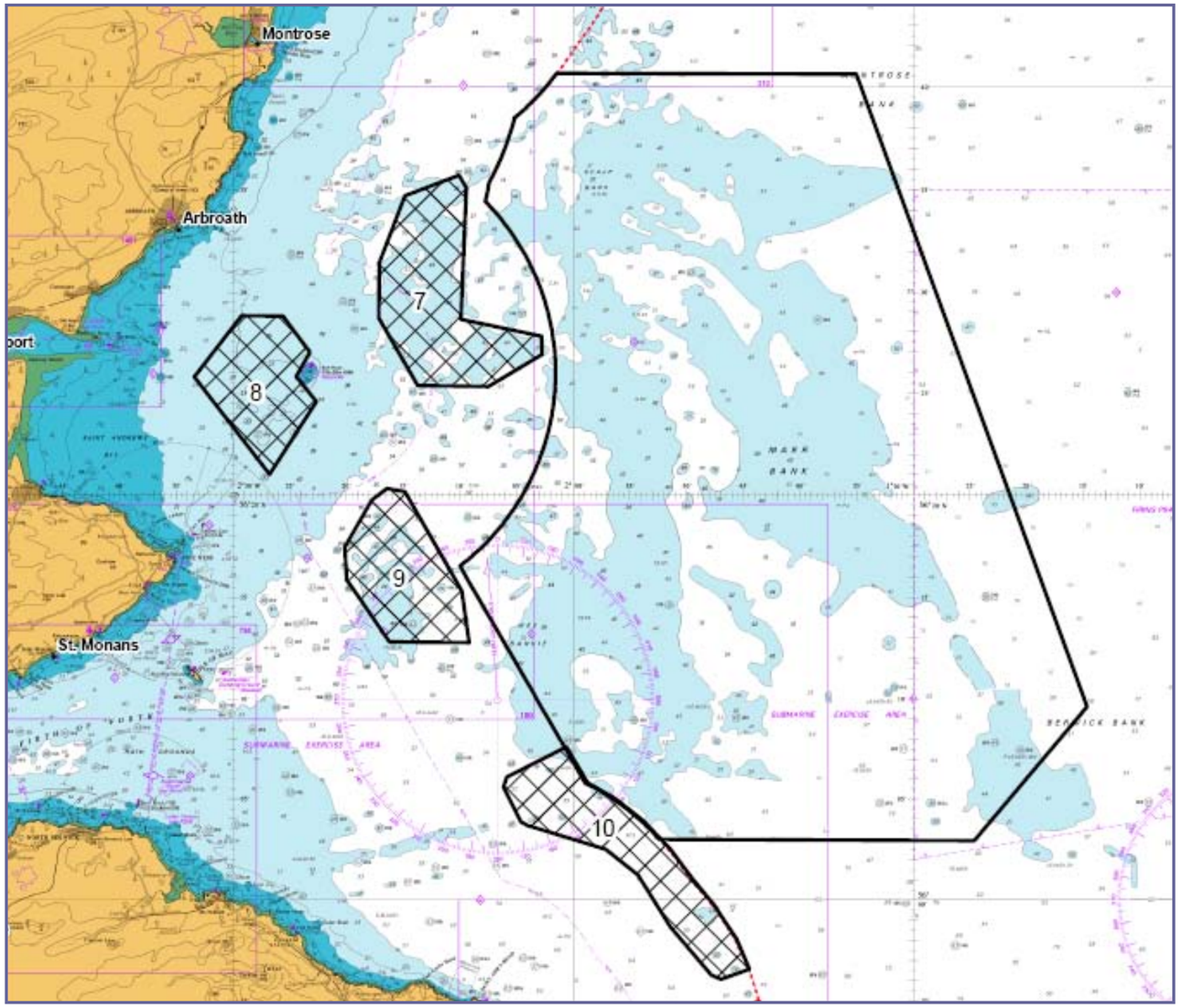

Scottish Territorial Waters Offshore Wind Farms - East Coast

Discussion Document - Cumulative Effects

September 2009

Discussion Paper

ROYAL HASKONING
thinking in
all dimensions

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SUMMARY

This discussion document aims to put forward to relevant stakeholders some preliminary considerations for the consenting of Scottish Territorial Waters offshore wind farm sites.

Due to the proximity of four proposed offshore wind farms off the Firths of Forth and Tay on the east coast of Scotland, the issue of cumulative effects is one which is recognised as requiring attention. This document is intended to initiate discussion with relevant stakeholders on the topic of cumulative effects assessment, prior to formal EIA scoping. It provisionally identifies those cumulative and in-combination issues that are expected to require future, more detailed assessment, and also those which are unlikely to.

The developers taking forward these four sites are working collaboratively during the early stages of project development to ensure that the following is achieved:

1. Identification of cumulative and in-combination environmental issues in the region;
2. Development of a framework/methodology for assessing cumulative and in-combination effects; and
3. Establishment of a common assessment platform, agreed with relevant stakeholders, which developers can carry forward during formal scoping, and further assessment of the environmental effects as part of individual project Environmental Impact Assessment.

This document primarily addresses point 1 of the above.

The document applies the following definitions of cumulative and in-combination effects:

Cumulative – the effects of one type of development with other types of the same development (i.e. wind farms and other wind farms).

In-combination – the effects of the above in combination with other, different projects and activities (e.g. wind farms in combination with dredging or wind farms in combination with shipping).

All current and foreseeable projects and activities in the study area which may interact to result in cumulative and in-combination effects have been described. Activities and projects associated with the following sectors have been considered:

- Offshore Wind Farms
- Commercial Fisheries
- Shipping and Navigation
- Waterfront and Coastal Development
- Airspace and Radar
- Military Activities
- Cables and Pipelines
- Oil and Gas Infrastructure
- Marine Aggregate Extraction
- Dredging and Sea Disposal
- Tourism and Recreation

Subsequently, and on the basis of a desk-based review of available information, potential cumulative and in-combination effects on the receptors listed below are discussed.

Physical Environment
- Hydrodynamic Processes and Geomorphology

Human Environment
- Seascape, Landscape and Visual Character

Physical Environment
- Water and Sediment Quality

Biological Environment
- Marine Benthos and Epibenthos
- Marine Mammals
- Natural Fishery Resources
- Ornithology
- Designated Sites
- Terrestrial & Intertidal Ecology (cable landfall)

Human Environment
- Socio-economics
- Shipping and Navigation
- Commercial Fisheries
- Tourism and Recreation
- Seabed Infrastructure
- Marine (and terrestrial) Archaeology
- Military and Aviation

Using available evidence and expert judgement, issues which are likely to require more detailed future assessment have been identified. The outcome of this process is shown in the table below, which identifies the key receptors and issues that may experience cumulative and in-combination effects.

Receptor	Key Issue Summary
Hydrodynamic processes and geomorphology	• Alteration of hydrodynamic conditions • Changes to the sedimentary environment • Effects on sedimentary seabed features
Marine mammals	• Disturbance as a result of elevated construction and operational sound • Collision risk • Barrier and displacement effects • Reduction of feeding resource
Natural fishery resources	• Disturbance as a result of elevated construction and operational sound • Barrier and displacement effects • Disruption of spawning and nursery grounds
Ornithology	• Disturbance as a result of elevated construction and operational sound • Habitat loss • Barriers to migrating birds • Collision risk
Designated sites	• Effects on site conservation objectives and status
Shipping and navigation	• Disturbance to shipping • Increased navigational risk
Commercial fisheries	• Displacement of activity • Displacement of commercial fish and shellfish resource • Increased catches as a result of positive effects on biodiversity/biomass
Seascape, landscape and visual character	• Effects on landscape and seascape character
Military and aviation	• Effects on military flight activity and safety • Effects on radar • Conflict with PEXA activities
Socio-economics	• Effects on expenditure and employment

The document concludes by providing recommendations in terms of how these issues may be further assessed, noting that some of the above may have positive attributes as well as negative. In order to progress towards a formal scoping of cumulative and in-combination effects, the Forth and Tay Offshore Windfarms Developers Groupwould welcome comments on this document from key stakeholders; a response template and details on how to respond are provided at the end of the document.

CONTENTS

1 INTRODUCTION

1.1 Background to Discussion Document

The allocation of offshore wind farm exclusivity agreements under the Scottish Territorial Waters (STW) process was determined in February 2009. Exclusive development rights were awarded for ten projects distributed around the Scottish coast, with a total award capacity of 6,438 MW (see Table 1.1 and Figure 1.1).

Table 1.1 Scottish Territorial Waters Sites. Source: The Crown Estate website.

Site Ref	Site Name	Company / Consortia	Size (MW)	Area (sq km)
1	Solway Firth	E.ON UK	300	61.46
2	Wigtown Bay	Dong Wind (UK) Ltd	280	51.07
3	Kintyre	Airtricity Holdings (UK) Ltd	378	69.40
4	Islay	Airtricity Holdings (UK) Ltd	680	94.58
5	Argyll Array	Scottish Power Renewables	1500	361
6	Beatrice	Airtricity Holdings (UK) Ltd SeaEnergy Renewables Ltd	920	121.3
7	**Inch Cape**	**NPower Renewables Ltd SeaEnergy Renewables Ltd**	**905**	**149.9**
8	**Bell Rock**	**Airtricity Holdings (UK) Ltd Fluor Ltd**	**700**	**92.82**
9	**Neart na Gaoithe**	**Mainstream Renewable Power Ltd**	**420**	**105.10**
10	**Forth Array**	**Fred Olsen Renewables Ltd**	**415**	**128.40**

The four sites highlighted in Table 1.1 and Figure 1.1 are located seawards of the Firths of Forth and Tay on the east coast of Scotland and lie in relatively close proximity to one another. There is potential for cumulative environmental effects to arise as a result of the development of these sites as well as the adjacent Round 3 Zone.

In association with The Crown Estate, the developers of the four STW sites off the Firths of Forth and Tay have formed the Forth and Tay Offshore Windfarms Developers Group (FTOWDG). The developers are currently collaborating in order to identify potential cumulative effects and ensure a standardised approach to their future assessment as part of individual project Environmental Impact Assessments (EIAs).

A similar approach was previously applied during the development of Round 2 offshore wind farm sites in the Thames and the Wash, whereby developers collaborated and agreed with statutory consultees and key stakeholders a common approach to baseline surveys and assessments which then supported the assessment of cumulative effects.

1.2 Strategic Environmental Assessment

The Scottish Government has commenced a Strategic Environmental Assessment (SEA) of its 'Plan for offshore wind energy in Scottish Marine Waters'. This Plan will be fundamental in taking forward the ten offshore wind farm sites (Table 1.1) granted exclusivity agreements by The Crown Estate. The SEA will consider the environmental effects of offshore wind farm development around the Scottish coastline and will identify areas of environmental constraint and opportunity on a regional basis to support the assessment of offshore wind farm development. It is currently envisaged that the SEA process will take approximately 12 months to complete.

Without pre-empting the findings of the SEA the FTOWDG is seeking to commence investigation of the environmental issues associated with development of the STW sites in order to identify and address any risks and constraints which may delay the consenting process.

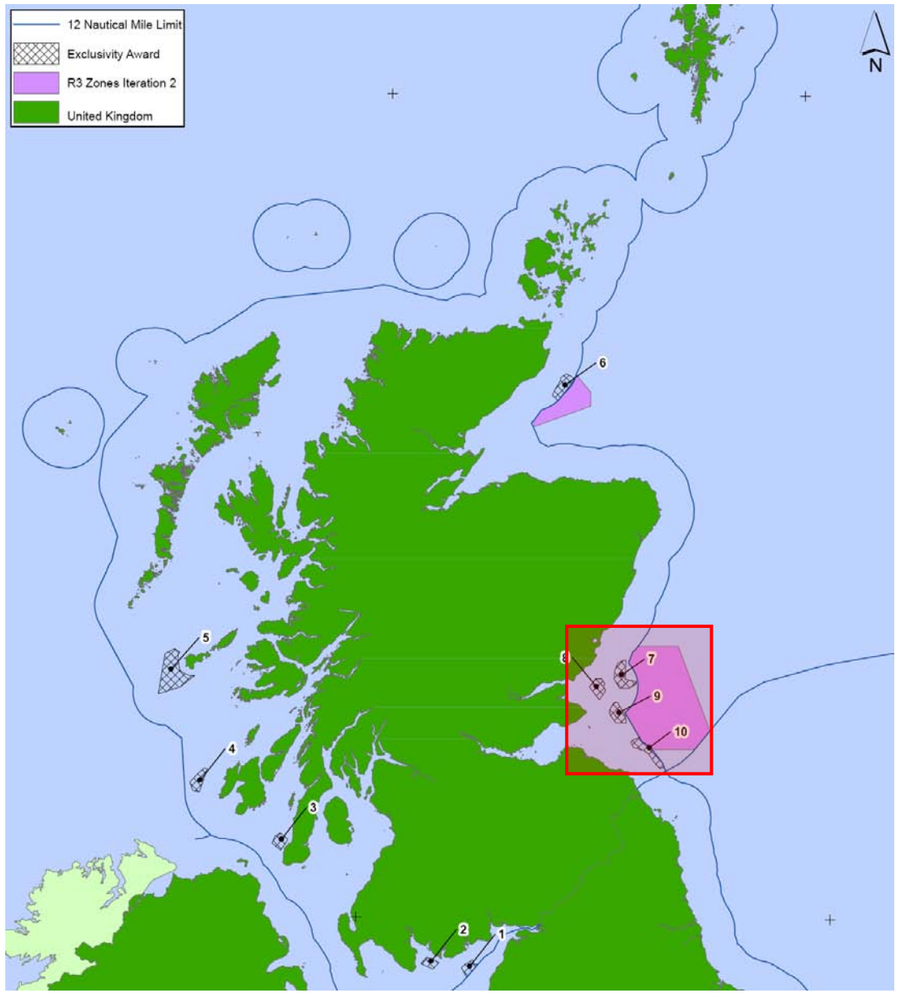

Figure 1.1 Scottish Territorial Waters Sites. Source: The Crown Estate website.

1.3 Document Objectives

This discussion document presents the current thinking of the FTOWDG in relation to potential cumulative effects of multiple wind farm site development on the east coast of Scotland.

The objectives of the document are as follows:

1. To demonstrate to statutory and other key consultees the commitment of the FTOWDG to addressing potential cumulative effects early and effectively;
2. To identify those potential environmental impacts which will likely need to be assessed cumulatively;
3. To propose for discussion a list of issues which, while they may need to be assessed on an individual project basis, are unlikely to give rise to cumulative effects and can therefore be 'scoped out' by agreement at an early stage;
4. To outline an intended future approach to the assessment of cumulative effects to inform the assessment of effects at site-level as part of individual EIAs;
5. To invite comment from statutory and other key consultees on the initial thoughts of the FTOWDG; and
6. To commence the process by which agreement on the approach, methodology and level of information to be applied to future assessment of cumulative effects, can be sought with statutory and other key consultees.

References are made in this document to the 'scoping' of cumulative effects; it is noted however that the term 'scoping' is used for practical reasons and this document does not represent a formal request for a scoping opinion under the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (as amended). However recommendations made in this document and responses from consultees could be used to inform the future scoping studies undertaken by each of the FTOWDG developers.

2 CUMULATIVE AND IN-COMBINATION EFFECTS

2.1 Requirement to Assess Cumulative Effects

The lead consent for STW projects is expected to be Section 36 of the Electricity Act 1989. EIA in support of this consent application will be required under the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000. Schedule 3 to these Regulations requires that in addition to the individual potential environmental effects of the proposed development, the potential for ***cumulative effects*** should also be considered and, where appropriate, assessed. Each of the STW projects will be subject to the requirements of the EIA Regulations.

The FTOWDG are also aware that attention will need to be given for the potential requirement for an Appropriate Assessment to be conducted under the terms of the European Habitats Directive. The Directive and the Conservation (Natural Habitats, & c.) Regulations 1994 (and 2007 amendment regulations) require that an Appropriate Assessment is conducted in respect of any plan of project, which is not directly connected with the management of a site for conservation purposes and which is likely to have a significant effect on a European site (i.e. Special Area of Conservation or Special Protection Area) either alone or ***in combination*** with other plans or projects.

2.2 Definitions

There are a number of definitions of cumulative and in-combination effects. Examples are provided below.

