.3 This chapter will set out the following:

- The responses from key statutory and non-statutory stakeholders to MORLs scoping requests and the TI and the draft ES;
- Information gathered from a desk top study of available data;
- A summary of the data collection and modelling that has been undertaken to provide a baseline description of the use of the Moray Firth by marine mammals including:
    - Harbour seal telemetry and habitat association modelling;
    - Harbour seal abundance at haul-out sites and at sea;
    - Grey Seal telemetry;
    - Passive acoustic monitoring to examine cetacean spatial and temporal variation across the Moray Firth;
    - Cetacean habitat association modelling;
    - Estimation of harbour porpoise density; and
    - Estimation of bottlenose dolphin density.
    - Individual baseline characteristics for the three proposed wind farm sites; and
    - The relevant legislative and planning context.

4.4.1.4 It should be noted that due to the mobile nature of the species in question, the ecological zone of impact is considered to be the entire Moray Firth for these assessments.

4.4.1.5 A more detailed account of all the information summarised in this chapter can be found in Technical Appendix 4.4 A (Marine Mammals Baseline)

4.4.1.6 The impact assessment is provided in the following chapters:

- Chapters 7.3, 10.3 and 14.3 (Marine Mammals); and
- Chapter 12 (Whole Project Assessment).

4.4.2 Consultations

4.4.2.1 Table 4.4-1 below summarises the consultation responses received with regards to marine mammals:

Table 4.4-1 Summary of Consultation Responses

Organisation	Consultation Response	MORL Approach
Marine Scotland (The Scottish Government)	**Scoping response:** • The presence of protected species such as European Protected Species must be included and considered as part of the application process. The presence of species on Schedule 5 of the Wildlife & Countryside Act 1981 should also be considered. • Details of noise pollution resulting from any construction activity and any associated potential effects on cetaceans / pinipeds / fish will be required. Noise assessments should take into consideration background noise. • The particular cause of concern with regards to cetaceans is the cumulative impact from all additional wind farm sites on the NE of Scotland.	Addressed in Chapters 7.3, 10.3 and 14.3.
Joint Nature Conservation Committee (JNCC) & Scottish Natural Heritage (SNH)	**Scoping Response:** • King *et al.,* (2009) framework, developed for ornithology, could be used for the assessment of other mobile species (although cetaceans are protected whether they are associated with a protected site or not). • It would be appropriate to consider the effects at population levels of marine mammal species as these will vary in extent and therefore require individual consideration for cumulative impact assessment. • It is advisable that the applicant proactively ensures that the early stages of Project design are influenced to minimise the risk to marine mammals. • JNCC & SNH recommends that the applicant considers and discusses the full range of mitigation techniques for noise impacts during construction. The choice of mitigation should be determined by review of the zone of potential impacts. In case of not sufficient evidence being gathered then it is necessary to use appropriate precaution. MORL & Beatrice Offshore Wind farm Ltd (BOWL) should collaborate in this issue.	Relevant points taken into account when amending the framework for assessing impacts on Marine Mammals (see Chapter 7.3, 10.3 and 14.3) With regards to noise mitigation techniques, MORL is working with The Crown Estate and other developers to investigate and develop best practice mitigation measures to reduce either the level of noise at the source or noise propagation.
	Comments on Draft ES: • Agree with the presented approach to EIA. • Are happy that the most likely and significant effects have been identified and assessed in the ES.	Noted Noted

Organisation	Consultation Response	MORL Approach
Joint Nature Conservation Committee (JNCC)	• Given some areas of uncertainty in the seal framework, may advise that a research and monitoring program be established in collaboration with developers. In particular to examine seal and dolphin responses to piling noise. • Are generally satisfied that the approach undertaken by MORL is the best currently possible and it is presented in a logical and robust framework that will enable decisions by the regulator to be made with reasonable confidence. Await results of peer review that may highlight areas requiring further examination. • Are satisfied with the rationale for not using the 186 dB threshold for PST onset in seals but feel there is insufficient evidence to use 198 dB as a replacement value, therefore advise MORL to present results for both values as feel the true value may lie between.	Relevant points taken into account when amending the framework for assessing impacts on marine mammals (see Chapters 7.3, 10.3 and 14.3). Further areas of research into marine mammal response to piling has been identified and contracts put in place to carry out surveys around MORL met mast (details of this, and other proposed survey methodologies provided in Chapter 7.3).
	• Would welcome some discussion about how piling locations in noise modelling were chosen. • Would recommend that the seal framework approach is adapted for the bottlenose dolphin population.	Details provided in Technical Appendix 7.3 A and summarised in each relevant chapter.
	• Would expect to see an assessment of the cumulative impacts on bottlenose dolphins from all wind farm developments within the populations range, arising from concurrent and subsequent development.	Cumulative impact assessment methodology presented within Chapter 14.3, which includes assessment of other projects within the range of bottlenose dolphin.
	• Agree that 25 years is an appropriate period of assessment for population modelling.	Noted.
Scottish Natural Heritage (SNH) – verbal advice	**Comments on Draft ES:** • Advise that grey seals generally considered to be temporary visitors to the Moray Firth from other areas and therefore haul-out sites outside of Firth do not need to be included in cumulative impact.	All points taken into account when amending the framework for assessing impacts on marine mammals (see Chapters 7.3, 10.3 and 14.3).
	• Advise that we are prepared to accept the fleeing animal model for PTS estimations with revision of the Subacoutech model with respect to the behaviour of a fleeing animal when it reaches the coast[1].	Noted.
Whale and Dolphin Conservation Society	Scoping response: • Monitoring strategy should reflect the range of cetaceans that can be present in the Moray Firth. • Quieter and more benign alternatives to piling should be considered where possible. • Concern raised regarding habitat displacement (short and long-term), which should be anticipated and monitored accordingly. • Monitoring strategy should cover entire length of construction period and 4-5 years beyond. • Concerns over potential impacts of land-fall site raised.	Relevant points taken into account when amending the framework for assessing impacts on marine mammals (see Chapters 7.3, 10.3 and 14.3).

[1] Animal modelled to remain in shallow water when it reaches the coast and thus continue to be exposed to noise.

Organisation	Consultation Response	MORL Approach
Whale and Dolphin Conservation Society (continued)	• Cumulative impacts should take into account full range of species present within the Moray Firth. • Behavioural impacts are anticipated to occur over a much wider range than physical effects. • Effort should be taken to prioritise research in order to fill data gaps. • Mitigation measures should be proven to be effective given the sensitivities of marine mammals in the area, with priorities given to techniques that prevent impacts. Effort should be made to reduce noise propagation. • Given the value of the region, an EPS licence is likely to be required. • Additional feedback: • Discussion upon how to include MoD aviation activity, whether it was necessary to consider as a potential cumulative impact with underwater noise impacts from construction activities. MFOWDG will contact JNCC (Ollie Payne) to establish information that is held with regards to MoD flight activity and how JNCC assess the impact of aerial noise underwater. • The concept of habituation to noise and impact on behaviour was also discussed. • A discussion was held centred on Minke whale distribution and seasonal foraging presence during Spring & Summer. • Discussion around the potential onshore grid connection point of the BOWL site, and the proximity to the WDCS Wildlife Centre at Spey Bay. • **Comments on draft ES:** • Recognise that there are existing technological limitations to using alternatives to piling for the entire Project and lack of established mitigation measures. • Suggest that it is important to have a well-considered research monitoring strategy in place to understand and recognise potential individual and population level impacts on both national and international species. • Acknowledge monopiles are not being used but have concerns over noise generated by installation of pin piles. • Cumulative impact assessment for minke whale and harbour porpoise should include impact beyond the Moray Firth. • Need to distinguish between management measures and mitigation. • May be appropriate to calculate minke whale densities for Summer months only (when are present) and not over the entire year. • Consider visual surveys to be an important component of ongoing monitoring work to understand potential impacts, particularly for minke whales. • Noise levels during construction remains a key concern and should be monitored.	Relevant points taken into account when amending the framework for assessing impacts on marine mammals (see Chapters 7.3, 10.3 and 14.3).

4.4.3 Desktop Study

4.4.3.1 At least 14 species of cetacean (whale, dolphin and porpoise) have been recorded within the Moray Firth along with two species of seals. The most commonly recorded species are discussed in brief here (see Table 4.4-2 below); for a full review of all the species recorded in the Moray Firth area, see Technical Appendix 4.4 A.

Table 4.4-2 List of Marine Mammals Commonly Recorded Within the Moray Firth, Adapted From a Variety of Sources Including Reid *et al.*, 2003, Robinson *et al.*, 2007 and Thompson *et al.*, 2010

Species	Latin Name	Occurrence
Pinnipeds		
Harbour (Common) Seal	***Phoca vitulina***	**Common, All Year**
A number of haul-out sites for harbour seals are located within the Moray Firth, primarily in the Beauly, Cromarty and Dornoch Firths (Thompson *et al.,* 1996b; SCOS, 2010). The harbour seal population in the Moray Firth has declined by 40 % compared to numbers recorded in the mid 1990s, with the population being relatively stable in recent years (SCOS, 2010). Harbour seals occur throughout the year in these areas, with peak numbers at haul-out sites between June and August when they are used as breeding sites (Thompson & Miller, 1990; Thompson *et al.,* 1996a). Seals within the Moray Firth are found to forage in waters of 10 to 50 m deep over areas with predominantly sandy sea beds. Tagging studies within the Firth have found that harbour seals generally travel no more than 60 km from their haul-out sites (Thompson *et al.,* 1996b), with a tendency to forage slightly further afield in the Winter and seasonal differences in the areas used (Thompson *et al.,* 1996a).		
Grey Seal	***Halichoerus grypus***	**Common, All Year**
Grey seals within the Moray Firth are predominantly observed during the Summer although smaller numbers are present throughout the year. Non-breeding grey seals have been observed at intertidal sites within the firths used by harbour seals. Breeding grey seals are mostly found at the rocky beaches and caves to the north (Thompson *et al.,* 1996b). It is thought that grey seals travel into the Moray Firth from different breeding sites (such as Orkney, Firth of Forth and Farne Islands) and use the area for food and non-breeding haul-out (Thompson *et al.,* 1996b). Tagging studies within the Moray Firth have identified grey seals foraged over a much wider area than the harbour seal, with great variation between individuals (Thompson *et al.,* 1996b).		
Cetaceans		
Harbour Porpoise	***Phocoena phocoena***	**Common, All Year**
Harbour porpoises are distributed throughout the Moray Firth (Hastie *et al.,* 2003b; Thompson *et al.,* 2010; Robinson *et al.,* 2007). Although the original SCANS surveys (Small Cetaceans in the European Atlantic and North Sea) did not encompass the Moray Firth, estimates of porpoise density for the closest surveyed regions were 0.36 and 0.78 animals / km^2 (Hammond *et al.,* 2002) with spatially smoothed predictions of porpoise density suggesting relatively high densities within the Moray Firth (1.2 animals / km^2). The SCANS II survey did include the Moray Firth (SCANS II, 2007) and estimated harbour porpoise densities within the ranges of the original SCANS estimates but lower than the smoothed prediction for the Moray Firth (0.4 to 0.6 animals / km^2). Recent data collected from the outer Moray Firth (DECC funded project), assessing the impact of seismic surveys on marine mammals, supports the relatively high occurrence of porpoises throughout the Firth with high detection rates of porpoises using autonomous passive acoustic detectors (CPODs)(Bailey *et al.,* 2010; Thompson *et al.,* 2010).		

Species	Latin Name	Occurrence
Bottlenose Dolphin	***Tursiops truncates***	**Common, All Year**
The most recent population estimate of dolphin abundance around the northeast coast of Scotland is 195 individuals (95 % probability interval 162 to 245; Thompson *et al.,* 2011). Although the majority of the population (71 to 111 individuals) appear to regularly utilise the Moray Firth SAC (95 % CI: 66 to 161), it is clear that a relatively high number of individuals also frequently utilise areas outside the SAC (Thompson *et al.,* 2006; 2009). The distribution of bottlenose dolphin sightings within the Moray Firth appear to be coastal, with the majority occurring in the inner Moray Firth and along the southern coast, generally in waters of less than 25 m deep (Hastie *et al.,* 2003a; Robinson *et al.,* 2007). Parts of the population exhibit movement patterns between the Moray Firth and other areas. For example: bottlenose dolphins from the Moray Firth SAC are regularly sighted in the Tay (Thompson *et al.,* 2011), and MORL are aware that the Firth of Forth & Tay Offshore Wind Developers Group (FTOWDG) commissioned a piece of work from SMRU Ltd that confirmed this connectivity, using the most up-to-date photography records of bottlenose dolphins known to be residing in the Moray Firth that have been recorded within the Firth of Tay.		
Common Dolphin	***Delphinus delphis***	**Common, Seasonal**
Predominantly found in the continental shelf waters in the Celtic Sea and the western approach to the English Channel. They have been frequently seen in the Sea of Hebrides during the Summer and occasionally in the North Sea, primarily in the Moray Firth region, with sightings becoming regular here during the Summer months since 2006 (Robinson *et al.,* 2010). No common dolphins were recorded in the North Sea during the SCANS II surveys (SCANS, 2007).		
White-Beaked Dolphin	***Lagenorhynchus albirostris***	**Common, Seasonal**
UK sightings predominantly recorded from around Scotland and the east coast of England (Northridge *et al.,* 1995; Reid *et al.,* 2003), although sightings within the Moray Firth are low compared to other areas. They have been recorded in UK waters all year round, with an increase in sighting frequency in coastal waters during the Summer months when the animals appear to move inshore (Evans, 1992; Northridge *et al.,* 1995; Weir *et al.,* 2007). The SCANS II Survey (2007) gave an overall abundance estimate for white-beaked dolphins of 22,664 (95 % CI = 10,341 to 49,670) and a density estimate for the Moray Firth, Orkney and Shetland areas combined of 0.018 animals per km^2 (0.86 CV).		
Minke Whale	***Balaenoptera acutorostrata***	**Common, Seasonal**
Minke whales are the most abundant baleen whale species within the Moray Firth, with sightings being reported throughout the area (Reid *et al.,* 2003; Robinson *et al.,* 2007; Thompson *et al.,* 2010). Much of the research has concentrated on the southern coast and deeper trench waters, with observations most commonly occurring in deeper waters further from the shore (Robinson *et al.,* 2007; Eisfeld *et al.,* 2009). Data indicates that minke whales visit the Moray Firth in late Summer to forage (Bailey & Thompson, 2009). The SCANS II Survey (2007) gave an overall abundance estimate for minke whale of 18,614 (95 % CI = 10,445 to 33,171) and a density estimate for the Moray Firth, Orkney and Shetland areas combined of 0.022 animals per km^2 (1.02 CV).		

4.4.4 Baseline Data Collection

4.4.4.1 Surveys to support habitat association modelling of marine mammals utilising the three proposed wind farm sites and wider Moray Firth have been conducted through either MORL funded surveys or through a collaborative study with the developers of the adjacent proposed BOWL site.

4.4.4.2 The collaborative studies, undertaken by Aberdeen University and SMRU Ltd, consist of:

- Harbour seal telemetry and habitat association modelling (4.4.5 of this chapter);
- Harbour seal abundance at haul-out sites and at sea (4.4.6 of this chapter);
- Grey seal telemetry (4.4.7 of this chapter);
- Passive acoustic monitoring to examine cetacean spatial and temporal variation across the Moray Firth (4.4.8 of this chapter);
- Cetacean habitat association modelling (4.4.9 of this chapter);

- Estimation of harbour porpoise density (paragraphs 4.4.9.8 and 4.4.9.9 below); and
- Estimation of bottlenose dolphin density (paragraphs 4.4.9.10 to 4.4.9.13 below).

4.4.4.3 In addition to this, a two year boat-based study of the three proposed wind farm sites was commissioned through Natural Power Consultants (NPC) to provide up-to-date, site-specific data on marine mammal distribution and relative abundance (paragraphs 4.4.9.14 to 4.4.9.19 below).

4.4.4.4 A more detailed account of all of this information can be found in Technical Appendix 4.4 A.

4.4.5 Harbour Seal Telemetry and Habitat Modelling

4.4.5.1 Harbour seal telemetry data for the Moray Firth was collated and habitat models were developed by SMRU Ltd and the University of Aberdeen to predict seal occurrence and foraging habitat preference. A full description of the methodology and results can be found in Section 3 of Technical Appendix 4.4 A.

4.4.5.2 The harbour seal data was collected using three tag types deployed on 37 individual seals between 1989 and 2009. A Bayesian state-space model (SSM) (Jonsen *et al.,* 2007; Bailey *et al.,* 2008) was applied to all raw data, accounting for location error for the different tag types, to provide standardised position estimates and a measure of certainty at regular intervals.

4.4.5.3 Habitat models used the harbour seal locations (from the SMM) and environmental data to predict seal occurrence and habitat preference. This was then scaled by the population size to estimate expected population densities. A combination of two methods were used, Generalised Additive Models (GAM) and a Generalised Estimating Equations (GEE). As habitat preferences can vary between seasons and sexes, the models were applied firstly, on all data combined and secondly using data from the Summer breeding season only (April to July).

4.4.5.4 The GAM approach used presence-absence of seals within 4 x 4 km grid cells (any cell that contained at least one seal SSM position was coded as 1 for seal presence) and was applied with a binomial error distribution with a logit link function. Based on the average travel speed and foraging trip duration (Thompson *et al.,* 1998), all grid cells within the Moray Firth were considered available habitat. Environmental variables applied were water depth, seabed slope, distance to nearest haul-out site and seabed sediment type.

4.4.5.5 As shown in Section 3.3 of Technical Appendix 4.4 A, the GAM showed that depth and seabed slope were significantly related to the probability of harbour seal presence. Probability of occurrence was highest at intermediate depths (approximately 15 to 50 m) and decreased with increasing seabed slope. Occurrence rate was highest within 30 km of the nearest haul-out site and declined rapidly beyond 100 km.

4.4.5.6 The GEE approach used a case / control approach where random control points were generated to represent habitat availability. This gave a measure of habitat preference, defined as the ratio of habitat-use to availability (Aarts *et al.,* 2008). Each seal and control location was associated with environmental data in the nearest 4 x 4 km grid cell. The same environmental variables were used as for the GAM.

4.4.5.7 The results from the GEE model indicated that seal foraging habitat preference is significantly related to sediment type, depth, slope and distance to nearest haul-out site. Sand, marine muddy sediment over sand and marine sediment were preferred over gravel, sandy, marine and gravel marine sediment. Compared to the distribution of the control points, seals preferred mid-water depths, shallow slopes and further distances from haul-out sites. Foraging habitat was highest in the north-eastern part of the Moray Firth and in small areas to the south-east.

4.4.5.8 An example of the outputs from these models can be found in Figure 4.4-2, Volume 6 a showing the predicted values from the GEE model (complete data set) of harbour seal habitat preference for the Moray Firth (white cells indicate no data). For the complete results, see Section 3.3 of Technical Appendix 4.4 A.

4.4.5.9 Results on data collected during the Summer did not vary greatly from the overall models. For the Summer-only GAM, depth and slope remained significant but distance to nearest haul-out site and sediment type were not. The Summer-only GEE model found seals significantly preferred sand, marine sediment over gravel, sandy, marine, gravel marine sediment and mud, and sandy sediment. This difference in sediment type may reflect differences in prey preferences during this period. Seals also preferred further distances from the haul-out sites compared to the distribution of the control points.

4.4.6 Harbour Seal Abundance at Sea and at Haul-Out Sites At Sea

4.4.6.1 In order to estimate the number of harbour seals using different parts of the Moray Firth, the output from the presence-absence GAM (described above) was combined with estimates of population size taken from Thompson *et al.,* 1997 and time series analysis of annual surveys conducted in the Dornoch Firth and Loch Fleet (Cordes *et al.,* 2011) (see Section 3 of Technical Appendix 4.4 A for full details).