1. *"accumulation of human induced changes in valued environmental components … additive or interactive"* (EC, 1993).
2. Cumulative effects, or impacts, are described as *"changes to the environment that are caused by an action in combination with other past, present and future human actions"* (CEAA, 1999). They can be positive or negative, as well as either direct (e.g. loss of habitat to development) or indirect (e.g. diffuse pollution). They can occur both spatially across geographic areas, and temporally over time, and can result from effects arising from a single development as well as effects arising from multiple developments.
3. *"… result from the incremental impact of the action when added to other past, present and reasonably foreseeable actions regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions …"* (US Council on Environmental Quality, 2005).
4. *"… effects that result from incremental changes caused together with other past, present or reasonably foreseeable actions"* (EC, 1999).
5. Neither the Habitats Directive nor the Regulations provide a definition of 'in-combination', although the Regulations do limit the scope of any in-combination test to 'other plans and projects', which include (English Nature, 2001):
   - *"Approved but as yet uncompleted plans or projects;*
   - *Permitted ongoing activities such as discharge consents or abstraction licences; and*
   - *Plans and projects for which an application has been made and which are currently under consideration but not yet approved by competent authorities."*

2.2.1 Recommended Definition

To aid assessment it is important to apply pragmatic and clear definitions of cumulative and in-combination effects. The following definitions are proposed, supported by guidance issued by the EC (European Communities, 2005).

Cumulative – the effects of one type of development with other types of the same development (i.e. wind farms and other wind farms).

In-combination – the effects of the above in combination with other, different projects and activities (e.g. wind farms in combination with dredging or wind farms in combination with shipping).

Question to Reader:

Q1. Do you agree with our definition of cumulative and in-combination effects? If not, what would you propose (please provide reasoning / a reference)?

2.3 Approach to Assessing Cumulative and In-Combination Effects

2.3.1 CEA Process

A proposed Cumulative Effects Assessment (CEA) process is mapped out in Table 2.1

Table 2.1 Typical Cumulative Effects Assessment process. (adapted from EIA process)

Process	Task	Aim/Objective	Work / Output (Examples)
CEA	Preliminary Review	• Describe the proposed development project(s) • Identify distance from other projects; • Identify if cumulative effects may arise, and if so types of effects. • Determine whether CEA is required	• Consultation with the developer • Consultation with statutory bodies • Local knowledge and information
	Scoping	• Identify environmental receptors likely to be affected by cumulative effects • Identify relevant projects and plans for inclusion in CEA • Identify spatial and temporal boundaries for the CEA • Describe the current state of the environment and any key environmental issues • Describe the nature of the cumulative effects that are likely to occur • Develop CEA methodology • Identify stakeholders and consultees	Scoping report including: • Background data comprising existing literature and specialist studies • Issues 'scoped out' (ie not requiring further assessment • Identification of areas requiring further investigation in the CEA • Description of appropriate methodology to be employed in the CEA • Consultation strategy
	Assessing Cumulative Effects	• Describe in detail the environmental baseline of the study area • Predict likely cumulative effects of the project(s) and alternatives • Assess cumulative effects arising from the project(s) and alternatives • Avoid, reduce or mitigate significant adverse cumulative effects and maximise beneficial cumulative effects • Develop proposals for monitoring of cumulative effects	• Specialist reports (marine mammal desk study) • Quantification of significant cumulative effects • Spatial and temporal analysis of cumulative effects • Solutions to adverse effects • Feedback into the design process, as applicable • Appropriate Assessment (if relevant)
	CEA	• Produce CEA report in accordance with available guidance	• CEA report / relevant coverage in EIA report

2.3.2 Cumulative Effects Assessment

The starting point for this discussion document is the description of the proposed STW developments which may interact cumulatively to result in environmental effects (see Section 3.1.1 below). Key environmental receptors / topics are listed below. These will also apply to any assessment of in-combination effects

Physical Environment
- Hydrodynamic Processes and Geomorphology
- Water and Sediment Quality

Biological Environment
- Marine Benthos and Epibenthos
- Marine Mammals
- Natural Fishery Resources
- Ornithology
- Designated Sites
- Terrestrial & Intertidal Ecology (cable landfall)

Human Environment
- Seascape, Landscape and Visual Character
- Socio-economics
- Shipping and Navigation
- Commercial Fisheries
- Tourism and Recreation
- Seabed Infrastructure
- Marine (and terrestrial) Archaeology
- Military and Aviation

It is noted that the terrestrial and marine elements of export cable routing and landfall have not been included in any further analysis at this stage, as there is insufficient information currently available.

Question to Reader:

Q2. Are there any other receptors relevant to cumulative or in-combination effects that should be included in this document?

2.3.3 In-combination effects

Other projects and activities which may act 'in-combination' with the STW developments to cause environmental effects are also identified. The projects and activities listed below have been considered and are discussed further in Section 3.1. In line with available guidance (e.g. EC, 1999) reference is made to projects and activities which are 'reasonably foreseeable' at the time of document publication; it is the view of the FTOWDG that the scope of CEA be limited to those projects and activities of which sufficient detail is known to underpin a meaningful future assessment.

- Offshore Wind Farms
- Commercial Fisheries
- Shipping and Navigation
- Waterfront and Coastal Development
- Airspace and Radar
- Military Activities
- Cables and Pipelines
- Oil and Gas Infrastructure
- Marine Aggregate Extraction
- Dredging and Sea Disposal
- Tourism and Recreation

Question to Reader:

Q3. Are there any other activities or projects that should be included in this document as giving rise to potential in-combination effects?

Subsequently the potential for cumulative and in-combination effects to arise is considered in the context of the environmental receptors that may be impacted. The parameters referenced in this study are those that would normally be considered in an Environmental Statement (ES), and are listed below. Potential effects are discussed in Section 3.2.

2.3.4 Study Area

For the purposes of producing this discussion document, an arbitrary study area was identified by placing a buffer of approximately 10km around the STW sites and the Round 3 Zone. To the south

the study area boundary intercepts the coastline north of Berwick-upon-Tweed and in the north reaches Montrose. This study area was set to purely to ensure that environmental baseline data was gathered across a consistent spatial area, and that all relevant in-combination activities were captured (see Figure 7.1).

It is recognised however, that different environmental aspects may require different study areas. For example, as a result of disturbance effects on wide ranging marine mammal species, expanded study areas may need to be defined on a species-by-species basis (see draft JNCC guidance for the protection of marine European Protected Species from injury and disturbance, July 2009).

3 IDENTIFYING POTENTIAL EFFECTS

3.1 Existing and Foreseeable Projects and Activities

This section identifies those projects and activities (existing and foreseeable) within the study area which may act in combination with the STW developments to cause environmental effects.

3.1.1 Offshore Wind Farms

Current and Proposed Activity

Table 3.1 and Figure 7.1 identify proposed development activity in the study area. There are no existing offshore wind farms within the study area, though four STW sites are proposed with a total capacity of approximately 2,380MW. At present The Crown Estate (TCE) has awarded STW developers exclusivity agreements, which enable the developer to explore the potential of the sites for offshore wind. Granting of a seabed lease, which will allow wind farm construction to proceed, will be subject to the outcome of a Strategic Environmental Assessment (SEA) for offshore wind that is expected to be completed during 2010, and subject to other statutory consents being obtained by developers.

Seaward of the STW sites is the Firth of Forth Round 3 Zone, which covers 2,859 km^2. Developers submitted applications for Round 3 Zones in March 2009 and successful bidders will be announced in 2009. The Firth of Forth Round 3 zone will be awarded to a single organisation and it is expected that development of the zone would involve the construction of several wind farm sites within the zone boundaries, with a potential capacity of up to 4,000 MW.

To the north of the study area there are operational and proposed offshore wind farm sites off Aberdeen and further north in the Moray Firth, and to the south off the north-east coast of England, is Blyth Offshore Wind Farm.

Table 3.1 Existing and proposed offshore wind farms.

Project	Description	Location	Status
Bell Rock	Installation of approx. 140 wind turbines, with approx. capacity of 700MW	Approx. 9 km east of St Andrews Bay on the Fife coastline	Application for consent expected 2011 earliest
Inch Cape	Installation of approx. 181 wind turbines, with approx. capacity 905MW	Approx. 15.5 km east of the Angus coastline	Application for consent expected 2011 earliest
Neart na Gaoithe	Approx. capacity 420MW	Approx. 15 km east of Fife Ness on the Fife coastline	Application for consent expected 2011 earliest
Forth Array	Approx. capacity 415MW	Approx. 17 km east of St Abbs on the Northumberland coastline	Application for consent expected 2011 earliest
Firth of Forth Round 3 Zone	Approx. capacity 2,500MW	Outside of the 12 nm territorial waters limit, east of the Firth of Forth	Application for consent expected 2013 earliest
Beatrice	Approx. capacity 920MW	Outer Moray Firth	Application for consent expected 2011 earliest
Moray Firth Round 3 Zone	To be confirmed	Outer Moray Firth	Application for consent expected 2013 earliest
Beatrice Demonstrator Project	2 turbines with max. capacity 10MW	Outer Moray Firth	Operational since 2006
Aberdeen Offshore Wind Farm	5 turbines, approx. capacity 115MW	1.5 – 5km east of the Aberdeen coastline	Site awarded
Blyth Offshore Wind Farm	2 turbines with max. capacity 3.8MW	1km off Blyth Harbour, north-east England	Operational since 2000

Data Gaps

Proposed wind farm development locations in Scottish Territorial Waters were announced in February 2009, and with site development in early stages, limited project information is currently available. Data which would inform a cumulative effects assessment is listed below.

- Construction methodologies and timelines (yet to be determined);
- The likely routes of subsea wind farm cables and landfall locations (yet to be determined);
- The layout of turbines or inter-array cables within the proposed sites (yet to be determined); and turbines numbers are not yet confirmed.
- The extent of development in the Round 3 Zone is not known; it is unlikely that the whole Zone would be developed but wind turbines may be installed across a large portion of the Zone.

3.1.2 Commercial Fisheries

Current and Proposed Activity

STW sites and the Firth of Forth Round 3 Zone are located within ICES rectangles[1] 40E6, 41E8, 41E7, 42E8 and 42E7. Vessel Monitoring Systems (VMS) data for 2005-2007 is plotted in Figure 7.2. The data has been processed to show speed filtered VMS transmissions per 5 km x 5 km square pixel; the speed filtering process identifies fishing vessels which, based on their speed of travel, are likely to be actively fishing (i.e. if they were travelling more slowly they would be near-stationary, and if they were travelling faster they would be steaming). These data relate to vessels over 15m in length. The data in Figure 7.2 therefore represents UK registered fishing vessel (over 15m length only)

[1] The Northeast Atlantic is divided into a number of ICES rectangles, each rectangle representing 0.5° latitude by 1° longitude (approximately 30 by 30 nautical miles).

activity. Based on available data, in a UK context, fishing vessel activity across the study area is low to moderate.

Table 3.2 summarises the main commercial species found within the region (in particular in ICES rectangle 41E7). The species are listed according to their level of importance in terms of landed live weight (Scottish Executive Inshore Fisheries Statistics). Catch data indicates that trawling for *Nephrops* and scallops dominates activity within the region (Scottish Government, 2008). In the context of the wider Scottish east coast *Nephrops* fishery, the volume and value of *Nephrops* landings is far greater at ports a significant distance north of the study area (i.e. Peterhead, Fraserburgh) (Aberdeenshire Council, 2008).

Table 3.2 Main species of commercial interest to local, UK and non-UK vessels in the ICES rectangle 41E7.

Species	Method of Capture	Targeted by			Importance	
		Local vessels	UK vessels	Non-UK vessels	Weight	Value
Nephrops	Trawling and creeling	✓	✓		74%	73%
Edible crabs	Creeling	✓			7%	3%
Surf clams	Hydraulic dredging	✓			6%	3%
Scallops	Scallop dredging	✓			4%	3%
Velvet crab	Creeling	✓			3%	2%
Lobster	Creeling and nets	✓			3%	13%
Razor fish	Hydraulic dredging	✓			2%	2%
Squid	Nets	✓	✓		0.3%	0.3%
Haddock	Otter trawlers and seiners	✓	✓		0.2%	0.01%
Cod	Otter trawlers, drifting anchored trammel and gillnets	✓	✓		0.1%	0.01%
Other					0.4%	0.68%

Vessels that fish within and around the STW sites land to several east coast ports including: Aberdeen; Arbroath; Anstruther; Burntisland; Crail; Dunbar; Eyemouth; Gourdon; Methil and Leven; Pittenweem; Montrose; St Andrews and St Monans.

In nearshore waters there is a designated Shellfish Growing Water, designated under the EC Shellfish Waters Directive that covers the Arbroath coastline[2]. Additionally a further shellfish growing area stretches from St Andrews southwards along the Fife coast to Fife Ness[3]. However there are no Crown Estate leases for commercial shellfish production in these areas.

Data Gaps

[2] http://www.sepa.org.uk/pdf/data/shellfish/2.pdf
[3] http://www.sepa.org.uk/pdf/data/shellfish/3.pdf

Vessels under 15m length are not captured by the data shown in Figure 7.2, but fishing activity within the 12nm limit is almost exclusively confined to <10m vessels. As such, the data may not accurately reflect patterns of inshore fisheries activity.

It is thought that the majority of fishing effort is undertaken by UK registered, and mainly Scottish vessels. International fishing interests are thought to be minimal across all STW sites. However, the exact composition of the local fishing fleet cannot be determined without further data analysis and consultation with local fishermen.

Finer scale spatial and temporal patterns of fishing activity may be better understood following consultation with the industry.

3.1.3 Shipping and Navigation

Current and Proposed Activity

Available shipping data is mapped in Figure 7.3; recognisable shipping routes and associated shipping levels are identified. Several shipping routes run through the STW sites and Round 3 Zone. The routes shaded in red in Figure 7.3 represent '90% shipping lanes' (i.e. 90% of shipping travelling along a particular route passes within the boundaries of these lanes). On a UK basis, vessel density (vessel movements per day) is low across the majority of routes and in most cases involves passage of fewer that 2 vessels per day on average.

The majority of vessel activity is associated with access to ports in the Firths of Forth and Tay and the area is mainly used by cargo vessels and tankers. Shipping in the Firths is controlled and scheduled by the Forth and Tay Navigation Service, which is manned 24 hours per day, 7 days per week.

Ports in the Firth of Forth handle annually over 30 million tonnes of cargo. This is mostly oil, petro-chemicals and liquefied gases, which pass through the port of Grangemouth and the two marine terminals at Hound Point and Braefoot. The Forth in general is a significant liquid exporting area of the UK, handling about 44% of the UK's liquefied gas exports, 16% of crude oil and 12.6% of other liquid products (Marico Marine, 2004). There is also considerable container and general cargo traffic at Grangemouth and other ports in the Forth such as Methil, Burntisland, Granton, Leith and Musselburgh. Within the Firth of Tay, Dundee is the main port and handles crude oil and general cargo, with some oil and gas related traffic.

There are no Traffic Separation Schemes or anchorages within the study area, though various traffic routing options have been considered within the Firth of Forth in light of the hazardous nature of many cargoes and the presence of designated nature conservation sites (e.g. Marico Marine, 2004).

Data Gaps

The data displayed in Figure 7.3 relates to larger vessels (over 100 tonnes), and will not capture movements of smaller commercial and recreational vessels, such as inshore fisheries vessels. Patterns of smaller vessel movement across or between sites could be confirmed through consultation and survey.

The construction and maintenance of offshore wind farms will involve significant vessel movements. At this time no estimate has been made of the number of vessel movements or nature of vessels associated with the installation and operation of the STW sites.

3.1.4 Waterfront and Coastal Development

Current and Proposed Activity

A number of waterfront development schemes are ongoing along the coastal stretches within the study area. Two prominent schemes are located at Leith in the Firth of Forth, and at Dundee in the Firth of Tay. Forth Ports' development plans for Edinburgh's Waterfront at Leith docks aim to create a waterfront destination combining new housing, new businesses, industry, community facilities, open spaces and a diverse variety of leisure facilities. Dundee has a Development Masterplan for its waterfront, which aims to improve access and create new civic space along the waterfront. Dundee Port, on the basis of its existing facilities and available development land, is also proposing to act as the key east coast port supporting the offshore renewables sector

A number of smaller scale waterfront development schemes are also ongoing or proposed, including for example, Bo'ness Harbour regeneration in the Firth of Forth.