4.4.6.2 The total number of seals in the Moray Firth population was dispersed across the 4 x 4 km grid squares produced by the presence-absence GAM. The predicted importance of each cell was accounted for, providing an estimate of the number of seals likely to occur in any one cell at any time. A level of uncertainty is not formally incorporated into this estimate. The use of a mean population estimate calculated for the year 1993 (Thompson *et al.,* 1997) when the population was at its peak, and the assumption that all seals may be foraging at the same time, produce a conservative estimate. Given that a proportion of the population are hauled out on every low tide throughout the year, and many typically remain at haul-out sites for several days between foraging trips. It is estimated that between 60 to 90 % of the total population is at sea at any one time, depending on season and the age and status of individual seals (Thompson *et al.,* 1998).

4.4.6.3 The results of the presence-absence GAM indicate that harbour seals may be widely dispersed across the Moray Firth, particularly over offshore sandbanks. The data suggest there is variability in importance for different areas, with some areas within the three proposed wind farm sites holding a density of up to 0.5 individuals per km^2. Figure 4.4-3, Volume 6 a illustrates the predicted number of harbour seals from Moray Firth haul-out sites in different 4 x 4 km grid squares.

At Haul-Out Sites

4.4.6.4 Counts made during the breeding season at the Dornoch Firth SAC indicate that there has been a steady decline in the number of seals observed since the mid-1990s with an apparent stabilisation over the last five to six years, while numbers in Loch Fleet have gradually increased (see Plate 4.4-1 below). This latter area has now become an established breeding site used by over 70 individually recognisable adult females (Thompson & Wheeler, 2008; Cordes *et al.,* 2011). For the purposes of the impact assessments undertaken for the Project, the two population figures have been combined to provide a joint population number.

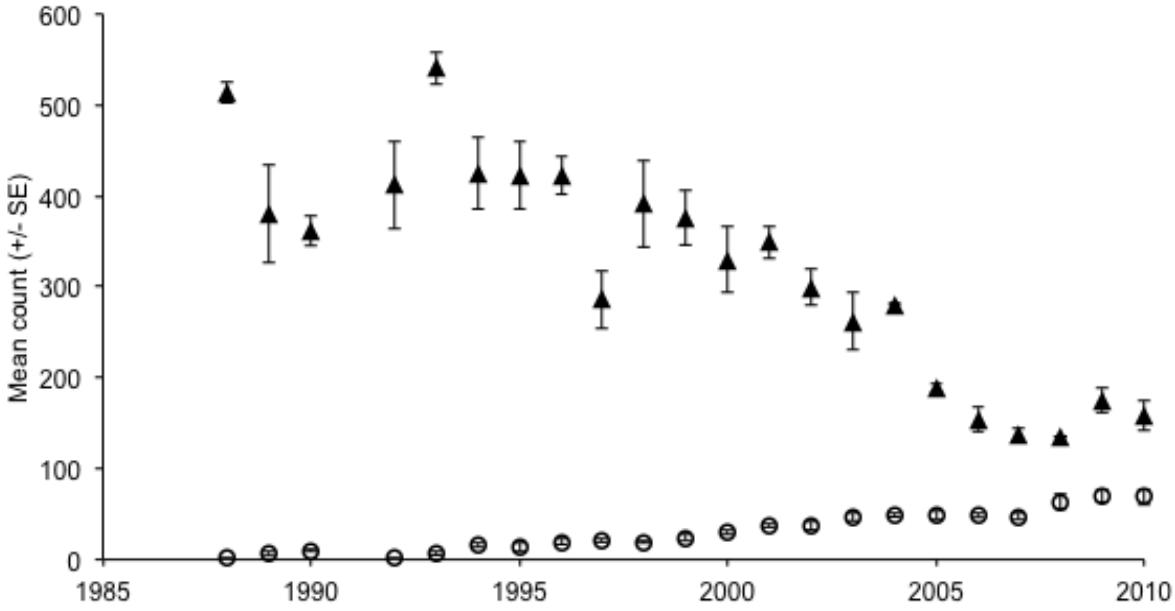

Plate 4.4-1 Trends in the Mean Pupping Season Count of Harbour Seals at Haul-Out Sites Within the Dornoch Firth (Triangles) and Loch Fleet (Circles). SE = Standard Error, the Size of Which is Indicated by the Bars Associated with Each Point.

4.4.7 Grey Seal Telemetry

4.4.7.1 Telemetry data collected from grey seals tagged by the Sea Mammal Research Unit were examined by SMRU Ltd to determine how many animals entered the Moray Firth, in particular the area around the MORL and BOWL development sites (see Section 4 of Technical Appendix 4.4 A for more details).

4.4.7.2 Grey seal pups are thought to disperse more widely than adults and so were examined separately. The extent of pup movement from breeding sites was examined using data from 39 tags deployed between 1993 and 2002 and the resulting tracks shown in Figure 4.4-4 of Volume 6 a.

4.4.7.3 Data from animals aged one year and above were also examined. A buffer zone extending 100 km from the boundary of the potential wind farm sites (in the MORL Zone and BOWL site) was generated. Tracking data from all animals that entered this zone were identified (65 animals in total, tagged between 1992 and 2008) and their track lines can be seen in Figure 4.4-5 of Volume 6 a.

4.4.7.4 Grey seal telemetry data from 1995 to 2008 were combined with aerial survey data from 1996 to 2009 to produce two maps of estimated total and at-sea (hauled-out data removed) usage in the area surrounding the MORL / BOWL proposed wind farm developments (see Section 4.2 of Technical Appendix 4.4 A for full methodology).

4.4.7.5 Figure 4.4-6, Volume 6 a shows spatial usage of grey seals around the MORL / BOWL proposed development sites. The map can be interpreted as the average number of seals in each 4 km^2 grid cell at any point in time. Within the study area, highest usage is located in the Inner Moray Firth, Dornoch Firth, and Pentland Firth. Possible offshore foraging patches can also be seen throughout the study area, mostly denoted in orange.

4.4.7.6 Figure 4.4-7 in Volume 6 a shows at-sea spatial usage of grey seals around the MORL / BOWL proposed development sites. The map shows similar patterns to the total usage map, although overall usage has decreased by 23 %. High usage in the Inner Moray Firth has been reduced as this was due to high predicted numbers at haul-outs.

4.4.8 Passive Acoustic Monitoring of Cetaceans

4.4.8.1 The University of Aberdeen has been conducting a number of passive acoustic monitoring (PAM) studies of cetaceans within the Moray Firth since 2005. Data from a number of studies were collated to examine the spatial and temporal variation of harbour porpoise and dolphins (any species) on the Smith Bank over the last five years. The details of these surveys are provided in Section 5 of Technical Appendix 4.4 A and are summarised in 4.4-3 below).

Table 4.4-3 Summary of Available PAM Data from the Moray Firth

Data Source	Years	Location
Beatrice Demonstrator Study	2005 to 2007	Inner Moray Firth, Beatrice demonstrator and Lossiemouth.
SNH & SEERAD Studies	2006 to 2008	Various locations in both coastal and offshore waters including those listed above (see Technical Appendix 4.4 A for details).
DECC Study	2009 to 2010	Various locations in both coastal and offshore waters (see Technical Appendix 4.4 A for details).
MORL & BOWL Joint Funded Study	2010 to 2011	Additional deployments within MORL & BOWL development area.

4.4.8.2 A combination of T-PODs (Timing Porpoise Detectors) and C-PODs has been used for these projects. A comparison of detection rates between these different types of hydrophone was conducted, the results of which can be found in Section 5.4.6 of Technical Appendix 4.4 A. PODs can distinguish between harbour porpoise and dolphins but cannot distinguish between different dolphin species.

4.4.8.3 The assessment of broad scale spatial variation in harbour porpoise and dolphin occurrence across the Moray Firth was based on data collected during the Department of Energy and Climate Change DECC funded study in 2009 and 2010. Both dolphins and porpoises were detected on each POD at least once although the number of detections varied.

4.4.8.4 Data were pooled from both of these years to provide an overall summary of spatial variation on occurrence for harbour porpoise (see Figure 4.4-8, Volume 6 a, which shows spatial variation in the occurrence of porpoise in the Summers (April-Oct) of 2009 and 2010). Pie charts representing the proportion of days animals were detected on C-PODs at each sampling location can be found in Figure 4.4-9, Volume 6 a. This representation uses pooled data from Thompson *et al.,* (2010a and 2011a.), and shows the spatial variation in the occurrence of dolphins in the Summers (April-Oct) of 2009 and 2010. Dolphins were detected regularly within the inner Moray Firth and along the southern Moray coast. Few dolphin detections were recorded in the central Firth area but detections increased again at more offshore locations, including those within the three proposed wind farm sites. Harbour porpoise detections were common throughout the whole study area, with the lowest levels of detection found in the coastal areas most frequently inhabited by dolphins.

4.4.8.5 The occurrence of harbour porpoise around the three proposed wind farm sites was further examined by estimating the median number of hours per day that porpoises were detected (Figure 4.4-10, Volume 6 a shows pie-charts for each sampling site that represent the median number of hours that porpoises were detected each day during the sampling period (April –Oct of 2009 and 2010)). Harbour porpoise appear to be present within the three proposed wind farm sites on an almost daily basis while the number of dolphin detections remained low throughout the year (see Plate 4.4-2 below).

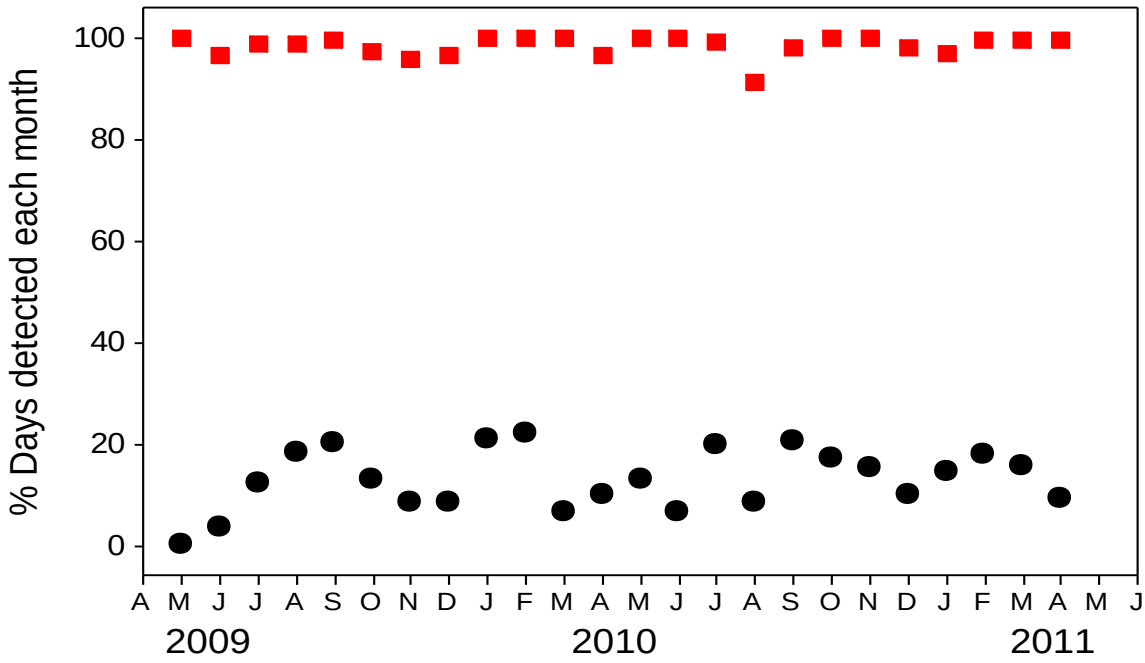

Plate 4.4-2 Monthly Values for the Percentage of Days that Harbour Porpoise (Squares) and Dolphins (Circles) were Detected Within the MORL Zone Development Areas

4.4.8.6 It is currently not possible to distinguish between different species of dolphin recorded using T-PODs or C-PODS and it is likely that detections from different areas of the Moray Firth represent different species of dolphin. In order to address this, a new whistle classifier was constructed in the PAMGUARD software by SMRU Ltd., (Gillespie *et al.,* 2008; SMRU Ltd., 2011) to distinguish bottlenose dolphins from other species of dolphin that may be observed within the Moray Firth (see Section 7.3 of Technical Appendix 4.4 A for more details).

4.4.8.7 Ecological Acoustic Recorders (EARs: http://oceanwidescience.org/docs/EAR.htm) were deployed at five sites within the MORL / BOWL development areas and one within the Moray Firth SAC between July and October 2010 (Plate 4.4-3 below). EARs were deployed on the same moorings being used by the University of Aberdeen (i.e. same location as C-PODS/T-PODs). Whistles were automatically detected using the "Whistle and Moan" detection module in the programme PAMGUARD, and recordings of five dolphin species (bottlenose, Risso's, white-beaked, white-sided and common) were sourced from around Scotland to train the whistle classifier.

4.4.8.8 A total of 50 classification events were generated using the whistle classifier, 22 of which were identified as bottlenose dolphins (BND), 21 as "others" and seven were determined by a manual operator to be false detections (FD) (see Plate 4.4-3 below). A manual operator investigated each classification event to determine whether there had been any false detections. The most common sound causing false detection was a "rubbing" sound likely associated with a swivel on the mooring of some of the EARs.

4.4.8.9 None of the dolphin detection events recorded within the three proposed wind farm sites were classified as being from bottlenose dolphins.

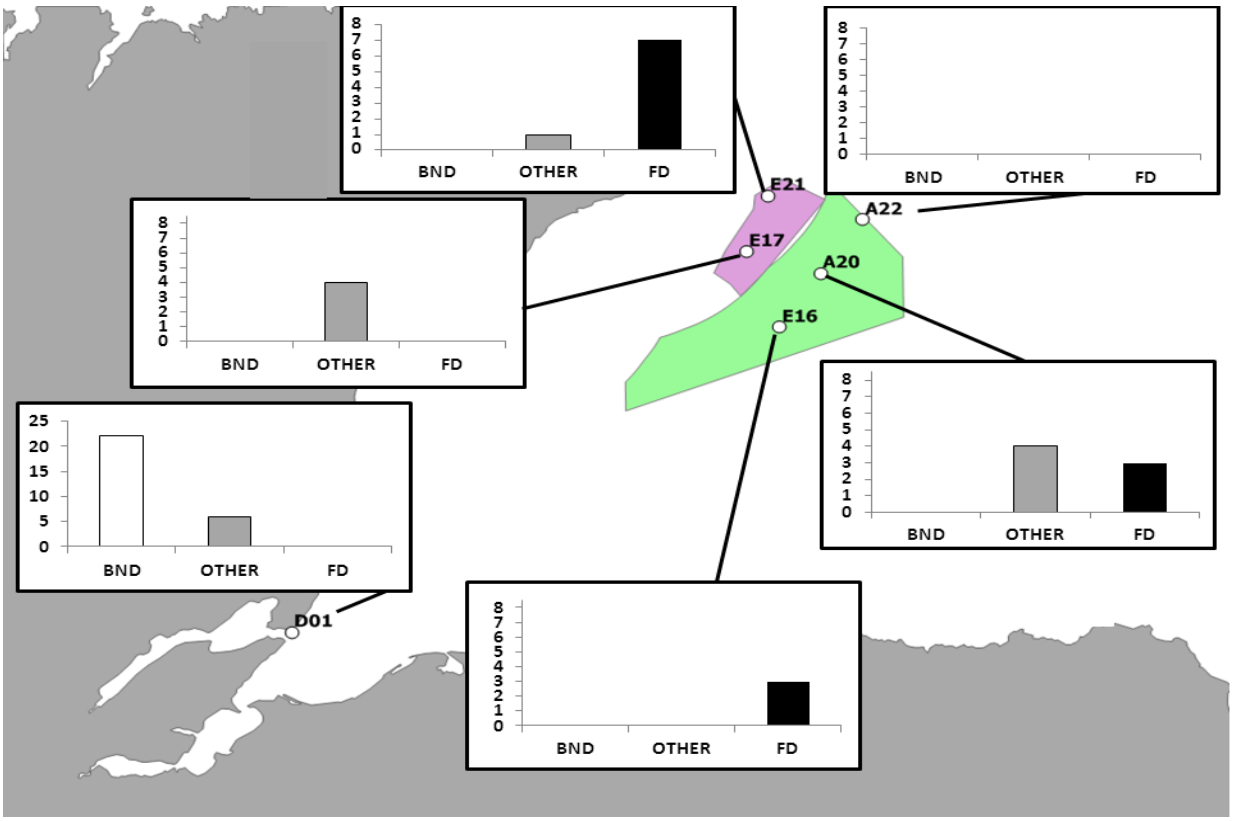

Plate 4.4-3 The Results of the Classification of Whistle Events in the EAR Data Using the Whistle Classifier. BND = Events Classified as Bottlenose Dolphins (White), OTHER = Events Classified as 'Other Species' (Grey) and FD = Events Classified as Dolphins, but Identified as False Detections by the Manual Operator (Black). Note: The Scale of the Y-Axis for the 'D01' EAR is Different to the EARs Deployed on the BOWL and MORL Development Areas

4.4.9 Cetacean Habitat Association Modelling

Harbour Porpoise

4.4.9.1 The University of Aberdeen conducted habitat association models for key cetacean species within the Moray Firth. A full description of the methodology can be found in Section 5 of Technical Appendix 4.4 A. Data utilised for the models were compiled from a variety of sources as listed in Table 4.4-4 below.

Table 4.4-4 Summary of Data Used in the Harbour Porpoise Habitat Modelling

Organisation	Location of Surveys	Year of Surveys	Number of Survey Days	Type of Survey
University of Aberdeen	Moray Firth SAC	2004 and 2005	25	Boat
University of Aberdeen	Outer Moray Firth	2009	14	Boat
University of Aberdeen	Outer Moray Firth	2010	13	Aerial
Natural Power Consultants	MORL Telford, Stevenson & MacColl sites	2010	24	Boat
Institute of Estuarine and Coastal Studies	Beatrice site	2010	14	Boat

4.4.9.2 Survey effort, sightings and environmental data were summarised for these five data sets across a 4 x 4 km grid. The environmental variables assessed were depth, slope, distance to coast and sediment type (expressed as proportion of sand and gravelly sand). Due to the low numbers of individual dolphin species recorded, separate models were run for harbour porpoises and all dolphin species combined.

4.4.9.3 Generalised Additive Mixed Models (GAMMs), using a negative binomial distribution, were used to model harbour porpoise distribution. Variables included in the final model were depth, proportion of sediment that was sand or gravelly sand, slope and the log of effort as an offset (the latter in order to take account of different effort intensities over different regions of the Moray Firth).

4.4.9.4 The final GAMM found that more porpoises were predicted at intermediate depths (around 40-50 m) with few animals observed in shallow or deep waters. At these optimal depths, an increase in predicted occurrence was associated with increases in the proportion of sand and gravelly sand.

4.4.9.5 The results of this model were then used to predict spatial variation in relative abundance across the Moray Firth. These values for relative abundance in each 4 x 4 km grid square were subsequently scaled to provide absolute abundance using the density estimates from aerial survey days (see Section 5.2 of Technical Appendix 4.4 A for details). The resulting values provide an indication of the number of porpoise likely to be present in each grid square (Figure 4.4-11, Volume 6 a).

Bottlenose Dolphin

4.4.9.6 Dolphin sightings collected between 1982 and 2010 were collated from a variety of sources (see Table 4.4-5 below for data sources) and classification trees (De'ath & Fabricius, 2000) were used to assess the likely species of dolphin that may be encountered within the Moray Firth, in particular the likelihood that an individual was a bottlenose dolphin. Depth, distances to coast, slope and sediment type were assigned to the location of each sighting and included in the model along with the coordinates of the middle of the corresponding grid square (see Section 5 of Technical Appendix 4.4 A for full methods).

Table 4.4-5 Summary of Data Used in the Bottlenose Dolphin Habitat Modelling

Dataset	Year	Number of Dolphin Sightings	Number of Animals Recorded
JNCC Seabirds at Sea	1980 to 1998	45	146
JNCC seismic MMO	1998 to 2006	23	94
MORL	2010	8	72
Crown Estate	2009 to 2010	4	15
University of Aberdeen AFEN	2001	4	43
University of Aberdeen 2009 boat	2009	1	3
University of Aberdeen 2010 aerial	2010	29	87
University of Aberdeen SAC	2004 to 2005	41	143
University of Aberdeen Photo ID	1990 to 2010	828	7,267

4.4.9.7 The results suggest that any dolphins encountered along the coastal strip are most likely to be bottlenose dolphins, while those encountered in offshore areas are more likely to be another species (see Figure 4.4-12, Volume 6 a which shows the predicted dolphin species composition within each 4 x 4 km grid cell).

Population Density Estimation for Harbour Porpoise

4.4.9.8 Aerial surveys, conducted in August / September 2010 as part of the DECC funded assessment for oil and gas management, were used to estimate cetacean density. In 2010, two blocks were aerially surveyed, one of which covered a large part of the three proposed wind farm sites (see Section 5 of Technical Appendix 4.4 A for full details). The aim of these surveys was to estimate density using the program Distance (Thomas *et al.,* 2010). Environmental variables that may have affected detection were included in the model, such as observer identity, sea state, sighting conditions and glare intensity.

4.4.9.9 Density was estimated for the entire survey area at 0.64 porpoises per km^2 and for the survey block that included the MORL Zone at 0.81 porpoises per km^2. This estimate indicates that the MORL Zone contained approximately 420 individual harbour porpoises during the survey period.

Population Density Estimation for Bottlenose Dolphin

4.4.9.10 Using the same methodology as described for harbour porpoise above, an estimate of 0.066 animals / km^2 (1.056 per 4 x 4 km cell) can be calculated for the density of all dolphin species in the Moray Firth (see Section 5 of Technical Appendix 4.4 A for full details of methodology).

4.4.9.11 The most recent estimate of the abundance of bottlenose dolphins along the whole of the east coast of Scotland is based on co-ordinated photo-identification studies in 2006 and 2007, which produced an estimate of 195 individuals (95 % highest posterior density intervals (HPDI): 162-253) (Cheney *et al.,* In Press a). More detailed annual surveys within the Moray Firth SAC between 2002 and 2010, indicate that around 50 % of these animals use the SAC in each year, with estimates ranging from 68 to 114 individuals; (mean = 93.3) but with overlapping confidence limits (Cheney *et al.,* In Press b). Overall, the number of dolphins using the SAC between 1990 and 2010 appears to be stable (Cheney *et al.,* In Press b).

4.4.9.12 Data from the classification tree analyses (Figure 4.4-12, Volume 6 a) were further used to account for spatial variation in the density of bottlenose dolphins in different parts of the Moray Firth . The resulting density map is provided (Figure 4.4-13, Volume 6 a). This map models the average number of dolphins, however this may not be the appropriate way to address this subject given that bottlenose dolphins generally form groups and their distribution at any one time will be more clumped than is represented here. Based on other available data sets it is suspected that the approach used here underestimates their use of the inner Firth and southern coast (see Section 6 of Technical Appendix 4.4 A for full discussion). However, the data used here is presently the only dataset that provides an overview of distribution across the whole area of interest. Cognisance will be taken of the likely distribution of the dolphins in groups, rather than being found individually, within the relevant impact assessment chapters.

4.4.9.13 Work is underway by Aberdeen University to model available data so that they better represent variations in the occurrence at both broad scale (inshore-offshore) and finer scale (within the coastal zone). Outputs from this work are anticipated during the latter stages of 2012. In the meantime, the existing data sources referred here provide good information on finer-scale variability in the occurrence of bottlenose dolphins within coastal waters of the Moray Firth.

Boat-Based Surveys, 2010 to 2012

4.4.9.14 NPC was commissioned to undertake boat-based marine mammal surveys between April 2010 and March 2012, with the aim of providing site specific data at an appropriate scale on marine mammal distribution.

4.4.9.15 The surveys followed a line-transect method, 2 km apart, designed to enable distance sampling of biological data and estimation of relative densities. Surveys covered the three proposed wind farm sites plus a 4 km buffer zone (see Figure 4.4-14, Volume 6 a). All marine mammals were recorded by a dedicated observer, with all observers trained to JNCC standards (see Section 8 of Technical Appendix 4.4 A for more details).

4.4.9.16 Ten species of marine mammal were identified during these surveys: grey seal, harbour seal, minke while, killer whale, sperm whale, common dolphin, bottlenose dolphin, Risso's dolphin, white-beaked dolphin, and harbour porpoise (see Section 8.3 of Technical Appendix 4.4 A for more details).

4.4.9.17 In order to show the distribution of individuals across the three sites and buffer areas, relative density plots were constructed for the most abundant species: harbour porpoise, minke whale, grey seal and all seals combined (see Figures 4.4-15a to d, Volume 6 a). Insufficient sightings were made to allow any analysis of distribution for the remaining species. The survey area was divided into a 2 x 2 km grid and mean numbers of observations per survey within each grid square calculated (see Technical Appendix 4.4 A for further details).

4.4.9.18 Distance sampling software Version 6.0 (Thomas *et al.,* 2010) was used to calculate relative density and population size within the site and the buffer areas for harbour porpoise, minke whale, grey seal and all seals combined (see Section 8.2 of Technical Appendix 4.4 A for further details). Since numbers of observations of other species were low this analysis was not considered to be appropriate for other species.

4.4.9.19 The results of the distance sampling analysis are presented in Table 4.4-6 and Table 4.4-7 below. Estimates of marine mammal densities (individuals per km^2) and abundance including 95 % Confidence Intervals (C.I.) are provided. Values for harbour porpoise and minke whale have been adjusted for unobserved animals or those unavailable for observing (e.g. underwater at the time) (see Section 8.3 of Technical Appendix 4.4 A for details) and minke whale estimates are based on Summer survey effort, only as none were observed outwith these months (April to September, 14 surveys).

Table 4.4-6 Relative Estimates for Marine Mammal Species in the Proposed Sites Combined and Buffer Zone Based on Distance Analysis of Data Collected During 28 Boat Surveys Carried Out Between April 2010 and March 2012. CI = Confidence Intervals

Population Estimate	Proposed Wind Farm Sites (combined)		Buffer	
	Estimate	95 % C.I.	Estimate	95 % C.I.
Grey Seal	15	10 to 22	15	10 to 22
All Seals	24	18 to 33	25	18 to 56
Harbour Porpoise	214	170 to 270	224	167 to 302
Minke Whale	3	2 to 5	3	2 to 5

Table 4.4-7 Relative Estimates (per km²) for Marine Mammal Species in the Proposed Sites Combined and Buffer Zone Based on Distance Analysis of Data Collected During 28 Boat Surveys Carried Out Between April 2010 and March 2012

Density estimate	Proposed Wind Farm Sites (combined)		Buffer	
	Estimate	95 % C.I.	Estimate	95 % C.I.
Grey Seal	0.05	0.03 to 0.07	0.04	0.03 to 0.06
All Seals	0.08	0.06 to 0.11	0.07	0.05 to 0.10
Harbour Porpoise	0.72	0.57 to 0.91	0.63	0.47 to 0.85
Minke Whale	0.01	< 0.01 to 0.02	< 0.01	< 0.01 to 0.02

4.4.10 Summary

Harbour Seal

4.4.10.1 Harbour seal is the most common seal species observed within the Moray Firth, with parts of the Inner Moray Firth designated a SAC for their protection. Counts made during the breeding season indicate a decline in numbers within the SAC in recent years but an increase in numbers across the Moray Firth as a whole. Tagging studies found the highest rates of occurrence for the harbour seal were within 30 km of their haul-out sites. Habitat association models highlighted areas of preferred habitat, primarily within the inner Firth, plus some areas close to the proposed developments in the north-eastern part of the Firth. Some preference was also shown for small areas of the south-east Firth in the vicinity of the proposed grid land-fall site. Modelling suggests some areas may contain up to 0.5 animals per km². To date, only six animals have been confirmed as a harbour seal during the boat-based surveys within the three proposed wind farm sites. A number of seals observed during the surveys were not identified to species level, some of which may have been harbour seals.

Grey Seal

4.4.10.2 Telemetry studies showed that grey seals regularly travel between the Moray Firth and haul-out sites outside the area. Areas with the highest usage within the Moray Firth included the Dornoch and Pentland Firths. Lower levels of usage (between one and five animals per 4 km grid square) were estimated for the three proposed sites combined and confirmed by the boat-based surveys. Areas of low usage are also predicted for the proposed land-fall site.

Harbour Porpoise

4.4.10.3 Passive acoustic monitoring indicates that harbour porpoise can be found throughout the Moray Firth. Harbour porpoise habitat models showed a preference for intermediate depths with increasing levels of sand and gravel, such as the Smith Bank. The boat-surveys supported this modelling, with the highest numbers of porpoises recorded in the south-east part of the survey area. Numbers predicted in the models for coastal areas were low.

4.4.10.4 Relative density estimates from boat-based surveys at the three proposed wind farm sites combined (0.16 animals / km²) were slightly lower than those predicted for the Moray Firth by the SCANS II surveys (0.4 to 0.6 animals / km²). However, if this predicted relative density is adjusted to allow for missed sightings (using g(0) values calculated for the SCANS II surveys; see Technical Appendix 4.4 A for methodology), this estimate rises to 0.72 animals / km², more in line to those predicted by SCANS (I and II). Those densities predicted using aerial data were higher still, with 0.81 porpoises per km² predicted for the area that includes the three proposed wind farm sites. It should be noted, however, that these aerial surveys coincide with the months during which the highest number of

porpoise were recorded during the boat-based surveys (refer to Figure 5.31 in Technical Appendix 4.4 A).

Bottlenose Dolphins

4.4.10.5 A resident population of bottlenose dolphins can be found within the Moray Firth, for which a SAC has been designated. Passive acoustic monitoring (which cannot differentiate between dolphin species) indicates that dolphins can be found throughout the Moray Firth. The EARs data (which does allow differentiation between species) suggest that those dolphins recorded in the vicinity of the three proposed wind farm sites are unlikely to be bottlenose dolphins, with this species being restricted to coastal waters (including the proposed landfall site area).

4.4.10.6 The most recent estimate of the abundance of bottlenose dolphins along the whole of the east coast of Scotland is based on co-ordinated photo-identification studies in 2006 and 2007, which produced an estimate of 195 (95 % highest posterior density intervals (HPDI): 162 to 253) (Cheney *et al.,* In Press a). More detailed annual surveys within the Moray Firth SAC between 2002 and 2010, indicate that around 50 % of these animals use the SAC in each year, with estimates ranging from 68 to 114 individuals; (mean = 93.3) but with overlapping confidence limits (Cheney *et al.,* In Press b). Bottlenose dolphin abundance in the vicinity of the three proposed wind farm sites are predicted to be low.

Other Cetacean Species

4.4.10.7 Of the other cetacean species observed within the Moray Firth, the minke whale is the most abundant. They have been shown to prefer sandbanks, as was shown by their distribution recorded during the boat-based surveys. The SCANS II surveys estimated 0.022 animals per km^2 for the Moray Firth, Orkney and Shetland combined, higher than the 0.01 animals per km^2 calculated from the boat-based surveys for the three proposed wind farm sites although the small sample size needs to be taken into account when interpreting these results.

4.4.10.8 White-beaked and common dolphins have been recorded within the Moray Firth but detailed information on their abundance is lacking. Both species were recorded within the proposed development areas during the boat-based surveys but in low numbers.

4.4.11 Individual Site Baseline Characteristics

4.4.11.1 Habitat modelling conducted by the University of Aberdeen and SMRU Ltd gives a broad scale indication of habitat preference by key marine mammal species within each of the three proposed sites (MacColl, Stevenson and Telford) to a 4 x 4 km resolution. Data collected during the site-specific boat-based surveys, collected to a 2 x 2 km resolution, were further examined to provide abundance estimates within each site. The conclusions drawn from this analysis are broadly in line with those habitat associations seen within the University of Aberdeen and SMRU Ltd data.

4.4.11.2 Sample size prevents distance analysis being conducted on each of the three proposed wind farm sites independently. In order to achieve an estimate of abundance within the three individual sites, the proportion of sightings recorded during the boat-based visual surveys within each site was calculated and the combined site estimates (Table 4.4-6 and Table 4.4-7 above) divided proportionately to give a level of abundance within each site. The results of this can be found in Table 4.4-8 below.

4.4.11.3 Of the three proposed wind farm sites, grey seals were more abundant in the proposed MacColl site, accounting for about half of the animals recorded during the boat-based surveys. The data for all seals (including those not identified to species) showed a similar pattern.

4.4.11.4 As with seals, harbour porpoise were more abundant in the proposed MacColl site, accounting for just under half of the animals recorded during the boat-based surveys. The proposed Telford site contained the fewest number of sightings. Presence of minke whales between the three individual sites appears to be fairly similar.

Table 4.4-8 Relative Abundance and Density Estimates for Harbour Porpoise, Minke Whales and Seals Within the Proposed Telford, Stevenson and MacColl Sites

	Telford	Stevenson	MacColl
Grey Seal			
% Observed	20.25	26.58	53.16
Population Estimate	3.04	3.99	7.97
Density Estimate	0.10	0.13	0.26
All Seals			
% Observed	23.66	29.01	47.33
Population Estimate	5.67	6.96	11.36
Density Estimate	0.02	0.02	0.04
Harbour Porpoise			
% Observed	19.41	35.37	45.21
Population Estimate	41.54	75.69	96.75
Density Estimate	0.13	0.26	0.33
% Observed	33.33	28.57	38.10
Population Estimate	0.99	0.86	1.14
Density Estimate	< 0.01	< 0.01	< 0.01

4.4.12 Legislative and Planning Framework

4.4.12.1 Marine mammals in UK territorial waters are protected by both European and National Legislation (see Chapter 4.1: Designated Sites). All cetaceans are listed on Annex IV of the Habitats Directive and therefore classed as European Protected Species and are fully protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) and the Offshore Marine Conservation (Natural Habitats, &c.) (Amendment) Regulations 2009.

4.4.12.2 Four species of marine mammal relevant to this development are also listed on Annex II of the Habitats Directive and requiring the designation of Special Areas of Conservation:

- Bottlenose dolphin (*Tursiops truncatus*);
- Harbour porpoise (*Phocoena phocoena*);
- Grey seal (Halichoerus grypus); and
- Harbour seal (*Phoca vitulina)*.

4.4.12.3 Two SACs have been designated within the Moray Firth for marine mammals (Figure 4.4-1, Volume 6 a, and Table 4.4-9 below):

- Moray Firth SAC – designated for bottlenose dolphin; and
- Dornoch Firth and Morrich More SAC – designated for harbour seals.

4.4.12.4 In addition to the above legislation, the following plans or agreements also apply to marine mammals:

- UK Biodiversity Action Plan (UK BAP); Marine (Scotland) Act 2010;
- Scottish Priority Marine Feature;
- OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic; and
- Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas 1994 (ASCOBANS).

4.4.12.5 While the three proposed wind farm sites are not within Scottish Territorial waters, it is recognised that the development may directly or indirectly affect marine mammal species within the 12 nm limit. Thus UK and Scottish policy on nature conservation is relevant to the protection of European Protected Species (EPS) within the Moray Firth.

Table 4.4-9 Designated Areas within the Moray Firth Listing Marine Mammals as Notified Features

Site	Status	Area (ha)	Relevant Notified Feature(s)
Dornoch Firth and Morrich More	SAC	8,700.53	Harbour seal and otter[2]
Moray Firth	SAC	151,347.17	Bottlenose dolphin

4.4.12.6 The following guidance documents have also been taken into account as part of the marine mammal assessment process:

- Seal Assessment Framework Document (Thompson *et al.,* 2011[3]);
- The deliberate disturbance of marine European Protected Species. Guidance for English and Welsh territorial waters and the UK offshore marine area (2008)[4, 5];
- The protection of marine European Protected Species from injury and disturbance, JNCC (2010);
- Methodologies for measuring and assessing potential changes in marine mammal behaviour, abundance or distribution arising from the construction, operation and decommissioning of offshore wind farms, by BioConsult SH (2008);
- Assessment and costing of potential engineering solutions for the mitigation of the impacts of underwater noise arising from the construction of offshore wind farms, by BioConsult SH (2008);
- Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal Institute of Ecology and Environmental Management, 2010; and
- Greening blue energy: Identifying and managing the biodiversity risks and opportunities of offshore renewable energy. 2010(Wilhelmsson *et al.*).

[2] Otters forage in shore waters, out to approximately 10 m water depth. As such, they are not considered further within the assessment.

[3] This document is provided in Technical Appendix 7.3 B

[4] http://jncc.defra.gov.uk/PDF/consultation_epsGuidanceDisturbance_all.pdf

[5] While we believe that DEFRA have adopted this guidance as it currently stands, the guidance has been amended to reflect slight changes in legislation and is currently under review.

4.4.12.7 Marine Scotland is currently drafting a revision of the protection of marine EPS guidance, in conjunction with SNH and JNCC. This guidance, unavailable at the time of publication of this ES, will be utilised when available if up-dates to any impact assessments are required (e.g. prior to sign off of the Construction Method Plan).

4.4.13 References

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4.5 Ornithology

4.5.1 Introduction

4.5.1.1 This chapter provides a description of the ornithological baseline conditions within the three proposed wind farms, OfTI and wider surrounding area. Ornithological interests associated with the OnTI are provided separately in Chapter 4.7 (Terrestrial Ecology) and associated impact assessment chapters.

4.5.1.2 The baseline study consisted of the following aspects:

- Consultation with relevant statutory and non–statutory bodies;
- Detailed desk study to establish the baseline conditions within the study area;
- Contemporary surveys (2009 to 2012) to inform the baseline assessment including:
    - Boat–based surveys (2010 to 2012);
    - Aerial surveys (2009 to 2010 and 2011);
    - Migration surveys (2010 to 2011); and
    - Seabird tracking study (2011).
- Consideration of the relevant key legislative and planning information.

4.5.1.3 A more detailed account of all the information summarised in this chapter can be found in:

- Technical Appendix 4.5 A (Ornithology Baseline and Impact Assessment);
- Technical Appendix 4.5 B (Aerial Ornithology Surveys for the Moray Firth Zone, Summer 2011); and
- Technical Appendix 4.5 C (Seabird Tracking and Modelling Report).

4.5.1.4 This baseline is used to inform the ornithology impact assessment described in:

- Chapters 7.4 , 10.4 and 14.4 (Ornithology); and
- Chapter 12.1 (Whole Project Assessment).

4.5.1.5 The Moray Firth area holds internationally important numbers of breeding seabirds and over–wintering waterbirds (e.g. ducks, divers, grebes and waders). In addition, this area is also important during the Spring and Autumn migration periods as a migratory route and feeding area for migratory species. The aim of this baseline assessment is to describe the use by ornithological interests of the three proposed wind farm sites, and the areas in which OfTI is proposed.