Another significant coastal development in the study area is the proposed Forth Replacement Crossing. In 2007 the Scottish Government selected a cable-stayed bridge to the west of the existing Forth Road Bridge, which is showing signs of deterioration, as the replacement crossing. Consultation on the proposed scheme is ongoing. If the project remains on schedule it will open in 2016.

Data Gaps

Consultation with Local Authorities / other statutory authorities would be required in order to capture information on all proposed waterfront and coastal development projects within the study area.

3.1.5 Airspace and Radar

Current and Proposed Activity

In terms of military airspace and radar, the general area is seen as a major training area for operational aircraft from the northern UK RAF/Military bases. A low flying training area referred to as Low Flying Area 16 covers the southern portion of the study area.

The nearest operational RAF base is located at Leuchars in Fife, approximately 20km inshore of the nearest STW site, Bell Rock. Fast fighter jets operate from Leuchars and the base is considered to play a critical part in the defence of the UK and its territorial waters. Approaching and departing aircraft may overfly some of the STW sites.

The primary approach radar at Leuchars may experience interference from several of the prospective sites.

The nearest significant MoD Air Defence radars are located at Remote Radar Heads (RRH) Buchan (approximately 80km north-west of the STW sites) and RRH Brizlee Wood (approximately 80km south-west of the STW sites).

In terms of civilian airspace and radar, airports located in or near coastal locations adjacent to the STW sites are listed in Table 3.3. Airway P18 runs north-south across the study area and is used by commercial aircraft flying at high altitude. East coast en route air traffic control services are run from Aberdeen Airport, Edinburgh Airport and Dundee Airport.

National Air Traffic Services (NATS) have identified areas where wind turbine developments may be of concern to operations; the shaded areas labelled 'high' in Figure 7.4 are those where developments are likely to interfere with the operational infrastructure of NATS. The shaded areas labelled 'medium' identify where there remains a potential to interfere with this infrastructure. The shaded area that extends from the north is associated with potential effects on the NATS radar at Perwinnes Hill, which supplies primary and secondary data to controllers at Aberdeen Airport and to the Control Centre at Prestwick.

Table 3.3 Airports nearest to STW sites.

Project / Activity	Company	Description	Location	Status
Aberdeen Airport	BAA	Commercial	Approx. 60km north of Inch Cape	Active
Dundee Airport	ScotAirways	Commercial	Approx. 30km west of Bell Rock	Active
Edinburgh Airport	BAA	Commercial	Approx. 80km west of Forth Array	Active
Fife Airport	Tayside Aviation	Leisure / small – scale commercial	Approx. 55km west of Neart na Gaoithe	Active
Perth Airport	Perth Airport	Leisure / small – scale commercial	Approx. 50km west of Bell Rock	Active
RAF Boulmer	Ministry of Defence	Military	Approx. 60km south of Forth Array	Active
RAF Leuchars	Ministry of Defence	Military	Approx. 20km west of Bell Rock	Active

Data Gaps

Consultation and technical studies will be required to fully understand the characteristics of each radar system.

3.1.6 Military Activities

Current and Proposed Activity

The study area is partially utilised by a number of military practice and exercise areas (PEXA). All PEXA are shown in Figure 7.4, and those that overlap with STW sites and the Round 3 Zone are detailed in Table 3.4.

Table 3.4 Military PEXA.

Project / Activity	Company	Description	Location	Status
PEXA X5641	Ministry of Defence	Used for 'general practice'	Partially within Neart na Gaoithe	Active

Project / Activity	Company	Description	Location	Status
			and Forth Array STW sites	
PEXA X5642	Ministry of Defence	Used for 'general practice'	Partially within Forth Array STW site	Active
PEXA D609	Ministry of Defence	RAF aircraft training	Partially within the Round 3 Zone	Active – firing activity
PEXA D613	Ministry of Defence	RAF air combat training	Partially within the Round 3 Zone	Active – firing activity

Data Gaps

Consultation with the Ministry of Defence is required to confirm the frequency and nature of activity within each PEXA. Offshore development is likely to be constrained where firing practice occurs unless PEXA boundaries were redefined.

3.1.7 Cables and Pipelines

Current and Proposed Activity

There are no cables or pipelines located within the study area. The nearest subsea cables lie over 50km to the north.

Associated with offshore wind farm development will be the laying of a number of new subsea power cables.

Data Gaps

The routes of subsea cables that will connect the proposed offshore wind farms to the onshore grid, and of wind farm inter-array subsea cables, are not known.

3.1.8 Oil and Gas Infrastructure

Current and Proposed Activity

There is little oil and gas infrastructure within the study area, indicative of limited exploitation potential. A single historical exploratory well (found to be dry, plugged and abandoned in 1985) is present in the Round 3 Zone. There are no current oil or gas licences covering the study area.

Onshore within the Firth there are extensive facilities to support the processing, handling and shipping of liquefied gas, crude oil and associated products, with major terminals at Hound Point and Braefoot Bay.

Data Gaps

There has been initial investigation into the possibility of creating carbon capture and storage sites beneath the seabed in the Firth of Forth (British Geological Survey website). It is not clear whether proposals have progressed beyond the feasibility study stage.

3.1.9 Marine Aggregate Extraction

Current and Proposed Activity

The nearest aggregate extraction sites lie over 20km inshore of the STW sites, with licences granted in the Tay Estuary and at Middle Bank in the Firth of Forth (Figure 7.4). No extraction is currently taking place. It is unlikely that there would be interest in aggregate extraction from the deeper offshore waters where seabed sediments are highly variable.

Data Gaps

None found.

3.1.10 Dredging and Sea Disposal

Current and Proposed Activity

Maintenance and capital dredging activity is concentrated in estuarine and coastal waters, at harbours and ports in the Firth of Forth and on the Fife coastline some distance inshore of the STW sites.

Several currently licensed sea disposal sites in coastal waters inshore of the study area receive the material arising from port and harbour dredging activity. These are mapped in Figure 7.4. There are additional disposal sites located further offshore in close proximity to the STW sites; these are detailed in Table 3.5.

Table 3.5 Sea Disposal Sites.

Project / Activity	Company	Description	Location	Status
Bell Rock disposal site	-	Historic sewage sludge disposal	Partially within Inch Cape STW site	Closed
St Abbs Head disposal site	-	Historic sewage sludge disposal	Partially within Forth Array STW site	Closed

The disposal sites shown in Table 3.5 historically received sewage sludge from the Edinburgh area, though dumping activity ceased in 1998. The cumulative total disposal at both sites was approximately 5.85 million tonnes of wet sludge over the operating period of 20 years.

Sediment sampling was regularly undertaken at the disposal sites up to cessation of dumping activity, with sample analysis considering metal and organic determinands. Additionally, benthic fauna have also been monitored. Sampling results suggest a mild effect of sludge disposal but show that seabed sediments display no signs of serious organic or heavy metal contamination (CEFAS, 1997; Hayes *et al*, 2005).

A historic marine munitions disposal site lies inshore of the STW sites, a short distance seaward of the Isle of May. It is no longer in use.

Data Gaps

The current status of the closed disposal sites which received sewage sludge is not known but post-dumping monitoring indicates that the sites are highly dispersive and long-term contaminant issues are unlikely to be encountered.

3.1.11 Tourism and Recreation

Regional statistics published by VisitScotland indicate that during 2008 UK residents took 0.55 million tourist trips to Fife, resulting in a spend of £98 m in the area. Overseas visitor trip numbers totalled 0.14 m with an associated spend of £85 m. In Angus and Dundee trips by UK visitors reached 0.42 m and trips by overseas visitors numbered 0.09m, resulting in spends of £71 m and £34 m respectively. The importance of tourism to these two regions is demonstrated by the proportions of local employment associated with the tourism sector; 9.2 per cent of employment is accounted for by tourism in Fife, and 8.7 per cent in Angus and Dundee. The coastlines and historical towns and villages of Fife and Angus are to a large extent the foundation of the local tourism, leisure and recreation industries, and the most-visited tourist attractions in these regions are all located on the coastal fringe.

SNH commissioned a review of marine and coastal recreation in Scotland (Land Use Consultants, 2007). The review indicates that the most popular specialist activities on the Scottish coastline are walking, sea fishing, shoreline fishing, sailing, kayaking and canoeing, and wildlife and bird watching. Coastal golf courses are also popular sites for recreation. Based on analysis of the number of trips made by visitors, it is apparent that the Firths of Forth and Tay are particularly important for recreation. In the coastal waters of the Firths, bird and wildlife watching are popular with boat trips running visitors to the Isle of May, Inchcolm Island, and other locations.

Further offshore, in the vicinity of the STW sites, recreation is minimal. There is some sailing activity and medium-use vessel cruising routes (i.e. popular routes on which some recreational craft will be seen at most times during summer daylight hours) do pass through the study area and are mapped on Figure 7.4. A number of charted wrecks lie within the study area, but their depth will put them beyond the reach of many recreational divers. Any diving activity is concentrated in inshore waters and around the Isle of May. It may be expected that some recreational sea angling will take place across the study area.

Data Gaps

Further analysis of available data may be undertaken to further define the level and nature of coastal and offshore tourism and recreation activity.

3.2 Potential Effects

This document suggests a division between environmental issues which will require detailed assessment of cumulative effects, and are therefore ‘scoped in’, and those which will not require it, and are therefore ‘scoped out’.

3.2.1 Effects ‘Scoped Out’

Table 3.6 below presents the issues which the FTOWDG consider can be scoped out of future CEA.

Table 3.6 Issues Scoped Out.

Environmental Issue	Comments
Water and sediment quality	The offshore nature of the STW sites means that the potential impact associated with disturbance to and dispersion of contaminated sediments is likely to be minor and site specific. Effects on inshore designated waters are unlikely. In addition, the dispersion of sediments (contaminated or clean) will be short term, arising during the construction phases of development. No interactions are expected.
Marine benthos and epibenthos	In most cases, wind farm construction is unlikely to lead to any significant change in seabed substrate or sediment type. Only short-term disturbance effects will be experienced and recolonisation by the surrounding infauna and epifauna can be expected to take place rapidly (Hiscock *et al*, 2002). This is validated by benthic data collected from other wind farm sites and offshore projects (e.g. Bio/Consult 2004, 2005; npower renewables 2008). The exception to this rule would be if large finds of a particular species or habitat of concern (e.g. biogenic reef) were encountered during site survey. On the basis of British Geological Survey seabed sediment data and results of wider North Sea benthic surveys (Eleftheriou *et al*, 2004) this is not expected, and if encountered, would be dealt with on a site-specific basis.
Marine archaeology	There are a number of shipwrecks located across the study area; none of those within or immediately adjacent to the STW sites are protected. Turbine and cable placement would seek to avoid any features of historical interest on the seabed and it is expected that the chance of accidental disturbance of features will be minimal. During operation impacts will be limited to potential indirect effects associated with altered patters of seabed sediment erosion and accretion. It is anticipated that marine archaeology can be effectively assessed and mitigated on an individual project basis; cumulative effects are not expected to occur. .
Tourism and recreation	Impacts on tourism and recreational activities will result from temporary disruption caused by construction activities. The limited seaborne activity, primarily sailing, will experience temporary disruption during the offshore works, while coastal activities may be affected by highly localised disruption at cable landfall and substation locations. Given the minimal nature of effects offshore and the localised nature of effects at the coast, it is expected that ay effects would be assessed on an individual site basis as part of project EIA. Secondary effects on tourism and recreation associated with seascape, landscape and visual character, and socio-economics, will be addressed under those topic headings.

Question to Reader:

Q4. Do you agree that the issues listed in the table above should be ‘scoped out’? If not, please provide comments.

3.2.2 Effects 'Scoped In'

The issues which may need to be considered as part of a cumulative effects assessment for the STW sites relate to the following environmental receptors:

- Hydrodynamic processes and geomorphology;
- Marine mammals;
- Natural fishery resource;
- Ornithology;
- Designated sites;
- Seascape, landscape and visual character;
- Socio-economics;
- Shipping and navigation;
- Commercial fisheries; and
- Military and aviation

The potential effects on these receptors are discussed further in the text below.

Hydrodynamic processes and geomorphology

Baseline Summary

Water depths across the STW sites vary considerably, ranging from approximately 20m to 60m Chart Daturm (CD). Seabed sediments across the study area are generally comprised of sand, muddy sand and gravelly sand. Beneath the sediments are Quaternary deposits comprising either till, pebbly glacio-marine muds, or sands with inter-bedded muds and silts. Below these, the solid geology is comprised of mudstones, siltstones and sandstones.

Wind direction in the Firth of Forth tends to follow the northeast/southwest axis of the firth. During the winter months, westerly airflows dominate, with occasional north-easterly flows. In contrast, during summer months westerly flows make up 50% of the air movements with north-easterly and easterly flows more important (35%).

Offshore wave conditions are experienced from between 340-200°N with on average approximately 35% of conditions occurring from between 20°N and 60°N. Significant wave heights over 4m can be experienced from any direction in the easterly sector but are most common between 0°N and 120°N as these follow the most extreme wind conditions from the north east. Annual mean significant wave height is approximately 1.3m (Garrad & Hassan, 2008).

Tidal currents run parallel to the coastline in a north east and south west direction. Brown *et al* (2001) have proposed the existence of a strong and persistent seasonal coastal southward sediment transport from the Firth of Forth to Flamborough Head, driven by bottom density fronts that fringe the dense pool of cold winter water formed in the central North Sea following stratification.

Key Issues

Based on available literature, the following are perceived to be the main potential effects on hydrodynamic processes as a result of wind farms within the marine environment (CEFAS, 2004):

- Alteration of local hydrodynamic conditions (i.e. waves and tidal flows);
- Changes to the sedimentary environment (e.g. suspended sediment concentrations, sediment transport pathways, patterns and rates, and sediment deposition);
- Alteration of sedimentary seabed structures (e.g. sandbanks and other large scale bedforms);
- Indirect effects of the above changes on other environmental receptors (e.g. benthos, fisheries, water quality).

Potential impacts on coastal processes are expected to be site-specific and localised. The STW sites lie in relatively deep water where seabed sediments are fairly coarse, residual currents are low and sediment movement is thought to be limited based on data taken from Admiralty Charts and British Geological Survey seabed sediment maps. While localised scour around turbine structures and cables may occur, it is unlikely that there will be any interaction between sites (ABPmer 2003, 2008; CEFAS, 2005).

However, given that EIA study areas for the STW sites will overlap to a high degree, the FTOWDG has opted to undertake a collaborative oceanographic survey which will see data relating to hydrodynamic conditions and sedimentary processes collected across the STW sites and a wider study area. Data will subsequently be shared and be used to inform site-specific EIAs and their consideration of cumulative effects.

Marine mammals

Baseline Summary

Grey and common seal colonies lie within relatively close proximity of the STW sites, with grey seals using the Isle of May and common seals using the Firth of Tay and Eden Estuary to breed and moult. Telemetry studies reveal dense foraging activity within the study area associated with common seals hauling out in St Andrews Bay (Hammond *et.al.*, 2004).

Six cetacean species frequently occur within the region: Harbour porpoise; white-beaked dolphin; Atlantic white-sided dolphin; killer whale; bottlenose dolphin; and, minke whale (Hammond *et.al.*, 2004). Peak cetacean sightings within the study area occur in summer months, with harbour porpoise, bottlenose dolphin and minke whale most commonly sighted (though note that increased sightings could be a factor of better weather and increased chance of observation). Bottlenose dolphins that belong to the Moray Firth SAC population are known to travel south into waters off Northumberland, and have been sighted off the Firths of Forth and Tay (JNCC website (a); Wilson *et al*, 2004).

Key Issues

Based on available literature, the following are perceived to be the main potential effects on marine mammals as a result of wind farms within the marine environment:

- Disturbance as a result of elevated construction and operational sound;
- Potential longer term avoidance of the development area by marine mammals;
- Increased collision risk due to construction and maintenance traffic;
- Potential reduction of the feeding resource due to effects on prey of noise and vibration, and habitat disturbance; and
- Conflict with commercial fisheries as a result of increased effort within reduced fishing areas.