4.5.1.6 Within the vicinity of the Moray Firth are several sites designated for ornithological interests: SPAs (Special Protection Areas), Ramsar sites, and SSSIs (Sites of Special Scientific Interest). Information on the designated sites short–listed for inclusion in the impact assessment is provided in Chapter 4.1 (Designated Sites); details of the designated sites long list are provided in Section 1.3 of Technical Appendix 4.5 A.

4.5.2 Consultations

4.5.2.1 A summary of the key consultation responses in relation to ornithological issues is included in Table 4.5-1 below.

Table 4.5-1 Summary of Key Ornithology Consultation Responses

Organisation	Consultation Response	MORL Approach
Marine Scotland (The Scottish Government)	The presence of protected species such as Annex 1 Birds or European Protected Species must be included and considered as part of the application process.	Legislative status considered for all species recorded on the site (Table 4, Technical Appendix 4.5 A).
SNH / JNCC	**Comments on Offshore Generating Station Scoping**	
	JNCC & SNH recommend that there should be a minimum of 3 bird surveyors and 1 marine mammal observer suitably trained and experienced during boat–based surveys. Observers should be rotated at regular, predefined intervals to prevent fatigue.	This was in line with the survey methodology adopted (4.5.3.3 of this chapter).
	Habitat modelling will help to better understand the reasons for bird numbers in the Round 3 zone, their spatial distribution and use of the site.	Environmental parameters were incorporated into the density surface modelling (Section 2.1.6 of Technical Appendix 4.5 A, and Technical Appendices 4.5 B and 4.5 C).
	The assessment of effects should be assessed within the context of the consequences to the relevant population and not simply the number of individuals affected.	Effects are assessed against SPA population sizes and regional populations (Section 4 and Table 3 of Technical Appendix 4.5 A).
	The disturbance leading to displacement of birds can and may occur during the operational period of the wind farm, in addition to construction and decommissioning.	The likely significant effects during operation were taken into account in Table 7.4–13, Chapter 7.4 (Ornithology).
	The flight height (and therefore survey techniques capable of gathering this information) is a key requirement to calculate collision risk. At present there is insufficient evidence available for the recommendation of avoidance rates and therefore a precautionary approach will be advised until better evidence has been provided.	Avoidance rates are discussed in 7.4.6 of Chapter 7.4 and Section 2.1.5 of Technical Appendix 4.5 A.
	TCE Strategic Ornithological Support Services (SOSS) will be reviewing the existing knowledge on collision risk and avoidance rates for offshore wind farms and this work should be referred to once it is published.	This SOSS document is discussed in Section 2.1.5 of Technical Appendix 4.5 A.
	JNCC & SNH recommend considering the energetic effects of barrier effects on migratory birds (particularly waterfowl and waders) and breeding seabirds.	Barrier effects are discussed in 7.4.6 of Chapter 7.4.
	An assessment of the potential for O&M boat and / or helicopter traffic to cause disturbance to birds using the site and possible displacement effects should be undertaken. Remote condition monitoring systems may help to reduce the number of turbine visits and therefore help to mitigate the effects of this type of disturbance.	O&M traffic is included in the disturbance assessment (7.4.6 of Chapter 7.4).

Organisation	Consultation Response	MORL Approach
SNH / JNCC (Continued)	Cumulative impact is a key issue for EIA and HRA. JNCC & SNH support the use of the King *et al.,* (2009) framework, but the approach may require adaptation as work progresses on EIA and HRA.	An ornithological CIA is provided in Chapter 14.4.
	The developer should assess the effects of their activities in the context of potential adverse effects on the site integrity of identified SPAs (using conservation objectives).	An assessment on the likely significant effects on SPAs is provided in 7.1.4 of Chapter 7.4.
	Please refer to the range of potential displacement rates provided in the offshore generating scoping response.	The potential displacement rates provided in the scoping response have been considered in the assessment and detailed in Table 4.5-2 below).
	JNCC & SNH welcome the adoption of the updated Band model for collision risk modelling and the use of population modelling to explore the potential effects to key bird populations.	The updated Band model has been used for collision risk modelling (7.4.6 of Chapter 7.4 and Section 2.1.5 of Technical Appendix 4.5 A. Population modelling has also been used (Table 7.4-10 in Chapter 7.4, and Section 2.1.9 of Technical Appendix 4.5 A).
	Comments on Transmission Infrastructure Scoping	
	JNCC & SNH consider that the ornithological interests for the OfTI can be addressed through desk–based appraisal.	The effects of the OfTI on ornithological interests were based on desk–study as recommended by JNCC and SNH (desk–study results presented in paragraph 4.5.3.1 below).
	There are likely to be few significant effects from construction. Potential effects could occur if there was significant boat–based disturbance from cable laying and associated vessel activity close to breeding seabird colonies.	Potential effects from the OfTI are considered in 10.4.6 of Chapter 10.4.
JNCC	**Comments on Draft Environmental Statement**	
	Recommendation was given on the inclusion of additional SPAs in the short–list for assessment for migratory species.	Additional SPAs have been included in the short–list (Table 3, Technical Appendix 4.5 A,).
	Check for more recent population estimates for SPAs.	Population estimates have been updated in Table 3, Technical Appendix 4.5 A.
	Further explanation requested on methodology used for density analysis, collision risk analysis, displacement analysis and population viability analysis	Further methodological details provided in Section 2.1 of Technical Appendix 4.5 A.

Organisation	Consultation Response	MORL Approach
RSPB	**Comments on Offshore Generating Station Scoping**	
	RSPB is content that the proposed programme of boat surveys, coupled with the use of aerial survey data and existing data e.g. from Beatrice Offshore Wind Farm (BOWL) bird surveys, meets currently–accepted standards.	Surveys undertaken as per details provided in Section 2 of Technical Appendix 4.5 A.
	In order to assess if the proposals are or are not likely to have an adverse effect on the integrity of any SPAs, it will be necessary to determine the origin of birds present on the development site, in terms of breeding colonies, and how populations, especially SPA populations, may be affected in terms of number and breeding success.	The origin of the birds present on the three proposed wind farms has been determined using flight direction analysis (Section 2.1.7 of Technical Appendix 4.5 A and Technical Appendix 4.5 B) and seabird tracking work (Technical Appendix 4.5 C and review in Section 4 of Technical Appendix 4.5 A.
	It will be necessary to use bird tracking data in order to collect information on the directions in which birds move to or from the development site and to and from SPA seabird breeding colonies.	A seabird tracking study was undertaken (Technical Appendix 4.5 C). A literature search of other tracking studies was also undertaken (Section 4 of Technical Appendix 4.5 A).
	There will be a need to carry out a HRA to determine the proposal's effect on SPA populations of geese and swans (and perhaps other species) which are likely to fly through the area.	An assessment of geese and swans was undertaken in Section 5.1 of Technical Appendix 4.5 A.
	RSPB believes that the potential for cumulative effects also arises from other proposals.	An ornithological CIA is provided in Chapter 14.4.
	For foraging seabirds RSPB suggests that it would be prudent to consider a much wider study area than that detailed in the scoping report (e.g. cumulative effects could accrue for species such as Manx shearwaters from Rum SPA or gannets from Forth Islands SPA).	SPAs further afield designated for species such as gannet and Manx shearwater were included in the SPA short–list (Table 3, Technical Appendix 4.5 A).
	Mitigation to be considered could include designs of the wind farm layout, turbine height and / or operational limitations such as shut–down periods, for example.	Ecological considerations fed into design of wind farm (Rochdale Envelope parameters) at early stage.
	The potential draw of any lighted structures to birds should be considered (lights within an area of very little light pollution means that attraction could be an issue).	The potential effect of lighted structures is discussed in 7.4.6 of Chapter 7.4

Organisation	Consultation Response	MORL Approach
RSPB (continued)	**Comments on Transmission Infrastructure Scoping**	
	The Environmental Management Plan should have a component specifically addressing Wildlife Management.	An Environmental Management Plan (EMP) will be discussed with consultees. A draft is presented in Technical Appendix 1.3 A.
	Comments on Draft Environmental Statement	
	For the estimation of the number of migrating geese passing through the sites, it was suggested there is a case for making a greater allowance for nocturnal flights (than 15 %) across the Moray Firth, at least in Autumn.	This was taken into account (Section 2.2.3 of Technical Appendix 4.5 A.
	Request for discussion on reliability of rates of displacement from Robin Rigg with data from only one year post–construction.	A discussion on the Robin Rigg wind farm results is provided in Section 2.1.8 of Technical Appendix 4.5 A.

4.5.2.2 JNCC / SNH recommended species–specific seasonal definitions (i.e. definition of the breeding and non-breeding seasons) and ranges for displacement rates for use in analysis for seven species (see Table 4.5-2 below). Seasonal definitions for four additional species are provided in Table 4.5-3 below.

Table 4.5-2 JNCC / SNH Recommended Species–Specific Seasonal Definitions and Ranges for Displacement Rates

Species	Displacement Rate	Breeding Season	Non–Breeding Season
Gannet	50 to 100 %	April to Sept	Oct to March
Guillemot	50 to 100 %	April to July	Aug to March
Razorbill	50 to 100 %	April to July	Aug to March
Puffin	50 to 100 %	April to Aug	Sept to March
Kittiwake	0 to 50 %	April to Aug	Sept to March
Herring Gull	0 to 50 %	April to Aug	Sept to March
Great Black–Backed Gull	0 to 50 %	April to Aug	Sept to March

Table 4.5-3 Species–Specific Seasonal Definitions for Four Additional Species

Species	Breeding Season	Non–Breeding Season
Arctic Tern	May to Aug	–
Fulmar	April to Sept	Oct to March
Little Auk	–	Oct to April
Great Skua	April to Aug	–

4.5.3 Offshore Generating Station and OfTI baseline Characteristics

Desktop Studies

4.5.3.1 Desk–based literature reviews were carried out to collate the most up to date information, to help inform the impact assessments, on aspects of seabird and migratory species ecology and behaviour such as foraging ranges and behaviour. Full details of these literature reviews are provided on a species–by–species basis in Section 4 of Technical Appendix 4.5 A. A summary of bird foraging distances, taken from BirdLife International data (and recommended by SNH and JNCC), are summarised in Table 4.5-4 below.

Table 4.5-4 Summary of Bird Foraging Distances, Taken from BirdLife International Data

	Foraging Distance (km)		
Species	**Maximum**	**Mean Maximum**	**Mean**
Fulmar	664	311.4	69.3
Gannet	640	308.4	140.1
Shag	20	16.4	6.5
Cormorant	50	31.7	8.5
Common Tern	37	33.8	8.7
Arctic Tern	21	12.2	11.7
Kittiwake	200	65.8	25.4
Great Skua	100	42.3	35.8
Arctic Skua	100	40.0	28.0
Guillemot	200	60.6	24.5
Razorbill	51	31.0	10.3
Puffin	200	62.2	30.3

4.5.3.2 For assessment of the OfTI, bird density data were taken from the literature to provide information for near–shore areas. These data were taken from an analysis of 26 years of ESAS surveys undertaken by JNCC (Kober *et al*., 2010), and are summarised in Table 4.5-5 below.

Table 4.5-5 Density Estimates (km²) for Moray Firth from Kober *et al.*, (2010)

Species	Breeding Season	Non–Breeding Season	Autumn
Fulmar	5 to 16	3 to 7	
Sooty Shearwater	0.14 to 1.48		
Manx Shearwater	0.1 to 3.7		
Gannet	0.9 to 2.9	0.4 to 1	
Cormorant	0.03 to 0.288	0 to 0.21	
Shag	0 to 5.73	0 to 8	
Great Skua	0.10 to 0.15	0.01 to 0.31	
Arctic Skua	0.019 to 0.21		0.014 to 1.112
Kittiwake	0.1 to 185.0	0.1 to 20.5	
Great Black–Backed Gull	0.01 to 0.81	0.01 to 1.21	
Common Gull	0.01 to 0.19	0.1 to 1.1	
Lesser Black–Backed Gull	0.1 to 4.0	0.1 to 4.0	
Herring Gull	0.1 to 44.8	0.1 to 9.2	
Guillemot	0.1 to 713.4	0.1 to 62.7	0.1 to 254.8
Razorbill	0.1 to 22.0	0.1 to 15.8	0.1 to 30.5
Puffin	0.1 to 14.8	0.1 to 3.8	

Boat–Based Surveys 2010 to 2012

4.5.3.3 Natural Power Consultants (NPC) were contracted to undertake 28 boat–based bird surveys between April 2010 and March 2012. The survey methodology followed the technique for ship–based seabird surveys outlined by Camphuysen *et al.,* (2004), and the recommendations to improve this methodology outlined by MacLean *et al.,* (2009). The survey followed a line–transect method with a strip width of 300 m on one side of the vessel. The 18 transects were 2 km apart, orientated in an east–west direction across the three proposed wind farm sites plus a buffer of approximately 4 km (Figure 4.5-1, Volume 6 b). Three experienced ornithological observers were involved in each survey; this involved one acting as observer, one acting as scribe and a third available to rotate positions in order to reduce fatigue. The method was designed to enable distance sampling of ornithological data and calculation of densities. Snapshots were undertaken at intervals of every 1 minute to record birds in flight, including information on flight heights (using height bands of 0 to 5 m, 5 to 10 m, 10 to 20 m, 20 to 200 m, 200 to 300 m, and 300 m+). Full details of the methodology can be found in Section 2.1 of Technical Appendix 4.5 A.

4.5.3.4 Summary tables for key species recorded in flight (Table 4.5-6 below) and using the sea (Table 4.5-7 below) are provided. Distance sampling software (Distance version 6.0; Thomas *et al*., 2010) was used to calculate these density and population size estimates of birds using the sea. Density surface models (model–based methods) were produced for six species (fulmar, gannet, kittiwake, guillemot, razorbill and puffin) which were recorded at a sufficient frequency to allow the analysis (Figures 4.5-2 to 4.5-7, Volume 6 b); for less frequently recorded species design–based methods were used to produce the density estimates. These analyses were undertaken for all species recorded in high enough

numbers for the analysis to be valid (see Section 2.1.6 of Technical Appendix 4.5 A for full details of the methodology). Counts of all species recorded during the boat–based surveys can also be found in Section 3.1.1 of Technical Appendix 4.5 A.

4.5.3.5 For species (fulmar, kittiwake, guillemot, razorbill and puffin) that were recorded frequently during boat–based surveys and are designated features of more than one of the three local SPAs (East Caithness Cliffs SPA, North Caithness Cliffs SPA, and Troup, Pennan and Lion's Heads SPA), flight direction analysis was undertaken to determine the most likely SPA from which birds would have originated (Section 3.1.5 of Technical Appendix 4.5 A). This used the boat–based survey data, whereby the site was broken down into different zones (i.e. groups of transects) which were analysed separately. The total number of flights during the breeding season in each of the eight compass directions was then plotted for each species in each zone. The aim of this was to ascertain if there were differences in flight directions across the different zones, or simple modality in the data across all three of the zones, inferring links to SPAs. Data collected on flight directions for birds in flight were also analysed separately for birds carrying fish, as these individuals can be assumed to be heading towards their colony for either chick feeding or courtship.

Table 4.5-6 Distribution of Birds at Different Flight Height Bands, Taken from 2010 to 2012 NPC Boat–Based Survey Snapshot Data. Only Species with > 9 Records are Included.

	Height Band						Total	% at 20 to 200m
Species	**0 to 5 m**	**5 to 10 m**	**10 to 20 m**	**20 to 200 m**	**200 to 300 m**	**300+ m**		
Fulmar	3,834	137	7				3,978	0
Sooty Shearwater	48						48	0
Manx Shearwater	11						11	0
Storm Petrel	45						45	0
Gannet	362	72	103	71			608	11.7
Dunlin	10						10	0
Arctic Skua	17	7	4				28	0
Great Skua	84	16	9	1			110	0.9
Kittiwake	958	507	561	97			2,123	4.6
Lesser Black–Backed Gull	3	4	1	3			11	27.3
Herring Gull	74	32	101	105	1		313	33.5
Great Black–Backed Gull	64	33	48	62			207	30
Arctic Tern	198	201	103	18			520	3.5
Guillemot	3,046	50	2				3,098	0
Razorbill	779	15	2				796	0
Guillemot / Razorbill	1,137	6					1,143	0

Species	Height Band						Total	% at 20 to 200m
	0 to 5 m	5 to 10 m	10 to 20 m	20 to 200 m	200 to 300 m	300+ m		
Little Auk	33						33	0
Puffin	394	3					397	0
Auk Sp.		20					20	0

Table 4.5-7 Density (Birds / km^2) and Abundance Estimates (Birds Using the Sea) for Species which were Recorded at a Sufficient Frequency to Allow the Model-Based or Design-Based Analysis, Taken from 2010 to 2012 NPC Boat–Based Survey Data

Species	Breeding Season				Non–Breeding Season				Model basis
	Density		Abundance		Density		Abundance		
	Site	Buffer	Site	Buffer	Site	Buffer	Site	Buffer	
Fulmar	2.77	1.91	782	750	0.25	0.20	197	189	Model
Gannet	0.66	0.46	100	86	0.04	0.05	23	20	Model
Great Skua	0.34	0.17	101	62	N / A	N / A	N / A	N / A	Design
Kittiwake	7.90	4.69	1,963	1,532	0.79	0.29	261	204	Model
Herring Gull	0.02	0.05	7	18	0.14	0.13	41	47	Design
Great Black–Backed Gull	0.91	1.48	271	526	0.36	0.22	106	77	Design
Arctic Tern	0.77	5.35	229	1,903	N / A	N / A	N / A	N / A	Design
Guillemot	25.57	18.60	6,732	6,943	2.84	3.47	990	1,021	Model
Razorbill	6.03	3.53	1,661	1,674	2.64	3.04	892	899	Model
Guillemot & Razorbill Combined	9.20	5.10	2,732	1,815	2.39	2.78	711	989	Design
Little Auk	N / A	N / A	N / A	N / A	0.51	0.38	151	136	Design
Puffin	6.55	5.55	1,916	1,971	0.75	1.05	450	463	Model

Aerial Surveys 2009 to 2010

4.5.3.6 Seven aerial surveys were undertaken over the three proposed wind farm sites in 2009 (May, June, August, November and December) and 2010 (two in February). The surveys covered the entire MORL Zone plus a 4 km buffer (Figure 4.5-8, Volume 6 b). The first three surveys were undertaken by HiDef Aerial Surveying (Hexter 2009) using high definition video. The four surveys in Winter 2009 / 2010 were carried out by WWT Consulting using traditional aerial survey methods (Camphuysen *et al.*, 2004). Full details of the methodology can be found in Technical Appendix 4.5 A. Density estimates were produced for the most numerous species (those with an estimate of > 10 birds / 100 km within the three proposed wind farm sites in either the breeding or non-breeding season) by calculating the numbers of birds per 100 km of linear transect (Table 4.5-8 below).

Table 4.5-8 Density Estimates (Birds per 100 km of Linear 2 km Wide Survey Transect) of Most Numerous Species Recorded During the 2009 to 2010 Aerial Surveys within Telford, Stevenson and MacColl and the 4 km Buffer Area

	Breeding Season		Non–Breeding Season	
Species	**Site**	**Buffer**	**Site**	**Buffer**
Fulmar	23.1	31.0	56.1	62.1
Gannet	11.9	15.3	1.0	0.5
Kittiwake	96.0	76.7	20.4	7.9
Gulls	63.8	43.8	30.7	27.1
Auks	366.5	233.7	135.0	94.5

Aerial Surveys 2011

4.5.3.7 Additional aerial surveys, designed by NPC to put the site distributions into a wider context and to further address species' connectivity with SPAs, were undertaken by Apem Imaging in Summer 2011. These involved the collection of digital still images over Telford, Stevenson and MacColl sites and over a wider study area (Figure 4.5-9, Volume 6 b). The survey aircraft was flown along transects 2 km apart from each other, aligned in a NNE to SSE direction, and images were captured every 250 m along each transect line, at a resolution of 2 cm ground sample distance (GSD). The images were then quality assured in two stages. First, a sample of the images not containing birds was re–examined, and then when all images containing birds had been isolated, a sample of these were taken and were quality assured for identification.