Marine mammals extensive use of sound for communication, prey capture, predator avoidance and probably navigation, and the possession of large gas-filled organs make them vulnerable to both disturbance and physiological damage from underwater noise of sufficient magnitude. Identifying these effects, and the levels of sound which may induce them, has been the subject of considerable research; extensive reviews are provided by Richardson *et al* (1995), Nowacek *et al* (2007), Southall *et al* (2007) and Weilgart (2007) and UK Strategic Environment Assessments have also addressed the issue of noise (e.g. Hammond *et al* 2006, 2008). The most significant potential disturbance of marine mammals from offshore wind farms identified to date arises from underwater noise associated with the installation of driven piled foundations.

Underwater noise can have a severe effect on marine mammals in the immediate vicinity of high level sources (Nedwell *et al*, 2003). As the distance from the source increases, noise will attenuate and the potential effects will diminish.

The effects of noise on marine mammals can be classed into three groups:

- Primary effects – such as immediate or delayed fatal injury of marine mammals near powerful sources e.g. explosive blasts underwater;
- Secondary effects – such as injury (including permanent or temporary hearing threshold shift), or deafness, which may have long term implications for survival; and
- Tertiary (behavioural) effects – such as avoidance of the area or masking of sounds that may have significant effects where the manmade source is in the vicinity of breeding grounds, migratory routes or feeding areas.

Recent studies funded by COWRIE (Nedwell *et al,* 2007; Thomsen *et al*, 2006; Nedwell *et al,* 2003) suggest that the noise generated during pile driving operations during wind farm construction may result in the injury of marine species at distances of the order of 100m from the piling activity. Calculations suggest that a strong avoidance reaction (above 90dB$_{ht}$) from a range of species will be expected within several kilometres. Noise may still be at a level that elicits a behavioural effect (above 70dB$_{ht}$) at ranges of the order of 10km or more.

The analysis of estimated spatial effects ranges in marine mammals in relation to pile driving activities, within the recent Offshore Energy SEA (DECC, 2009), concluded that pile driving sources are generally unlikely to have a significant effect on marine mammal populations. This is due to the fact that the spatial scales over which either observable or biologically meaningful effects are likely to result do not generally support significant groups of animals. The only exception is where populations of small odontocetes occur at locally high population densities.

Once installation is complete, the effective noise propagated from an array of operational turbines is less well characterised, though evidence to date suggests that *operational* noise levels are unlikely to result in effects on marine mammals (DECC, 2009).

One of the most relevant pieces of legislation in terms of assessing and mitigating for the effects of noise on marine mammals is The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), which form the legal basis for the implementation of the EU Habitats and Birds Directives in Scottish territorial waters. Under Regulation 39 it is an offence "deliberately to disturb" any European Protected Species, which include all species of dolphin, porpoise and whale, and several species of marine turtle. The Regulations were amended in 2007 (referred to as The Conservation (Natural Habitats &c.) Amendments (Scotland) Regulations 2007) to provide further interpretation of the term "disturbance", which prior to amendment, had been a cause of considerable contention in terms of what actually constitutes disturbance and whether disturbance is permissible as part of a consented development. Amended Regulation 39 (under The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007) now states that it is an offence:

> "(v) to disturb such an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs; or
>
> (vi) to disturb such an animal in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young;"

The significance of Regulation 39 to most offshore wind farm developments, which tend to be located away from centres of breeding and raising young, lies in the first point.

At present, there is limited guidance from Scottish Natural Heritage or the Scottish Government on how to tackle this issue of deliberate disturbance, however the JNCC (2008) has produced draft guidance which provides an interpretation of what constitutes a 'significant' group and explains the 'disturbance offence' in greater detail. It is anticipated that the final, post-consultation version of the guidance will be issued at some time in late 2009, following production of the draft version in July 2009. The guidance refers to the Habitats Directive Article 12 Guidance (European Commission, 2007) stating that in their view significant disturbance must have some ecological impact.

Natural fishery resource

Baseline Summary

The presence and extent of spawning and nursery grounds within the study area is mapped in Figure 7.6, Figure 7.7 and Figure 7.8, and summarised in Table 3.7.

Table 3.7 Spawning and nursery ground within or adjacent to sites. Source: CEFAS.

Species	Spawning Grounds	Nursery Grounds	Seasonality of Spawning
Cod	In north east corner of Round 3 Zone	In all STW sites and much of Round 3 Zone	Jan to Apr
Herring	In south of Round 3 Zone and within Forth Array STW site	None – approx. 20km inshore of nearest STW site	Autumn
Plaice	In all STW sites and part of Round 3 Zone	In Bell Rock STW site	Jan to Mar
Whiting	In Round 3 site and in Inch Cape and Forth Array STW sites	Throughout all STW sites and Round 3 Zone	Jan to Jun
Nephrops	In all STW sites and much of Round 3 Zone	In all STW sites and much of Round 3 Zone	Throughout the year
Sandeel	In all STW sites and much of Round 3 Zone	In all STW sites and much of Round 3 Zone	Winter months – Nov to Feb
Sprat	In eastern portion of Round 3 Zone	Throughout all STW sites and Round 3 Zone	Mar to Aug
Lemon sole	Throughout all STW sites and Round 3 Zone	Throughout all STW sites and Round 3 Zone	May to Sep
Haddock	None	In far eastern portion of Round 3 Zone	Mar to May

Species	Spawning Grounds	Nursery Grounds	Seasonality of Spawning
Saithe	None	In Inch Cape, Bell Rock, and Forth Array STW sites and north west of Round 3 Zone	Late winter and spring

The River Tay and River Forth, over 20km inshore of the nearest STW sites, are known to support a number of diadramous (migratory between fresh and salt waters) species, specifically sea trout, Atlantic salmon and eels. Table 3.8 below shows the approximate timings of upstream migrations.

Table 3.8 Timings of migration for diadramous species. Source: Tay District Salmon Fisheries Board.

Species	Timing of upstream migration
Salmon	main run August – October
Eel	Elvers migrate upstream from January to June, with a May peak

Atlantic salmon are an Annex II species under the European Habitats Directive and are a primary reason for the designation of the River Tay as a Special Area of Conservation. Atlantic salmon associated with the Tay and Forth pass through the estuaries on migration to and from offshore feeding grounds. Little is known about the salmon's migration of behaviour once the open sea is reached, however evidence (Hawkins *et al*, undated) suggests that fish movements are likely to occur nearer to the coast. For example, the Atlantic salmon associated with the Tay pass through the estuary on migration to and from offshore feeding grounds. It does appear from attempts at netting that the smolts move away from the coast very quickly and recent experimental fishing for smolts at sea has shown they migrate north quickly (Tay District Salmon Fisheries Board).

Key Issues

The issues listed below are considered to be relevant to the assessment of potential cumulative effects on the natural fishery resource within the study area. They are essentially the same as those that would be considered during a site-specific assessment, but the effects need to be considered on a broader scale.

It should be noted that in addition to the potential impacts set out below, benefits/enhancement to the natural fishery resource could arise due to the development of offshore wind farms. Such benefits could be associated with the new habitat conditions created and the restriction of fishing access.

The following paragraphs summarise potential effects resulting from wind farm construction and operation.

Construction effects (short term and reversible):

- Degradation of water quality locally due to elevated suspended sediment concentrations, affecting epi-benthos, larvae and fish present within the water column; and
- Elevated noise during construction acting as a barrier to some fin fish species (it is likely that hearing specialists, including sprat and herring, would be able to detect the noise of a pile driving operation at a level that would induce behavioural changes, such as disturbance, at a distance of up to 30km [Shepherd *et al*, 2006]).

Operational effects [4]*:*

- Increased trawling effort within areas which previously may have seen limited effort (due to displacement);
- Increased fishing effort targeting epifaunal species;
- Disruption of spawning and nursery areas as a result of the instalment of turbines, cables and scour protection;
- Possible enhancement of fishery.

Potential effects on herring (which have isolated spawning and nursery grounds, and which are considered to be a hearing sensitive species) and sandeel (which was historically over-fished within this region, and which supports important ecosystem functioning across the offshore sandbanks where seabirds and marine mammals feed) are likely to be of particular concern in terms of a cumulative effects assessment. However, it may be possible to avoid adverse effects on these autumn/winter spawning species by timing wind farm construction to avoid sensitive periods.

Electromagnetic field (EMF) effects from underwater cables on elasmobranchs (and other electro-sensitive species) have been the subject of research (e.g. Gill *et.al*, 2009). Study indicates that elasmobranch species can respond to EMF associated with subsea cables, but that responses (e.g. change in swimming direction, change in migratory route) are not predictable and do not always occur. Effects appear to be species dependent and individual specific, with individuals moving either more or less within the zone of EMF. Further monitoring at offshore wind farm sites is recommended; evidence gathered to date suggests that effects of EMF are negligible (e.g. Faber Maunsell & Metoc, 2007). At this stage it is not considered that EMF effects will be extensive or act on a cumulative basis, and can be addressed on a site-specific basis.

In order to collate comprehensive natural resource data within the study area, a multi-strand approach would typically be adopted. This would require:

- Analysis of combined epifaunal and fish surveys using appropriate gears to acquire fish and epifaunal data simultaneously;
- Analysis of all available fisheries data (e.g. sandeel monitoring data);
- Scottish Fisheries Protection Agency / Marine Fisheries Agency data (landings, overflight data, patrol vessel sightings, effort statistics, etc); and
- Consultation with relevant Fishermens' associations and individual fishermen.

It is important to characterise fish communities in relation to specific sites. Information collected can be used to characterise species diversity in relation to habitat type, sediment characteristics, depth and faunal community. Given the requirement for site-specific data, it is likely that individual wind farm developers will initiate characterisation of their respective sites. This information can then be fed into a generic document describing the natural resource across the wider area. This would provide both site-specific data and a broad scale assessment of the natural resources present and the generic document could be used by developers to pull the relevant information on cumulative effects (associated with their site) into their EIA.

Ornithology

Baseline Summary

[4] Potential effects are dependent on the existence of safety zones and distance between turbines.

In addition to coastal and inshore bird surveys, boat-based seabird surveys across major sandeel grounds, including those within the study area, have been undertaken between 1991 and 2004 and data has been collated in a report by Camphuysen (2005) as part of the IMPRESS (Interactions between the Marine environment, PREdators and prey: implications for Sustainable Sandeel fisheries) project. In addition The Crown Estate has recently announced its commissioning of aerial bird surveys, which will cover the Firth of Forth Round 3 Zone and nearby STW sites.

Although there are no designated sites within the STW sites or Round 3 Zone, it is an important area for seabirds. In coastal waters proximate to the STW sites, extension of existing SPA designations is being considered. A 2km seaward extension of the current Forth Islands SPA (approximately 25 km to the west of the zone) is proposed to reflect the ecological dependence on the marine environment of the following species: northern gannet; Atlantic puffin; razorbill; common guillemot; and, northern fulmar. A JNCC report published in 2007 recommends seaward extension of the Firth of Tay and Eden Estuary SPA (approximately 30 km west of the study area) following analysis of bird count data collected during aerial bird surveys of Tay Bay spanning five seasons. Data gathered demonstrates that the numbers of wintering red-throated divers present would justify the qualification of Tay Bay's inshore waters as an SPA. Data presented in a series of JNCC reports demonstrates that red-throated divers are widely distributed across Tay Bay. No potential marine SPA boundary has been identified to date.

The area may also be part of an important seasonal flyway for a number of geese and sea duck species, namely pink-footed and barnacle geese and velvet scoter, red breasted merganser, eider and long tailed duck.

Key Issues

There are a number of potential issues relating to offshore wind farms that could have a cumulative effect on bird populations. These largely centre around the following, and arise both on a site-specific basis and at a more strategic level:

- Habitat loss during construction – direct disturbance from construction work and ancillary activity;
- Habitat loss during operation – direct disturbance from the operation of the turbines as well as maintenance activity;
- Modification to migratory routes – involving increased energy consumption and, if development forms a physical barrier, possible removal of nearby feeding and roosting sites;
- Collision risk to birds – both for short range daily movements and long range migratory movements; and
- Disruption to habitat function – displacement of feeding areas with increased predation or reduction in prey availability, disruption of movements to, from and within breeding-roosting-foraging sites.

Excepting collision risk issues, some of the main potential impacts from single or multiple developments will centre on displacement. In some instances, particularly for mobile rafting flocks, this may not have any significant implications, but for species potentially dependent on a defined site for foraging (e.g. seabirds which may be using the Wee Bankie / Marr Bank complex), impacts could be more important.

The aerial bird survey commissioned by The Crown Estate will be undertaken in 2009 and results are expected to inform a more detailed scope of a cumulative effects assessment.

Designated sites

Baseline Summary

Large stretches of the Scottish coastline inshore of the STW sites have been designated as a result of the presence of habitats and/or species of nature conservation importance. Figure 7.9 shows the location and extent of sites of international, national and local importance. The STW sites lie approximately 20km from the nearest coastal designated sites.

Table 3.9 below lists those sites of European significance, which have been designated under the European Birds and Habitats Directives.

To supplement the existing network of mostly terrestrial Special Protection Areas (SPAs) around the UK and to better recognise the ecological requirements of birds using the marine environment, the Joint Nature Conservation Committee and country agencies (e.g. SNH, Natural England and CCW) are currently investigating the potential designation of a suite of new marine SPAs based on the presence of inshore aggregations of non-breeding waterbirds and offshore aggregations of seabirds, in addition to the seaward extension of a number of existing seabird breeding colony SPAs. There is scope for the designation of a number of new SPAs in proximity to the Firth of Forth and Firth of Tay coastline (JNCC website (b)).

To supplement the existing network of Special Areas of Conservation (SACs), new potential SACs are being identified in UK offshore waters for Annex I habitats (reefs, sandbanks, submarine structures made by leaking gases). Several potential offshore SACs have already been identified, none of which fall within or near to the study area. However, it is expected that several more offshore sites where Annex I habitat is present will also become potential SACs in the near future.

Table 3.9 Coastal Designated sites of European importance, Source: JNCC website.