4.5.3.8 The data collected using these methods were then used in analyses of flight direction, allowing linkages to be made between birds using the surveyed area and the various adjacent SPAs using circular statistics. Population estimates and smoothed density surface distribution maps for the surveyed area were also derived from these data (Table 4.5-9 below; Figures 4.5-10 to 4.5-15, Volume 6 b). Flight direction data was collected in each survey. An example for each of the six species which breed at more than one of the three closest SPAs (fulmar, great black-backed gull, kittiwake, guillemot, razorbill and puffin) is shown in Figures 4.5-16 to 4.5-21, Volume 6 b. Full details of the methods and results (including figures on flight direction from all surveys) are provided in Technical Appendix 4.5 B.

Table 4.5-9 Population Estimates from the Apem Imaging Aerial Surveys

Species	**Population Estimate**		**Confidence Interval**	**% in the Three Development Sites Compared to Whole Survey Area**
Guillemot	Survey area	69,485	(68,801 to 70,247)	9.8
	Three Sites	6,832	(6,774 to 6,893)	
Razorbill	Survey area	59,846	(58,936 to 60,861)	4.2
	Three Sites	2,517	(2,495 to 2,538)	
Guillemot & Razorbill Combined	Survey area	149,353	(147,161 to 151,610)	4.6
	Three Sites	6,832	(6,774 to 6,893)	
Puffin	Survey area	11,780	(11,686 to 11,874)	4.6
	Three Sites	541	(537 to 544)	

Species	Population Estimate		Confidence Interval	% in the Three Development Sites Compared to Whole Survey Area
Fulmar	Survey area	21,241	(20,973 to 21,541)	4.1
	Three Sites	880	(872 to 887)	
Great Black–Backed Gull	Survey area	950	(903 to 1,000)	0.5
	Three Sites	5	(5 to 5)	
Kittiwake	Survey area	47,765	(46,484 to 48,993)	2.6
	Three Sites	1,225	(1,197 to 1,256)	

Migration Surveys 2010 to 2011

4.5.3.9 Migration surveys, designed by NPC as part of the Integrated Ornithological Monitoring Plan (IOMP; Walls *et al.*, 2009), were undertaken in Autumn 2010 and Spring 2011. These consisted of dedicated migration observers carrying out observations during the boat–based surveys and from coastal vantage points. This work was carried out and coordinated by NPC, with RPS Group Ltd. on behalf of Moray Offshore Renewables Limited (MORL) and Beatrice Offshore Wind Farm Limited (BOWL).

4.5.3.10 A dedicated migration observer was present on both MORL and BOWL survey vessels whilst undertaking the boat–based ESAS surveys during the Autumn 2010 and Spring 2011 migration periods. Coastal migration observations were undertaken from four coastal vantage points to collect additional flight route data. The locations for the coastal vantage points can be found in Figure 4.5-22 (Volume 6 b). Observations were undertaken between mid–September and mid–November, and between mid–March and mid–May.

4.5.3.11 The main aim of these surveys was to provide additional data on migrating swans and geese. Estimates of numbers of migrating swans and geese expected to fly through the Telford, Stevenson and MacColl sites are provided in Table 4.5-10 below. These were calculated by extrapolating the number of geese recorded based on observation hours and available daylight (plus estimates of nocturnal flights). Full details of the survey and analysis methodology can be found in Section 2.2 of Technical Appendix 4.5 A. A flight was judged as 'probably' flying through the wind farm sites if extrapolation of the linear flight direction intersected with one of the sites. A flight was judged as 'possibly' flying through the wind farm sites if this extrapolated flight route was within 2 km of one of the sites.

Table 4.5-10 Estimates of Annual Swans / Geese Flights and Mortality, Based on Migration Surveys

	Extrapolated Number of Flights		
Species	**Possible**	**Probable**	**Total**
Whooper Swan	0	36	36
Pink–Footed Goose	5,202	18,705	23,907
Greylag Goose	206	3,049	3,255
Barnacle Goose	175	0	175

Seabird Tracking Study 2011

4.5.3.12 A seabird tracking study was also designed by NPC as part of the IOMP (Walls et al., 2009). GPS loggers were attached to four key species of seabirds (fulmar, kittiwake, guillemot and razorbill), by the Marine Biology and Ecology Research Centre, University of Plymouth, at the Berriedale Cliffs SSSI within the East Caithness Cliffs SPA (Figure 4.1-1, Volume 6 b). Other SPAs were not selected for this work due to issues with safe access to other colonies. The loggers were deployed for periods of over 36 hours, allowing for the completion of at least one full foraging trip. Only known breeding birds were targeted and devices were only deployed on those known to be on eggs or chicks, to reduce the risk of abandonment.

4.5.3.13 The data from the GPS loggers was used to plot the exact routes taken by each bird on each foraging bout (defined by at least one fix being taken at least one kilometre from the colony) to focus on foraging activity, giving data on the duration and range of foraging trips. A summary of the results is provided in Table 4.5-11 below. Data were binned into cells of a systematic grid (7 km x 7 km for fulmar, and 3 km x 3 km for other species) which were then used to indicate levels of use per grid cell at both individual and species' levels (Figures 4.5-23 to 4.5-26, Volume 6 b). Grid size was determined by reference to foraging behaviour.

4.5.3.14 Additional modelling was undertaken to predict the foraging distributions of breeding fulmar, kittiwake, guillemot and razorbill from three SPAs (East Caithness Cliffs SPA, North Caithness Cliffs SPA, and Troup, Pennan and Lion's Heads SPA) (Figures 4.5-27 to 4.5-30, Volume 6 b). These predictions were based on mean foraging distance from the tracking data and environmental covariates (measures of sea depth and slope, sediment type, sea surface temperature and chlorophyll a) initially tested for correlation with the tracking data using GLMMs (Generalised Linear Mixed Models).

4.5.3.15 Full details of the methodology and results can be found in Technical Appendix 4.5 C. A summary of results is presented in Table 4.5-11 below.

Table 4.5-11 Summary of Results from the Seabird Tracking Technical Appendix 4.5 C

Species	No. Tracked	No. of Foraging Trips	Flight Direction	Avg. Trip Duration (h)	Mean Range (km)	No. Within the Three Proposed Sites
Fulmar	15	28	SE	12.6	47.4	3 (10.7)
Kittiwake	19	30	SW to SE	13.3	41.9	0 (0 %)
Guillemot	20	62	SW to SE	13.7	40.2	0 (0 %)
Razorbill	18	58	S to SW	10.9	30.3	0 (0 %)

4.5.4 Individual Site Baseline Characteristics

4.5.4.1 There are differences in density estimates for the three proposed wind farm sites for some species (fulmar, gannet, great skua, kittiwake), whereas other species have similar density estimates (herring gull) (Table 4.5-12 and Table 4.5-13 below).

Table 4.5-12 Summary of Baseline Differences

Individual Wind Farm Sites	Summary of Baseline Characteristics
Telford Wind Farm	This site is the most north–easterly of the three proposed wind farm sites, and is therefore closest to North Caithness Cliffs SPA and East Caithness Cliffs SPA. The site has the lowest densities of fulmar, gannet, guillemot, razorbill and puffin.

Individual Wind Farm Sites	Summary of Baseline Characteristics
Stevenson Wind Farm	This site is at the south–east of the three proposed wind farm sites, and is therefore closest to Troup, Pennan and Lion's Head SPA. The site has the highest densities of fulmar, guillemot and puffin; and lowest densities of great skua, kittiwake, herring gull, great black–backed gull, Arctic tern, little auk.
Maccoll Wind Farm	This site is at the south–west of the three proposed wind farm sites, and is therefore closest to Troup, Pennan and Lion's Head SPA. The site has the highest densities of gannet, great skua, kittiwake, herring gull, great black–backed gull, Arctic tern, razorbill and little auk.

Table 4.5-13 Abundance (ABD) and Density Estimates (DENS) for the Three Proposed Wind Farm Sites

Species		Abundance and Density Estimates of Birds Using The Sea					
		Telford		Stevenson		MacColl	
		Summer	Winter	Summer	Winter	Summer	Winter
Fulmar	ABD	193	49	317	80	272	69
	DENS	2.07 / km²	0.52 / km²	4.10 / km²	1.04 / km²	2.18 / km²	0.55 / km²
Gannet	ABD	16	4	32	7	53	12
	DENS	0.17 / km²	0.04 / km²	0.41 / km²	0.09 / km²	0.42 / km²	0.10 / km²
Great Skua	ABD	31	0	24	0	46	0
	DENS	0.33 / km²	0	0.31 / km²	0	0.37 / km²	0
Kittiwake	ABD	655	87	398	53	910	121
	DENS	7.03 / km²	0.94 / km²	5.14 / km²	0.68 / km²	7.30 / km²	0.97 / km²
Herring Gull	ABD	2	13	2	10	3	19
	DENS	0.02 / km²	0.14 / km²	0.02 / km²	0.12 / km²	0.03 / km²	0.15 / km²
Great Black–Backed Gull	ABD	84	33	64	25	123	48
	DENS	0.90 / km²	0.35 / km²	0.82 /km²	0.32 / km²	0.99 / km²	0.39 / km²
Arctic Tern	ABD	71	0	54	0	104	0
	DENS	0.76 / km²	0	0.69 / km²	0	0.83 / km²	0
Guillemot	ABD	1,725	254	2,081	306	2,926	430
	DENS	18.49 / km²	2.72 / km²	26.88 / km²	3.96 / km²	23.48 / km²	3.45 / km²
Razorbill	ABD	390	209	429	230	842	452
	DENS	4.18 / km²	2.24 / km²	5.54 / km²	2.98 / km²	6.76 / km²	3.63 / km²
Little Auk	ABD	0	47	0	35	0	69
	DENS	0	0.50 / km²	0	0.46 / km²	0	0.55 / km²
Puffin	ABD	508	119	569	134	839	197
	DENS	5.45 / km²	1.28 / km²	7.35 / km²	1.73 / km²	6.74 / km²	1.58 / km²

4.5.5 Legislative and Planning Framework

4.5.5.1 The following legislation has been taken into account as part of the ornithological assessment process:

- The European Directive 2009/147/EC on the conservation of wild birds (EU Birds Directive);
- Ramsar Convention on Wetlands of International Importance 1971;
- Bonn Convention on the Conservation of Migratory Species of Wild Animals 1979, as amended;
- Conservation of Habitats and Species Regulations 2010;
- Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007;
- Conservation (Natural Habitats, &c.) Regulations 1994;
- Wildlife and Countryside Act 1981, as amended;
- The Nature Conservation (Scotland) Act 2004; and
- The Marine (Scotland) Act 2010.

4.5.5.2 The following guidance has also been taken into account as part of the ornithological assessment process:

- Camphuysen, C.J., Fox, T., Leopold, M.F. & Petersen, I.K. (2004). Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the UK. A report for COWRIE;
- Maclean, I.M.D., Wright, L.J., Showler, D.A. & Rehfisch, M.M. (2009). A review of assessment methodologies for offshore wind farms. A report for COWRIE;
- Walls, R., Pendlebury, C., Budgey, R., Brookes, K. & Thompson, P. (2009). Revised best practice guidance for the use of remote techniques for ornithological monitoring at offshore wind farms. A report for COWRIE;
- King, S., MacLean, I., Norman, T. & Prior, A. (2009). Developing guidance on ornithological cumulative impact assessments for offshore wind farm developers. A report for COWRIE;
- Band, W., Madders, M. and Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms;
- Band, W. (2011). Using a collision risk model to assess bird collision risks for offshore windfarms. Report to SOSS;
- Institute of Ecology and Environmental Management (2010) Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal;
- Planning Advice Note 60 on Planning for Natural Heritage (2000); and
- Scottish Planning Policy (SPP), 2010.

4.5.6 References

Band, W. (2011). Using a collision risk model to assess bird collision risks for offshore windfarms. Report to SOSS.

Camphuysen, C.J., Fox, T., Leopold, M.F. & Petersen, I.K. (2004). Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the UK. A report for COWRIE.

Hexter, R. (2009). High resolution video survey of seabirds and mammals in the Moray Firth, Hastings, West Isle of Wight and Bristol Channel Areas in periods 5, 6 and 7. COWRIE Ltd. St. Andrews, United Kingdom.

Maclean, I. M. D., Wright, L. J., Showler, D.A. & Rehfisch, M. M. (2009). A review of assessment methodologies for offshore wind farms. A report for COWRIE.

Thomas, L., Buckland, S. T., Rexstad, E. A., Laake, J. L., Strindberg, S., Hedley, S. L., *et al., (*2010). *Distance software: design and analysis of distance sampling surveys for estimating population size*. Journal of Applied Ecology, 47, 5–14.

Walls, R., Pendlebury, C., Budgey, R., Brookes, K. & Thompson, P. (2009). *Revised best practice guidance for the use of remote techniques for ornithological monitoring at offshore wind farms*. A report for COWRIE.

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4.6 Intertidal Ecology

4.6.1 Introduction

4.6.1.1 Intertidal ecology refers to the coastal habitats and associated plants and animal species and communities present between the high and low mean spring tide marks. Information on the ecology of intertidal areas at the study area was acquired from a biotope mapping survey conducted at Fraserburgh Beach. Site specific survey and analysis methodologies were agreed with Marine Scotland and followed JNCC Procedural Guidelines 3-1 (Wyn & Brazier, 2001). The study area (see Technical Appendix 4.6 A) was defined by assessing the onshore cable route as it traverses the beach at Fraserburgh and also assessing within 500 m either side to account for likely significant effects associated with the movement of plant and installation equipment.

4.6.1.2 The study consisted of the following aspects:

- Consultation with relevant statutory and non-statutory bodies;
- Detailed desk study to establish the baseline conditions within the study area;
- Field surveys to inform the baseline assessment through mapping and sediment core sampling within the study area; and
- Consideration of the relevant key legislative and planning information.

4.6.1.3 A detailed account of the site specific survey together with presentation of relevant physical and biological sample data and results is provided in Technical Appendix 4.6 A (Intertidal Ecology Technical Report).

4.6.1.4 This baseline is used to inform the intertidal ecology impact assessment described in:

- Chapters 10.5 and 14.5 (Intertidal Ecology); and
- Chapter 12.1 (Whole Project Assessment).

4.6.2 Consultations

4.6.2.1 Table 4.6-1 below provides a description of the only consultation relevant for the intertidal ecology assessment received to date.

Table 4.6-1 Summary of Consultations

Organisation	Consultation Response
Marine Scotland	• Statutory agreement of site specific survey and analysis methodologies
RSPB Scotland	• Required confirmation on the timing of the surveys to be reported

4.6.3 Baseline Characteristics

4.6.3.1 The following describes the baseline intertidal ecology of the export cable landfall and onshore cable route within the study area. Information presented in this baseline derives from desktop studies and site specific surveys as detailed below.

4.6.4 Desktop Studies

4.6.4.1 The beach at Fraserburgh may be regarded as a high energy intertidal environment exhibiting a relatively steep profile with a width of 120 m (Eletheriou & Robertson, 1988) and comprising moderate to well sorted mobile sands. Sediment fauna include a range of polychaetes, crustaceans and molluscs typically found in dynamic, mobile sands.

4.6.4.2 Rocky communities are typically colonised by barnacles and limpets on vertical surfaces, with fucoid (brown) algae existing sublittorally and displaying distinct zonation patterns.

4.6.4.3 The beach landfall site does not hold any statutory designation for nature conservation. Sand dunes and associated nature conservation interests are dealt with in Chapter 4.7 (Terrestrial Ecology).

4.6.5 Site Specific Surveys

4.6.5.1 Field work was conducted in accordance with JNCC Procedural Guidelines 3-1 (Wyn & Brazier, 2001) and comprised the mapping of intertidal habitats between the mean high water spring tide mark and the low spring water tide mark. Conspicuous plants and animals associated with each habitat were recorded. Both the habitat and species data were subsequently combined and used to classify biotopes. The surveys were conducted in the study over two days (15/08/11 to 16/08/11). Surveys comprised modified Phase I habitat mapping techniques. In addition to the mapping of habitats, the surveys also included sediment core sampling for determination of faunal content and to assist biotope classification following guidance described in JNCC Procedural Guidelines 3-1 (Wyn & Brazier, 2001). A total of 12 sampling points were selected at Fraserburgh Beach (see Technical Appendix 4.6 A). Surveys were conducted during low spring tides to allow the lowest reaches of the shore to be accessed. Key species and substrate conditions were identified *in situ*. A full account of the site specific surveys is provided as Technical Appendix 4.6 A supporting this Environmental Statement.

4.6.5.2 Three biotope classifications (Connor *et al*., 2004) were ascribed to the intertidal region of the landfall site. A biotope map for Fraserburgh Beach is presented in Figure 4.6-1, Volume 6 b. A summary of the biotopes found is provided in Table 4.6-2 below. No species of nature conservation importance or biotopes which are rare or restricted in distribution were recorded.

4.6.5.3 Surveys of the intertidal beach communities revealed that the sediments contained extremely depauperate communities of invertebrates. At most sampling points, either none or only a few polychaetes, isopods or amphipods were recorded. The biotope which corresponded to this habitat and associated community types was classified as LS.LSA.MoSa, describing barren or amphipod mobile sand shores. This biotope is mainly found on moderately exposed and exposed shorelines where wave action resulting from the wind and tide disturbs the sediments. Beaches which support this biotope often have a relatively steep profile and are susceptible to the upper shore drying out in between tides. Few beach fauna species can tolerate these conditions resulting in a beach community consisting of a limited number of individuals and a reduced species diversity.

4.6.5.4 Two rocky shore biotopes were also recorded within the study area at Fraserburgh Beach. These included the LR.HLR.MusB.Sem.LitX biotope which describes the barnacle, *Semibalanus balanoides* and winkle *Littorina* spp. on exposed to moderately exposed boulders and cobbles. This biotope was prominent to the north of the survey area on boulders and bedrock subject to regular tidal inundation. The other biotope was classified as LR.FLR.Lic.YG. This biotope describes yellow and grey lichens on supralittoral rock and was recorded on the sea defence rock armour above the beach.

4.6.5.5 No rare or protected biotopes or species were recorded during the site specific survey. Species and biotopes at Fraserburgh Beach were regarded as highly typical and representative of high energy intertidal environments in the UK.

Table 4.6-2 Summary of the Biotopes Found at Fraserburgh Beach

Site	Biotope Classification and Community	Representative Beach Photograph	Description of Habitat
Fraserburgh Beach	LS.LSa.MoSa Barren or amphipod-dominated mobile sand shores.		Clean mobile sandy shores. May be duned or rippled due to wave action or tidal currents. May dry out between tides, especially on upper shore.
Fraserburgh Beach	LR.HLR.MusB.Sem.LitX *Semibalanus balanoides* and *Littorina* spp. on exposed to moderately exposed eulittoral boulders and cobbles		Large patches of boulders, cobbles and pebbles in the eulittoral zone on exposed to moderately exposed shores.
Fraserburgh Beach	LR.FLR.Lic.YG Yellow and grey lichens on supralittoral rock		Band of lichens including *Xanthoria parietina, Caloplaca marina, Caloplaca thallincola* or *Ramalina* sp. on stable boulders in supralittoral (splash) zone.