Site	Designation	Conservation Interest
Firth of Tay and Eden Estuary	SPA	**Qualifying species**: Breeding populations of little tern *Sterna albifrons* and marsh harrier *Circus aeruginosus*. bar-tailed godwit *Limosa limosa islandica*, greylag goose *Anser anser*, pink-footed goose *Anser brachrhynchus*, and redshank *Tringa tetanus*.
Firth of Forth Islands*	SPA	**Qualifying species**: Breeding populations of Arctic tern *Sterna paradisaea*, common tern *Sterna hirundo*, roseate tern *Sterna dougallii*, Sandwich tern *Sterna sandvicensis*, gannet *Morus bassanus*, lesser black-backed gull *Larus fuscus*, puffin *Fratercula arctica*, shag *Phalacrocorax aristotelis*
St Abb's Head to Fast Castle*	SPA	**Qualifying species:** Razorbill *Alca torda*, guillemot *Uria aalge*, kittiwake *Rissa tridactyla*, herring gull *Larus argentatus*, shag *Phalacrocorax aristotelis*.
Montrose Basin	SPA	**Qualifying species:** Over-wintering populations of greylag goose *Anser anser,* pink-footed goose *Anser brachrhynchus*, redshank *Tringa tetanus* and Knot *Calidris canutus.*
Buchan Ness to Collieston Coast*	SPA	**Qualifying species**: During the breeding season, the area regularly supports 95,000 individual seabirds.
Coquet Island	SPA	**Qualifying species**: Breeding populations of Arctic Tern *Sterna paradisaea,* Common Tern *Sterna hirundo,* Roseate Tern *Sterna dougallii,* Sandwich Tern *Sterna sandvicensis,* Puffin *Fratercula*

Site	Designation	Conservation Interest
		arctica. During the breeding season, the area regularly supports 33,448 individual seabirds.
Fala Flow	SPA	**Qualifying species**: Over-wintering Pink-footed Goose *Anser brachyrhynchus*.
Farne Islands	SPA	**Qualifying species**: Breeding populations of Arctic Tern *Sterna paradisaea,* Common Tern *Sterna hirundo,* Roseate Tern *Sterna dougallii,* Sandwich Tern *Sterna sandvicensis,* Guillemot *Uria aalge,* Puffin *Fratercula arctica.* During the breeding season, the area regularly supports 142,490 individual seabirds.
Firth of Forth	SPA	**Qualifying species**: On passage Sandwich Tern *Sterna sandvicensis.* Over-wintering Bar-tailed Godwit *Limosa lapponica,* Golden Plover *Pluvialis apricaria,* Red-throated Diver *Gavia stellata,* Slavonian Grebe *Podiceps auritus,* Knot *Calidris canutus,* Pink-footed Goose *Anser brachyrhynchus,* Redshank *Tringa totanus,* Shelduck *Tadorna tadorna,* Turnstone *Arenaria interpres.* The area regularly supports at least 20,000 waterfowl.
Fowlsheugh	SPA	**Qualifying species**: Breeding populations of Guillemot *Uria aalge,* Kittiwake *Rissa tridactyla.* During the breeding season, the area regularly supports 170,000 individual seabirds.
Gladhouse Reservoir	SPA	**Qualifying species**: Over-wintering Pink-footed Goose *Anser brachyrhynchus.*
Imperial Dock Lock, Leith	SPA	**Qualifying species**: Breeding populations of Common Tern *Sterna hirundo.*
Lindisfarne	SPA	**Qualifying species**: Breeding populations of Little Tern *Sterna albifrons.* Over-wintering Bar-tailed Godwit *Limosa lapponica,* Golden Plover *Pluvialis apricaria,* Whooper Swan *Cygnus cygnus,* Grey Plover *Pluvialis squatarola,* Greylag Goose *Anser anser,* Knot *Calidris canutus,* Light-bellied Brent Goose *Branta bernicla hrota,* Wigeon *Anas penelope.* Migratory Ringed Plover *Charadrius hiaticula.* The area regularly supports at least 20,000 waterfowl.
Loch Leven	SPA	**Qualifying species**: Over-wintering Whooper Swan *Cygnus cygnus,* Pink-footed Goose *Anser brachyrhynchus,* Shoveler *Anas clypeata.* The area regularly supports at least 20,000 waterfowl.
Loch of Skene	SPA	**Qualifying species**: Over-wintering Whooper Swan *Cygnus,* Greylag Goose *Anser anser*.
Muir of Dinnet	SPA	**Qualifying species**: Over-wintering Greylag Goose *Anser anser*. The area regularly supports at least 20,000 waterfowl.
South Tayside Goose Roosts	SPA	**Qualifying species:** Over-wintering Greylag Goose *Anser anser,* Pink-footed Goose *Anser brachyrhynchus.* The area regularly supports at least 20,000 waterfowl.
Ythan Estuary, Sands of Forvie and Meikle Loch	SPA	**Qualifying species:** Breeding populations of Common Tern *Sterna hirundo,* Little Tern *Sterna albifrons,* Sandwich Tern *Sterna sandvicensis.* Over-wintering Pink-footed Goose *Anser brachyrhynchus.* The area regularly supports at least 20,000 waterfowl.
Firth of Tay and Eden Estuary	SAC	**Qualifying habitats**: Estuaries (sandbanks slightly covered by seawater all the time, and mudflats and sandflats not covered by seawater at low tide).
		Qualifying species: Common seal *Phoca vitulina*.
Barry Links	SAC	**Qualifying habitats**: Embryonic shifting dunes, shifting dunes along the shoreline, fixed dunes with herbaceous vegetation, Atlantic decalcified fixed dunes, humid dune slacks.
Isle of May	SAC	**Qualifying habitats**: Reefs.
River Tay	SAC	**Qualifying habitats**: Oligotrophic to mesotrophic standing waters with vegetation. **Qualifying species**: Atlantic salmon *Salmo salar,* sea lamprey *Petromyzon marinus,* brook lamprey *Lampetra planeri,* river lamprey *Lampetra fluviatilis,* otter *Lutra lutra*.
Berwickshire and North Northumberland Coast	SAC	**Qualifying habitats:** Mudflats and sandflats not covered by seawater at low tide, large shallow inlets and bays, reefs, submerged or partially submerged sea caves **Qualifying species:** Grey seal *Halichoerus grypus*
Moray Firth	SAC	**Qualifying habitats:** Sandbanks slightly covered by seawater all the time **Qualifying species:** Bottlenose dolphin *Tursiops truncatus*.
Dornoch Firth and Morrich More	SAC	**Qualifying habitats:** Estuaries, mudflats and sandflats not covered by seawater at low tide, *Salicornia* and other annuals colonising mud and sand, Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), embryonic shifting dunes, shifting dunes along the shoreline with *Ammophila arenaria* (`white dunes`), fixed dunes with herbaceous vegetation (`grey dunes`), decalcified fixed dunes with *Empetrum nigrum*, Atlantic decalcified fixed dunes (*Calluno-Ulicetea*), humid dune slacks, coastal dunes with *Juniperus* spp., sandbanks which are slightly covered by sea water all the time, reefs. **Qualifying species:** Otter *Lutra lutra*; Common seal *Phoca vitulina*.

* Marine SPA extension proposed.

Key Issues

The distance between the STW sites and existing designated sites means that it is unlikely that offshore development will directly impact designations. However, offshore wind farm development (both individual sites and sites acting cumulatively) within the study area could present significant issues for a number of bird species upon which coastal SPA designations are based, and thus have resulting significant effects on the conservation objectives and conservation status of the relevant SPA. Whilst attempts would be made to avoid coastal designated sites, cable routing and onshore substation development may also affect designated site features.

Conservation objectives for designated sites generally seek to main the population, distribution and extent of designated features, and the structure and function of the site.

Under the European Habitats and Birds Directives and the transposing Conservation (Natural Habitats, & c.) Regulations 1994 (and 2007 amendment regulations) the competent authority (in this case the Scottish Government) must consider the effect of a development on European sites when considering whether to grant an application for consent. As outlined in Section 2.1, in its Appropriate Assessment, the competent authority must consider whether projects are likely to have a significant effect on a European site either alone or *in combination* with other plans or projects.

Seascape, landscape and visual character

Baseline Summary

Scottish Natural Heritage commissioned a study to contribute to strategic guidance on areas where the impact of offshore wind energy development on Scottish seascapes is likely to be of least significance (Scott *et al*, 2005). In general, the east coast of Scotland was found to have a higher relative capacity for wind farm development than the west coast, as a result of its lower visibility ratings, open coastlines, and fewer designated landscapes. The findings of the seascape assessment are presented in Table 3.10 and Figure 7.5, and landscape designations are also shown in the figure.

Table 3.10 Seascape Sensitivity. Source: Scott *et al.* (2005).

Seascape Unit	Sensitivity	Capacity Rating
Berwick upon Tweed	Low - Medium	Higher
Firth of Forth	Medium	Med – Higher
East Fife / Firth of Tay	Medium	Med – Higher
North East Coast	Low – Medium	Higher

Key Issues

The relevant seascape units are judged to be of low to medium sensitivity and based upon the guidance presented in Table 3.11 only the Bell Rock STW site has the potential to have a minor-medium effect on seascape sensitivity, lying partially inside of the 13km coastal buffer (BMT Cordah, 2003).

Table 3.11 Effects of proposed development for different seascape unit sensitivities. Source: BMT Cordah (2003).

Seascape unit sensitivity	Significance of effect		
	Possible minor or no effect	Threshold to possible medium effect	Threshold of possible major effects
Low / no sensitivity	8km+ offshore	N/A	<8km offshore
Medium sensitivity	13km+ offshore	8-13km offshore	<8km offshore
High sensitivity	24km+ offshore	13-24km offshore	<13km offshore

Although wind farm sites located beyond the 13km buffer would not be expected to have major effects on seascape, landscape or visual character, sites will be visible beyond this buffer. As such, all of the proposed STW sites and development within parts of the Round 3 Zone may need to be included in a cumulative effects assessment.

Cumulative landscape assessment is well understood and can be undertaken using standard landscape and visual impact assessment (LVIA) techniques, such as Zones of Visual Influence mapping and use of viewpoint/photomontage analysis at visually sensitive locations. Developers should seek to undertake joint LVIAs based on a 'maximum development' scenario.

Socio-economics

Baseline Summary

Much of the open coastline between Aberdeen and Eyemouth is relatively sparsely populated although the Firths of Forth and Tay support major population centres (Edinburgh and Dundee respectively).

Industries such as agriculture, fishing and construction have traditionally been important in the Fife and Angus regions. Engineering, new technology and tourism industries have replaced declining traditional industries.

Key Issues

The development of the STW sites may have an effect on the following:

- Expenditure – supporting a multitude of companies supplying goods and services required to develop, operate and maintain the wind farm;
- Employment – direct development, construction and operations employment, as well as indirect employment further up the supply chain;
- Commercial fisheries; and
- Tourism and recreation.

Local infrastructure improvements, such as port expansion, are also likely to result. The economic impact will be most significant during the construction phase and given current programming for the development of sites, the impact will be spread over many years, and will conceivably extend up to 2020 and beyond. As a rule of thumb it is considered that for every megawatt installed, approximately £1 million of economic expenditure occurs (DTI, 2002). As well as economic benefits, wider beneficial effects will arise through the development of renewable energy, and will include reduced greenhouse gas emissions and energy consumption.

It is possible that specific sectors, such as commercial fisheries and tourism, will have concerns regarding the knock-on economic effects of wind farm development, resulting from, for example, restricted access to fishing grounds or altered visual character.

Assessment of effects can be undertaken on both a site-specific and multi-site basis, using available information on emissions reductions and economic return per MW installed.

Shipping and navigation

Baseline Summary

Shipping activity across the study area is described in Section 3.1.3 above.

Key Issues

The construction and operation of the STW sites may impact upon shipping and navigation in a number of ways, including:

- Temporary disturbance to regular shipping traffic due to the movement of installation vessels to and from the site during construction, and due to the location of wind turbines and subsea cables;
- Constriction of shipping routes due to exclusion of shipping from zones around each turbine / farm;

- Resulting increase in vessel density in unobstructed routes;
- Resulting increase in voyage distance / times;
- Increased navigational risk and collision risk due to the existence of wind turbines, and associated increased risk of pollution events;
- Visual obscuring of existing navigational markers; and
- Possible interference with vessel radar systems.

Cumulative effects are expected to arise given the close proximity of the STW sites and Round 3 Zone, and relatively high levels of activity associated with commercial ports in the Forth and Tay.

The main data requirement for assessing navigational issues, including cumulative issues, is for an up-to-date maritime traffic survey of each of the proposed sites (typically undertaken as part of individual site EIAs). Assessment requirements are specified by the Maritime and Coastguard Agency (MGN 371 – *Offshore Renewable Energy Installations – Guidance on UK Navigational Practice, Safety and Emergency Response Issues*). A requirement exists for each individual site and its immediate surroundings to be fully surveyed in order to detect marine activity that could be affected. Survey data is typically supplemented by analysis of longer-term statistical data on vessel activity and consultation with local experts and users.

In the case of the STW sites, a combined traffic survey covering all sites is expected to be more effective and ensure no gaps in spatial data coverage. Additional desk-based analysis of longer term data could be undertaken on a site-by-site basis and subsequently shared by developers as needed.

The development of any mitigation measures will need to be coordinated between sites to ensure, for example, that displaced traffic is not simply diverted away from one site but into another.

Commercial fisheries

Baseline Summary

Commercial fisheries activity across the study area is described in Section 3.1.2 above.

Key Issues

The potential effects on commercial fisheries resulting from wind farm construction and operation are as follows:

- Loss of access to fishing grounds during construction;
- Displacement to less profitable grounds;
- Concentration of fishing effort on remaining available grounds;
- As a result of the concentration of effort, the possibility of conflict between operators of different types of gear;
- Increased steaming times to fishing grounds;
- Potential reduced Catch Per Unit Effort as a result of displacement to less profitable grounds;
- Elevated running costs;
- Displacement of or reduction in, fish and shellfish resources due to the effects of wind farm installation and operation; and
- Positive effects, such as increases in biodiversity and biomass leading to increased catches.

In order to collate and interpret comprehensive fisheries data for the study area, and to allow an assessment of the potential for cumulative effects to arise, a multi-strand approach could be adopted. This may require:

- Analysis of Scottish Fisheries Protection Agency / Marine Fisheries Agency data (landings, overflight data, patrol vessel sightings, effort statistics, etc);
- Consultation with relevant Fishermens' Associations and individual fishermen;
- Port visits and assessment of catch / landings; and
- Possible dedicated quantification by observers of catch aboard vessels deploying gear types within specific development sites.

Once this data collection exercise has been undertaken as part of individual EIAs, the data can be shared in order to make an effective judgement on cumulative effects. Data sharing will be ongoing, with data being accumulated as the individual projects undertake their EIAs.

Military and aviation

Baseline Summary

Military and aviation activity across the study area is described in Sections 3.1.5 and 3.1.6 above.

Key Issues

The construction and operation of the STW sites may impact upon military and aviation activity in a number of ways, including:

- Interference with military flight patterns;
- Interference with radar systems (signal distortion causing loss of radar performance and detection of erroneous signals);
- Conflict with / disturbance of military practice and exercise activity taking place within PEXA.

The Ministry of Defence assesses proposals for wind farms on a case-by-case basis and therefore issues are usually considered to be site-specific. However, in the case of the east coast STW sites and the Round 3 Zone it will be necessary to consider cumulative effects, particularly on military flight activity and the safety of aircraft using RAF Leuchars.

Question to Reader:

Q5. Do you agree that all the issues listed above in Section 3.2 should be 'scoped in'? If not, please provide comments.

3.3 Summary

At this stage it is thought that a future CEA would take account of the effects listed in Table 3.12 and Table 3.13 below, taking account of both 'cumulative' and 'in-combination' effects.

Following consultation and a more detailed formal scoping exercise, undertaken on a site-specific basis, it may be possible to further define the scope of the CEA and identify more specific interactions between particular sites, thus eliminating the need for *all* developers to consider *all* potential effects.

Table 3.12 Cumulative Effects

Wind Farm Sites	Receptors to be Further Assessed	Receptors 'Scoped-out'
Inch Cape Bell Rock Neart na Gaoithe Forth Array Firth of Forth Round 3 Beatrice STW site Beatrice Demonstrator Moray Firth Round 3 Aberdeen Offshore Wind Farm Blyth Offshore Wind Farm	• Hydrodynamic processes and geomorphology • Marine mammals • Natural fishery resource • Ornithology • Designated sites • Shipping and navigation • Commercial fisheries • Seascape, landscape and visual character • Military and aviation • Socio-economics	• Water and sediment quality • Marine benthos and epibenthos • Marine archaeology • Tourism and recreation

Table 3.13 In-Combination Effects

Other Projects and Activities	Receptors to be Further Assessed (for one or more STW sites)	Brief Justification
Commercial fisheries	Natural fishery resources	Fisheries constrained or pushed into new areas leading to changes in the targeting of natural resources
	Shipping and navigation	Fisheries constrained or pushed into new areas with potential for increased interaction with other shipping
	Socio-economics	Fisheries constrained or pushed into new areas with potential for effects on current fishing effort and associated costs (e.g. as a result of increased steaming time)
Shipping and navigation	Marine mammals	Shipping activity constrained or pushed into new areas, with potential effects of associated noise on marine mammals
	Natural fishery resources	Shipping activity constrained or pushed into new areas, with potential effects of associated noise on sensitive fish species
	Commercial fisheries	Shipping activity constrained or pushed into new areas, with potential loss of (or loss of access to) fishing grounds
	Socio-economics	Shipping activity constrained or pushed into new areas with potential for effects on fuel use and journey times
Waterfront and coastal development	Designated sites	Multiple developments may increase pressure on designated site features
	Seascape / landscape	Multiple developments may impact landscape, seascape and visual character
	Socio-economics	Multiple developments may result in more significant socio-economic effects
Airspace and radar	Military and aviation (and radar)	Multiple developments may affect existing activities
Military activities	Military and aviation (and radar)	Multiple developments may affect existing activities
Cables and pipelines	None	N/A
Oil and gas infrastructure	None	N/A
Marine aggregate extraction	None	N/A
Dredging and sea disposal	None	N/A
Tourism and recreation	None	N/A

4 FURTHER INVESTIGATION OF KEY EFFECTS

4.1 Future Assessment Recommendations

The methodologies by which cumulative effects will be assessed will be agreed with consultees as part of future scoping exercises undertaken by the FTOWDG.

Table 4.1 below presents the initial thoughts of the FTOWDG on approaches to cumulative effects assessment. Recommendations are made with regard to where data gathering and assessment may best be undertaken on an individual site basis, or collaboratively across a wider study area that encompasses more than one of the STW sites.

It is thought that cumulative effects will need to be assessed across varying study areas, set on a receptor-by-receptor basis. For example, when considering cumulative effects on seascape, landscape and visual character, a study area can be set on the basis of recognised limits of visual significance. In this case, in line with best practice guidance, 35 km radius buffers would be set around each STW sites and areas of overlapping effects would be identified. Initial thoughts on study areas are also presented in Table 4.1.

In light of the recent publication of guidance relating to the assessment of the cumulative effects of offshore wind farms on birds, the FTOWDG have commissioned AMEC to consider in further detail the approach to cumulative effects assessment for ornithology and marine mammals. A summary of AMEC's outputs are provided in Sections 4.1.1 and 4.1.2.

Table 4.1 Assessment Recommendations.

Parameter	Key Issue Summary	Approach to Assessment
Hydrodynamic processes and geomorphology	• Alteration of hydrodynamic conditions • Changes to sedimentary environment • Effects on sedimentary seabed features	Likelihood of cumulative effects thought to be negligible. However, given logistical benefits, FTOWDG are undertaking a collaborative oceanographic study, and the resulting data will be used to inform individual EIAs.
Marine mammals	• Disturbance as a result	Assessment to adhere to the approach detailed in

Parameter	Key Issue Summary	Approach to Assessment
	of elevated construction and operational sound • Collision risk • Barrier and displacement effects • Reduction of feeding resource	recently published guidance (King *et al*, 2009) – for further detail see Section 4.1.2. It is proposed that a study area covers waters from Peterhead in the north to the Farne Islands off Northumberland in the south to take account of species mobility.
Natural fishery resources	• Disturbance as a result of elevated construction and operational sound • Barrier and displacement effects • Disruption of spawning and nursery grounds	Resources will be characterised on a site-specific basis as part of the EIA process. Developers may then pool data in a generic document covering a wider study area. This document will provide both site-specific data and broad-scale assessment of the natural resources present, and developers can pull relevant information on cumulative effects from this document into their EIAs. A study area will be set on the basis of consultation with relevant bodies, will encompass all STW sites, and for practical purposes is likely to follow ICES rectangle boundaries. The study area will also need to take account the potential spatial extent of noise disturbance during construction.
Ornithology	• Disturbance effects on breeding and foraging seabirds • Habitat loss • Barriers to migrating birds • Collision risk	Assessment to adhere to the approach detailed in recently published guidance (King *et al*, 2009) – for further detail see Section 4.1.1. It is proposed that a study area covers waters from Peterhead in the north to the Farne Islands off Northumberland in the south to take account of bird migration and general species mobility.
Designated sites	• Effects on site conservation objectives and status	It is expected that the requirement for Appropriate Assessment will be determined on a site-by-site basis. The Appropriate Assessment process requires the consideration of in-combination effects. Any assessment will be supported by the sharing of information by developers.
Shipping and navigation	• Disturbance to shipping • Increased navigational risk	It would be cost-effective for developers to commission a shared maritime traffic survey to be undertaken across wider study area encompassing all STW sites and Zone 2 R3 developments and an appropriate buffer.
Commercial fisheries	• Displacement of activity (and associated costs) • Displacement of commercial fish and shellfish resource • Increased catches as a result of positive effects on biodiversity/biomass	Developers will seek to cooperate with data collection and analysis during EIA so that information can be pooled to make an effective judgement on cumulative effects. This will be a progressive process, with data accumulated as individual projects undertake EIA. A study area will be set on the basis of consultation with relevant bodies, will encompass all STW sites and R3 Zone 2 developments, and for practical purposes is likely to follow ICES rectangle boundaries.
Seascape, landscape and visual character	• Effects on landscape and seascape character	Adherence to established practice in relation to Seascape and Visual Impact Assessment, which takes account of cumulative effects (e.g. DTI, 2005). 35 km radius study areas around each STW site will identify areas of overlapping effects (DTI, 2005).
Military and aviation	• Effects on military flight activity and safety • Effects on radar • Conflict with PEXA activities	Joint consultation with the Ministry of Defence and Civil Aviation Authority and shared radar effects study (where information is not commercially sensitive). Consultation and advisory zones delineate the areas around civilian and military radar in which potential effects need to be taken into account (e.g. see DECC, 2009, Appendix 3h), though a specific radar effects study area will be determined through consultation.
Socio-economics	• Effects on expenditure and employment	It is likely that assessment of effects will be undertaken on a site-specific basis, and based on a review of available literature relating to the socio-economic effects of offshore wind farm development, with developers subsequently sharing information to enable an informed assessment of cumulative effects within their EIAs.

Question to Reader:

Q6. Do you think all of the 'key issues' have been identified in Table 4.1?

Q7. Do you have any comments to make on the proposed approach to assessment outlined in Table 4.1?

4.1.1 Approach to Assessment – Ornithology

COWRIE (Collaborative Offshore Wind Research Into The Environment) has recently issued new guidance on cumulative impact assessment for ornithology (King *et al*, 2009). To ensure standardisation and allow information exchange between developers and consultees, it is proposed that each of the FTOWDG developers adheres to the assessment methodology outlined in this guidance.

The guidance proposes, at the scoping stage, to seek:

- Agreement on key species likely to be at risk;

- Identification of key sites and their interest features which may be affected (SPAs, Ramsars, SSSIs and their populations likely to be affected by offshore wind farm development);
- Definition of relevant populations and the geographical area over which cumulative impacts are to be considered;
- Agreement of approaches to, and methods of, data collection; and
- Agreement of data analysis methods and impact assessment.

The FTOWDG have commenced the first stage of scoping, using 'key features' tables to identify species which may be at risk of cumulative effects. The highly detailed tables have not been included in this discussion document, but will be provided to relevant consultees for comment. A summary of the findings is provided here.

The key features tables define:

- Species which may be found on each site;
- Regional SPAs plus their qualifying and assemblage features;
- Important non-SPA species which may be affected; and
- Other projects which may have cumulative ornithological effects.

Species tables were compiled using public domain sources (e.g. JNCC surveys, SPA data sheets, Strategic Environmental Assessment data for regional seas, etc.) as no site-specific surveys have yet been undertaken.

SPAs were identified within a provisional area agreed between the developers and The Crown Estate ranging between Peterhead in the north and The Farne Islands in the south. It should be noted, that for birds, the size of the study area used was more extensive than that shown in Figure 7.1 to allow for the effects of migration and the general mobility of the species. The extent of the final area to be incorporated will be the subject of further discussion with Scottish Natural Heritage.

Cross-tabulation between SPA and site species was carried out to produce a long-list of species, including non-SPA species, which may be susceptible to cumulative effects. This was then reviewed using a range of criteria to produce the short list which is presented in Table 4.2.

The main criteria for review and inclusion in the list included the species' status (e.g. as an SPA feature, Annex 1 or BAP species); its ecology or behaviour (e.g. whether it has a foraging range which is likely to include the wind farm area and/or spends a relatively large proportion of its flight time at rotor height); and, the species sensitivity to offshore wind farms derived from published data (e.g. Garthe & Hüppop, 2004).

The list was finally reviewed against the bird species likely to be present in the adjacent Round 3 Zone as identified in the Offshore Energy SEA (DECC, 2009) and Langston (2009).

Following this method, 28 SPA species, plus three non-SPA species were identified as having the potential to experience significant cumulative effects. The list may be further refined pending the outcome of further discussions and field surveys. The species identified in Table 4.2 are those it is proposed to consider in future CEA.

Table 4.2 Species which may be susceptible to cumulative effects.

Arctic tern	Guillemot	Roseate tern
Black throated diver*	Herring gull	Sandwich tern
Common tern	Kittiwake	Shag
Eider	Lesser black backed gull	Shelduck
Gannet	Long tailed duck	Slavonian grebe
Great crested grebe	Pink footed goose	Velvet scoter
Greater black-backed gull*	Puffin	Whooper swan
Greater scaup	Red breasted merganser	
Greylag goose	Red-necked grebe*	

* Species not listed as qualifying or assemblage species for regional SPAs.

4.1.2 Approach to Assessment – Marine Mammals

Given the applicability of the COWRIE methodology to mobile and wide-ranging species, the approach described in Section 4.1.1 has also been applied to the identification of cetacean and other marine mammal species that may be susceptible to cumulative effects. As stated above, the detailed 'key features' tables are not included in this discussion document, but will be provided to relevant consultees for comment. Table 4.3 identifies those species to be considered in future CEA.

Table 4.3 Species which may be susceptible to cumulative effects.

Common seal	Grey seal	Harbour porpoise
Bottlenose dolphin *		

* assuming the range of the Moray Firth population extends as far south as the STW sites.

5 DOCUMENT CONSULTEES

It should be noted that no formal consultation with statutory authorities or other relevant stakeholders has been undertaken by the FTOWDG to date in relation to cumulative effects.

The FTOWDG at this time wish to undertake targeted consultation on this Discussion Document with those organisations listed in Table 5.1.

A consultee response template is provided at the end of this document.

Table 5.1 Discussion document consultees.

Consultee	Role
Scottish Natural Heritage	With regards to renewable energy casework SNH aims to: • Maintain role as a key advisor on natural heritage implications; • Provide environmental information; • Analyse impacts objectively and be constructive in the scope for mitigation; and • Help Scottish Ministers in considering natural heritage issues.
Historic Scotland	An Executive Agency of the Scottish Government charged with safeguarding Scotland's historic environment.
Scottish Government Energy Consents Unit	Responsible under the 1989 Electricity Act for processing applications for Section 36 and Section 37 consent. Also acts an initial point of contact for associated applications under the Food and Environment Protection Act (FEPA) and Coastal Protection Act (CPA).
Department for Energy and Climate Change	The Department of Energy and Climate Change is responsible for all aspects of UK energy policy, and for tackling global climate change on behalf of the UK.
Marine Scotland	A Directorate of the Scottish Government, managing Scotland's seas for prosperity and environmental sustainability. Responsible for

Consultee	Role
	determining FEPA licences.
Northern Lighthouse Board	The General Lighthouse Authority for Scotland and the Isle of Man. It is a non-departmental public body responsible for marine navigation aids around coastal areas.
Maritime and Coastguard Agency	Ensure safety at sea, responsible for implementing British and International maritime law and safety policy.
Natural England	Ensure natural environment is conserved, enhanced and managed for the benefit of present and future generations, thereby contributing to sustainable development. A relevant consultee as a result of potential cross-border environmental effects.
Joint Nature Conservation Committee	Statutory advisor to the Government on UK and international nature conservation and provide guidance relevant to offshore wind development (e.g. protected species disturbance guidance).
East Lothian Council	Committed to ensuring development takes place in a sustainable manner. Possible consenting role in relation to onshore project elements (e.g. substation) and a statutory consultee in the Section 36 consenting process.
Fife Council	Committed to ensuring development takes place in a sustainable manner. Possible consenting role in relation to onshore project elements (e.g. substation) and a statutory consultee in the Section 36 consenting process.
Dundee City Council	Committed to ensuring development takes place in a sustainable manner. Possible consenting role in relation to onshore project elements (e.g. substation) and a statutory consultee in the Section 36 consenting process.
Angus Council	Committed to ensuring development takes place in a sustainable manner. Possible consenting role in relation to onshore project elements (e.g. substation) and a statutory consultee in the Section 36 consenting process.
Royal Society for the Protection of Birds Scotland	Responsibility to protect birds and the environment.
British Trust for Ornithology	The Trust is an independent, scientific research trust, investigating the populations, movements and ecology of wild birds in the British Isles.
Scottish Fishermen's Federation	Preserve and promote the collective interests of Fisherman's Associations and the fishing industry.
Chamber of Shipping	The Chamber works with Government, Parliament, international organisations, unions and the general public on behalf of the sectors that make up the shipping industry to ensure that the UK continues to be a global centre for shipping business.
Ministry of Defence / Defence Estates	Safeguarding of MOD activities, land and infrastructure.
National Air Traffic Services	Provision of air traffic control.
Civil Aviation Authority	Support safe and efficient operations by regulating navigation and communications infrastructure for UK airspace.
Highlands and Islands Airports Ltd	The company's purpose is to maintain the safe operation of its airports, and to support economic and social development in the Highlands and Islands. HIAL currently operates 10 airports, including Dundee Airport.
Forth Ports	Control navigation within the Firths of Forth and Tay.
Scottish Environment Protection Agency	Statutory consultee in the Section 36 consenting process, and Section 37 applications. Responsible for controlling discharges to surface water, groundwater and tidal waters out to a 3-mile limit. Provided information regarding potential flooding.
Health and Safety Executive	Aims to protect people against the risks to health or safety arising out of work activities.
Scottish Inshore Fisheries Groups	Manage Scotland's inshore fisheries and give commercial inshore fishermen a voice in wider marine management developments.

6 REFERENCES

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7 SUPPORTING FIGURES

All supporting figures are presented below and are cross-referenced within the document text.

Figure 7.1 Initial Study Area (set for Discussion Document only)

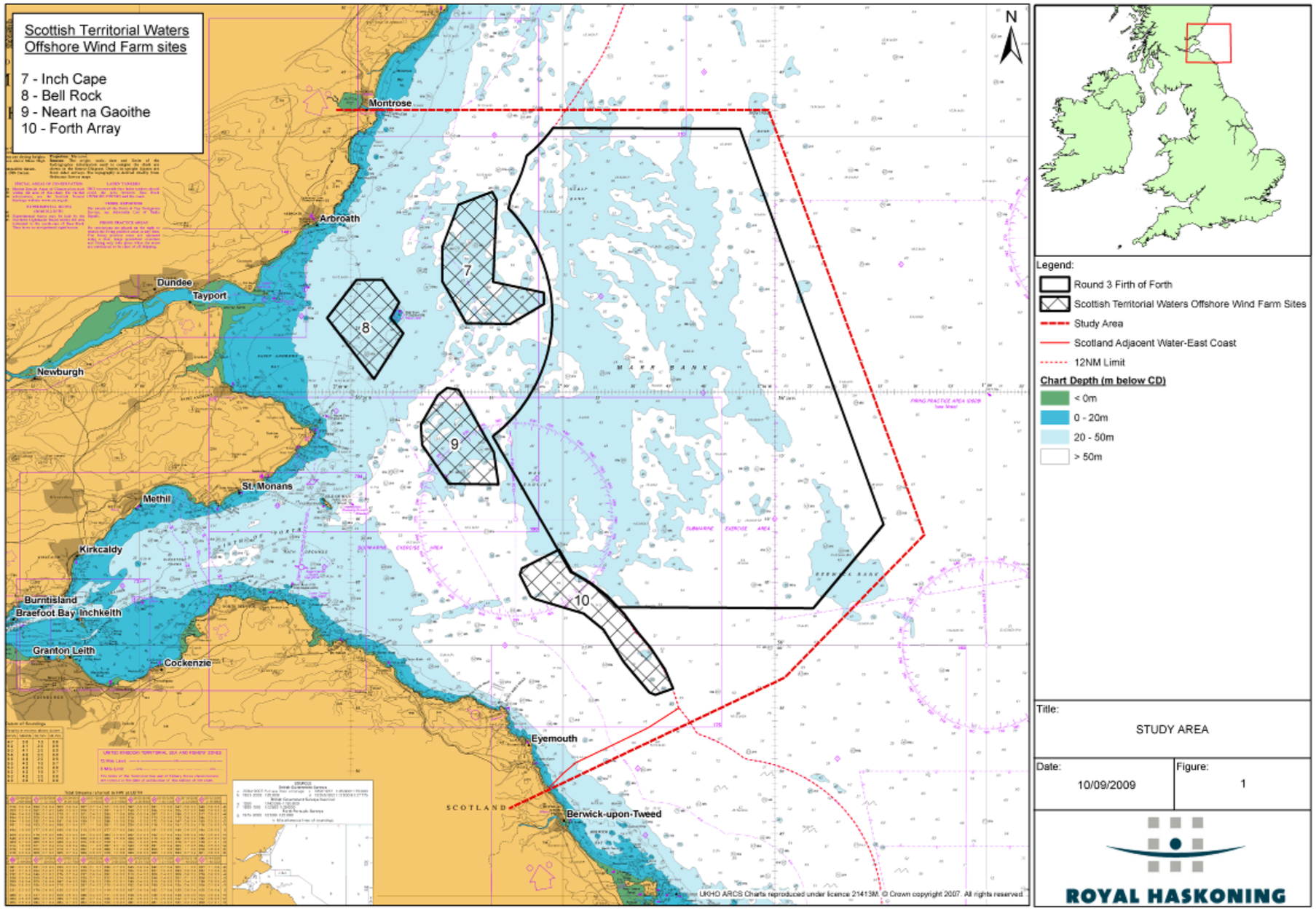


Figure 7.2 Commercial Fisheries Activity (vessels >15m in length)