4.6.6 *Legislative and Planning Framework*

4.6.6.1 The legislation and guidance relevant to the intertidal ecology assessment is in line with that described in Chapter 4.2 (Benthic Ecology).

4.6.7 *Refererences*

Connor, D.W., Allen, J.H., Golding, N., Howell, K.L., Lieberknecht, L.M., Northen, K.O. & Reker, J.B. (2004). The marine habitat classification for Britain and Ireland, version 04.05 (internet version). Joint Nature Conservation Committee

Eleftheriou, A. & Robertson, M.R. (1988) The intertidal fauna of sandy beaches – a survey of the east Scottish coast. Department of Agriculture and Fisheries for Scotland, Aberdeen (Scottish Fisheries Research Report, No. 38)

Wyn, G. & Brazier, P. (2001) Procedural Guideline No 3-1. In-situ intertidal biotope recording. In: Davis *et al.,* Marine Monitoring Handbook. ISBN 1 85716 550 0. pp. 223-228.

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4.7 Terrestrial Ecology

4.7.1 Introduction

4.7.1.1 This chapter details the existing terrestrial ecology baseline conditions present within and adjacent to the proposed development. It covers birds, habitats and protected species (mammals and freshwater species). Ornithology, fish and mammal interests associated with the offshore development are dealt with separately in the following chapters:

- Chapters 4.3, 7.2, 10.2 and 14.2 (Fish and Shellfish Ecology);
- Chapters 4.4, 7.3, 10.3 and 14.3 (Marine Mammals); and
- Chapters 4.5, 7.4, 10.4 and 14.4 (Ornithology).

4.7.1.2 The study area is comprised of a number of environments, including urban, rural, agricultural, industrial and coastal land.

4.7.1.3 The study consisted of the following aspects:

- Consultation with relevant statutory and non–statutory bodies, including SNH, SEPA, SWT and Ugie Angling Association;
- Detailed desk study to establish the baseline conditions within the study area;
- Field surveys to inform the baseline assessment; and
- Consideration of the relevant key legislative and planning information.

4.7.1.4 A detailed account of this information is provided in:

- Technical Appendix 4.7 A (Terrestrial Ecology Technical Report); and
- Technical Appendix 4.7 B (Terrestrial Ecology Confidential Report – Protected Species).

4.7.1.5 This baseline is used to inform the terrestrial ecology impact assessment described in:

- Chapters 10.6 and 14.6 (Terrestrial Ecology);
- Chapter 12.1 (Whole Project Assessment); and
- Chapter 12.2 (Habitat Regulations Appraisal Summary).

4.7.1.6 Within the vicinity of the onshore cable route several sites are designated for ornithological or ecological interests: SPAs, Ramsar sites, SACs and SSSIs. Information on the designated sites shortlisted for inclusion in the impact assessment is provided in Chapter 4.1 (Designated Sites).

4.7.2 Consultations

4.7.2.1 Consultation for OnTI was carried out during 2011 to confirm the desk study approach and baseline field survey methodology, and to provide historical records and any other relevant information (Table 4.7-1 below). For full scoping consultations, refer to Chapter 1.4 (Stakeholder Consultation).

Table 4.7-1 Terrestrial ecology Consultation Responses

Organisation	Consultation Response	MORL Response
SNH and JNCC	**Scoping response:** Recommended contacting the following bodies: • North East Scotland Biological Records Centre (NESBReC); • RSPB; • County Bird Recorder; • The BTO (British Trust for Ornithology) in relation to WeBS; • The North Sea Bird Club; • The local Raptor Study Group; • Saving Scotland's Red Squirrels; • District Salmon Fishery Boards; and • Aberdeenshire Council Planning Authority (in relation to Sites of Interest to Natural Science).	The following were contacted: • NBN; • NESBReC; • RSPB; • The BTO in relation to WeBS; and • Aberdeenshire Council Planning Authority (in relation to Sites of Interest to Natural Science).
	• Terrestrial Species: Approved all proposed surveys. Supported proposal to carry out wintering pink–footed goose desk study. Advised that District Salmon Fishery Board be contacted about potential impacts to salmonids and other fish species at river crossings, and whether electro–fishing surveys are required. Suggested that experienced freshwater pearl mussel surveyor carry out initial freshwater pearl mussel survey. Advised that EIA include details of proposed locations and methods for crossing water courses, including any mitigation.	• Wintering pink–footed goose desk study was carried out. Freshwater pearl mussel surveys were carried out by experience surveyor. Details of proposed locations and methods for crossing water courses, including mitigation, were included in EIA wherever known.
	• Natural and Semi–Natural Habitats: Approved of proposed phase 1 habitat and NVC survey. Carbon–rich soils should be identified in EIA for attention of SEPA.	• Carbon–rich soils, specifically dry modified bog, blanket bog and acid / neutral flush and spring, were identified in EIA for attention of SEPA.
	• Designated Sites: Approved list of designated sites with reminder that all qualifying interests should be carefully considered.	• Designated sites and qualifying interests were all carefully considered
	• Coastal Geomorphology: Highlighted important sand dune features at Loch of Strathbeg SSSI. Concerned that Scoping Report does not indicate whether impacts to sand dune features can be avoided, or if any mitigation might be proposed; this must be addressed in EIA.	• The onshore cable route will not make landfall near the Loch of Strathbeg SSSI, thus sand dune features there will not be impacted.

Organisation	Consultation Response	MORL Response
SNH and JNCC (Continued)	• Ornithology: All Loch of Strathbeg SPA qualifying features should be carefully considered. Suggested that foraging ranges be used to ascertain SPA connectivity. Any mitigation should consider balanced needs of all qualifying features.	• All Loch of Strathbeg SPA qualifying features were carefully considered. Pink–footed goose foraging ranges were used to ascertain SPA connectivity.
	• Habitats: Reminded that water–dependent features (e.g. Rora Moss SSSI) should be carefully considered for impacts caused by pollution or disruption to hydrology.	• Water–dependent features were carefully considered for impacts caused by pollution or disruption to hydrology.
	• Recommended that the following are contacted: - NBN	The following were contacted: - NBN
SNH	• SNH gave the following guidance to determine baseline ecology: • The following baseline field surveys should be carried out: phase 1 habitat (to include consideration of peat habitats); protected species surveys for otter, badger, water vole, red squirrel, Scottish crossbill and bats; and freshwater pearl mussel survey of the River Ugie. However baseline field surveys for wildcat and pine marten are unlikely to be necessary, and surveys for great crested newt and reptiles are not required.	• All baseline surveys were carried out as recommended by SNH. Surveys for Scottish crossbill were not carried out as suitable habitat for this species was lacking within the onshore cable route.
	• Baseline desk study of all protected species should be carried out using: WeBS, RSPB and NBN. Also potential disturbance to wintering geese should be investigated using data from local goose management schemes (28 February 2011).	• Baseline desk study of all protected species was carried out using WeBS, RSPB and NBN. All potential disturbance to wintering pink–footed geese was investigated using data from local goose management schemes.
	• Confirmation on freshwater pearl mussel survey methodology (08 July 2011). For consultation response, refer to Technical Appendix 4.7 A.	• No response necessary.
	• Highlighted international importance of Loch of Strathbeg for wintering pink–footed geese. Refers to study by University of Aberdeen which indicates geese are highly mobile in their feeding behaviour. Suggests goose population is fluid, with flocks constantly departing and arriving. Goose numbers peak in Spring and Autumn. Most SNH data relate to March and April when goose numbers are highest. Goose distribution in fields relates to a number of factors, not least crop in field, with a preference for shorter grass (28 July 2011).	• No response necessary.
	• Discussion about freshwater pearl mussel records (31 August 2011). For consultation response, refer to Technical Appendix 4.7 A.	• No response necessary.

Organisation	Consultation Response	MORL Response
SEPA	**Scoping response:** • Approved of proposed phase 1 habitat and NVC (National Vegetation Classification) survey and recommended guidance to help identify wetlands 'A Functional Wetland Typology for Scotland'.	• No response necessary.
	• Site layout should avoid impacts on all wetlands, in particular active blanket bog. If impacts are predicted then mitigation should be provided.	• Impact assessment and mitigation provided for wetland habitats
	• Groundwater–dependent terrestrial ecosystems are protected under Water Framework Directive. Results of NVC survey and Appendix 2 of SEPA's Planning guidance on wind farm developments should be used to identify if wetlands are groundwater–dependent terrestrial ecosystems. If groundwater–dependent terrestrial ecosystems are located within radius of (i) 100 m from roads, tracks and trenches, or (ii) 250 m from borrow pits and foundations, then any impacts will require further assessment. This assessment should be carried out whether or not features in (i) and (ii) occur inside or outside site boundary so that micro–siting does not necessitate further NVC surveys. Results and any mitigation should be provided.	• GWDTE were not identified as it was considered this should be done in detail once final cable route design has been completed. All habitats were mapped to Phase 1, and in some cases to NVC, level. However additional analysis of these data will be required to identify GWDTE, such analysis is difficult without final cable route design.
	• Roads, tracks or trenches or other excavation work within 100 m, or borrow pits within 250 m, of groundwater–dependent terrestrial ecosystems identified as highly sensitive (in Appendix 2 of SEPA's Planning Guidance on wind farm developments) should be reconsidered. Further studies will be required if infrastructure remains within buffer zones.	• No response necessary.
	Comments on Draft ES: • Satisfied that phase 1 habitat and NVC surveys carried out correctly.	• No response necessary.
	• Highlighted lack of assessment as to whether identified wetland habitats were groundwater–dependent terrestrial ecosystems (GWDTE). Advised that final environmental statement should identify all GWDTE within 100 m of cable route, and provide assessment of likely impacts. However a precise cable route will first be required to assess likely impacts:	• GWDTE were not identified as it was considered this should be done in detail once final cable route design has been completed. All habitats were mapped to Phase 1, and in some cases to NVC, level. However additional analysis of these data will be required to identify GWDTE, such analysis is difficult without final cable route design.

Organisation	Consultation Response	MORL Response
SEPA (Continued)	• Highlighted that onshore cable route crosses Savoch Burn and Ellie Burn, avoidance of these burns during cable route design is advised. It is also recommended that trenching should not take place for considerable lengths alongside the River Ugie.	• It is not thought that the onshore cable route will cross the Savoch or Ellie Burns. It is thought that these burns lie further to the east near Savoch at NK050585 (Savoch Burn) and NK037595 (Ellie Burn). Nonetheless, appropriate mitigation has been suggested.
	• Recommended that dune grassland habitat at Fraserburgh Bay landfall site should be left in as natural condition as possible with any hard engineering kept to a minimum, information on any hard engineering to be installed will be provided in the final environmental statement. HDD is SEPA's preferred option for crossing the dune grassland habitat, as opposed to trenching. Should trenching be taken forward, then justification should be provided in the final environmental statement.	• HDD will be the installation method used at the Fraserburgh Bay landfall site. As this method is technically feasible for up to 1 km, and the dune grassland habitat extends for approximately 300 m at its widest point, the habitat will be left in as natural condition as possible.
RSPB	**Scoping response:** • Suggested that construction may disturb foraging birds associated with following SPAs: Buchan Ness to Collieston Coast SPA (herring gull colony), Loch of Strathbeg SPA (pink–footed goose, greylag goose, barnacle goose and whooper swan) and Troup, Pennan and Lion's Heads SPA (herring gull colony). Habitats Regulation Assessment will be required.	• Impacts on qualifying features of the Buchan Ness to Collieston Coast SPA, Loch of Strathbeg SPA and Troup, Pennan and Lion's Heads SPA were considered in the EIA.
	• Concerned that breeding bird survey methodology may under–record small, non–vocal species and only provide indicative picture of avian assemblage. Agreed this is adequate to aid decision–making on route choice where non–designated sites are concerned as impacts on breeding birds can mostly be avoided by carrying out construction during Winter. However more detailed bird survey of particular sections may be required for route micro–siting.	• Preconstuction breeding bird surveys and presence of an Ecological Clerk of Works (ECoW) have been recommended as mitigation.
	• Agreed that Winter survey for foraging pink–footed geese unnecessary unless desk study suggests the species may be present. Also agreed that construction likely to cause minimal disturbance to foraging farmland and coastal species.	• No response necessary
	• Baseline desk study should consult Francis and Cook (2011).	• Francis and Cook (2011) consulted.

Organisation	Consultation Response	MORL Response
RSPB (Continued)	**Additional Feedback:** • Recommended consideration of the following: wintering pink–footed geese at Loch of Strathbeg SPA (Appropriate Assessment may be required if construction takes place during Winter); and breeding herring gulls at Bullers of Buchan near Boddam, which forms part of Buchan Ness to Collieston Coast SPA (Appropriate Assessment may be required if construction takes place during breeding season) (19 July 2011). For consultation response, refer to Technical Appendix 4.7 A.	• Wintering pink–footed geese at Loch of Strathbeg SPA and breeding herring gulls at Boddam were considered.
	• Discussion about corn bunting presence within the onshore cable route. Hywel Maggs confirmed Aberdeenshire was remaining UK stronghold for the species. He agreed that potential construction impacts on the species would be low and of a temporary nature. It was verified that there is no ideal season for construction as corn bunting are present all year round (31 August 2011).	• No response necessary
	Comments on draft ES: • Concur that there will be no significant impacts on Loch of Strathbeg SPA, terrestrial breeding birds or coastal wintering birds.	• No response necessary.
	• Concerned that there may be negative impacts on Buchan Ness to Collieston Coast SPA and Loch of Strathbeg SSSI	• Buchan Ness to Collieston Coast SPA and Loch of Strathbeg SSSI addressed in EIA.
SWT	**Scoping response:** • Highlighted the presence of SWT Reserve at Longhaven Cliffs. SWT happy to provide GIS (Geographical Information System) shapefile of reserve boundary and data on request. Please keep SWT informed of proposal as it progresses.	• Acknowledged. SWT reserve Longhaven Cliffs is approximately 3km south of the onshore cable route and substation.
Ugie Angling Association	• Provision of historical freshwater pearl mussel records (09 and 23 August 2011).	• No response necessary.

4.7.3 Onshore Transmission Infrastructure Baseline Characteristics

Desktop Studies

Coastal Birds

4.7.3.1 Relevant seabird breeding colony records were sought from Seabird 2000. A record was received for one colony of 63 pairs of herring gull in Fraserburgh town.

4.7.3.2 Relevant wetland bird count data was sought from WeBS. Records were received for two count sites: Fraserburgh Bay and Loch of Strathbeg (the latter approximately 2.5 km from the proposed onshore cable route at its nearest point). For results tables, refer to Technical Appendix 4.7 A.

Corn Bunting

4.7.3.3 Relevant corn bunting information for northeast Scotland was sought from RSPB. They advised that the 30 territories recorded during the breeding bird survey (4.7.3.21 of this chapter) may comprise < 7 % of the northeast Scotland population and < 5 % of the total Scottish population. For results table and detailed figures, refer to Technical Appendix 4.7 A.

4.7.3.4 Corn buntings occur in open, lowland arable and mixed farmland. Nests are built on the ground within crops or dense, grassy vegetation. The following nesting habitats are favoured (Forrester *et al.,* 2007):

- Cereals;
- Set–aside;
- Improved grassland (ungrazed);
- Unimproved grassland (ungrazed);
- Brassica crops;
- Pea crops;
- Bean crops;
- Linseed crops; and
- Bulbs.

4.7.3.5 The following Winter feeding habitats are favoured (Forrester *et al.,* 2007):

- Cereal stubbles;
- Oilseed rape stubbles;
- Livestock feed sites;
- Grain spills;
- Unharvested crops; and
- Newly sown Spring cereals.

4.7.3.6 Corn buntings typically rear two broods per year, first clutches are laid from late May and second clutches are laid as late as mid–August, thus chicks can still be in the nest well into September (Forrester *et al.,* 2007). Early nests are usually built in Autumn–sown cereals or grass managed for silage and later nests in Spring–sown cereals; the chick diet is centred on insects (Francis and Cook, 2011).

4.7.3.7 Corn buntings are largely sedentary and form flocks from late October to early May. In Winter, the flocks sometimes move locally when deep snow or ploughing of stubble reduces food supplies. The species has very similar breeding and Winter distributions (Forrester *et al.,* 2007).

Wintering Pink–Footed Goose

Loch of Strathbeg SPA

4.7.3.8 Loch of Strathbeg SPA qualifies for designation under the Birds Directive for regularly supporting wintering wildfowl populations of European importance. It is an important stopover site for UK wintering and migrating pink–footed, greylag and barnacle geese. It is a designated SPA, SSSI and Ramsar site and an RSPB reserve. The pink–footed goose is a SPA qualifying species, with Winter numbers of 39,924 individuals (mean five year peak monthly count 1991/1992 to 1996/1997), 17.7 % of the wintering eastern Greenland / Iceland / UK population. For detail on designated sites, refer to Chapter 4.1 (Designated Sites).

SNH Goose Management Scheme

4.7.3.9 The SNH Loch of Strathbeg Goose Management Scheme (GMS) encompasses 87 km^2 of land north and east of a line connecting Rosehearty, Strichen, Mintlaw and Peterhead. Piloted in 1994, the GMS operates during March and April, when goose numbers are highest prior to migration. Although pink–footed geese are not threatened, birds are vulnerable in Spring having lost condition during Winter. The GMS is organised around land use zones comprising feeding, buffer and scaring zones.

Key Goose Management Scheme Findings, 2004 to 2007

4.7.3.10 In 2004, eight surveys were completed between 2007 March and 18 April. Goose distribution was determined by driving fixed transects. Flock counts recorded in March were higher than those recorded in April. Most records were of pink–footed geese and all geese were feeding on pastures.

4.7.3.11 In March 2004, flock distribution varied considerably between the five survey days. On two days, most flocks were recorded inside the GMS boundary, and on three days, most flocks were recorded outside the boundary. Inside the GMS boundary, flocks were concentrated northwest and southeast of Loch of Strathbeg, and in a wide area south of the loch. Outside the GMS boundary, flocks were concentrated southwest of Fraserburgh and in a river valley south of the onshore cable route.

4.7.3.12 In April 2004, kernel analysis was used to identify areas most heavily used by geese. Two areas were identified, one northwest of Loch of Strathbeg and one southeast, which together accounted for 50 % of flocks. A third area which accounted for 25 % of flocks surrounded the previous two areas, an area southwest of Fraserburgh and an area southwest of the GMS boundary.

4.7.3.13 Overall in March and April 2004, the majority of geese were recorded within the GMS boundary, however there was considerable variation in flock location between survey days.

Goose Distribution in Relation to GMS Fields

4.7.3.14 In March 2004, approximately one third (27.4–35.5 %) of geese recorded within the whole study area were recorded within fields of the management scheme, and almost half (39.6–49.8 %) of the geese recorded within the management scheme boundary were recorded within fields of the management scheme. Similar, but higher values were noted for April. Feeding zone fields were found to be more favourable, accounting for over two thirds of flocks and birds recorded. In April 2004, preference for field type was less pronounced with more birds being recorded within buffer zones.

4.7.3.15 The mean number of geese found during March and April surveys represented 94 % and 91 % of the mean Loch of Strathbeg roost count for those months, respectively. These figures account for a significant majority of birds associated with the SPA.

4.7.3.16 Within the GMS boundary, the most heavily used areas formed the basis of refuge selection for the scheme during 2002 to 2004. Only two areas outside the boundary of the existing management scheme were identified, one just to the southwest of Fraserburgh and one to the southwest of the scheme boundary. Due to considerable variation in use of areas by geese over a two month period the future use of these sites is not certain.

4.7.3.17 Key GMS results from monitoring goose use of refuges during 2004 to 2007 are presented in Table 4.7-2 below.

Table 4.7-2 Monitoring Goose use of Refuges, 2004 to 2007

	2004		2005		2006		2007	
	March	April	March	April	March	April	March	April
% of total Loch of Strathbeg goose population supported by sites included within scheme	40 %	68 %	24 %	43 %	42 %	73 %	47 %	76 %
% of total roost population supported by RSPB Loch of Strathbeg grass fields	7 %	8 %	2.1 %	6 %	6 %	15 %	14 %	22 %
Reference	Patterson and Thorpe, 2006a		Patterson and Thorpe, 2006c		Patterson and Thorpe, 2006d		Patterson and Thorpe, 2007	

Protected Habitats and Species

North East Scotland Local Biodiversity Action Plan (NE LBAP)

4.7.3.18 Priority habitats, birds and mammals most likely to occur within the onshore cable route were sought from the NE LBAP. Twenty–five priority habitats and 48 priority bird and mammal species were found. For results tables, refer to Technical Appendix 4.7 A.

National Biodiversity Network (NBN)

4.7.3.19 Relevant bird, mammal and freshwater pearl mussel records within the onshore cable route were sought from the NBN. One hundred and thirty–two bird species (green–listed Birds of Conservation Concern, BoCCs, without conservation designations were not included) and six mammal species were found. For results tables, refer to Technical Appendix 4.7 A.

Field Survey Management

4.7.3.20 Baseline field surveys were carried out from May to September 2011 to quantify use of the onshore cable route by breeding birds, protected mammals and freshwater pearl mussel and to map habitats and assess their potential to support bats. The onshore cable route included a 250 m buffer which formed the 'ecology survey area'. This totalled 44.5 km^2 and was used throughout the baseline field surveys (except the breeding bird survey, see 4.7.3.21 below). To facilitate management of the baseline field surveys, the ecology survey area was overlain by 43 x 2 km^2 'ecology survey tiles' (Figures 4.7-1 and 4.7-2, Volume 6 b).

Breeding Bird Survey

Methods

4.7.3.21 The breeding bird survey was carried out from 10 May to 01 July 2011 (Figure 4.7-1, Volume 6 b). For survey schedule, refer to Technical Appendix 4.7 A.

4.7.3.22 When this survey was commissioned in early May 2011, the onshore cable route was 1 km wide throughout its length. Two parallel transects ran the length of the route, 500 m apart, and surveyors walked each transect and recorded ornithological activity 250 m to the left and right, thus covering the 1 km width of the route. This methodology progressed for rounds 1, 2 and 3 of the breeding bird survey. A round comprised a visit to each ecology survey tile in the ecology survey area. However on 16 June 2011, towards the end of

round 3, the onshore cable route was widened in some areas to allow for inclusion of additional route options within the preliminary onshore export cable design. These areas were called 'additional survey areas' and new transects were established to capture them. These areas were surveyed during round 3 only, where possible. The onshore cable route prior to the 16 June 2011 widening, plus the additional survey areas, became the ecology survey area used for all subsequent baseline field surveys.

4.7.3.23 Given the timescales for submission of the environmental statement, further breeding bird surveys in 2012 cannot be undertaken during the optimal period. However, the onshore cable route habitats are relatively homogenous (4.7.3.34 in this chapter) and the breeding bird assemblage is typical of the managed, open landscape of arable land and improved grassland in north east Scotland (4.7.3.30 below). The main key species, corn bunting, breeds late in the season (4.7.3.6 above). Therefore, it is considered that the 2011 breeding bird survey data are sufficiently robust to represent the ornithology of the onshore cable route.

4.7.3.24 The survey followed CBC (Common Bird Census) methodology (Gilbert *et al.,* 1998; Marchant, 1983). The survey was carried out from 1 hr before dawn to 6 hrs after dawn and three rounds of the survey were completed (apart from the additional survey areas which were surveyed during round 3 only, where possible). The survey was undertaken in good visibility, avoiding persistent rain or fog, excessive cold or heat and wind exceeding Beaufort force 4. The location and behaviour of all birds were recorded directly onto 1:10,000 Ordnance Survey maps using standard British Trust for Ornithology (BTO) notation.

4.7.3.25 Records were digitised using GIS software and territory analysis was carried out on the resulting maps. Birds were assumed to be holding territory if one or more of the following behaviours were observed:

- Displaying or singing;
- Presence of a nest, eggs or young (including newly–fledged);
- Agitated behaviour, specifically, alarm calls or distraction display; and / or
- A territorial dispute.

4.7.3.26 In the absence of any of these behaviours, a pair observed together in suitable habitat was considered to be holding a territory. Other records were considered to be non–breeding birds.

4.7.3.27 Within rounds, multiple records of the same species were considered to be either the same or different bird(s) using professional judgement. This was done by examining the information recorded by surveyors, as well as known variations in territory size of species in different habitats.

4.7.3.28 Where surveyors had not recorded whether multiple records of the same species were the same or different bird(s), a separation distance appropriate to the species was applied. Multiple records within this distance were considered to be the same bird(s), while multiple records beyond this distance were considered to be different bird(s).

4.7.3.29 Overall estimation of the number of territories was undertaken by examining records from the three survey rounds and employing professional judgement. For skylark, the round with the highest number of singing males was used. For meadow pipit, round 1 was used (during this round fledged juveniles would not yet be visible) to calculate density of pairs per km^2.

Results

4.7.3.30 Baseline field survey results show that the habitat within the onshore cable route supports a typical assemblage of farmland and coastland birds. A total of 80 species was recorded within the 44.5 km^2 of the onshore cable route. None of the 36 green–listed BoCCs was considered for territory analysis. Of the red and amber–listed BoCCs considered for

territory analysis, 29 were taken forward for analysis resulting in 1,154 territories (Figures 4.7-4 to 4.7-6, Volume 6 b). Fifteen red and amber–listed BoCCs were not taken forward for territory analysis because either too few records were made or breeding behaviour was not observed. For results tables and detailed figures, refer to Technical Appendix 4.7 A.

4.7.3.31 Additional survey areas were only surveyed during round 3 of the breeding bird survey, they therefore contain territories only analysed from data from one visit, and hence represent a minimum number of territories.

Phase 1 Habitat Survey

Methods

4.7.3.32 The Phase 1 habitat survey was carried out from 18 to 26 July 2011 (Figure 4.7-2, Volume 6 b). For the survey schedule, refer to Technical Appendix 4.7 A.

4.7.3.33 This survey defined phase 1 habitat type and extent across the 44.5 km^2 of the ecology survey area following standard JNCC (2010) guidelines. The phase 1 habitat classification and associated field survey technique provides a relatively rapid system to record semi–natural vegetation and other wildlife habitats. Each habitat type is defined by way of a brief description and is allocated a specific name, alpha–numeric code and unique mapping colour. The system has been widely used and continues to act as the standard phase 1 technique for habitat survey across the UK. The ecology survey area was walked, habitats were inspected and delineated directly onto 1:10,000 Ordnance Survey maps using standard phase 1 alphanumeric notation. Target notes (TNs) were made to highlight features of interest or any aspect too small to be mapped, these were supported by photos and GPS (Global Positioning System) coordinates. Target notes are referred to throughout the text and in figures by a sequential number prefixed with TNE or TNT (e.g. TNE17 or TNT3). Where designated conservation sites, areas of high biodiversity or peat in the superficial geology were encountered, these were mapped to NVC level (Rodwell, 1991 to 2006) using 2 x 2 m quadrats. For peat in the superficial geology, depth was measured < 50 cm and > 50 cm to aid classification of phase 1 and NVC bog categories. For detail on peat, refer to Chapter 3.7 (Hydrology, Geology and Hydrogeology).

Results

4.7.3.34 Baseline field survey results show that the habitat within the onshore cable route comprises an intensively managed, open landscape of predominantly arable land and improved grassland, with a small number of built–up areas. A total of 35 phase 1 habitat types and eight NVC communities were recorded within the 44.5 km^2 of the onshore cable route. For results tables, photos and figures, refer to Technical Appendix 4.7 A.

4.7.3.35 Four strands of the invasive species Japanese knotweed (*Fallopia japonica*) were found. These were recorded as target notes (TNE19, TNE20, TNE21 and TNE46).

4.7.3.36 Field boundaries and woodland edges form important linear features in otherwise open, homogonous landscapes such as the arable land and improved grassland within the cable onshore cable route. Native, species–rich hedgerows were widespread, comprising rowan (*Sorbus aucuparia*), silver birch (*Betula pendula*), hawthorn (*Crataegus monogyna*), hazel (*Corylus avellana*) and elder (*Sambucus nigra*). Fences, with or without hedgerows, were common and a small number of dry stone walls existed.

4.7.3.37 Phase 1 habitats within the onshore cable route were summarised into the following habitat categories (0.3 % of land could not be accessed):

- Arable land and grassland (78.3 %);
- Built–up areas (8.7 %);
- Woodland (4.7 %);
- Scrub, tall herb and fern (2.4 %);

- Coastland (1.9 %);
- Mire (1.7 %);
- Water and wetland features (1.3 %); and
- Rock and quarry (0.7 %).

4.7.3.38 Key phase 1 habitats within these categories are summarised below.

Arable Land and Grassland

4.7.3.39 The prevalence of this habitat category (78.3 %) underscores the predominance of agriculture within the landscape of the onshore cable route. Arable land (69.9 %) was the most widespread phase 1 habitat, comprising mostly barley, wheat, oilseed rape, oats, silage, potatoes and short–term grazing. Improved grassland (6.5 %) was the second most widespread habitat. Semi–improved neutral grassland (0.9 %), poor semi–improved grassland (0.7 %), unimproved neutral grassland (0.3 %) and marshy grassland (0.04 %) comprised the remaining phase 1 habitats within this category.

4.7.3.40 Arable land and grassland within the onshore cable route potentially overlaps with six UK BAP priority habitats (arable field margins; coastal and floodplain grazing marsh; lowland meadows; upland hay meadows; maritime cliff and slopes; and purple moor grass and rush pastures) and three NE LBAP priority habitats (farmland; and field margins and boundary habitats).

Built–up Areas

4.7.3.41 The low occurrence of this habitat category (8.7 %) highlights the largely rural nature of the landscape within the onshore cable route. Buildings and roads (each 3.0 %) were jointly the third most widespread phase 1 habitats within the onshore cable route, with a small concentration at Fraserburgh. Amenity grassland (1.9 %), ephemeral short perennial (0.5 %) and bare ground (0.3 %) comprised the remaining phase 1 habitats within this category.

4.7.3.42 Built–up areas within the onshore cable route potentially overlap with one NE LBAP priority habitat (urban areas).

Woodland

4.7.3.43 The scarcity of this habitat category (4.7 %) reflects the openness of the landscape within the onshore cable route. Plantation woodland (4.3 %) was more common than semi–natural woodland (0.4 %), consistent with the managed nature of habitats within the onshore cable route. Plantation mixed (2.3 %), broadleaved (1.2 %) and coniferous (0.8 %) woodland mainly occurred as commercial forestry blocks or shelter belts, or along roadsides and around farm buildings. Semi–natural broadleaved (0.2 %), semi–natural mixed (0.2 %) and semi–natural coniferous (0.002 %) woodland mostly occurred as small, disconnected linear features. Woodlands were usually mature and comprised the following species: Sitka spruce (*Picea sitchensis*), lodgepole pine (*Pinus contorta*), Scots pine (*Pinus sylvestris*), silver birch, sycamore (*Acer pseudoplatanus*), pedunculate oak (*Quercus robur*), rowan, goat willow (*Salix caprea*) and wych elm (*Ulmus glabra*).

4.7.3.44 Woodland within the onshore cable route potentially overlaps with ten UK BAP priority habitats (lowland beech and yew woodland; lowland mixed deciduous woodland; lowland wood–pastures and parkland; upland birchwoods; upland mixed ashwoods; upland oakwood; wet woodland; aquifer–fed naturally fluctuating water bodies; maritime cliff and slopes; and native pinewoods) and two NE LBAP priority habitats (wood pasture, parkland and wayside trees; and wet and riparian woodland).

Scrub, Tall Herb and Fern

4.7.3.45 Tall ruderal herb and fern (1.5 %) was the most common phase 1 habitat within this category, mostly bordering linear features such as railway lines, field boundaries and watercourses. Rosebay willowherb (*Epilobium angustifolium*) was the most widespread species, alongside common nettle (*Urtica dioica*) and broadleaved dock (*Rumex obtusifolius*). Scattered (0.6 %) and dense / continuous (0.2 %) scrub occurred on many field verges, along drainage ditches and among grazed fields. Common gorse (*Ulex europeaus*) was the most frequent species, with occasional rowan, goat willow and silver birch seedlings interspersed.

4.7.3.46 Scrub, tall herb and fern within the onshore cable route potentially overlaps with nine UK BAP priority habitats (aquifer–fed naturally fluctuating water bodies; lowland beech and yew woodland; lowland mixed deciduous woodland; lowland wood–pastures and parkland; native pinewoods; upland birchwoods; upland mixed ashwoods; upland oakwood; and wet woodland) and one NE LBAP priority habitat (field margins and boundary habitats).

Coastland

4.7.3.47 This habitat category comprised only dune grassland (1.9 %), where marram (*Ammophila arenaria*) was dominant alongside lady's bedstraw (*Galium vernum*), dogwood (*Cornus* spp.) and cowslip (*Primula vernus*). This habitat has been much reduced by development of the Fraserburgh Golf Club (phase 1 habitat amenity grassland) at the north end of the onshore cable route.

4.7.3.48 Coastland within the onshore cable route potentially overlaps with five Annex I habitats (shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); fixed dunes with herbaceous vegetation ("grey dunes"); Atlantic decalcified fixed dunes (*Calluno–Ulicetea*); humid dune slacks; and embryonic shifting dunes), two UK BAP priority habitats (coastal sand dunes; and lowland dry acid grassland) and three NE LBAP priority habitats (coastal habitats and shingle; Moray Coast; and estuarine and intertidal habitats).

Mire

4.7.3.49 Mire accounted for 1.7 % of phase 1 habitats within the onshore cable route.

4.7.3.50 Mire within the onshore cable route potentially overlaps with three Annex I habitats (degraded raised bogs still capable of natural regeneration; blanket bog; and depressions on peat substrates of the *Rhynchosporion*), four UK BAP priority habitats (blanket bog; lowland raised bog; fens; and maritime cliff and slopes) and two NE LBAP priority habitats (lowland raised bog; and wetland).

4.7.3.51 Peat in the superficial geology occurs in three areas within the onshore cable route: one wide swathe and two small areas at NK014546 and NK043499. For detail on peat, refer to Chapter 3.7 (Hydrology, Geology and Hydrogeology).

4.7.3.52 The Phase 1 habitat dry modified bog (0.6 %) was recorded in four areas within the onshore cable route (from north to south):

- In the centre of the wide swathe of peat in the superficial geology, blanket bog had been damaged by heather beetle and / or burning. With the heather dead / dying and increased coverage of wavy hair–grass (*Deschampsia flexuosa*), the habitat had become dry modified bog (TNE41). This bog likely derived from National Vegetation Classification (NVC) habitat M19 *Calluna vulgaris–Eriophorum vaginatum*: M19a *Erica tetralix* sub–community;
- Between the wide swathe of peat in the superficial geology and the small area of peat at NK014546, dry modified bog (TNE39) occurred again where blanket bog had been damaged, in this case by drainage, regeneration of trees and other works

possibly related to the adjacent decommissioned refuse tip. The area closely resembled NVC habitat M17a, but due to lack of *Sphagnum* mosses and damage from the above sources, it was classed as dry modified bog. The moss *Sphagnum fallax* was only recorded in ditches, with occasional patches of the moss *Sphagnum capilifolium* among harestail cottongrass (*Eriophorum vaginatum*). In wet depressions, harestail cottongrass was more prevalent than ling heather (*Calluna vulgaris*); however on dry hummocks the reverse was true. As with the bog previously described (TNE41), this bog likely derived from NVC habitat M19a *Calluna vulgaris–Eriophorum vaginatum*;

- On the southern edge of the wide swathe of peat in the superficial geology, dry modified bog (TNE33) occurred with a small section of *Sphagnum* mosses; and
- Approximately 1.5 km south of the wide swathe of peat in the superficial geology, dry modified bog (TNE27) occurred at an area of deep peat and convergence of the phase 1 habitats acid / neutral flush and spring, tall ruderal herb and fern, swamp and scattered trees. The bog was classified as NVC habitat M19 *Calluna vulgaris–Eriophorum vaginatum*: M19a *Erica tetralix* sub–community.

4.7.3.53 The Phase 1 habitat blanket bog (0.6 %) was also recorded in four areas within the onshore cable route (from north to south):

- On the northern edge of the wide swathe of peat in the superficial geology, blanket bog (NK004551) bordered a large area of the phase 1 habitat acid / neutral flush and spring;
- On the northern edge of the wide swathe of peat in the superficial geology, blanket bog (TNE42) closely resembled NVC habitat M19 *Calluna vulgaris–Eriophorum vaginatum*: M19a *Erica tetralix* sub–community;
- Just outside the southeast corner of the wide swathe of peat in the superficial geology, blanket bog (TNE34) was grazed by livestock, had no trees, and yet was still active with some patches of bare peat. The area closely resembled NVC habitat M19 *Calluna vulgaris–Eriophorum vaginatum*: M19a *Erica tetralix* sub–community. Harestail cottongrass was most common, with varying cover of ling heather and *Sphagnum* mosses. Species favouring drier conditions occurred on hummocks and drier areas of bog, specifically the moss *Hypnum jutlandicum*, heath bedstraw (*Galium saxatile*) and tormentil (*Potentilla erecta*). While *Sphagnum* mosses occurred in the depressions and wetter areas of bog; and
- In the southeast corner of the wide swathe of peat in the superficial geology, an area of blanket bog (TNE36) closely resembled NVC habitat M17a *Drosera rotundifolia–Sphagnum* spp. sub–community. This bog was drier than that previously described (TNE34), with *Sphagnum* mosses only occurring in isolated pools. The moss *Hypnum jutlandicum* was more common here, with the moss *Pleurozium schreberi* and a greater coverage of way hair–grass, indicating drier conditions. Scattered trees, specifically silver birch and goat willow, will dry the peat to some extent. Drainage channels cut across the bog will also have a drying effect.

4.7.3.54 Unlike dry modified and blanket bog, acid / neutral flush and spring was less closely associated with peat in the superficial geology. This phase 1 habitat (0.5 %) was recorded in several areas within the onshore cable route (from north to south):

- Two areas of acid / neutral flush and spring (NK014632 and NK013631) were recorded adjacent to the phase 1 habitats marginal vegetation and inundation vegetation;
- An area of acid / neutral flush and spring (TNE53) closely resembled the NVC habitats M23a *Juncus effusus–Galium palustre* and MG10a *Holcus lanatus–Juncus effusus* on the outer, drier edges, and M4 *Carex rostrata–Sphagnum fallax* in the wetter centre;
- Areas of acid / neutral flush and spring (NK015614, NK017609 and NK019610) occurring among woodlands were classified as NVC habitats M23 *Juncus effusus–*

Galium palustre, M4 *Carex rostrata–Sphagnum fallax*, M5 *Carex rostrata–Sphagnum squarrosum* and M6 *Carex echinata–Sphagnum fallax / denticulatum*;

- An area of acid / neutral flush and spring (TNE43) was recorded next to a pond. This area was classified as NVC habitat M4 *Carex rostrata–Sphagnum fallax*. The following typical species were recorded: the *Sphagnum* mosses *Sphagnum fallax* and *Sphagnum palustre*, the moss *Polytrichum commune*, bottle sedge (*Carex rostrata*), soft rush (*Juncus effusus*) and harestail cottongrass;
- A nearby area of acid / neutral flush and spring (TNE43) was classified as NVC habitat M6 *Carex echinata–Sphagnum fallax / denticulatum*: M6c *Juncus effusus* sub–community. Soft rush in this area was dense and tall (approximately 160 cm) with a species–poor understory. The mosses *Sphagnum fallax* and *Polytrichum commune*, Yorkshire fog (*Holcus lanatus*) and sheep's sorrel (*Rumex acetosella*) were present. This area was drier than the flush previously described (TN43);
- A nearby bog pool community comprised areas of NVC habitats MG10a *Holcus lanatus–Juncus effusus* sub–community (TNE44) and M2 *Sphagnum cuspidatum / fallax*: M2b *Sphagnum fallax* sub–community (TNE44A). Both *Sphagnum* species were present in the pools with ling heather, harestail cottongrass and common bog cotton (*Eriophorum angustifolium*), while wavy hair–grass occurred on the edges;
- An area of acid / neutral flush and spring (TNE45) occurring around a new pond was classified as NVC habitat M23a *Juncus effusus–Galium palustre*;
- An area of acid / neutral flush and spring (TNE35) was classified as NVC habitat M23a *Juncus effusus–Galium palustre*;
- An area of acid / neutral flush and spring (TNE27) occurred at an area of deep peat and convergence of the phase 1 habitats dry modified bog, tall ruderal herb and fern, swamp and scattered trees. The flush was classified as NVC habitat M23a *Juncus effusus–Galium palustre*;
- An area of acid / neutral flush and spring near the River Ugie (TNE25) was classified as NVC habitat M5 *Carex rostrata–Sphagnum squarrosum*. This flush was species–rich, with the following tall forbs recorded: meadowsweet (*Filipendula ulmaria*), marsh bedstraw (*Galium palustre*), water horsetail (*Equisetum fluviatile*), two–rowed watercress (*Nasturtium officinale*), water forget–me–not (*Myosotis scorpioides*) and bottle sedge;
- An area of acid / neutral flush and spring (TNE11) occurred around a small pond with species–rich vegetation; and
- One area of acid / neutral flush and spring (TNE9) was difficult to classify. This area was wet over a peat depth of > 50 cm and although some soft rush and wavy hair–grass were recorded, large patches of marsh cinquefoil (*Potentilla palustris*) were also present.

Water and Wetland Features

4.7.3.55 Due to issues surrounding lone working near water and also unstable, soft ground, survey of water and wetland features was restricted to areas considered safe for lone access. Running water (0.5 %) was common within the onshore cable route. Marginal vegetation (0.4 %) was largely associated with the River Ugie. Common reed (*Phragmites australis*) was often dominant, with occasional meadowsweet and rosebay willowherb. Standing water (0.2 %) occurred as ponds, with species which included common clubrush (*Scirpus lacustris*), pondweed (*Potamogeton* spp.), duckweed (*Lemna minor*), branched bur–reed (*Sparganium erectum*) and bulrush (*Typha latifolia*). Swamp (0.2 %) occurred in five areas: next to an old railway (NK018606); in a wet area (NK013514) associated with tall ruderal herb and fern, acid neutral flush and spring and dry modified bog; a wet corner (TNE26B) of arable land; adjacent to the River Ugie (TNE23) with dominant common reed, some meadowsweet and other tall forbs; and in a woodland (TNE6C) alongside common reed

and occasional soft rush. Inundation vegetation (0.1 %) occurred in two areas (TNE54 and NK000620). This phase 1 habitat was not associated with watercourses, but rather with wet edges of arable land, often merging with tall ruderal herb and fern.

4.7.3.56 Water and wetland features within the onshore cable route potentially overlap with three Annex I habitats (hard oligo–mesotrophic waters with benthic vegetation of *Chara* spp.; water courses of plain to montane levels with *Ranunculion fluitantis* and *Callitricho–Batrachion* vegetation; and oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and / or of the *Isoëto–Nanojuncetea*), five UK BAP priority habitats (maritime cliff and slopes; aquifer–fed naturally fluctuating water bodies; fens; purple moor grass and rush pastures; and reedbeds) and three NE LBAP priority habitats (rivers and burns; wetland; and field margins and boundary habitats).

Rock and Quarry

4.7.3.57 Seven areas of quarry habitat (0.4 %) occurred within the onshore cable route (TNE51, TNE50, TNE26A, NK035494, NK034490, TNE13, TNE10A). Three sand quarries were active, while the four inactive quarries were largely overgrown with common gorse and other scrub species, or exhibited short growth on areas of sand where succession can be slow.

Protected Species Survey

Methods

4.7.3.58 The protected species survey was carried out from 18 July to 31 August 2011 (Figure 4.7-2, Volume 6 b). For survey schedule, refer to Technical Appendix 4.7 A.

4.7.3.59 Field evidence of the following protected species was searched for across the 44.5 km^2 of the ecology survey area:

- Otter;
- Badger;
- Water vole; and
- Red squirrel.

Otter

4.7.3.60 All safely accessible watercourses in the ecology survey area were searched for field evidence of otter. Evidence was recorded directly onto 1:10,000 Ordnance Survey maps. Photos and GPS coordinates were taken to support recordings made on maps. Otter field evidence recorded is as described by Bang and Dahlstrøm (2001) and SNH (2008):

- Holts: these are underground features where otters live. They can be tunnels within banksides, underneath rootplates or boulder piles and even man–made structures such as disused drains. Holts are used by otters to rest during the day and are the usual site of natal or breeding sites. Otters may use holts permanently or temporarily;
- Couches: these are above–ground resting sites. They may be partly sheltered or fully exposed. Couches may be regularly used, especially in reedbeds and on in–stream islands. They have been known to be used as natal and breeding sites. Couches can be very difficult to identify, sometimes consisting of no more than an area of flattened grass or earth, and are best identified by the presence of other field evidence (e.g. spraints). Where rocks or rock armour are used as couches, these can be almost impossible to identify without observing the otter in–situ;
- Feeding evidence: the remains of prey items may be found at preferred feeding stations. Remains of fish, crabs or skinned amphibians can indicate the presence of otter;

- Spraints: otter faeces can be used to mark territories, often on in–stream boulders. They can be present within or outside the entrances of holts and couches. Spraints have a characteristic smell and often contain fish remains;
- Prints: otters have characteristic footprints that can be found in soft ground and muddy areas;
- Paths: these are terrestrial routes that otters take when moving between resting sites and watercourses, or at high flow conditions when they will travel along bank sides in preference to swimming; and
- Slides and play areas: slides are typically worn areas on steep slopes where otters slide on their bellies, often found between holts / couches and watercourses. Play areas are used by juvenile otters in play, and are often evident by trampled vegetation and the presence of slides. These are often positioned in sheltered areas adjacent to the natal holt.

Badger

4.7.3.61 All suitable habitats in the ecology survey area were searched for field evidence of badger. Evidence was recorded directly onto 1:10,000 Ordnance Survey maps. Photos and GPS coordinates were taken to support recordings made on maps. Badger field evidence recorded is as described by Neal and Cheeseman (1996), Bang and Dahlstrøm (2001) and SNH (2001):

- Setts: these are wider than they are tall with a flattened bottom, they are typically 30 cm across;
- Spoil heaps: these are heaps of earth excavated by badgers. Material is often coarse due to badgers' large paws and claws, and heaps may contain scratched rocks, badger remains or hairs. Spoil heaps outside entrances of a well–established sett can be very large, and often have a well–defined furrow or groove from sett entrance to spoil heap;
- Foraging signs: badgers often dig 'snuffle holes' for worms or soil–dwelling grubs. These are typically conical in shape, 10 to 15 cm across, with material dug out on more than one side. Badgers also occasionally dig up wasps' and bees' nests in late Summer;
- Latrines: these are small pits similar to snuffle holes which contain badger faeces. Faeces can be soft and muddy in appearance, or contain wing cases of insects, husks of grain or stones / pips of berries. Latrines are often, though not always, found close to setts and can comprise one to more than a dozen pits. Importantly, they are also used as territorial boundary markers;
- Prints: badger prints are very distinctive, with a broad, kidney–shaped pad and five toes lined up at the front. Fore prints (4.5 to 6.5 cm across) are larger than hind prints (4.0 to 5.0 cm across), and the imprints of claw ends are further away from the toes on fore prints as the claws are much longer;
- Runs: well–used badger runs are often very conspicuous. Runs typically link between sett entrances, or lead away from a sett towards foraging grounds or other setts. They can also be found well away from setts, often where badgers cross roads or go through gaps beneath fences;
- Scratching posts: setts often have one or more scratching posts nearby, the bark on the trees will be scored, shredded or completely removed up to a height of 1 m; and
- Hair: these are white or off–white with a black band towards the tip. They are 7 to 10 cm long, the black band is 1 to 2 cm and the white tip is about 1 cm, they are quite coarse and oval in cross–section. Hairs are often found stuck in brambles or barbed wire fences.

Water Vole

4.7.3.62 All suitable habitats in the ecology survey area were searched for field evidence of water vole. Evidence was recorded directly onto 1:10,000 Ordnance Survey maps. Photos and GPS coordinates were taken to support recordings made on maps. Water vole field evidence includes:

- Burrows: these are wider than they are tall, 4 to 8 cm across and usually surrounded by characteristic grazed 'lawns'. There may be droppings near burrow entrances, but no spoil heaps;
- Feeding stations: these are often located along runs or haul–out platforms at the water's edge. At the base of vegetation, they consist of neatly clipped stems of grass, sedge or rush up to 10 cm long with grooved teeth marks at the cut ends;
- Latrines: these are typically found at prominent points along watercourses such as flat stones or bare earth. They contain lozenge–shaped droppings, approximately 8–12 mm long and 4–5 mm wide. Fresh droppings are greenish, changing to black when older;
- Prints: these are star–shaped, although hard to tell apart from prints of brown rat; and
- Runs: these usually occur within 3 m of a watercourse. They are low tunnels pushed through vegetation, 5 to 9 cm across and branching, linking the watercourse with feeding areas and burrow entrances.

Red Squirrel

4.7.3.63 All suitable habitats in the ecology survey area were searched for field evidence of red squirrel. Evidence was recorded directly onto 1:10,000 Ordnance Survey maps. Photos and GPS coordinates were taken to support recordings made on maps. Coniferous forests were targeted, particularly those containing Scots pine, and were inspected for the presence of dreys and feeding evidence, specifically, stripped pine cones.

Results

4.7.3.64 Baseline field survey results show that the habitat within the onshore cable route supports a typical assemblage of farmland and freshwater protected species; specifically, otter, an EU–protected species, and badger, protected under the Protection of Badgers Act 1992. Twenty–four records of otter field evidence and 53 records of badger field evidence were made within the 44.5 km^2 of the onshore cable route (Figures 4.7-7 to 4.7-9, Volume 6 b). No field evidence of other protected species was found. For results table, photos and detailed figures, refer to Technical Appendix 4.7 A, and for badger sett results table, photos and figures, refer to Technical Appendix 4.7 B.

Bat Roost and Habitat Suitability Survey

Methods

4.7.3.65 The bat roost and habitat suitability survey was carried out from 18 to 26 July 2011 in parallel with the Phase 1 habitat survey (Figure 4.7-2, Volume 6 b). For survey schedule, refer to Technical Appendix 4.7 A.

4.7.3.66 Potential habitat suitability for bats was assessed across the 44.5km^2 of the ecology survey area. As surveyors walked the ecology survey area recording phase 1 habitats, habitats were also considered for their potential suitability to support roosting, foraging or commuting bats. Surveyors categorised habitats to be of high, medium or low suitability for bats, based on roosting, foraging or commuting suitability criteria (Table 4.7-3 below). Thus, potential bat roosts (building, bridges, mature trees), commuting routes (linear features such as hedgerows and lines of trees) and foraging habitat (water bodies, marshy grassland, cow fields) were classed to be of low, medium or high value. Photos,

target notes and GPS coordinates were taken to support recordings made on maps. In the office, habitat suitability was digitised using GIS software and overlain onto aerial imagery. Interpretation notes were made based on the target notes and habitat suitability.

Table 4.7-3 Bat habitat Survey Criteria

Potential Habitat Suitability	Roosting Habitat	Foraging Habitat	Commuting Habitat
High	Woodlands: any trees with roost potential – cracks, crevices and other gaps. Diverse choice of roosts. Caves, tunnels, mines and ice houses with humid atmospheres and sheltered, stable temperature conditions. Low disturbance.	High insect abundance. Native woodland, trees and hedgerows offering abundant shelter and diverse edge habitat. Slow flowing or still freshwater features with sheltered, vegetated edges. Low disturbance from lighting, pollutants and human activity. Pasture fields with cows.	Continuous, unbroken linear features (with little or no artificial lighting present) providing shelter and / or foraging opportunities and connectivity with other landscape features including roosting and foraging habitat. Includes treelines, woodland edge, hedgerows, waterways, walls, woodland tracks, road and drainage networks and buildings.
Medium	Roost sites and access points in cracks, crevices and gaps present, but not ideal due to size, disturbance, exposure.	Moderate insect abundance. Native woodland, trees and hedgerows offering some shelter and edge habitat. Fast flowing freshwater features offering some sheltered edges.	Partly discontinuous features offering some shelter and / or foraging opportunities. Continuous features with some form of artificial lighting.
Low	No suitable roost sites or access points visible. Less than one tree in 100 has roost potential due to age or species. High disturbance. Direct lighting on features.	Coniferous woodland, improved agriculture and built–up areas with low plant diversity and / or insect abundance. Lack of shelter, poorly connected to roost sites and commuting routes. High disturbance levels from lighting, pollutants and human activity.	Discontinuous features offering no shelter and / or isolated from potential roosting and / or foraging areas. Abundant artificial lighting.

Results

4.7.3.67 Baseline field survey results show that the habitat within the 44.5 km^2 of the onshore cable route has limited potential to support roosting, foraging or commuting bats. Results reveal only small areas of highly suitable bat habitat: mature deciduous woodland near water set in a well–connected landscape with buildings. Limited potential is compounded by a lack of suitable linear features to connect the few areas of high suitability. For results tables, photos and figures, refer to Technical Appendix 4.7 A.

4.7.3.68 Studies of bat habitat preferences show most species favour deciduous / mixed woodland and water for foraging. Bats favour landscapes with well–connected networks of different foraging habitats with abundant mature trees and buildings for roosting. They require a varied supply of insect prey throughout the year, thus intensive agricultural landscapes tend to be of low habitat suitability. Local climate is also important, with higher winds and lower night temperatures reducing bat activity. Consequently, the

onshore cable route's northerly latitude and managed, open landscape of predominantly arable land and improved grassland, lacking well–connected networks of different foraging habitats, suggests low numbers and diversity of bats.

4.7.3.69 Grampian supports at least five resident bat species (Haddow and Herman, 2000):

- Soprano pipistrelle;
- Common pipistrelle;
- Brown long–eared bat;
- Daubenton's bat; and
- Natterer's bat.

4.7.3.70 Soprano pipistrelles use a wide range of habitats and roost in various buildings and trees, however they strongly favour foraging over water, especially rivers and lochs with marginal woodlands, yet few such waterbodies exist within the onshore cable route. However common pipistrelles are better adapted to agricultural landscapes with limited woodland and water, such as that within the onshore cable route. Daubenton's bat is a specialist of sheltered, calm water with a healthy chironomid midge population, yet few such waterbodies exist within the onshore cable route. Brown long–eared and Natterer's bats favour foraging habitat of mixed landscapes with mature woodland, and roosting habitat in old, large buildings, yet few such habitats exist within the onshore cable route. Thus, common pipistrelle is likely to be best adapted to the habitat within the onshore cable route.

Freshwater Pearl Mussel Survey

Methods

4.7.3.71 The freshwater pearl mussel survey was carried out from 09 August to 04 September 2011 (Figure 4.7-3, Volume 6 b). For survey schedule, refer to Technical Appendix 4.7 A.

4.7.3.72 The freshwater pearl mussel habitat suitability and presence / absence survey was carried out along the River Ugie and its tributaries within a 100 m upstream buffer and a 500 m downstream buffer of the ecology survey area. The total length of watercourse within these buffers was 20.2 km. The survey was carried out in bright light, low, clear flow, and in water sufficiently shallow for safe wading. The River Ugie flow regime was above base level during some of the survey period.

4.7.3.73 An initial bankside survey assessed river substrate to estimate habitat suitability. Freshwater pearl mussel favour gravel substrates, cobbles, crevices, lees of larger boulders and overhanging banks (SNH, 2003). Once an apparently suitable stretch was identified, the river was entered at the nearest point and an in–channel survey carried out. Searches were made using an underwater viewing aid called a bathyscope, in an upstream direction, inspecting favourable sites. Loose debris and trailing weed were moved aside but the river bed was not disturbed. Fast–flowing shallow riffles and slow, deep channels and pools were entered where possible. Some areas could not be safely accessed due to very deep water or silty substrate, however such areas were few and small and thus did not affect assessment of the River Ugie for freshwater pearl mussel. Photos and GPS coordinates were taken to support recordings.

4.7.3.74 Other river habitat data were recorded:

- Channel type;
- Chanel substrate;
- Average channel width and depth;
- Bankside vegetation; and
- Adjacent land use.

Results

4.7.3.75 No freshwater pearl mussels were found within the survey area.

4.7.4 Legislative and Planning Framework

4.7.4.1 The legislation below was taken into account within the terrestrial ecology assessment process:

- The European Council Directive 2009/147/EC on the conservation of wild birds (EU Birds Directive);
- The European Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (EU Habitats Directive);
- Ramsar Convention on Wetlands of International Importance 1971;
- Bonn Convention on the Conservation of Migratory Species of Wild Animals 1979, as amended;
- Conservation of Habitats and Species Regulations 2010;
- Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007;
- Conservation (Natural Habitats, &c.) Regulations 1994;
- Wildlife and Countryside Act 1981, as amended;
- The Nature Conservation (Scotland) Act 2004; and
- The Protection of Badgers Act 1992.

4.7.4.2 In addition to the above legislation, the guidance detailed in the following paragraphs was also taken into account.

Birds of Conservation Concern (BoCC)

4.7.4.3 The population status of UK birds is reviewed every five years to provide an up–to–date assessment of conservation priorities. The 2009 review of BoCC allocated 246 species onto red, amber or green lists. Seven quantitative criteria were used to assess population status: global conservation status, recent decline, historical decline, European conservation status, rare breeders, localised species and international importance.

UK BAP Priority Habitats and Species

4.7.4.4 The UK Biodiversity Action Plan (UK BAP), published in 1994, is the UK's response to the Convention on Biological Diversity (CBD) which the UK signed in Rio de Janeiro in 1992. Action plans for the most threatened habitats and species have been written to aid recovery. The current list of UK BAP priority habitats and species, reviewed in 2007, contains 65 habitats and 1,150 species. Selection of this list followed consideration by expert working groups against a set of criteria based on international importance, rapid decline and high risk.

Scottish Biodiversity List

4.7.4.5 The Scottish Biodiversity List (SBL), published in 2005, is a list of flora, fauna and habitats which Scottish Ministers consider to be important for Scottish biodiversity conservation. The list was developed by a partnership of organisations, specifically, the Scottish Biodiversity Forum as well as the Scottish public. The criteria include scientific criteria as well as a social criterion of culturally important species and habitats based on a survey of the Scottish public.

NE LBAP Priority Habitats and Species

4.7.4.6 The NE LBAP aims to protect and enhance local biodiversity across Aberdeen, Aberdeenshire and Moray. Formed in 1996, it is a partnership of statutory and voluntary agencies and individuals. The NE LBAP develops Local Action Plans which set out measures to conserve priority habitats.

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