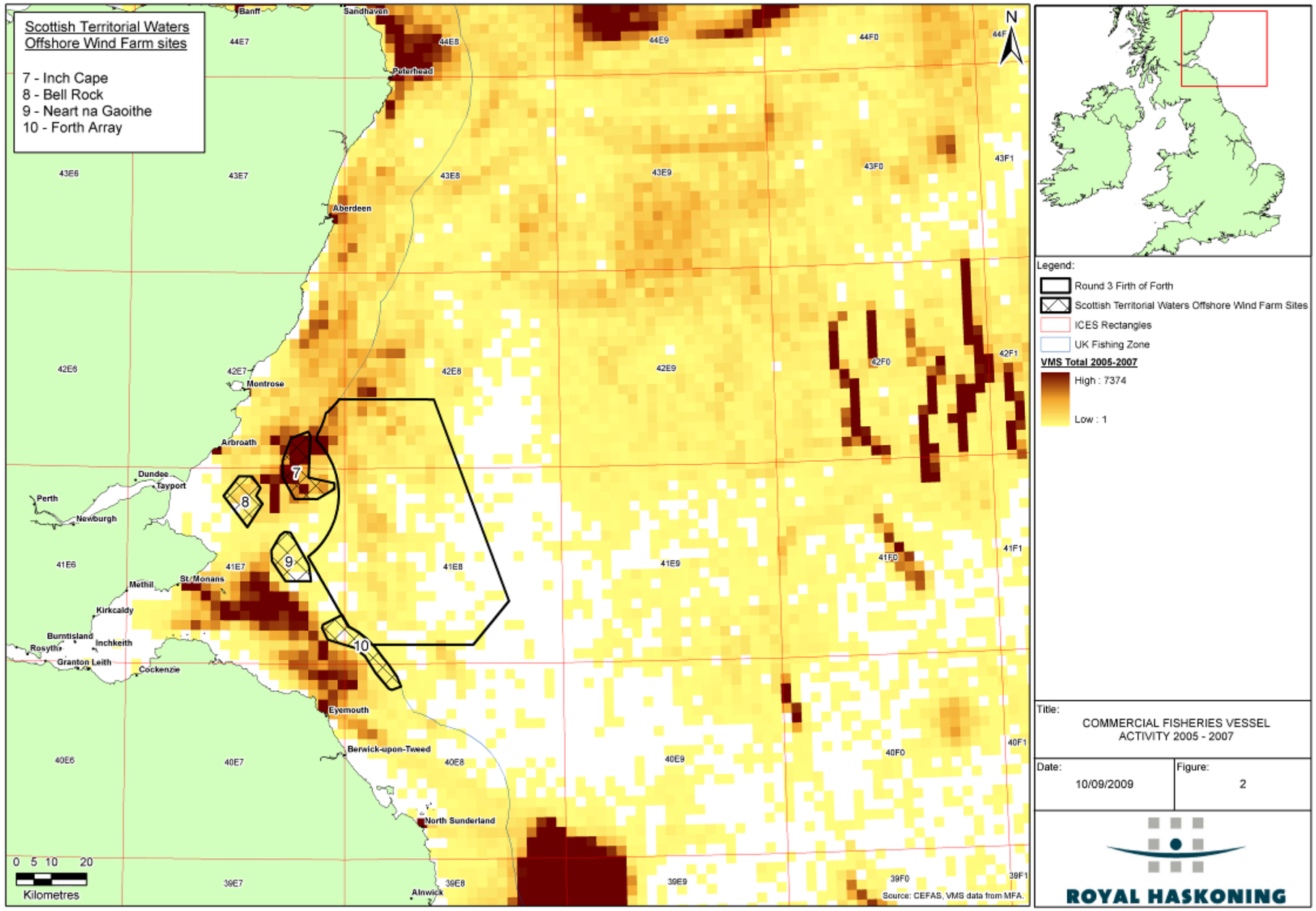


Figure 7.3 Shipping Activity (vessels > 100 tonnes)

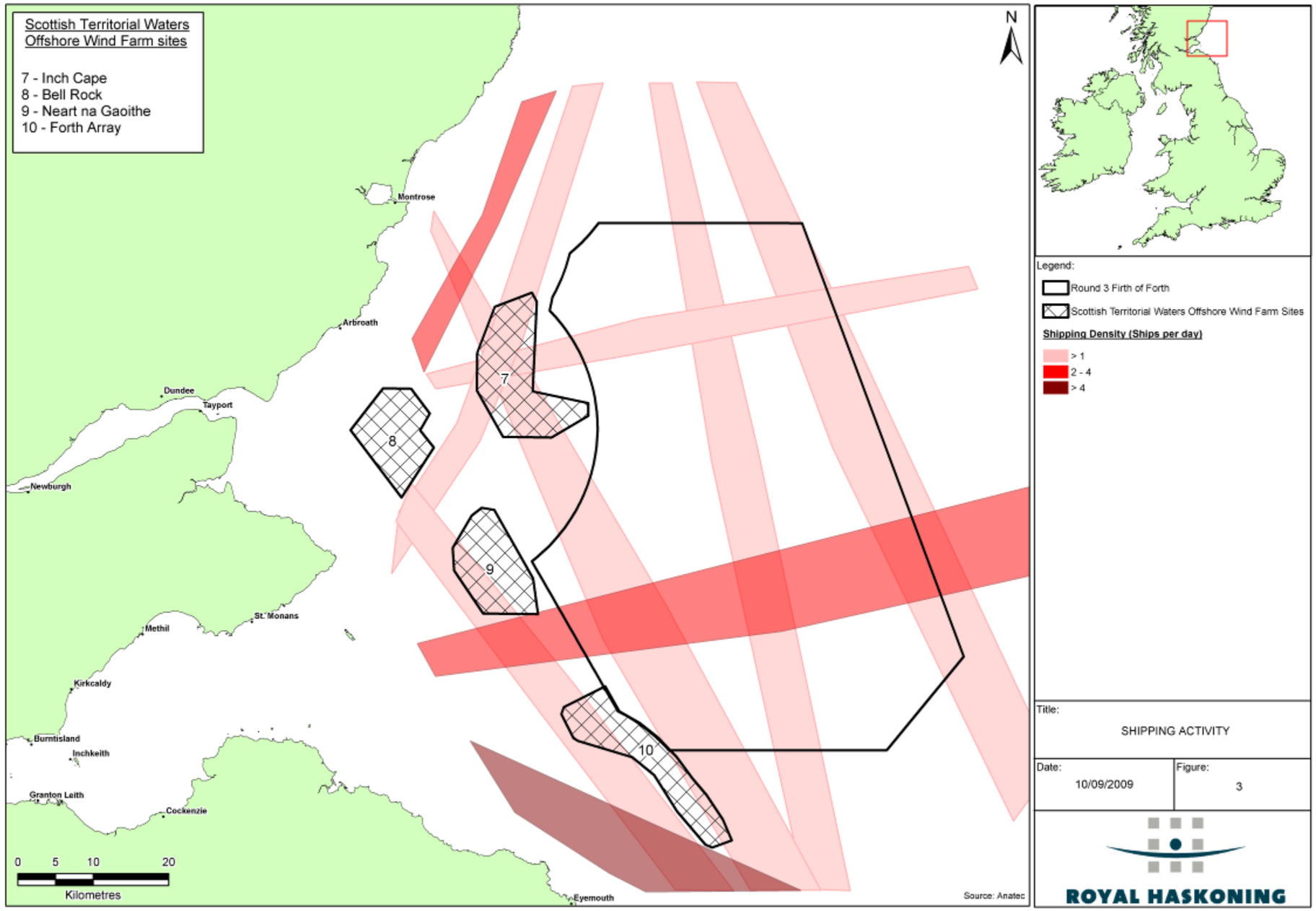


Figure 7.4 Other Human Activities

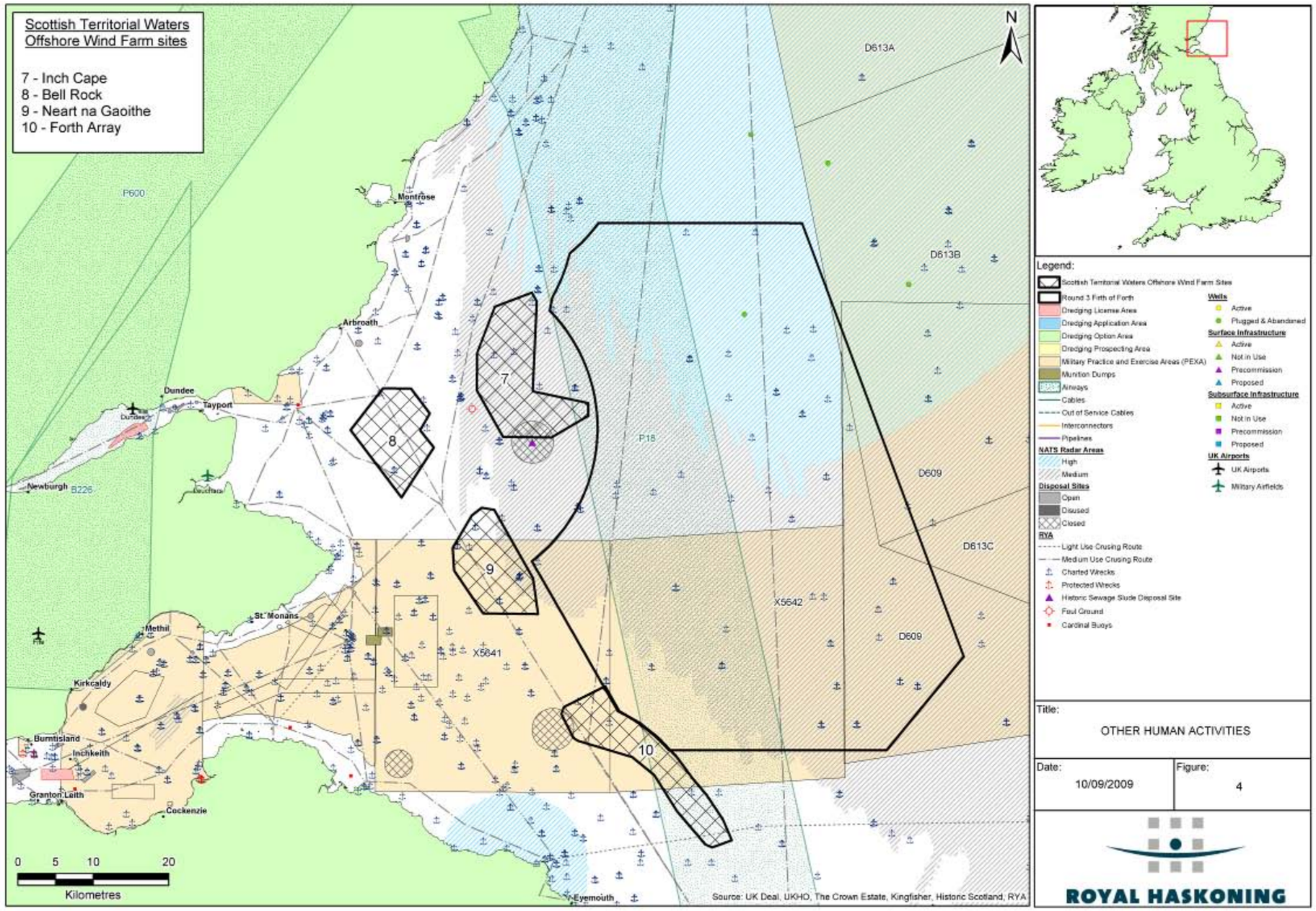


Figure 7.5 Seascape Considerations

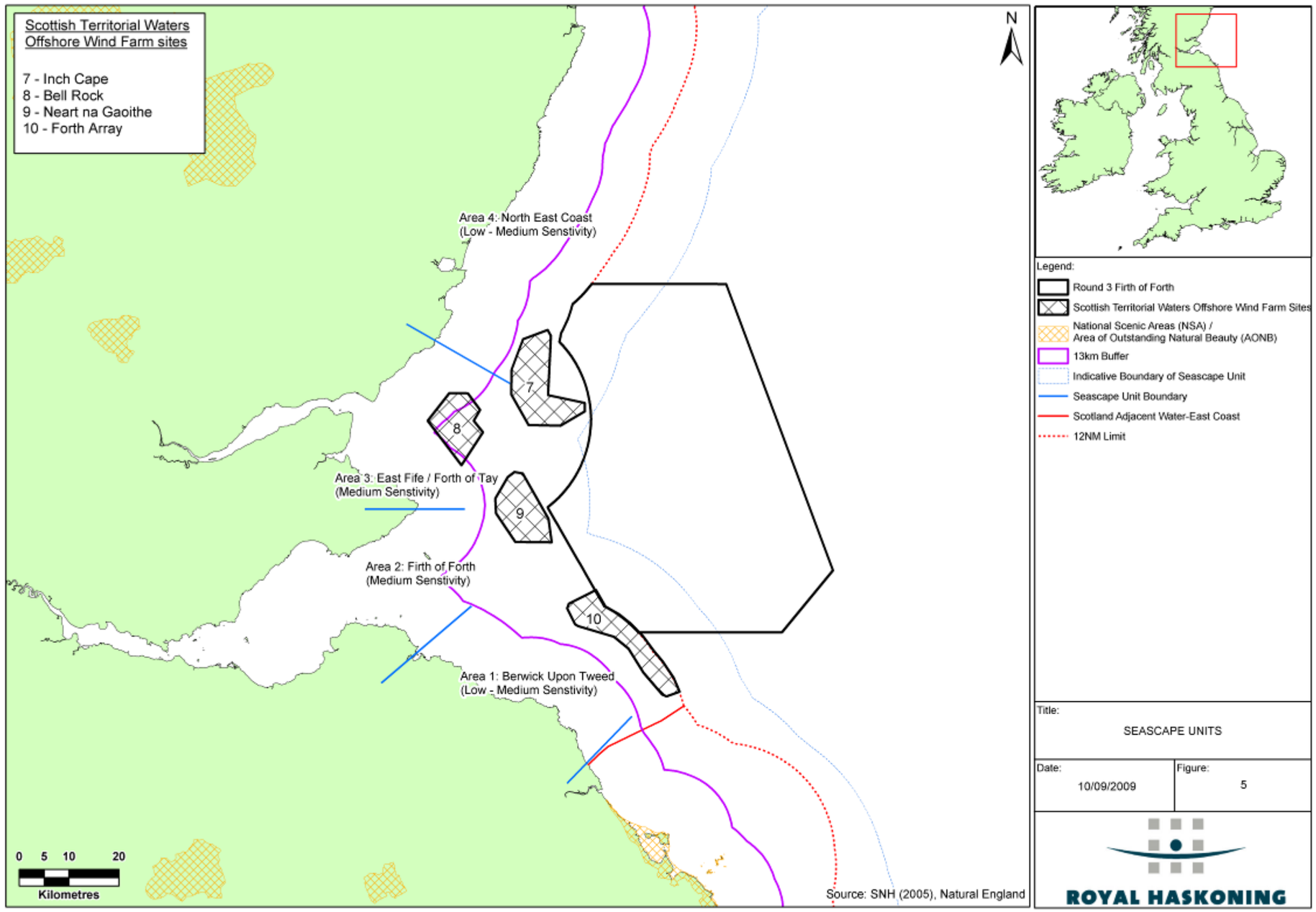


Figure 7.6 Fish Spawning Grounds (UK Biodiversity Action Plan species)

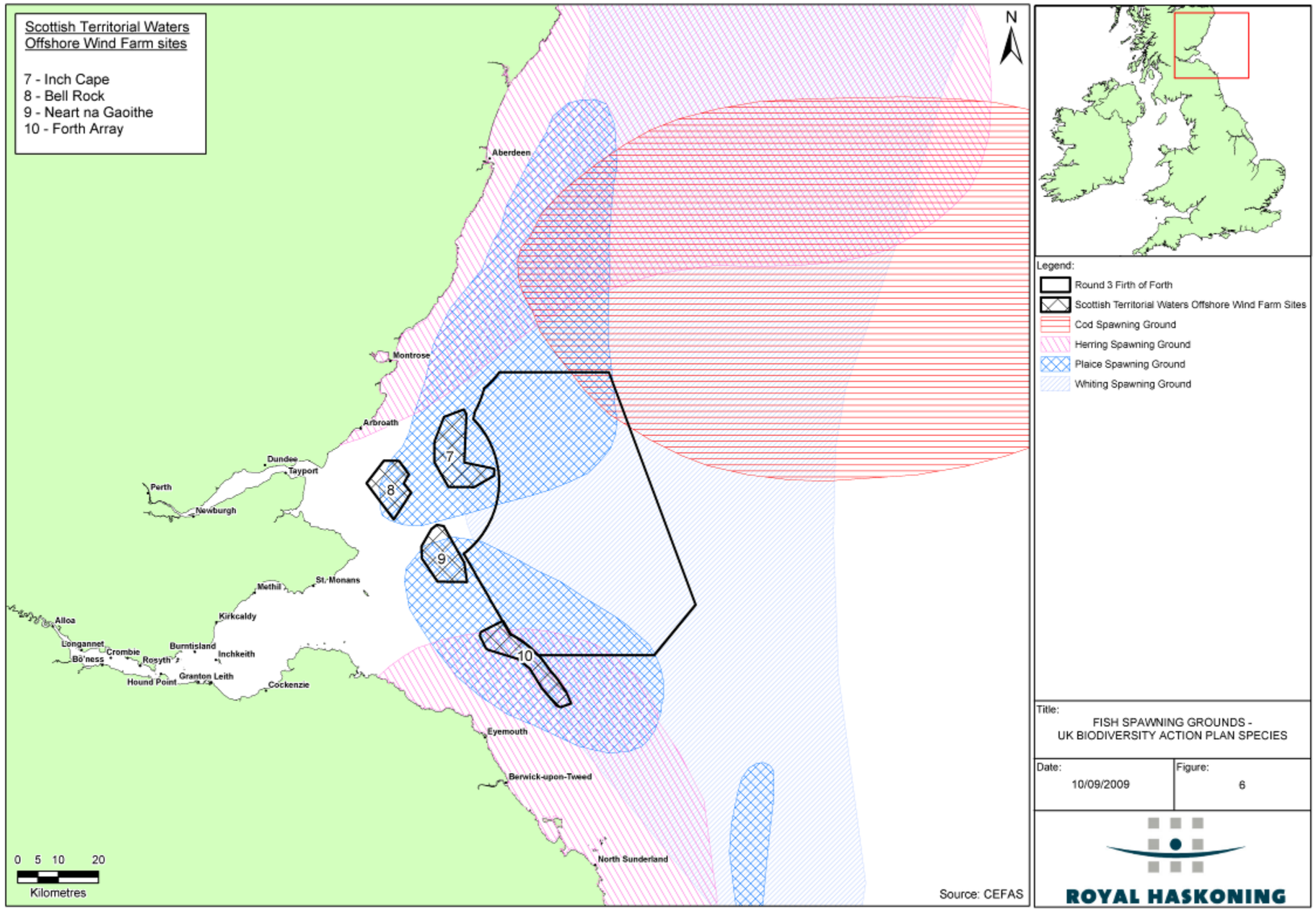


Figure 7.7 Fish Spawning Grounds (Other Species)

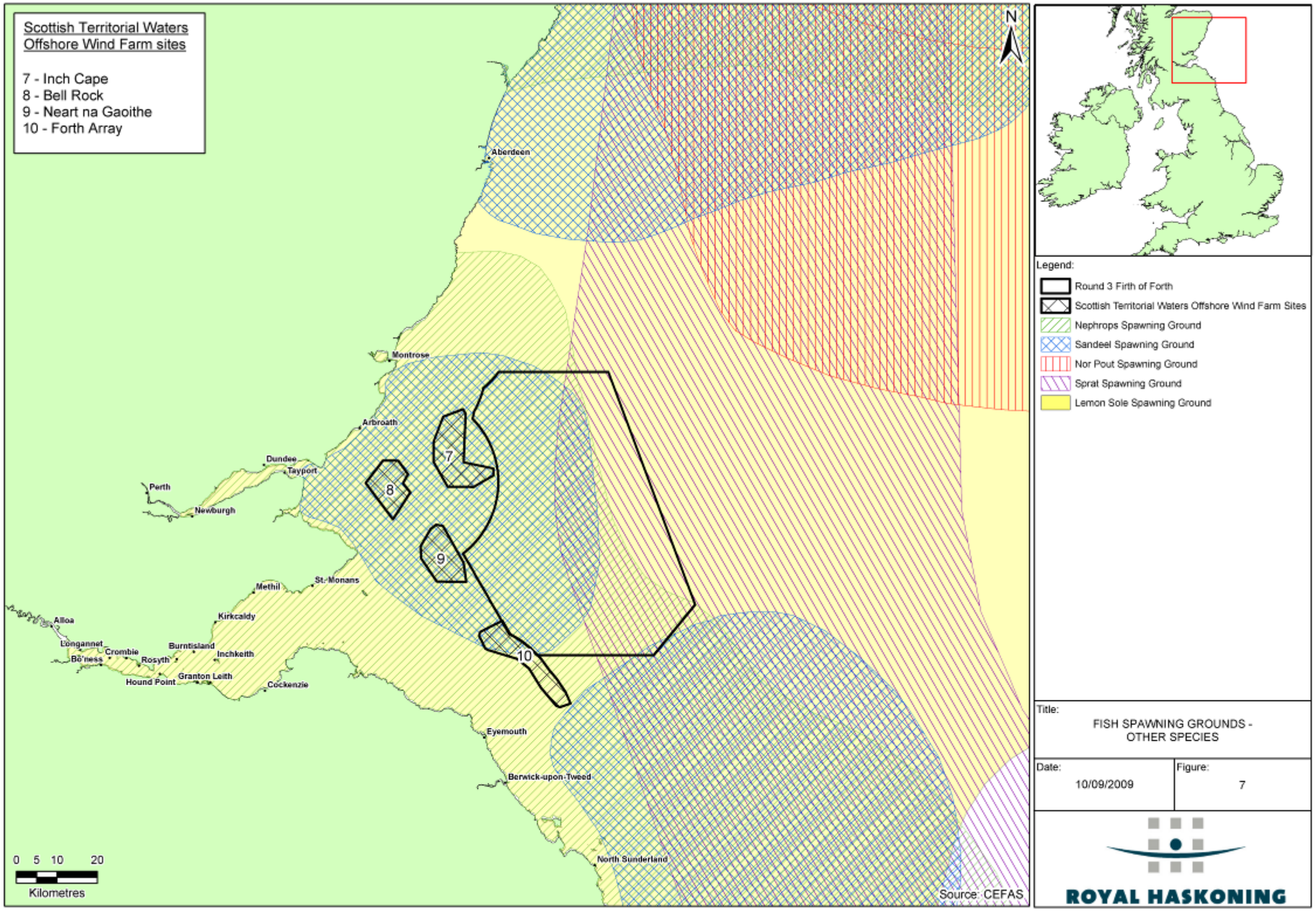


Figure 7.8 Fish Nursery Grounds

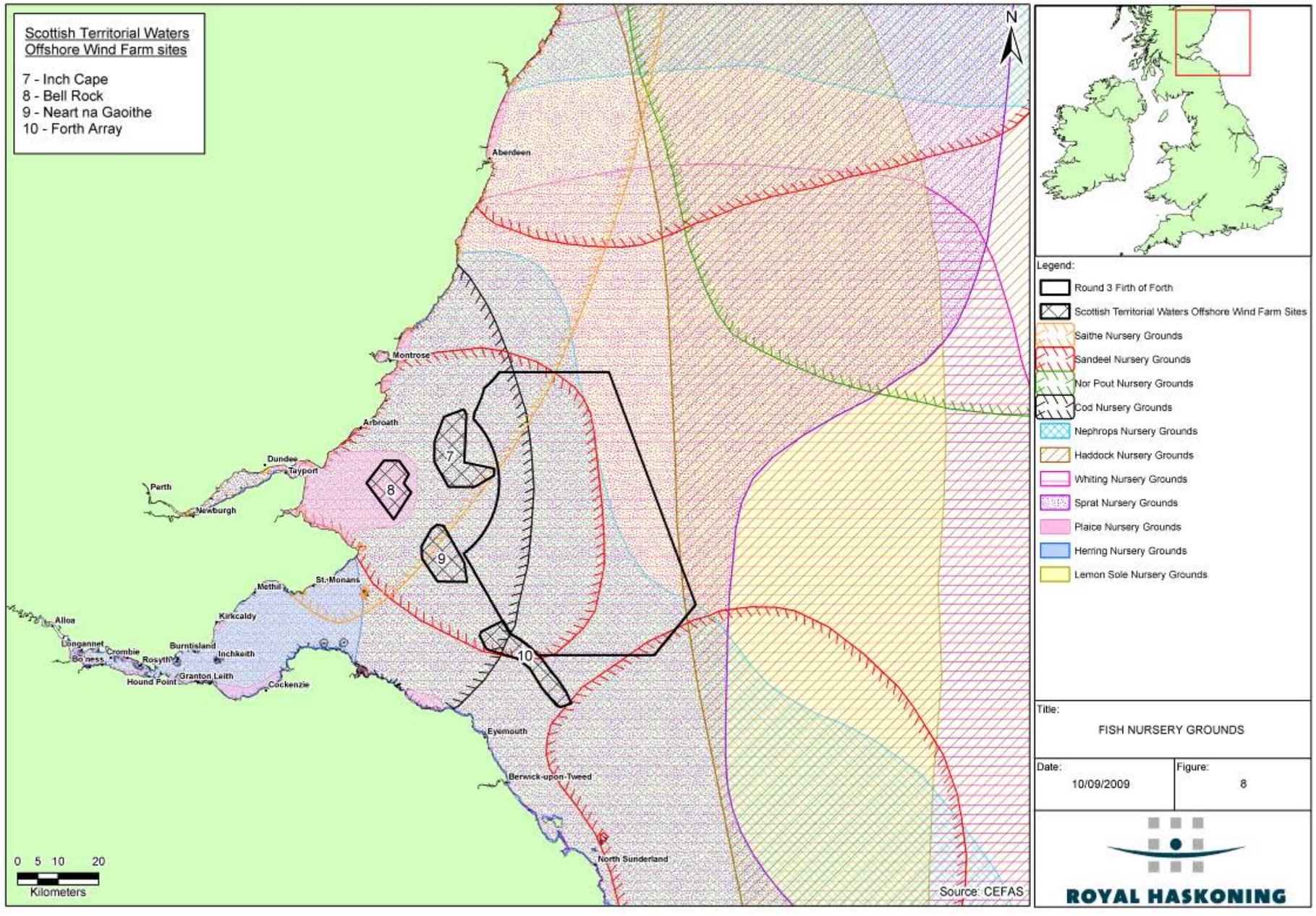
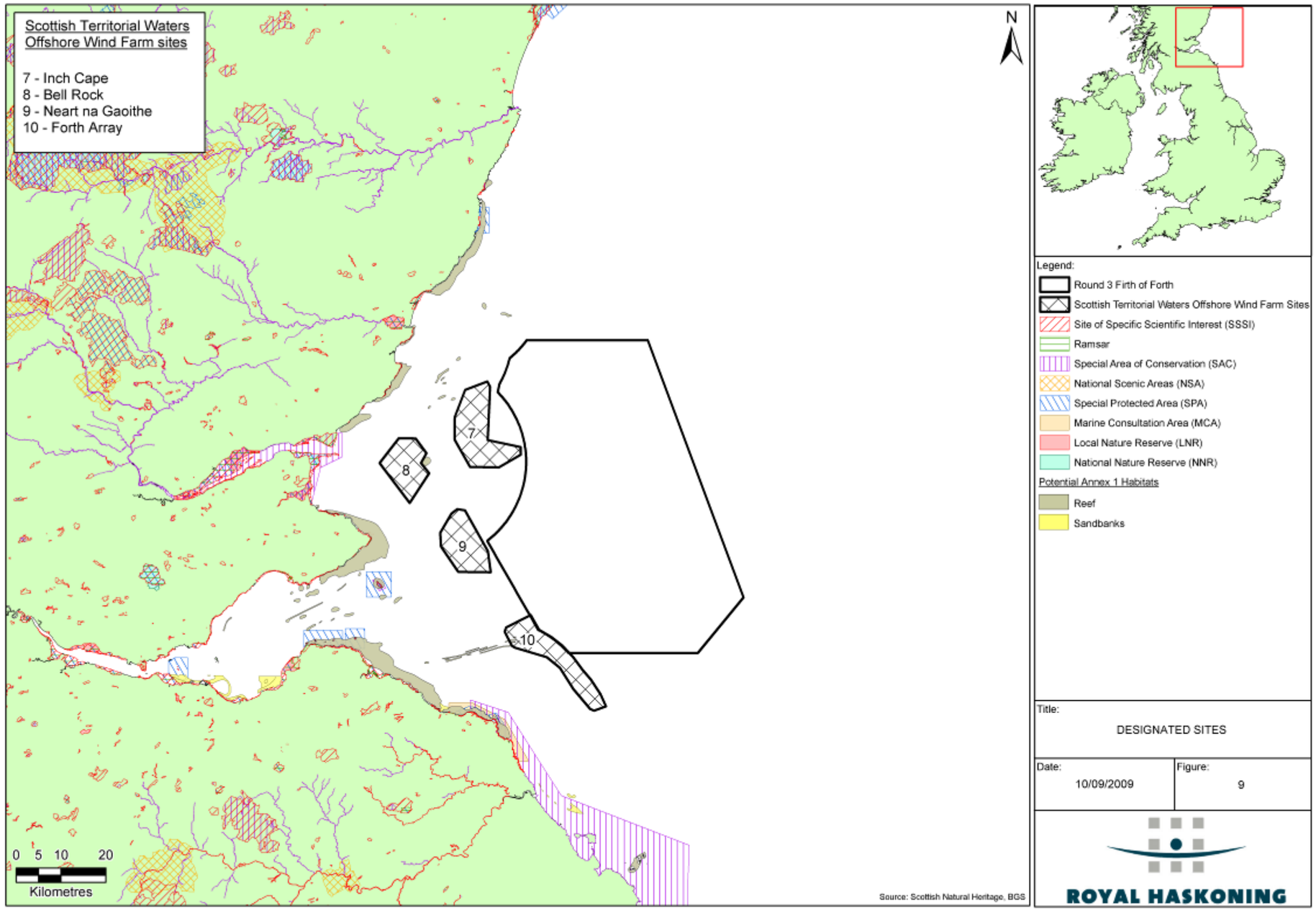


Figure 7.9 Designated Sites



Consultee Response Template

We would be pleased to receive your views on this Discussion Document. In particular we are interested in your responses to the questions below, but would also welcome any additional comments you may have.

Please complete the template below and return your response by 3 weeks after receipt of the document to:

Forth and Tay Developers Group, care of:

Sarah Wright, Royal Haskoning, Environment Division, 126 West Regent Street, Glasgow, G2 2BH
Email: s.wright@royalhaskoning.com
Fax: 0141 222 5771

Q1. Do you agree with our definition of cumulative and in-combination effects? If not, what would you propose (please provide reasoning / a reference)?

Q2. Are there any other receptors relevant to cumulative or in-combination effects that should be included in this document?

Q3. Are there any other activities or projects that should be included in this document as giving rise to potential in-combination effects?

Q4. Do you agree that the issues listed in Table 3.6 should be 'scoped out'? If not, please provide comments.

Q5. Do you agree that the issues listed in Section 3.2 should be 'scoped in'? If not, please provide comments.

Q6. Do you think all of the 'key issues' have been identified in Table 4.1?

Q7. Do you have any comments to make on the proposed approach to assessment outlined in Table 4.1?

Any other comments: