Department for
Business, Energy
& Industrial Strategy

OFFSHORE OIL & GAS LICENSING 32ND SEAWARD ROUND

Habitats Regulations Assessment

Stage 1 – Block and Site Screenings

November 2019

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Contents

1 Introduction

1.1 Background and overview of plan

The plan/programme covering this and future seaward licensing rounds has been subject to a Strategic Environmental Assessment (OESEA3), completed in July 2016. The SEA Environmental Report includes detailed consideration of the status of the natural environment and potential effects of the range of activities which could follow licensing, including potential effects on conservation sites. The SEA Environmental Report was subject to an 8 week public consultation period following which a post-consultation report was produced. The post-consultation report summarises the comments received and provides further clarifications which has enabled the decision to adopt the plan/programme. This decision has allowed the Oil & Gas Authority (OGA) to progress with further seaward oil and gas licensing rounds. BEIS 2018 documents a review of the OESEA3 Environmental Report undertaken to assess the continued currency of the information base of the SEA, its conclusions and recommendations and suitability to underpin continued leasing and licensing in relevant UK waters.

In August 2019 the OGA offered 796 Blocks for licensing as part of a 32nd Seaward Licensing Round covering mature and frontier areas of the UK continental shelf (UKCS).

The exclusive rights to search and bore for petroleum in Great Britain, the territorial sea adjacent to the United Kingdom and on the UKCS are vested in the Crown and the *Petroleum Act 1998* (as amended) gives the OGA the power to grant licences to explore for and exploit these resources. Offshore licensing for oil and gas exploration and production commenced in 1964 and has progressed through a series of Seaward Licensing Rounds. A Seaward Production Licence grants exclusive rights to the holders “to search and bore for, and get, petroleum” in the area covered by the Licence but it does not constitute any form of approval for activities to take place in the Blocks, nor does it confer any exemption from other legal or regulatory requirements. Offshore activities are subject to a range of statutory permitting and consenting requirements, including, where relevant, activity-specific Appropriate Assessment (AA) under Article 6(3) of the Habitats Directive (Directive 92/43/EC).

The *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) implement the requirements of Articles 6(3) and 6(4) of the Habitats Directive with respect to oil and gas activities in UK territorial waters and on the UK Continental Shelf. The *Conservation of Offshore Marine Habitats and Species Regulations 2017 cover* other relevant activities in offshore waters (i.e. excluding territorial waters). Within territorial waters, the Habitats Directive is transposed into UK law via the *Conservation of Habitats and Species Regulations 2017* in England and Wales, the *Conservation (Natural Habitats, &c.) Regulations 1994* in Scotland (for non-reserved matters), and the *Conservation (Natural Habitats, &c) Regulations (Northern Ireland) 1995* (as amended) in Northern Ireland.

1.2 Purpose

As the petroleum licensing aspects of the plan/programme are not directly connected with or necessary for nature conservation management of European (Natura 2000[1]) sites, to comply with its obligations under the relevant regulations, the Department for Business, Energy and Industrial Strategy[2] (BEIS) is undertaking a Habitats Regulations Assessment (HRA).

In this HRA, the Department has applied the Habitats Directive test[3] (elucidated by the European Court of Justice in the case of Waddenzee (Case C-127/02)[4]) which is:

> *…any plan or project not directly connected with or necessary to the management of the site is to be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives if it cannot be excluded, on the basis of objective information, that it will have a significant effect on that site, either individually or in combination with other plans or projects.*
>
> *…where a plan or project not directly connected with or necessary to the management of a site is likely to undermine the site's conservation objectives, it must be considered likely to have a significant effect on that site. The assessment of that risk must be made in the light inter alia of the characteristics and specific environmental conditions of the site concerned by such a plan or project.*

1.3 Approach to screening

This screening assessment is the first stage of the HRA to determine whether licensing of any of the Blocks offered in the 32nd Seaward Round may have a significant effect on a relevant site, either individually or in combination[5] with other plans or projects. The screening assessment has been undertaken in accordance with the European Commission Guidance (EC 2000) and with reference to other guidance and reports, including the Habitats Regulations Guidance Notes (English Nature 1997, Defra 2012, SEERAD 2000), SNH (2015), the National Planning Policy Framework (MHCLG 2019[6]), English Nature report, No. 704

[1] This includes Special Areas of Conservation (SAC) and Special Protection Areas (SPA), and potential sites for which there is adequate information on which to base an assessment.
[2] Note that while certain licensing and related regulatory functions were passed to the OGA (a government company wholly owned by the Secretary of State for BEIS) on 1 October 2016, environmental regulatory functions are retained by BEIS, and are administered by the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED).
[3] See Article 6(3) of the Habitats Directive.
[4] Also see the Advocate General's Opinion in the recent 'Sweetman' case (Case C-258/11), which confirms those principles set out in the Waddenzee judgement.
[5] Note that "in-combination" and "cumulative" effects have similar meanings, but for the purposes of HRA, and in keeping with the wording of Article 6(3) of the Habitats Directive, "in-combination" is used to describe the potential for such effects throughout. More information on the definitions of "cumulative" and "in-combination" effects are available in MMO (2014a) and Judd *et al.* (2015).
[6] Which states that "listed or proposed Ramsar sites", should receive the same protection as European sites.

(Hoskin & Tyldesley 2006) and Natural England report NECR205 (Chapman & Tyldesley 2016).

The approach taken to screening has been to identify all relevant European sites with the potential to be affected by exploration/appraisal activities that could follow licensing (i.e. those sites with marine qualifying features or with a marine ecological linkage such as anadromous and catadromous fish) (see Section 3). These sites are screened for the likelihood of significant effects based on the nature and scale of potential activities (as outlined in Section 2). Consideration is also given as appropriate to the site-specific advice on operations. For the purposes of assessment, the screening assumes that any activity which could follow licensing is undertaken in the absence of mitigation. This approach is consistent with recent judgements of the European Court of Justice[7] and the UK High Court[8], on where within the HRA process mitigation can be taken into account. Those Blocks which are screened in will be subject to a second stage of HRA, Appropriate Assessment, if applied for and before licence award decisions are taken. It should be noted that should a licence award be made, any activities that may follow licensing will be subject to activity-specific assessment and where necessary, an HRA.

This screening assessment report is organised as follows:

- Overview of the plan, including a list and map of the Blocks offered, summary of the licensing process and nature of the activities that could follow (see Section 2)
- Identification of all European sites potentially affected, together with their various interest features (Section 3 and Appendix A)
- Description of the screening assessment process used to identify likely significant effects on relevant European sites (Section 4)
- The screening assessment including a consideration of in-combination effects (Section 5)
- Summary of conclusions including a list of Blocks from which likely significant effects on relevant European sites could not be discounted at the screening stage and for which further assessment (Appropriate Assessment) is required before a licence award decision can be made (Section 6 and Appendix B)

[7] People Over Wind and Sweetman vs. Coillte Teoranta C-323/17 (http://curia.europa.eu/juris/document/document.jsf?docid=200970&doclang=EN), clarified in Grace and Sweetman vs. An Bord Pleanala C-164/17 (http://curia.europa.eu/juris/document/document.jsf;jsessionid=F3195E5E6EE57FFD1D414A11FDD5E35E?text=&docid=204392&pageIndex=0&doclang=EN&mode=lst&dir=&occ=first&part=1&cid=4768745)
[8] Gladman Developments Ltd. vs. Secretary of State for Housing, Communities and Local Government and Medway Council (https://www.bailii.org/ew/cases/EWHC/Admin/2019/2001.html)

2 Blocks offered and potential activities

2.1 Blocks offered

Offshore Blocks on offer during the 32nd Seaward Licensing Round which are considered in this screening assessment are listed in Table 2.1 and shown on Figure 2.1. The Blocks are located to the West of Shetland, in the central and northern North Sea, and the Mid-North Sea High and southern North Sea.

2.2 Licensing

The exclusive rights to search and bore for petroleum in Great Britain, the territorial sea adjacent to the United Kingdom and on the UK Continental Shelf (UKCS) are vested in the Crown and the *Petroleum Act 1998* (as amended) gives the OGA the power to grant licences to explore for and exploit these resources. The main type of offshore Licence is the Seaward Production Licence. Offshore licensing for oil and gas exploration and production commenced in 1964 and has progressed through a series of Seaward Licensing Rounds. A Seaward Production Licence may cover the whole or part of a specified Block or a group of Blocks. A Seaward Production Licence grants exclusive rights to the holders "to search and bore for, and get, petroleum" in the area covered by the Licence but it does not constitute any form of approval for activities to take place in the Blocks, nor does it confer any exemption from other legal or regulatory requirements. Offshore activities are subject to a range of statutory permitting and consenting requirements, including, where relevant, activity-specific AA under Article 6(3) of the Habitats Directive (Directive 92/43/EC).

Several sub-types of Seaward Production Licence (Traditional, Frontier and Promote) were replaced after the 28th Round by the single "Innovate" licence[9]. As per previous licensing structures, the Innovate licence is made up of three terms covering exploration (Initial Term), appraisal and field development planning (Second Term), and development and production (Third Term). The lengths of the first two terms are flexible, but have a maximum duration of 9 and 6 years respectively. The Third Term is granted for 18 years but may be extended if production continues beyond this period. The Innovate licence introduces three Phases to the Initial Term, covering:

[9] *The Petroleum and Offshore Gas Storage and Unloading Licensing (Amendment) Regulations 2017* amend the Model Clauses to be incorporated in Seaward Production Licences.

- Phase A: geotechnical studies and geophysical data reprocessing (note that the acquisition of new seismic could take place in this phase for the purpose of defining a 3D survey as part of Phase B, but normally this phase will not involve activities in the field)

- Phase B: shooting of new seismic and other geophysical data

- Phase C: exploration and appraisal drilling

Applicants may propose the Phase combination in their submission to the OGA. Phase A and Phase B are optional and may not be appropriate in certain circumstances, but every application must propose a Phase C, except where the applicant does not think any exploration is needed (e.g. in the development of an existing discovery or field re-development) and proposes to go straight to development (i.e. 'straight to Second Term'). The duration of the Initial Term and the Phases within it are agreed between the OGA and the applicant. Applicants may choose to spend up to 4 years on a single Phase in the Initial Term, but cannot take more than 9 years to progress to the Second Term. Failure to complete the work agreed in a Phase, or to commit to the next Phase means the licence ceases, unless the term has been extended by the OGA.

Financial viability is considered prior to licence award for applicants proposing to start at Phase A or B, but further technical and financial capacity for Phase C activities would need to be demonstrated before the licence could enter Phase C and drilling could commence. If the applicant proposes to start the licence at Phase C or go straight to the Second Term, the applicant must demonstrate that it has the technical competence to carry out the activities that would be permitted under the licence during that term, and the financial capacity to complete the Work Programme, before the licence is granted. It is noted that the safety and environmental capability and track record of all applicants are considered by the OGA (in consultation with the Offshore Safety Directive Regulator)[10] through written submissions before licences are awarded[11].

As part of these written submissions operators must demonstrate that they have the relevant safety and environmental capabilities to undertake the proposed work programme (e.g. company environmental policies, awareness of statutory safety and environment provisions, and has environmental management systems). Where full details cannot be provided via the written submissions at the application stage, licensees must provide supplementary submissions that address any outstanding environmental and safety requirements before approvals for specific offshore activities such as drilling can be issued. In all instances applicants must submit an environmental sensitivity assessment, demonstrating at the licence application stage that they are aware of environmental sensitivities relevant to the Blocks being

[10] The Offshore Safety Directive Regulator is the Competent Authority comprising of the Department for Business, Energy and Industrial Strategy (BEIS) Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) and the Health and Safety Executive (HSE) working in partnership.
[11] Refer to OGA technical guidance and safety and environmental guidance on applications for the 32nd Round at: https://www.ogauthority.co.uk/licensing-consents/licensing-rounds/

applied for and the adjacent areas, and understand the constraints and potential impacts they might have on the proposed work programme.

2.3 Activity

As part of the licence application process, applicants provide the OGA with details of work programmes they propose in the Initial Term. These work programmes are considered along with a range of other factors by the OGA before arriving at a decision on whether to license the Blocks and to whom. There are three levels of drilling commitment:

- A Firm Drilling Commitment is a commitment to the OGA to drill a well. Firm drilling commitments are preferred on the basis that, if there were no such commitment, the OGA could not be certain that potential licensees would make full use of their licences. However, the fact that a licensee has been awarded a licence on the basis of a “firm commitment” to undertake a specific activity should not be taken as meaning that the licensee will actually be able to carry out that activity. This will depend upon the outcome of all relevant activity-specific environmental assessments.

- A Contingent Drilling Commitment is also a commitment to the OGA to drill a well, but it includes specific provision for the OGA to waive the commitment in light of further technical information.

- A Drill or Drop (D/D) Drilling Commitment is a conditional commitment with the proviso that the licence is relinquished if a well is not drilled.

Note that Drill-or-Drop and Contingent work programmes (subject to further studies by the licensees) will probably result in a well being drilled in less than 50% of the cases.

The OGA general guidance[12] makes it clear that an award of a Production Licence does not automatically allow a licensee to carry out any offshore petroleum-related activities from then on (this includes those activities outlined in initial work programmes, particularly Phases B and C). Offshore activities (see Table 2.2) such as seismic survey or drilling are subject to relevant activity-specific environmental assessments by BEIS, and there are other regulatory provisions exercised by the Offshore Safety Directive Regulator and bodies such as the Health and Safety Executive. It is the licensee’s responsibility to be aware of, and comply with, all regulatory controls and legal requirements, and work offshore cannot proceed until the relevant consents/approvals are in place.

The proposed work programmes for the Initial Term are detailed in the licence applications. For some activities, such as seismic survey, the potential impacts associated with noise could occur some distance from the licensed Blocks and the degree of activity is not necessarily

[12] https://www.ogauthority.co.uk/media/5888/general-guidance-32nd-seaward-licensing-round-june-2019.pdf

proportional to the size or number of Blocks in an area. In the case of direct physical disturbance, the licence Blocks being applied for are relevant.

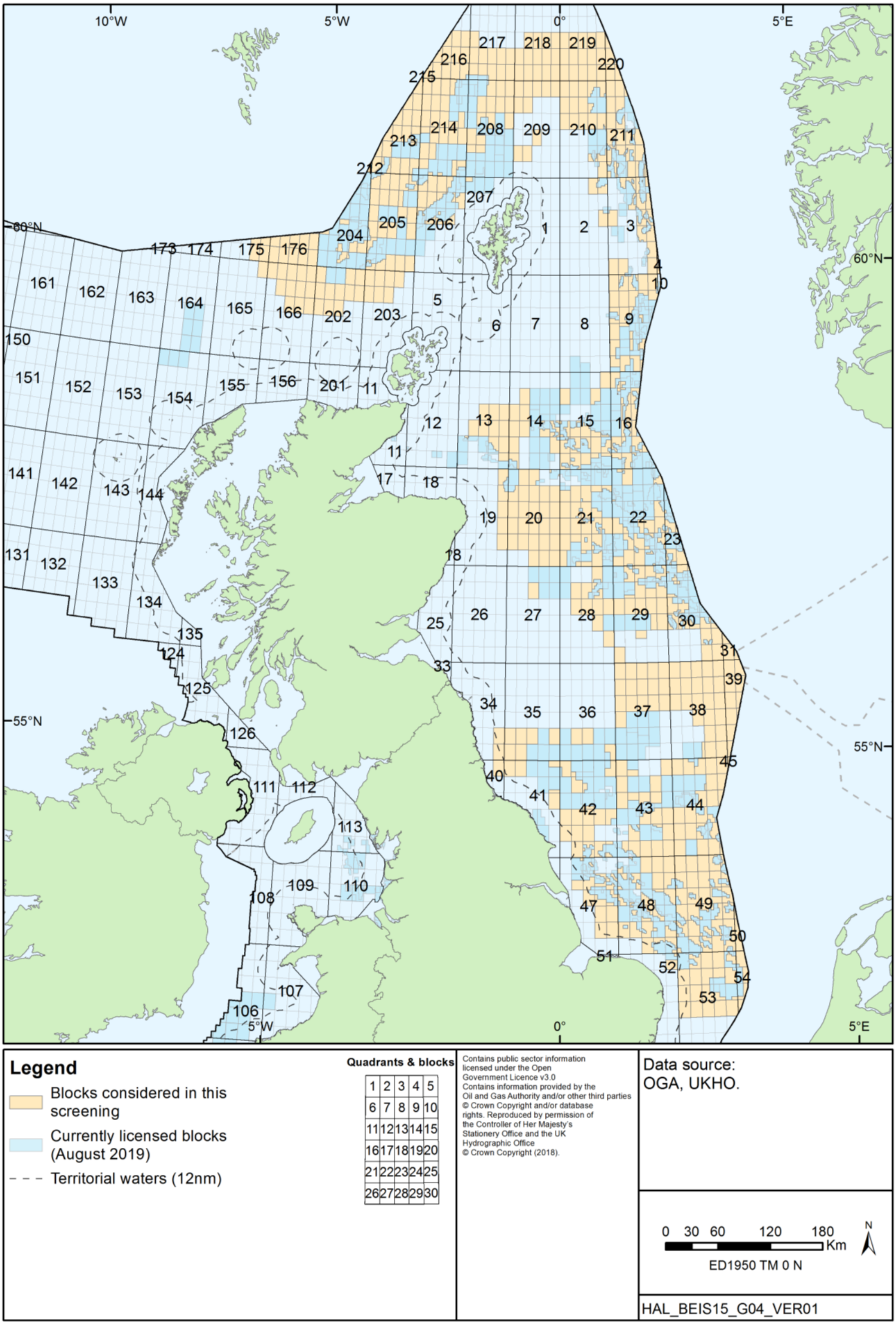
Table 2.1: List of Blocks offered in the 32nd Seaward Licensing Round

West of Shetland									
165/5	166/1	166/2	166/3	166/4	166/5	166/7	166/8	166/9	166/10
166/13	166/14	166/15	175/24	175/25	175/29	175/30	176/20	176/21	176/22
176/23	176/24	176/25	176/26	176/27	176/28	176/29	176/30	202/1	202/4
202/5	202/6	202/7	202/8	202/9	202/10	202/11	202/12	202/13	203/1
203/2	203/3	203/4	203/6	203/7	203/8	204/16	204/18c	204/22a	204/23c
204/24c	204/25c	204/28c	204/29a	205/1b	205/2b	205/3	205/4c	205/5b	205/6
205/7	205/8	205/9b	205/11	205/14b	205/15	205/16b	205/17	205/18	205/20
205/21c	205/26e	205/26f	205/27b	205/28	205/29	205/30	206/1b	206/2	206/3
206/4b	206/6	206/7b	206/8b	206/9c	206/9d	206/10c	206/11c	206/11e	206/12b
206/13c	206/13d	206/14b	207/1a	208/3a	208/4	208/5	208/7	208/8	208/9
208/10	208/12b	208/13a	208/15	208/16	208/17b	208/21b	208/22b	209/1	209/2
209/3	209/4	209/5	209/6	209/7	209/18	209/21	209/22	210/1	210/2
210/3	210/4b	210/5c	210/6	210/7	210/8	210/9b	210/11	210/12	210/13
210/14	210/15b	210/24c	210/24f	210/25c	210/30c	211/1	211/2	211/3	211/6
211/7b	211/9	211/11	211/12b	211/14b	211/16b	211/17	211/18f	211/18g	211/18i
211/19b	211/21b	211/22e	211/22f	211/23a	211/24c	211/26a	211/26b	211/26c	211/27b
211/28d	211/29i	211/29j	211/30b	212/30	213/4	213/5	213/8	213/9	213/10
213/12	213/13	213/14	213/15	213/16	213/17	213/18	213/19b	213/20a	213/20b
213/21	213/22	213/25a	213/26a	213/27b	213/27c	213/28	213/29	213/30b	214/1
214/2	214/3	214/4c	214/6	214/7	214/8	214/11	214/12	214/13	214/14b
214/15b	214/16a	214/17	214/18	214/19	214/20	214/21	214/22b	214/26b	214/27a
214/28b	214/29b	214/30c	215/30	216/17	216/18	216/19	216/20	216/21	216/22
216/23	216/24	216/25	216/26	216/27	216/28	216/29	216/30b	217/16	217/21
217/22	217/23	217/24	217/25	217/26b	217/27a	217/28a	217/29	217/30	
Central and Northern North Sea									
2/4b	2/5b	2/5c	2/15b	3/2d	3/3c	3/4f	3/4h	3/5b	3/8h
3/9d	3/10a	3/11a	3/14c	3/15d	3/19d	3/20c	3/20d	3/25b	3/26
3/27a	3/30	4/21	4/26	9/1	9/2d	9/3c	9/3d	9/4	9/5a
9/6	9/7	9/8b	9/9e	9/10c	9/11d	9/11e	9/12b	9/13e	9/14f
9/16	9/17a	9/18g	9/21c	9/23c	9/23e	9/24a	9/26c	9/27b	9/28c
9/29b	10/6b	13/13	13/14	13/15	13/17	13/18	13/19	13/20	13/21b
13/22b	13/24c	13/25	13/30a	14/7	14/11	14/12	14/16	14/17	14/19b
14/19c	14/20c	14/20d	14/20g	14/21	14/25b	14/26b	15/5	15/6	15/9b
15/16c	15/16e	15/16g	15/17a	15/18e	15/19c	15/20e	15/21g	15/21h	15/21i
15/22b	15/22c	15/23c	15/23d	15/24	15/25d	15/26a	15/27b	15/28b	15/29f
15/30b	16/1a	16/1b	16/2b	16/4	16/6c	16/6d	16/7d	16/7e	16/7f
16/8b	16/12c	16/12d	16/13b	16/17b	16/17d	16/18b	16/21e	16/22b	16/22d
16/23b	16/24b	16/24c	16/26b	16/27d	16/28c	16/30	19/5b	19/10b	19/15
19/20	19/25	20/2	20/3b	20/5d	20/5e	20/6c	20/7	20/8	20/9
20/10	20/11	20/12	20/13	20/14	20/15	20/16	20/17	20/18	20/19
20/20	20/21	20/22	20/23	20/24	20/25	20/28	20/29	20/30	21/6c
21/7	21/8b	21/9b	21/10b	21/11	21/12b	21/13b	21/14b	21/16	21/17
21/18b	21/18c	21/19c	21/19d	21/20b	21/21	21/22b	21/23a	21/24b	21/24c

Table 2.1: List of Blocks offered in the 32nd Seaward Licensing Round

21/26b	21/27c	21/28c	21/28d	21/29c	22/1a	22/2b	22/5c	22/6d	22/15a
22/16a	22/17a	22/18c	22/19c	22/20c	22/22c	22/23c	22/24i	22/24j	22/25c
22/26b	22/27b	22/28b	22/29b	22/29e	23/1	23/11d	23/16d	23/17	23/26c
23/26f	23/27b	27/8	28/4b	28/7	28/8a	28/9e	28/9f	28/12	28/13
28/14	28/15	28/19	28/25	29/2d	29/2e	29/3b	29/4b	29/5d	29/7c
29/8b	29/9a	29/10d	29/11	29/12	29/13	29/14	29/15	29/19b	29/20
29/23a	29/26	30/1b	30/1g	30/2b	30/3b	30/6b	30/6c	30/7e	30/11c
30/12e	30/14c	30/16g	30/16h	30/17c	30/17d	30/17e	30/18b	30/19b	30/20b
30/24a	30/25a	30/29	30/30	31/21	31/26	31/27	218/17	218/18	218/19
218/20	218/21	218/22	218/23	218/24	218/25	218/26	218/27	218/28	218/29
218/30	219/16	219/17	219/18	219/19	219/20	219/21	219/22	219/23	219/24
219/25	219/26	219/27	219/28	219/29	219/30	220/16	220/21	220/22	220/26
220/27									
Mid-North Sea High and Southern North Sea									
34/25	34/30	35/21	35/22	35/23	35/25	35/26	35/27	36/22	36/23
36/30b	37/1	37/2	37/3	37/4	37/5	37/6	37/7	37/8	37/9
37/10	37/11	37/12	37/13	37/14	37/15	37/16	38/1	38/2	38/3
38/4	38/5	38/6	38/7	38/8	38/9	38/10	38/11	38/12	38/13
38/14	38/15	38/18	38/19	38/20	38/24	38/25	38/28b	38/29	38/30
39/1	39/2	39/3	39/6	39/7	39/11	39/12	39/16	39/17	39/21
39/26	40/5	41/1	41/2	41/5b	41/10b	41/15	42/1b	42/2c	42/5b
42/7b	42/8a	42/13b	42/16	42/17	42/18	42/19	42/20b	42/21	42/22
42/23	42/27	42/28e	42/28f	42/28g	42/28h	42/29b	42/29c	42/30b	42/30c
43/1	43/2b	43/5	43/6	43/9	43/11	43/12b	43/13a	43/14c	43/18a
43/19a	43/20	43/22b	43/22c	43/24c	43/25	43/26b	43/27b	43/28	43/29
43/30	44/1	44/2b	44/3b	44/4	44/5	44/8a	44/9	44/10	44/13b
44/14	44/15	44/16	44/17	44/18b	44/19b	44/21	44/22	44/23a	44/23b
44/24d	44/25	44/26	44/28	44/29a	44/30b	45/1	47/2b	47/3g	47/3i
47/3j	47/7b	47/8e	47/9e	47/10e	47/10f	47/10g	47/13c	47/14b	47/15b
47/15e	47/19	47/20	47/24	47/25	48/1e	48/2c	48/3	48/4	48/5
48/6b	48/6d	48/7d	48/7e	48/9	48/10b	48/11b	48/12g	48/13c	48/14b
48/14c	48/15c	48/17e	48/17f	48/18d	48/18e	48/19d	48/21b	48/22d	48/23d
48/24c	48/25c	48/25d	48/28b	48/29b	48/29c	48/30b	48/30c	49/1	49/2
49/3	49/4e	49/5d	49/6b	49/6c	49/7	49/8b	49/9b	49/9e	49/10e
49/11c	49/12d	49/13	49/14a	49/15b	49/16b	49/17b	49/18b	49/18c	49/19c
49/19d	49/20c	49/20d	49/21d	49/21e	49/22b	49/23b	49/23c	49/24b	49/24c
49/25c	49/26b	49/27c	49/28c	49/28e	49/29b	49/30b	50/11	50/16	50/21
50/26	52/5b	52/5c	53/2c	53/3	53/4	53/5d	53/6	53/7	53/8b
53/9b	53/10b	53/11	53/12	53/13b	53/14c	53/15b	53/16	53/17	53/18
53/19	53/20	54/1a	54/6b	54/11b	54/16				

Figure 2.1: Location of Blocks offered in the context of existing licences



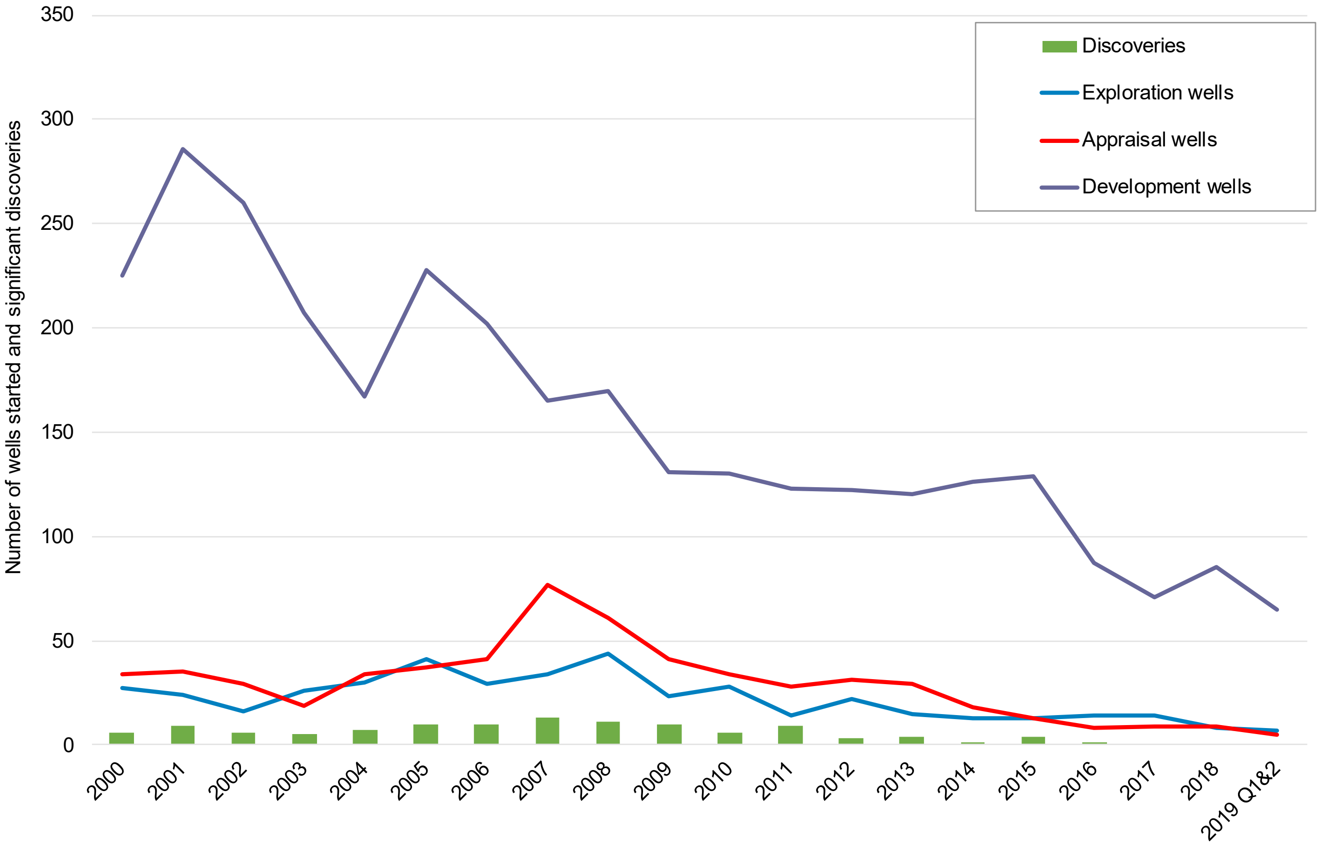
2.3.1 Likely scale of activity

This assessment has been undertaken at the stage at which Blocks are offered for licensing. To place the scale of the 32nd Round in context, recent seaward licensing rounds (i.e. those having taken place in the last 10 years) have attracted applications for between 8% and 28% of the Blocks offered (for the 31st and 30th Rounds). On past experience the activity that actually takes place is less than what is included in the work programme at the licence application stage. A proportion of Blocks awarded may be relinquished without any offshore activities occurring. Activity after the Initial Term is much harder to predict, as this depends on the results of the initial phase, which is, by definition, exploratory. Typically less than half the wells drilled reveal hydrocarbons, and of that, less than half will have a potential to progress to development. For example, the OGA analysis of exploration well outcomes from the Moray Firth & Central North Sea between 2003 and 2013 indicated an overall technical success rate of 40% with respect to 150 exploration wells and side-tracks (Mathieu 2015). Depending on the expected size of finds, there may be further drilling to appraise the hydrocarbons (appraisal wells). For context, Figure 2.2 highlights the total number of exploration and appraisal wells started on the UKCS each year since 2000 as well as the number of significant discoveries made (associated with exploration activities).

Discoveries that progress to development may require further development drilling, installation of infrastructure such as wellheads, pipelines and possibly fixed platform production facilities, although recent developments are mostly tiebacks to existing production facilities rather than stand-alone developments. For example, of the 33 current projects identified by the OGA's Oil & Gas Pathfinder (as of 2nd August 2019)[13], 19 are planned as subsea tie-backs to existing infrastructure, 3 involve new stand-alone production platforms and 4 are likely to be developed via Floating Production, Storage and Offloading facilities (FPSO). The final form of development for many of the remaining projects is not decided, with some undergoing re-evaluation of development options but some are likely to be subsea tie-backs. Figure 2.2 indicates that the number of development wells has declined over time and this pattern is likely to continue. The nature and scale of potential environmental impacts from the drilling of development wells are similar to those of exploration and appraisal wells and thus the screening criteria described in Section 4 are applicable to the potential effects of development well drilling within any of the 32nd Round Blocks.

[13] https://itportal.ogauthority.co.uk/eng/fox/path/PATH_REPORTS/pdf

Figure 2.2: UKCS Exploration, appraisal & development wells, and significant discoveries since 2000



Note: The description "significant" generally refers to the flow rates that were achieved (or would have been reached) in well tests (15 mmcfgd or 1000 BOPD). It does not indicate the commercial potential of the discovery.

Source: OGA Drilling Activity (July 2019), Significant Offshore Discoveries (October 2018)

2.3.2 32nd Round activities considered by the HRA

The nature, extent and timescale of development, if any, which may ultimately result from the licensing of 32nd Round Blocks is uncertain, and therefore it is regarded that at this stage a meaningful assessment of development level activity (e.g. pipelay, placement of jackets, subsea templates or floating installations) cannot be made. Once project plans are in place, subsequent permitting processes relating to exploration, development and decommissioning, would require assessment including HRA where appropriate, allowing the opportunity for further mitigation measures to be identified as necessary, and for permits to be refused if necessary. In this way the opinion of the Advocate General in ECJ (European Court of Justice) case C-6/04, on the effects on Natura sites, "*must be assessed at every relevant stage of the procedure to the extent possible on the basis of the precision of the plan. This assessment is to be updated with increasing specificity in subsequent stages of the procedure*" is addressed. Therefore, only activities as part of the work programmes associated with the Initial Term and its associated Phases A-C will be considered in this HRA (see Table 2.2).

For the purposes of this screening assessment, the implications of geophysical survey and drilling are considered in a generic way for all the Blocks offered; a generic description of the nature and scale of these activities is given in Table 2.2 below. The screening assessment considers:

- The potential physical disturbance and drilling effects associated with the drilling of an exploration or appraisal well within each Block offered.
- The potential underwater noise effects associated with undertaking a seismic survey within each Block offered (as well as undertaking site-specific seismic operations including rig site survey and Vertical Seismic Profiling).
- The potential for in-combination effects.

Subsequent Appropriate Assessment (AA) of Blocks applied for, for which a likely significant effect cannot currently be excluded will consider an approach based on the maximum likely work programme associated with the Initial Term and its associated Phases A-C.

Table 2.2: Indicative overview of potential activities that could arise from Block licensing

Potential activity	Description	Assumptions used for assessment
Initial Term Phase B: Geophysical survey		
Seismic (2D and 3D) survey	2D seismic involves a survey vessel with an airgun array and a towed hydrophone streamer (up to 12 km long), containing several hydrophones along its length. The reflections from the subsurface strata provide an image in two dimensions (horizontal and vertical). Repeated parallel lines are typically run at intervals of several kilometres (minimum *ca*. 0.5km) and a second set of lines at right angles to the first to form a grid pattern. This allows imaging and interpretation of geological structures and identification of potential hydrocarbon reservoirs. 3D seismic survey is similar but uses several hydrophone streamers towed by the survey vessel. Thus closely spaced 2D lines (typically between 25 and 75m apart) can be achieved by a single sail line.	These deep-geological surveys tend to cover large areas (300-3,000km^2) and may take from several days up to several weeks to complete. Typically, large airgun arrays are employed with 12-48 airguns and a total array volume of 3,000-8,000 in^3. From available information across the UKCS, arrays used on 2D and 3D seismic surveys produce most energy at frequencies below 200Hz, typically peaking at 100Hz, and with a peak broadband source level of around 256dB re 1μPa @ 1m (Stone 2015). While higher frequency noise will also be produced which is considerably higher than background levels, these elements will rapidly attenuate with distance from source; it is the components < 1,000Hz which propagate most widely.
Initial Term Phase C: Drilling and well evaluation		
Rig tow out & de-mobilisation	Mobile rigs are towed to and from the well site typically by 2-3 anchor handling vessels.	The physical presence of a rig and related tugs during tow in/out is both short (a number of days depending on initial location of rig) and transient.
Rig placement/ anchoring	Semi-submersible rigs are used in deeper waters (normally >120m). Mooring is achieved using either anchors (deployed and recovered by anchor handler vessels) or dynamic positioning (DP) to manoeuvre into and stay in position over the well location. Eight to 12 anchors attached to the rig by cable or chain are deployed radially from the rig; part of the anchoring hold is provided by a proportion of the cables or chains lying on the seabed (catenary).	Semi-submersible rig anchors (if used) may extend out to a radius of 1.5-1.8km in North Sea waters of the UK. An ES for an exploration well in Block 18/05 in *ca*. 90m water depth estimated that the area of seabed affected by anchoring was *ca*. 0.01km^2 (Apache North Sea Limited 2006), and in deeper waters (e.g. West of Shetland) the seabed footprint may be in the order of 0.06km^2.

Potential activity	Description	Assumptions used for assessment
	Jack-up rigs are used in shallower waters (normally <120m) and jacking the rig legs to the seabed supports the drilling deck. Each of the rig legs terminates in a spud-can (base plate) to prevent excessive sinking into the seabed. Unlike semi-submersible rigs, jack-up rigs do not require anchors to maintain station and these are not typically deployed for exploration activities, with positioning achieved using several tugs, with station being maintained by contact of the rig spudcans with the seabed. Anchors may be deployed to achieve precision siting over fixed installations or manifolds at production facilities, which are not considered in this assessment.	It is assumed that jack-up rigs will be three or four-legged rigs with 20m diameter spudcans with an approximate seabed footprint of 0.001km^2 within a radius of *ca*. 50m of the rig centre. For the assessment it is assumed that effects may occur within 500m of a jack-up rig which would take account of any additional rig stabilisation (rock placement) footprint. A short review of 18 Environmental Statements, which included drilling operations in the southern North Sea since 2007 (specifically in quadrants 42, 43, 44, 47, 48, 49 and 53) indicated that rig stabilisation was either not considered necessary and/or assessed as a worst case contingency option. Where figures were presented, the spatial scale of potential rock placement operations was estimated at between 0.001-0.004km^2 per rig siting.
Marine discharges	Typically around 1,000 tonnes of cuttings (primarily rock chippings) result from drilling an exploration well. Water-based mud cuttings are typically discharged at, or relatively close to sea surface during “closed drilling” (i.e. when steel casing in the well bore and a riser to the rig are in place), whereas surface hole cuttings are normally discharged at seabed during “open-hole” drilling. Use of oil based mud systems, for example in highly deviated sections or in drilling water reactive shales, would require onshore disposal or treatment offshore to the required standards prior to discharge.	The distance from source within which smothering or other effects may be considered possible is generally a few hundred metres. For the assessment it is assumed that effects may occur within 500m of the well location covering an area in the order of 0.8km^2 (refer to Section 4.2 for supporting information).
Conductor piling	Well surface holes are usually drilled “open-hole” with the conductor subsequently inserted and cemented in place to provide a stable hole through which the lower well sections are drilled. Where the nature of the seabed sediment and shallow geological formations are such that they would not support a stable open-hole (i.e. risking collapse), the conductor may be driven into the sediments. In North Sea exploration wells, the diameter of the conductor pipe is usually 26” or 30” (<1m), which is considerably smaller than the monopiles used for offshore wind farm foundations (>3.5m diameter), and therefore require less hammer energy and generate noise of a considerably lower amplitude. For example, hammer energies to set conductor pipes are in the order of 90-270kJ (see: Matthews 2014, Intermoor website), compared to energies of up to 3,000kJ in the installation of piles at some southern North Sea offshore wind farm sites. Direct measurements of underwater sound generated during conductor piling are limited. Jiang *et al.* (2015) monitored conductor piling operations at a jack-	The need to pile conductors is well-specific and is not routine. It is anticipated that a conductor piling event would last between 4-6 hours, during which time impulses sound would be generated primarily in the range of 100-1,000Hz, with each impulse of a sound pressure level of approximately 150dB re 1μPa at 500m from the source.

Potential activity	Description	Assumptions used for assessment
	up rig in the central North Sea in 48m water depth and found peak sound pressure levels (L_{pk}) not to exceed 156dB re 1 μPa at 750m (the closest measurement to source) and declining with distance. Peak frequency was around 200Hz, dropping off rapidly above 1kHz; hammering was undertaken at a stable power level of 85 ±5 kJ but the pile diameter was not specified (Jiang *et al.* 2015). MacGillivray (2018) reported underwater noise measurements during the piling of six 26" conductors at a platform, six miles offshore of southern California in 365m water depth. After initially penetrating the seabed under its own weight, each conductor was driven approximately 40m further into the seabed (silty-clay and clayey-silt) with hammer energies that increased from 31 ±7 kJ per strike at the start of driving to 59 ±7 kJ per strike. Between 2.5-3 hours of active piling was required per conductor. Sound levels were recorded by fixed hydrophones positioned at distances of 10-1,475m from the source and in water depths of 20-370m, and by a vessel-towed hydrophone. The majority of sound energy was between 100-1,000Hz, with peak sound levels around 400Hz. Broadband sound pressure levels recorded at 10m from source and 25m water depth were between 180-190dB re 1μPa (SEL = 173-176dB re 1μPa·s), reducing to 149-155dB re 1μPa at 400m from source and 20m water depth (SEL = 143-147dB re 1μPa·s).	
Rig/vessel presence and movement	On site, the rig is supported by supply and standby vessels, and helicopters are used for personnel transfer.	Supply vessels typically make 2-3 supply trips per week between rig and shore. Helicopter trips to transfer personnel to and from the rig are typically made several times a week. A review of Environmental Statements for exploratory drilling suggests that the rig could be on location for, on average, up to 10 weeks. Support and supply vessels (50-100m in length) are expected to have broadband source levels in the range 165-180dB re 1μPa@1m, with the majority of energy below 1kHz (OSPAR 2009). Additionally, the use of thrusters for dynamic positioning has been reported to result in increased sound generation (>10dB) when compared to the same vessel in transit (Rutenko & Ushchipovskii 2015).

Potential activity	Description	Assumptions used for assessment
Rig site survey	Rig site surveys are undertaken to identify seabed and subsurface hazards to drilling, such as wrecks and the presence of shallow gas. The surveys use a range of techniques, including multibeam and side scan sonar, sub-bottom profiler, magnetometer and high-resolution seismic involving a much smaller source (mini-gun or four airgun cluster of 160 in^3) and a much shorter hydrophone streamer. Arrays used on site surveys and some Vertical Seismic Profiling (VSP) operations (see below) typically produce frequencies predominantly up to around 250Hz, with a peak source level of around 235dB re 1μPa @ 1m (Stone 2015).	A rig site survey typically covers 2-3km^2. The rig site survey vessel may also be used to characterise seabed habitats, biota and background contamination. Survey durations are usually of the order of four or five days.
Well evaluation (e.g. Vertical Seismic Profiling)	Sometimes conducted to assist with well evaluation by linking rock strata encountered in drilling to seismic survey data. A seismic source (airgun array, typically with a source size around 500 in^3 and with a maximum of 1,200 in^3, Stone 2015) is deployed from the rig, and measurements are made using a series of geophones deployed inside the wellbore.	VSP surveys are of short duration (one or two days at most).

3 Relevant Natura 2000 sites

Sites were considered for inclusion/exclusion in the screening process with respect to whether there was an impact pathway[14] between the marine features for which they are designated and potential exploration/appraisal activities which could arise following Block licensing (see Table 2.2). Sites considered include designated Natura 2000 sites and potential sites for which there is adequate information on which to base an assessment.

Guidance in relation to sites which have not yet been submitted to the European Commission is given by Circular 06/2005 (ODPM 2005) which states that: "*Prior to its submission to the European Commission as a cSAC, a proposed SAC (pSAC) is subject to wide consultation. At that stage it is not a European site and the Habitats Regulations do not apply as a matter of law or as a matter of policy. Nevertheless, planning authorities should take note of this potential designation in their consideration of any planning applications that may affect the site.*" In accordance with the National Planning Policy Framework (MHCLG 2019), devolved policy (e.g. Scottish Planning Policy) and Marine Policy Statement (HM Government 2011), the relevant sites considered here include classified and potential SPAs[15], designated and candidate SACs and Sites of Community Importance (SCIs), and any proposed site extensions. The full details of all sites including their type, status and qualifying features are provided in Appendix A.

If further Natura 2000 sites are established during this HRA process, they will be subject to screening and if necessary included in subsequent Appropriate Assessment stages. The primary sources of site data were the latest JNCC SAC and SPA summary data (version as of 26th March 2019[16]). Interest features and site characteristics were filtered for their coastal and marine relevance (also noting the separate data on Natura 2000 sites with marine components, versions as of 5th September 2019 and 28th August 2019 respectively[17]). The websites of the relevant Statutory Nature Conservation Bodies (SNCBs) were also reviewed to verify and augment site information including SNH[18] and Natural England[19,20]. Any sites

[14] Based on knowledge of potential sources of effect resulting from the activities (from previous BEIS AAs and SEAs), and pathways by which these effects may impact receptors present on the site (from previous BEIS AAs and SEAs, Statutory Nature Conservation Body advice on operations and literature sources etc). Also refer to Section 4.2.

[15] Further consultation on proposed Special Protection Areas in Scotland is underway: https://consult.gov.scot/marine-scotland/sea-and-site-classification/. It has been recommended that the Pentland Firth pSPA be removed from the network. This site is still listed in this document while the consultation is ongoing, and any further consideration will depend on the whether or not the site is taken forward for classification by Scottish Ministers.

[16] https://hub.jncc.gov.uk/assets/a3d9da1e-dedc-4539-a574-84287636c898

[17] SACs: https://hub.jncc.gov.uk/assets/598a60db-9323-4781-b5a8-dcf0ca3b29f9, SPAs: https://hub.jncc.gov.uk/assets/07078ed3-496d-432b-974e-1754b47536c7

[18] http://gateway.snh.gov.uk/sitelink/index.jsp

[19] http://publications.naturalengland.org.uk/category/6490068894089216

[20] https://www.gov.uk/government/collections/conservation-advice-packages-for-marine-protected-areas

designated in the future would also be considered as necessary in subsequent project-specific assessments.

The sites included in the screening process include:

- Coastal and marine Natura 2000 sites along the coasts of the United Kingdom and in territorial waters
- Offshore Natura 2000 sites (i.e. those largely or entirely beyond 12nm from the coast)
- Riverine Natura 2000 sites designated for migratory fish and/or the freshwater pearl mussel
- Relevant sites in adjacent states
- Coastal Ramsar sites

A number of Natura 2000 sites are designated for mobile species (seabirds, marine mammals and fish) which may be present beyond site boundaries. These are considered in Section 4.6.

In addition, Natura 2000 sites in the waters of other member states at or adjacent to the UK median line have been considered. All relevant sites are shown in Figures 3.1 to 3.6 overleaf with further site details in Appendix A.

Figure 3.1: SPAs included in the screening process: west of Shetland

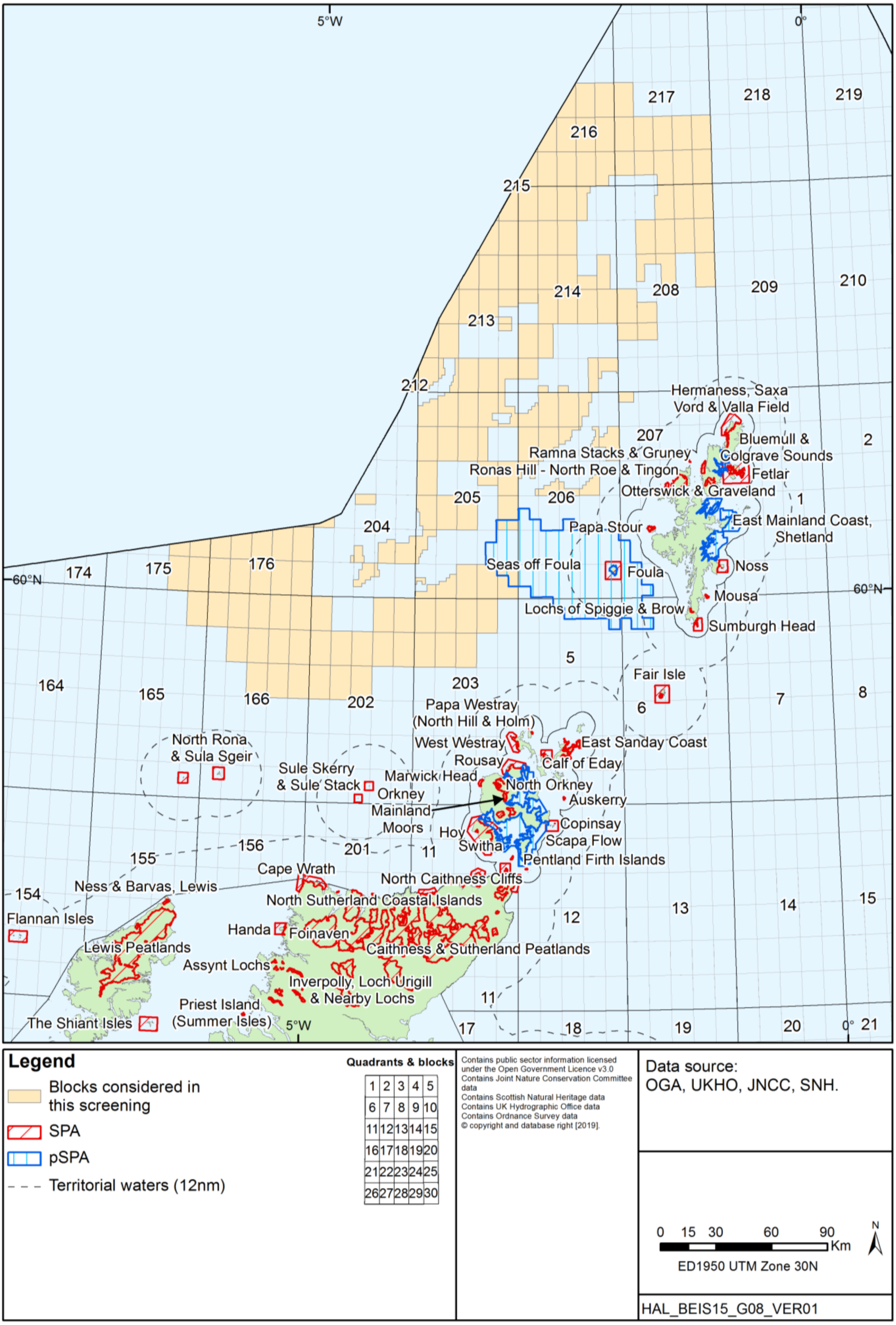


Figure 3.2: SPAs included in the screening process: central and northern North Sea

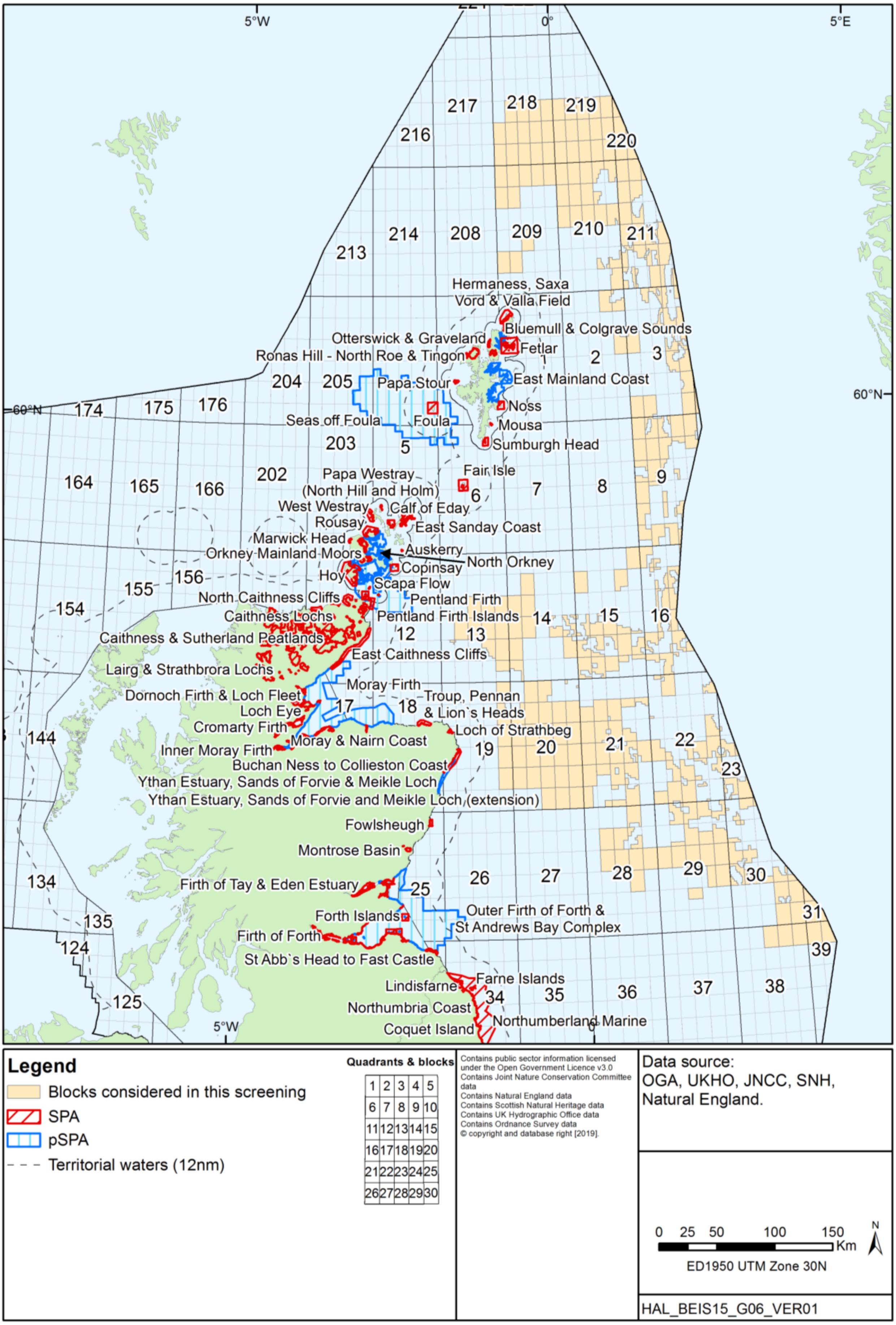


Figure 3.3: SPAs included in the screening process: mid-North Sea High and southern North Sea

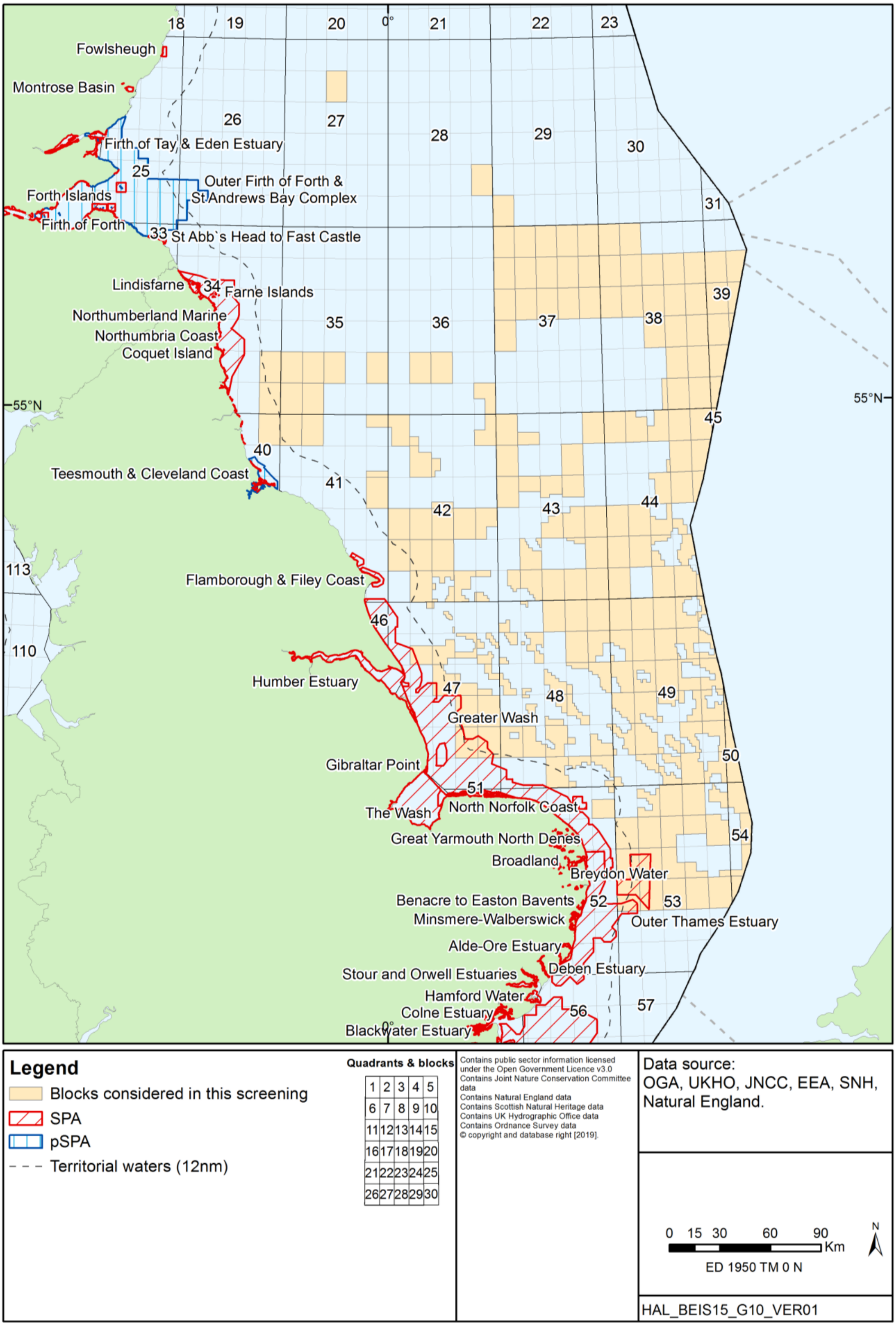


Figure 3.4: SACs included in the screening process: west of Shetland

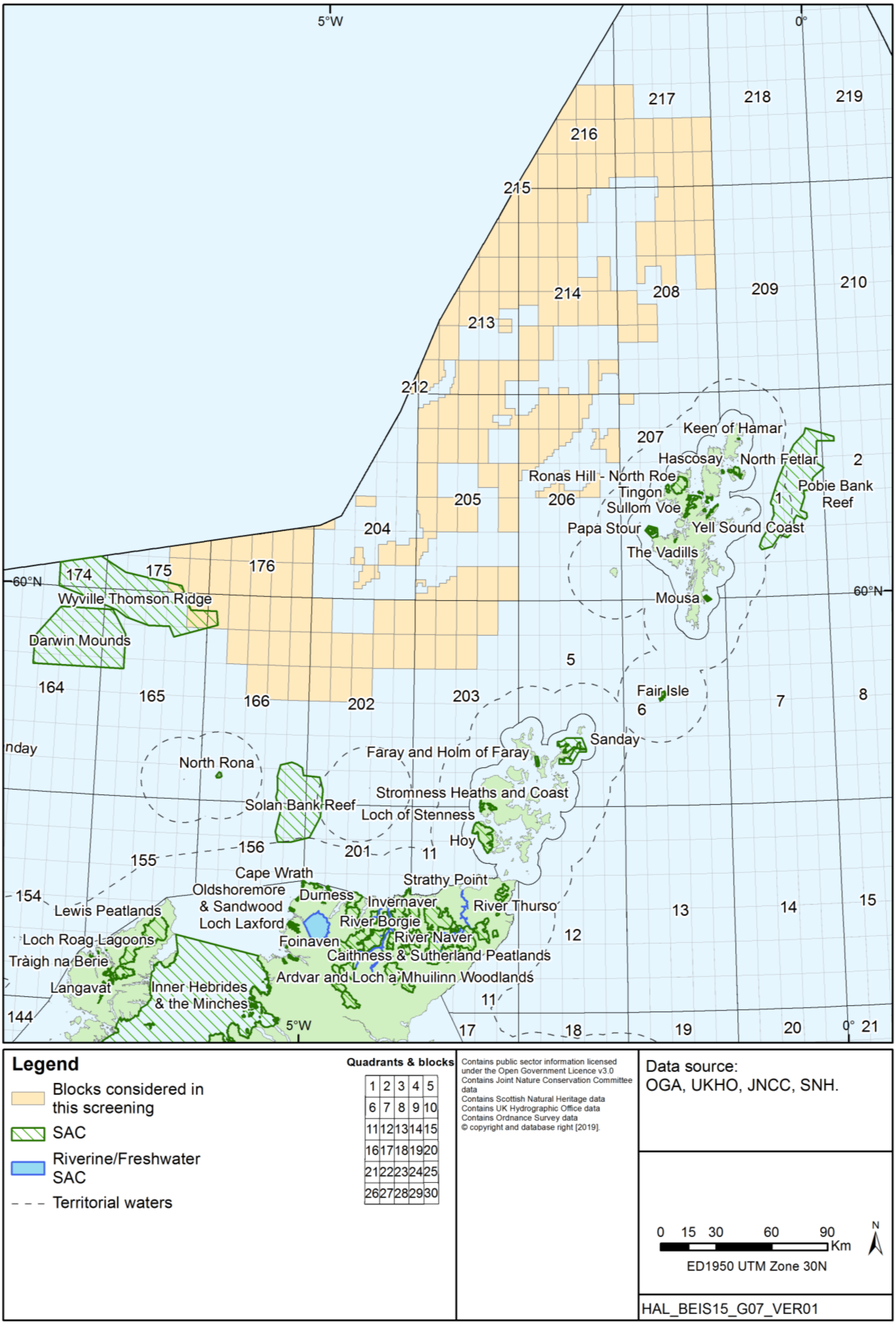


Figure 3.5: SACs included in the screening process: central and northern North Sea

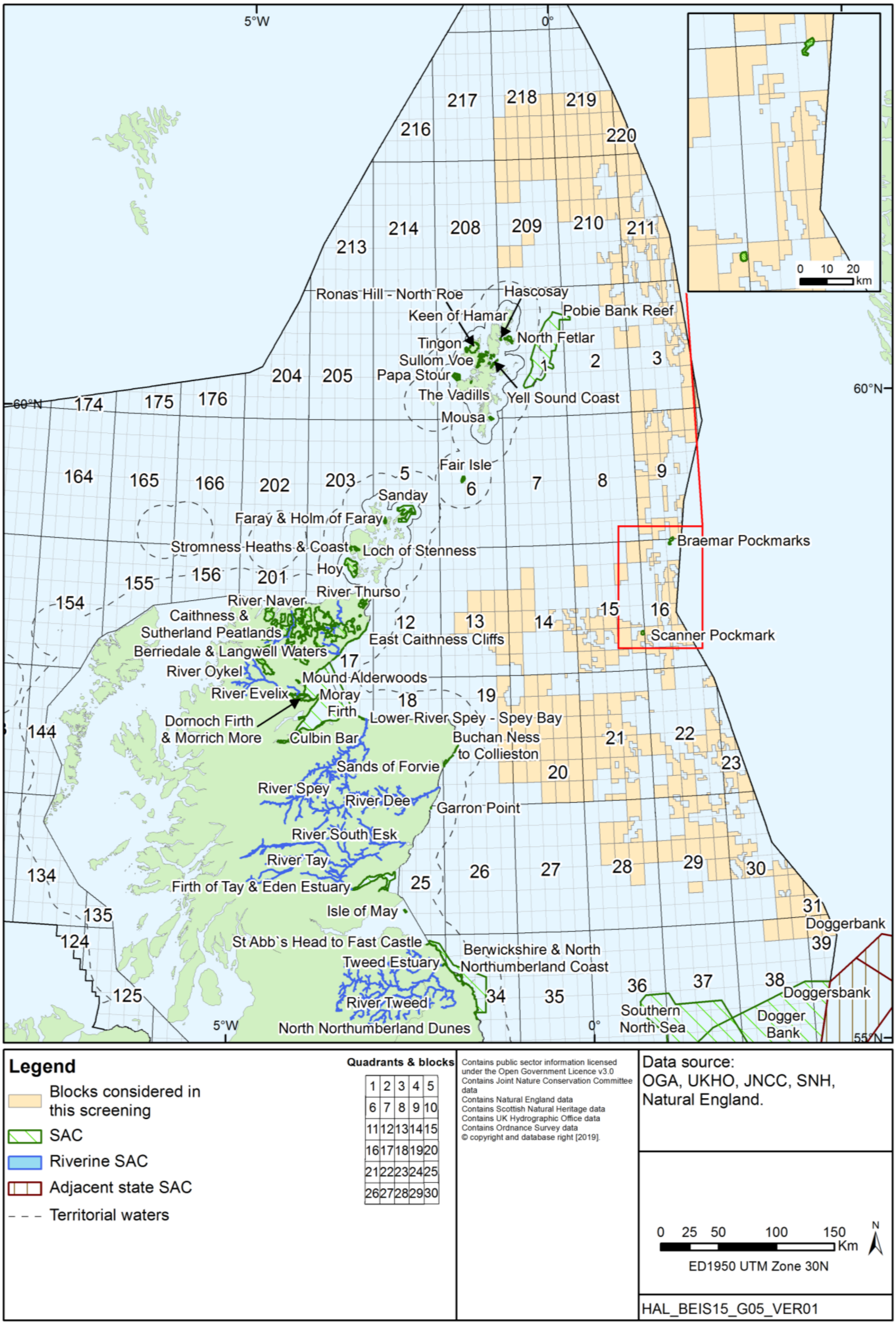
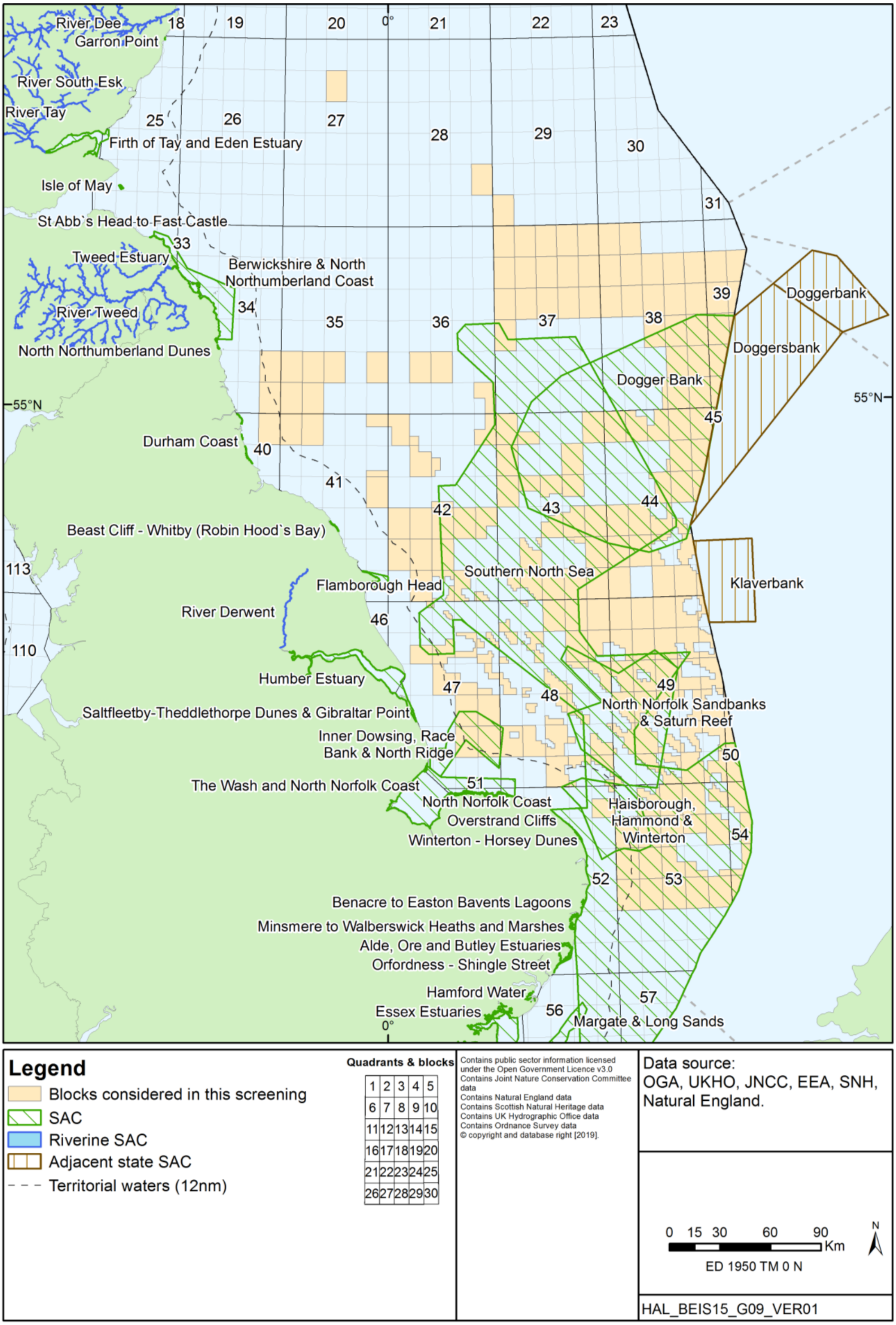


Figure 3.6: SACs included in the screening process: mid-North Sea High and southern North Sea



4 Screening Assessment Process

4.1 Introduction

This screening assessment is the first stage of an HRA to determine whether licensing of any of the Blocks offered in the 32nd Round is likely to have a significant effect on a relevant European site, either individually or in combination with other plans or projects. The approach to the screening assessment has been undertaken in accordance with the European Commission Guidance (EC 2000) augmented by reference to a range of other guidance and reports (see list in Section 1.3).

The approach taken to screening has been to:

- Define the likely location and nature of exploration/appraisal activities that could follow licensing, together with their potential to result in likely significant effects on European sites – see Section 2.
- Identify all relevant European sites and their qualifying primary and non-primary features with the potential to be affected by exploration/appraisal activities (i.e. those sites with marine features or with a marine ecological linkage) – see Section 3 and Appendix A.
- Screen the relevant sites for the likelihood of significant effects that could result from the licensing of individual Blocks offered, based on the nature and scale of potential effects from exploration and appraisal activities and mapping in a geographic information system (GIS) – see Section 5. Consideration is also given as appropriate to the potential for mobile qualifying species (e.g. seabirds, marine mammals and fish) to be present beyond relevant site boundaries – see Section 4.6.
- Screen the relevant sites for likely significant effects that could result from the licensing of individual Blocks offered, in combination with other marine activities and plans – see Sections 4.7 and 5.
- Those Blocks which are screened in (i.e. for which likely significant effects on relevant European sites could not be discounted at the screening stage) will be subject to a second stage of HRA, Appropriate Assessment, if applied for and before licence award decisions are taken – see Section 6 and Appendix B.

4.2 Sources of effect considered in this screening

As outlined in Section 2.3, activities which may be undertaken during the initial term of a Seaward Production Licence will comprise exploration activities in the form of seismic survey and exploration or appraisal drilling. The foreseeable interactions from these activities with the potential to result in likely significant effects on relevant Natura 2000 sites are therefore assessed in this report. These activities, their environmental effects, and relevant legal and other controls are extensively described in the previous SEA Environmental and Technical Reports[21] and are not duplicated in detail here.

Subsequent field development activity is contingent on successful exploration and appraisal and may or may not result in the eventual installation of infrastructure. Where relevant, such future activities will themselves be subject to a screening procedure and tests under the Habitats Directive.

In recent years, much work has been undertaken in the area of sensitivity assessments and activity/pressure (i.e. mechanisms of effect) matrices (e.g. Tillin *et al*. 2010, JNCC 2013, Tillin & Tyler-Walters 2014, Defra 2015, Robson *et al.* 2018, the Scottish Government Feature Activity Sensitivity Tool, FeAST, the MarESA tool, Tyler-Walters *et al*. 2018). These matrices are intended to describe the types of pressures that act on marine species and habitats from a defined set of activities and are related to benchmarks where the magnitude, extent or duration is qualified or quantified in some way and against which sensitivity may be measured – note that benchmarks have not been set for all pressures. The sensitivity of features to any pressure is based on tolerance and resilience, and can be challenging to determine (e.g. see Tillin & Tyler-Walters 2014, Pérez-Domínguez *et al.* 2016, Maher *et al.* 2016), for example due to data limitations for effect responses of species making up functional groups and/or lack of consensus on expert judgements. Outputs from such sensitivity exercises can therefore be taken as indicative.

This activity/pressure approach now underpins advice on operations (e.g. as required under Regulation 37 of the *Conservation of Habitats and Species Regulations 2017*[22], Regulation 21 of the *Conservation of Offshore Marine Habitats and Species Regulations 2017* and those relevant to Regulations of the devolved administrations) for many of the sites included in this assessment. Where available, the advice on operations identifies a range of pressures for site features in relation to oil and gas exploration activity[23], along with a standard description of the activity, pressure benchmarks, and justification text for the activity-pressure interaction (including with reference to source information). The relevance of the pressures to site-specific

[21] https://www.gov.uk/guidance/offshore-energy-strategic-environmental-assessment-sea-an-overview-of-the-sea-process

[22] Under this Regulation, advice must be provided by the appropriate nature conservation body to other relevant authorities as to: a European site's conservation objectives and any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated.

[23] Under the activity category, "oil and gas exploration and installation" (also see the activity, exploratory drilling in the latest JNCC PAD), pressures include: above water noise, abrasion/disturbance of the substrate on the surface of the seabed, penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion, habitat structure changes - removal of substratum (extraction), siltation rate changes, including smothering (depth of vertical sediment overburden), hydrocarbon & PAH contamination, introduction of other substances (solid, liquid or gas), synthetic compound contamination, transition elements & organo-metal (e.g. TBT) contamination, introduction or spread of non-indigenous species, litter, barrier to species movement, collision above/below water with static or moving objects not naturally found in the marine environment (e.g., boats, machinery, and structures), introduction of light, visual disturbance, underwater noise changes and vibration.

features are identified; however, in many instances assessment of the sensitivity of a feature to a given pressure has not been made, or it has been concluded that there is insufficient evidence for a sensitivity assessment to be made at the pressure benchmark[24]. Whilst the matrices provided as part of the advice are informative and identify relevant pressures associated with hydrocarbon exploration, resultant impacts at a scale likely to give rise to significant effects are not inevitable consequences of activity, and they can often be mitigated through timing, siting or technology (or a combination of these). The Department expects that these options would be evaluated by the licensees and documented in the environmental assessments required as part of the activity-specific consenting regime.

A review of the range of pressures identified in SNCB advice for the relevant sites was undertaken for the purpose of this assessment. The review concluded that the evidence base for potential effects of oil and gas exploration from successive Offshore Energy SEAs and the review of the OESEA3 Environmental Report (BEIS 2018) covers the range of pressures identified in the advice for the relevant sites (as summarised in Sections 4.4-4.6) and has therefore been used to underpin the assessment against site-specific information. It is noted that existing controls are in place for many relevant pressures (e.g. hydrocarbon & PAH contamination, introduction of other substances (solid, liquid or gas), synthetic compound contamination (including antifoulants), transition elements & organo-metal contamination, introduction or spread of non-indigenous species, and litter), either directly in relation to oil and gas activities (as outlined in Section 4.3) or generally in relation to shipping controls (e.g. MARPOL Annex I and V controls on oil and garbage respectively, and the Ballast Water Management Convention). In addition to Natura 2000 site advice on operations, the conservation objectives have been taken into account during the screening process.

Consideration of the potential for activities to result in likely significant effects was made, informed by the evidence base in the scientific literature, relevant BEIS Strategic Environmental Assessments, and recent Environmental Statements for the relevant activities. Based on this consideration, this screening assessment addresses those sources of impact generally considered to have the potential to affect relevant Natura 2000 sites, specifically:

- Physical disturbance and drilling effects (e.g. from rig siting, marine discharges, rig/vessel presence and movement)
- Underwater noise effects
- In-combination effects

Potential accidental events, including spills, are not considered in this HRA screening as they are not part of the work plan. Measures to prevent accidental events, response plans and potential impacts in the receiving environment would be considered as part of the environmental impact assessment (EIA) process for specific projects that could follow licensing

[24] Note that pressure benchmarks are used as reference points to assess sensitivity and are not thresholds that identify a likely significant effect within the meaning of the Habitats Regulations.

when the location, nature and timing of the proposed activities are available to inform a meaningful assessment of such risks. The EIA would be informed by the modelling undertaken for the Oil Pollution Emergency Plan (OPEP). The OPEP is assessed by BEIS, and a range of organisations, and other Government departments are consulted by BEIS during the OPEP determination process. The OPEP includes an assessment of spill risk, response arrangements, interface arrangements, training and exercises specific to an installation or operation[25]. A comprehensive overview of spill risk on the UKCS from offshore oil & gas activity and related potential environmental effects is provided in OESEA3 (DECC 2016).

4.3 Existing regulatory requirements and controls

The HRA screening assumes that the high level controls described below are applied as standard to activities since they are legislative requirements which if not adhered to would constitute an offence. These are distinct from mitigation measures which may be identified and employed at a project-specific level to avoid adverse effects on site integrity.

4.3.1 Physical disturbance and drilling effects

There is a mandatory requirement to have sufficient recent and relevant data to characterise the seabed in areas where activities are due to take place (e.g. rig placement)[26]. If required, survey reports must be made available to the relevant statutory bodies on submission of a relevant permit application or Environmental Statement for the proposed activity, and the identification of any potential sensitive habitats by such survey (including those under Annex I of the Habitats Directive) may influence BEIS's decision on a project level consent.

Discharges from offshore oil and gas facilities have been subject to increasingly stringent regulatory controls over recent decades (see review in DECC 2016, and related Appendices 2 and 3). As a result, oil and other contaminant concentrations in the major streams (drilling wastes and produced water) have been substantially reduced or eliminated (e.g. the discharge of oil based muds and contaminated cuttings is effectively banned), with discharges of chemicals and oil exceeding permit conditions or any unplanned release, potentially constituting a breach of the permit conditions and an offence. Drilling chemical use and discharge is subject to strict regulatory control through permitting, monitoring and reporting (e.g. the mandatory Environmental Emissions Monitoring System (EEMS) and annual environmental performance reports). The use and discharge of chemicals must be risk assessed as part of the permitting process (e.g. Drilling Operations Application) under the *Offshore Chemicals Regulations 2002* (as amended), and the discharge of chemicals which would be expected to have a significant negative impact would not be permitted.

[25] http://www.hse.gov.uk/osdr/assets/docs/opep-guidance-rev4-oct-2017.pdf, also see http://www.hse.gov.uk/osdr/index.htm
[26] See BEIS (2019). The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended) – a guide.

At the project level, discharges would be considered in detail in project-specific EIAs (and where necessary through HRAs) and chemical risk assessments under existing permitting procedures.

4.3.2 Underwater noise effects

Controls are in place to cover all significant noise generating activities on the UKCS, including geophysical surveying. Seismic surveys (including VSP and high-resolution site surveys), sub-bottom profile surveys and shallow drilling activities require an application for consent under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) and cannot proceed without consent. These applications are supported by an EIA, which includes a noise assessment. Applications are made through BEIS's Portal Environmental Tracking System using a standalone Master Application Template (MAT) and Geological Survey Subsidiary Application Template (SAT). Regarding noise thresholds to be used as part of any assessment, applicants are encouraged to seek the advice of relevant SNCB(s) (JNCC 2017) in addition to referring to European Protected Species (EPS) guidance (JNCC 2010). Applicants should be aware of recent research development in the field of marine mammal acoustics, including the development of a new set of criteria for injury (NMFS 2018, referred to as NOAA thresholds), which were recently adopted as updated criteria thresholds in the peer-reviewed literature (Southall *et al*. 2019).

BEIS consults the relevant statutory consultees on the consent applications for advice and a decision on whether to grant consent is only made after careful consideration of their comments. Statutory consultees may request additional information or risk assessment, specific additional conditions to be attached to consent (such as specify timing or other specific control measures), or advise against consent.

It is a condition of consents issued under Regulation 4 of the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) for oil and gas related seismic and sub-bottom profile surveys that the JNCC guidelines for minimising the risk of injury to marine mammals from geophysical surveys are followed. Where appropriate, EPS disturbance licences may also be required under the *Conservation of Offshore Marine Habitats and Species Regulations 2017*[27]. The updated JNCC guidelines (2017) reaffirm that adherence to these guidelines constitutes best practice and will, in most cases, reduce the risk of deliberate injury to marine mammals to negligible levels. Applicants are expected to make every effort to design a survey that minimises sound generated and consequent likely impacts, and to implement best practice measures described in the guidelines.

In addition, potential disturbance of certain qualifying species (or their prey) may be avoided by the seasonal timing of offshore activities. For example, periods of seasonal concern for individual Blocks on offer have been highlighted with respect to seismic survey and fish spawning (see Section 2 of OGA's Other Regulatory Issues[28] which accompanied the 32nd

[27] Disturbance of European Protected Species (EPS) (i.e. those listed in Annex IV) is a separate consideration under Article 12 of the Habitats Directive, and is not considered in this assessment.
[28] https://www.ogauthority.co.uk/media/5883/other-regulatory-issues-july-2019.pdf

Round offer) which licensees should take account of. Licensees should also be aware that it may influence BEIS's decision whether or not to approve particular activities.

4.4 Physical disturbance and drilling effects

Exploration activities may exert the following pressures[29] which have the potential to cause physical disturbance and drilling effects on Natura 2000 sites:

- Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion from jack-up drilling rig spud can placement, semi-submersible drilling rig anchor placement, dragging and the contact of anchor cables and chains with the seabed (see Section 4.4.1)
- Abrasion/disturbance of the substrate on the surface of the seabed and smothering/siltation rate change through the discharge of surface hole cuttings around the well, placement of wellhead assembly, and by settlement of drill cuttings onto the seabed following discharge near sea surface (see Section 4.4.2)
- Physical change to another seabed type through rock placement around jack-up legs for rig stabilisation (see Section 4.4.3)
- Contamination (see Section 4.4.4)
- Introduction or spread of non-indigenous species (see Section 4.4.5)
- Visual disturbance (and underwater noise changes, covered in Section 4.5), introduction of light and collision associated with the presence and movement of vessels causing displacement of sensitive receptors (see Section 4.4.6)
- Collisions above or below water with static or moving objects (see Section 4.4.7)

These are described briefly below and have informed the setting of screening criteria for physical disturbance and drilling effects (Section 4.4.8).

4.4.1 Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion

Semi-submersible rigs normally use anchors to hold position, typically between 8 and 12 in number at a radius related to water depth, seabed conditions and anticipated metocean conditions. The seabed footprint associated with semi-submersible rig anchoring results from a combination of anchor scars caused by anchors dragging before gaining a firm hold, and scraping by the cable and/or chain linking the anchor to the rig, where these contact the seabed (the catenary contact). In relatively shallow North Sea depths, rig anchors extend to a radius of up to *ca*. 1,500m (note that semi-submersible rigs are typically not used in water

[29] Following those noted in Section 4.2.

depths of less than 120m). In contrast, in the Faroe-Shetland Channel, a rig drilling in 1,200m water depth had anchors extending to a radius of some 2,750m (which accords with Gulf of Mexico experience, see Continental Shelf Associates 2006). In the deeper waters to the west of the UK, including to the West of Shetland, the use of anchors could be avoided through the use of dynamically positioned (DP) drill ships or DP semi-submersible rigs. These use a number of thrusters and accurate positioning information to maintain their station.

Jack-up rigs, normally used in shallower water (<120m), leave three or four seabed depressions from the feet of the rig (the spud cans) around 15-20m in diameter. The form of the footprint depends on factors such as the spudcan shape, the soil conditions, the footing penetration and methods of extraction, with the local sedimentary regime affecting the longevity of the footprint (HSE 2004). For example, side scan survey data from a 2011 pipeline route survey in Blocks 30/13c and 30/14 showed spudcan depressions associated with the drilling of a previous well in 2006 (no information on the depths of the depressions was provided). The well was located in a *ca*. 70m water depth, exposed to low tidal currents (0.1-0.26m/s) with sediments consisting of fine to medium silty sand with gravel, cobbles and coarse sand also present (Maersk 2011). By comparison, swathe bathymetry data collected as part of FEPA monitoring of the Kentish Flats wind farm off the Kent coast indicated a set of six regular depressions in the seabed at each of the turbine locations resulting from jack-up operations. Immediately post-construction, a January 2005 survey recorded these depressions as having depths of between 0.5 and 2.0m. By November 2007, these depths had reduced by an average of 0.6m indicating that the depressions were naturally infilling as a result of the mobile sandy sediments present across the area (Vattenfall 2009). In locations with an uneven or soft seabed, material such as grout bags or rocks may be placed on the seabed to stabilise the rig feet, and recoverable mud mats may be used in soft sediment (see below).

4.4.2 Abrasion/disturbance of the substrate on the surface of the seabed and habitat structure changes – removal of substratum

The surface hole sections of exploration wells are typically drilled riserless, producing a localised (and transient) pile of surface-hole cuttings around the surface conductor. These cuttings are derived from shallow geological formations and a proportion will be similar to surficial sediments in composition and characteristics. The persistence of cuttings discharged at the seabed is largely determined by the potential for it to be redistributed by tidal and other currents. After installation of the surface casing (which will result in a small quantity of excess cement returns being deposited on the seabed), the blowout preventer (BOP) is positioned on the wellhead housing. These operations (and associated activities such as ROV operations) may result in physical disturbance of the immediate vicinity (a few metres) of the wellhead. When an exploration well is abandoned, the conductor and casing are plugged with cement and cut below the mudline (seabed sediment surface) using a mechanical cutting tool deployed from the rig and the wellhead assembly is removed. The seabed “footprint” of the well is therefore removed although post-well sediments may vary in the immediate vicinity of the well compared to the surrounding seabed (see for example, Jones *et al*. (2012)).

The extent and potential impact of drilling discharges have been reviewed in successive SEAs, OESEA, OESEA2 and OESEA3 (DECC 2009, 2011 and 2016, respectively, also see BEIS 2018).

Relevant information on the recovery of benthic habitats to smothering mainly comes from studies of dredge disposal areas (see Newell *at al.* 1998). Recovery following disposal occurs through a mixture of vertical migration of buried fauna, together with sideways migration into the area from the edges, and settlement of new larvae from the plankton. The community recolonising a disturbed area is likely to differ from that which existed prior to construction. Opportunistic species will tend to dominate initially and on occasion, introduced and invasive species may then exploit the disturbed site (Bulleri & Chapman 2010). Harvey *et al.* (1998) suggest that it may take more than two years for a community to return to a closer resemblance of its original state (although if long lived species were present this could be much longer). Shallow water (<20m) habitats in wave or current exposed regimes, with unconsolidated fine grained sediments have a high rate of natural disturbance and the characteristic benthic species are adapted to this. Species tend to be short lived and rapid reproducers and it is generally accepted that they recover from disturbance within months. By contrast a stable sand and gravel habitat in deeper water is believed to take years to recover (see Newell *et al.* 1998, Foden *et al*. 2009).

4.4.3 Physical change to another seabed type

As noted, there may be a requirement for jack-up rig stabilisation (e.g. rock placement or use of mud mats) depending on local seabed conditions, however this is not typical. In soft sediments, rock deposits may cover existing sediments resulting in a physical change of seabed type. The introduction of rock into an area with a seabed of sand and/or gravel can in theory provide “stepping stones” which might facilitate biological colonisation including by non-indigenous species by allowing species with short lived larvae to spread to areas where previously they were effectively excluded. On the UK Continental Shelf, natural “stepping stones” are widespread and numerous for example in the form of rock outcrops, glacial dropstones and moraines, relicts of periglacial water flows, accumulations of large mollusc shells, carbonate cemented rock etc., and these are often revealed in rig site and other (e.g. pipeline route) surveys. The potential for man-made structures to act as stepping stones in the North Sea and the impact of their removal during decommissioning is being investigated as part of the INSITE[30] programme. Phase 1 projects (2015-2017) are now complete; those of relevance suggest that man-made structures may influence benthic community structure and function but only on a limited spatial scale. Modelling indicates the potential for biological connectivity between structures in the North Sea but this has not been validated by empirical data (ISAB 2018). BEIS are supporting Phase 2 of the INSITE research, which aims to tackle gaps in understanding of the role of man-made structures in marine ecosystems. Key areas to be investigated in the second phase include enhancing the understanding of the larval biology of ecologically significant biofouling species, the contribution of man-made structures as

[30] https://www.insitenorthsea.org/

artificial reefs, and approaches to the monitoring and environmental assessment of drill cuttings piles, renewable energy installation footings, and cables.

4.4.4 Contamination[31]

The past discharge to sea of drill cuttings contaminated with oil based drill mud (OBM) resulted in well documented acute and chronic effects at the seabed (e.g. Davies *et al.* 1989, Olsgard & Gray 1995, Daan & Mulder 1996). These effects resulted from the interplay of a variety of factors of which direct toxicity (when diesel based muds were used) or secondary toxicity as a consequence of organic enrichment (from hydrogen sulphide produced by bacteria under anaerobic conditions) were probably the most important. Through OSPAR and other actions, the discharge of oil based and other organic phase fluid contaminated material is now effectively banned. The "legacy" effects of contaminated sediments on the UKCS resulting from OBM discharges have been the subject of joint industry work (UKOOA 2002) and reporting to OSPAR.

The UK Government/Industry Environmental Monitoring Committee has reviewed UK offshore oil and gas monitoring requirements with an aim to ensure that adequate data is available on the environmental quality status in areas of operations for permitting assurance and to meet the UK's international commitments to report on UK oil industry effects. This strategy has been implemented since 2004 and has included regional studies in various parts of the North Sea, and surveys around specific single and multi-well sites. The most recent survey was undertaken as part of BEIS SEA monitoring with a survey in the Fladen Ground in late 2015 (see Appendix 1b of OESEA3).

Overall, there are positive indications of recovery of sediments and communities in both the Fladen Ground and East Shetland Basin from the historic effects of oil-based mud discharges. The total PAH and total n-alkane concentrations in Fladen Ground sediments were all lower in 2001 than in 1989 and are now at levels which are considered below 'background'. The results of the most recent Fladen Ground survey confirm this general pattern of recovery.

In contrast to historic oil based mud discharges[32], effects on seabed fauna resulting from the discharge of cuttings drilled with water based muds (WBM) and of the excess and spent mud itself are usually subtle or undetectable (e.g. Cranmer 1988, Neff *et al*. 1989, Hyland *et al*. 1994, Daan & Mulder 1996, Currie & Isaacs 2005, OSPAR 2009, Bakke *et al.* 2013, DeBlois *et al.* 2014, Aagaard-Sørensen *et al.* 2018). Considerable data has been gathered from the North Sea and other production areas, indicating that localised physical effects are the dominant mechanism of ecological disturbance where water-based mud and cuttings are discharged. Modelling of WBM cutting discharges has indicated that deposition of material is generally thin and quickly reduces away from the well. Jones *et al.* (2006, 2012) compared

[31] Including contamination from transition elements and organo-metals, hydrocarbons and PAHs, synthetic compounds and the introduction of other substances (solid, liquid or gas).
[32] OSPAR Decision 2000/3 on the Use of Organic-Phase Drilling Fluids (OPF) and the Discharge of OPF-Contaminated Cuttings came into effect in January 2001 and effectively eliminated the discharge of cuttings contaminated with oil based fluids (OBF) greater than 1% by weight on dry cuttings.

pre- and post-drilling ROV surveys of a West of Shetland exploration well in Block 206/1a in *ca*. 600m water depth and documented physical smothering effects within 100m of the well. Outside the area of smothering, fine sediment was visible on the seafloor up to at least 250m from the well. After 3 years, there was significant reduction of cuttings material visible particularly in the areas with relatively low initial deposition (Jones *et al*. 2012). The area with complete cuttings cover had reduced from 90m to 40m from the drilling location, and faunal density within 100m of the well had increased considerably and was no longer significantly different from conditions further away.

OSPAR (2009) concluded that the discharge of water-based muds and drill cuttings may cause some smothering in the near vicinity of the well location. The impacts from such discharges are localised and transient, but may be of concern in areas with sensitive benthic fauna, for example corals and sponges. Field experiments on the effects of water-based drill cuttings on benthos by Trannum *et al*. (2011) found after 6 months only minor differences in faunal composition between the controls and those treated with drill cuttings. This corresponds with the results of field studies where complete recovery was recorded within 1-2 years after deposition of water-based drill cuttings (Daan & Mulder 1996, Currie & Isaacs 2005).

Finer particles may be dispersed over greater distances than coarser particles although exposure to WBM cuttings in suspension will in most cases be short-term (Bakke *et al.* 2013). Chemically inert, suspended barite has been shown under laboratory conditions to potentially have a detrimental effect on suspension feeding bivalves. Standard grade barite, the most commonly used weighting agent in WBMs, was found to alter the filtration rates of four bivalve species (*Modiolus modiolus, Dosinia exoleta, Venerupis senegalensis* and *Chlamys varia*) and to damage the gill structure when exposed to 0.5mm, 1.0mm and 2.0mm daily depth equivalent doses (Strachan 2010, Strachan & Kingston 2012). All three barite treatments altered the filtration rates leading to 100% mortality. The horse mussel (*M. modiolus*) was the most tolerant to standard barite with the scallop (*C. varia*) the least tolerant. Fine barite, at a 2mm daily depth equivalent, also altered the filtration rates of all species, but only affected the mortality of *V. senegalensis*, with 60% survival at 28 days. The bulk of WBM constituents (by weight and volume) are on the OSPAR list of substances used and discharged offshore which are considered to Pose Little or No Risk to the Environment (PLONOR). Barite and bentonite are the materials typically used in the greatest quantities in WBMs and are of negligible toxicity. Field studies undertaken by Strachan (2010) showed that the presence of standard grade barite was not acutely toxic to seabed fauna but did alter benthic community structure. When the suspended barite levels used in laboratory studies are translated to field conditions (i.e. distances from the point of discharge) it is clear that any effects will be very local to a particular installation (in the case of oil and gas facilities, well within 500m).

4.4.5 Introduction or spread of non-indigenous species

Through the transport and discharge of vessel ballast waters (and associated sediment), and to a lesser extent fouling organisms on vessel/rig hulls, non-native species may be introduced to the marine environment. Should these introduced species survive and form established breeding populations, they can result in negative effects on the environment. These include: displacing native species by preying on them or out-competing them for resources; irreversible genetic pollution through hybridisation with native species, and increased occurrence of harmful algal blooms (as reviewed in Nentwig 2006). The economic repercussions of these ecological effects can also be significant (see IPIECA & OGP 2010, Lush *et al*. 2015, Nentwig 2007). In response to these risks, a number of technical measures have been proposed such as the use of ultraviolet radiation to treat ballast water or procedural measures such as a mid-ocean exchange of ballast water (the most common mitigation against introductions of non-native species). Management of ballast waters is addressed by the International Maritime Organisation (IMO) through the International Convention for the Control and Management of Ships Ballast Water & Sediments, which entered into force in 2017[33]. The Convention includes Regulations with specified technical standards and requirements (IMO Globallast website[34]). Further, oil and gas activity is unlikely to change the risk of the introduction of non-native species as the vessels typically operate in a geographically localised area (e.g. rigs may move between the Irish Sea and North Sea), and the risk from hull fouling is low, given the geographical working region and scraping of hulls for regular inspection.

4.4.6 Visual disturbance

Blocks may support important numbers of birds at certain times of the year including overwintering birds and those foraging from coastal SPAs. Therefore, the presence and/or movement of vessels and aircraft from and within Blocks during exploration and appraisal activities could temporarily disturb birds from relevant SPA sites. In areas where helicopter transits are regular, a degree of habituation to disturbance amongst some birds has been reported (see Smit & Visser 1993). The anticipated level of helicopter traffic associated with Block activity (2-3 trips per week, see Table 2.2) is likely to be insignificant in the context of existing helicopter, military and civilian aircraft activity levels. However, some Blocks on offer are in less-explored areas and helicopter traffic may deviate from established main routes (e.g. in the mid-North Sea High and parts of the northern North Sea[35]), causing temporary disturbance of birds not previously exposed to this pressure.

Physical disturbance of seaduck and other waterbird flocks by vessel and aircraft traffic associated with hydrocarbon exploration and appraisal is possible, particularly in SPAs established for shy species (e.g. common scoter). Such disturbance can result in repeated disruption of bird feeding, loafing and roosting. For example, large flocks of common scoter were observed being put to flight at a distance of 2km from a 35m vessel, though smaller flocks were less sensitive and put to flight at a distance of 1km (Kaiser 2002, also see Schwemmer *et al.* 2011). Larger vessels would be expected to have an even greater disturbance distance (Kaiser *et al.* 2006). Mendel *et al.* (2019) further note behavioural response in red-throated diver within 5km of ships. With respect to the disturbance and subsequent displacement of seabirds in relation to offshore wind farm (OWF) developments, the Joint SNCB interim displacement advice[36] recommends for most species a standard

[33] http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships%27-Ballast-Water-and-Sediments-(BWM).aspx
[34] http://archive.iwlearn.net/globallast.imo.org/the-bwmc-and-its-guidelines/index.html
[35] https://www.aurora.nats.co.uk/htmlAIP/Publications/2018-09-13-AIRAC/html/eAIP/EG-ENR-6-en-GB.html
[36] http://jncc.defra.gov.uk/pdf/Joint_SNCB_Interim_Displacement_AdviceNote_2017.pdf

displacement buffer of 2km with the exception of the species groups of divers and sea ducks. Divers and sea ducks have been assessed as being the most sensitive species groups to offshore development and associated boat and helicopter traffic. Therefore for divers and sea ducks a 4km displacement buffer is recommended. Whilst displacement effects for divers have been detected at greater distances (e.g. 5-7km, Webb 2016; significant changes noted at 10-16.5km, Mendel *et al.* 2019), this relates to the construction and operation of offshore wind farms which have a much larger spatial and temporal footprint than oil and gas exploration activities.

A significant number of various bird species migrate across the North Sea region twice a year or use the area as a feeding and resting area (OSPAR 2015). Some species crossing or using the area may become attracted to offshore light sources, especially in poor weather conditions with restricted visibility (e.g. low clouds, mist, drizzle, Wiese *et al*. 2001), and this attraction can potentially result in mortality through collision (OSPAR 2015). As part of navigation and worker safety, and in accordance with international requirements, drilling rigs and associated vessels are lit at night and the lights will be visible at distance (some 10-12nm in good visibility). Guidelines (applicable to both existing and new offshore installations) aimed at reducing the impact of offshore installations lighting on birds in the OSPAR maritime area are available (OSPAR 2015). Exploration drilling activities are temporary so a drilling rig will be present at a location for a relatively short period (e.g. on average up to 10 weeks), limiting the potential for significant interaction with migratory bird populations. Given the seasonal nature of the sensitivity, where relevant it is more appropriate to consider this in project level assessment (e.g. EIA and HRA where necessary), when the location and timing of activities are known.

The presence and/or movement of vessels from and within Blocks during exploration and appraisal activities could also potentially disturb marine mammals foraging within or close to sites for which they are a qualifying feature. Reported responses include avoidance, changes in swimming speed, direction and surfacing patterns, alteration of the intensity and frequency of calls and increases in stress-related hormones (Rolland *et al.* 2012, Dyndo *et al.* 2015, Veirs *et al.* 2016). Harbour porpoises, white-sided dolphins and minke whales have been shown to respond to survey vessels by moving away from them, while white-beaked dolphins have shown attraction (Palka & Hammond 2001). A study on captive harbour porpoises in a semi-natural net-pen complex in a Danish canal, recorded their behaviour while simultaneously measuring underwater noise of vessels passing the enclosure; reaction to noise was defined to occur when a highly stereotyped ‘porpoising’ behaviour was observed. Porpoising occurred in response to almost 30% of vessel passages; the most likely behavioural trigger were medium- to high- frequency components (0.25–63 kHz octave bands) of vessel noise, while low-frequency components of vessel noise and additional pulses from echo-sounders could not explain the results (Dyndo *et al*. 2015). A tagging study of a small number of free-ranging porpoises in Danish coastal waters estimated that porpoises encountered vessel noise 17–89% of the time (from evaluation of the wideband sound and movement tag recordings). Occasional high-noise levels (coinciding with a fast ferry) were associated with vigorous fluking, bottom diving, interrupted foraging and even cessation of echolocation, leading to significantly fewer prey capture attempts at received levels greater than 96 dB re 1 mPa (16 kHz third-octave, Wisniewska *et al.* 2018).

More evidence is available on bottlenose dolphins, especially for coastal populations. Shore-based monitoring of the effects of boat activity on the behaviour of bottlenose dolphins off the US South Carolina coast, indicated that slow moving, large vessels, like ships or ferries, appeared to cause little to no obvious response in bottlenose dolphin groups (Mattson *et al*. 2005). Pirotta *et al*. (2015) used passive acoustic techniques to quantify how boat disturbance affected bottlenose dolphin foraging activity in the inner Moray Firth. The presence of moving motorised boats appeared to affect bottlenose dolphin buzzing activity (foraging vocalisations), with boat passages corresponding to a reduction by almost half in the probability of recording a buzz. The boat effect was limited to the time where a boat was physically present in the sampled area and visual observations indicated that the effect increased for increasing numbers of boats in the area (Pirotta *et al.* 2013). Dolphins appeared to temporarily interrupt their activity when disturbed, staying in the area and quickly resuming foraging as the boat moved away.

Of primary concern for this HRA, is whether vessels linked to potential operations result in a significant increase to overall local traffic. New *et al*. (2013) developed a mathematical model simulating the complex social, spatial, behavioural and motivational interactions of coastal bottlenose dolphins in the Moray Firth to assess the biological significance of increased rate of behavioural disruptions caused by vessel traffic. A scenario was explored in which vessel traffic increased from 70 to 470 vessels a year but despite the more than six fold increase traffic, the dolphins' behavioural time budget, spatial distribution, motivations and social structure remained unchanged. While harbour porpoises appear to be more sensitive to potential disturbance than bottlenose dolphins, the increase in vessel traffic linked to the proposed plan is expected to be negligible (see Table 2.2). In UK waters, a modelling study indicated a negative relationship between the number of ships and the presence and abundance of harbour porpoises within relevant management units when shipping intensity exceeded a suggested threshold of approximately 50 ships per day (within any of the model's 5km grid cells) in the Celtic Sea/Irish Sea and 80 ships per day in the North Sea (Heinänen & Skov 2015). The Marine Management Organisation commissioned project "Mapping UK shipping density and routes from AIS" (MMO 2014b) and the 2015 national dataset of marine vessel traffic[37] provides relevant shipping density information[38]. From 2015 AIS-derived ship density data, the approaches to major ports such as in the Humber and Thames regions had estimated shipping densities of up to 500 vessels per week, with the majority of coastal waters (10-25 vessels per week) and offshore waters (<5 vessels per week) supporting much lower densities. Jones *et al.* (2017) used the MMO (2014b) data to highlight areas where high rates of co-occurrence between seals at-sea and shipping coincided with SACs. They predicted exposure to shipping (and associated shipping noise) was likely to be high in areas where very high intensities of spatial overlap occurred for one or both species of seals such as Orkney (e.g. Faray and Holm of Faray SAC), Shetland (e.g. Yell Sound Coast SAC), east coast of Scotland and England (e.g. Berwickshire and North Northumberland Coast SAC, Humber

[37] https://data.gov.uk/dataset/vessel-density-grid-2015

[38] Note that shipping densities are low over the majority of Blocks with higher densities primarily in coastal waters close to major ports.

Estuary SAC, the Wash and North Norfolk Coast SAC), west Scotland (South East Islay Skerries SAC) and north Wales (no adjacent SAC with seals as a feature).

4.4.7 Collisions above or below water with static or moving objects

Worldwide, collisions with vessels are a potential source of mortality to marine mammals, primarily cetaceans. Whales are occasionally reported to be struck and killed, especially by fast-moving ferries but smaller cetacean species and seals can also be impacted by propeller strikes from smaller vessels. In the UK certain areas experience very high densities of commercial and recreational shipping traffic, some of which may also be frequented by large numbers of marine mammals; despite this, relatively few deaths are recorded as results of collisions (Hammond *et al.* 2008). Between 2000 and 2009, only 11 out of 1,100 post-mortems on harbour porpoises and common dolphins identified collision as the cause of death (UKMMAS 2010). Advice on operations for the Southern North Sea SAC[39] indicates that post mortem investigations of harbour porpoise deaths have revealed death caused by trauma (potentially linked with vessel strikes) is not currently considered a significant risk (e.g. see Deaville & Jepson 2011).

4.4.8 Screening criteria for physical and drilling effects

With respect to **physical and drilling effects**, any Block should be screened in that is within or overlaps with a Natura 2000 site, together with any Block within a buffer of 10km from a Natura 2000 site where there is a potential interaction between site features and exploration/appraisal activities in the Block.

Blocks and relevant Natura 2000 sites screened in on the basis of physical and drilling effects are shown in Figures 5.1 (SPAs) and 5.2 (SACs), and listed in Appendix B2. The relevant impact pathways to be considered at the AA stage will depend on the location of the Blocks applied for and the qualifying features of the relevant sites. The potential for interactions of mobile qualifying species (primarily seabirds, marine mammals and fish) with exploration and appraisal activities when outside of relevant Natura 2000 site boundaries is considered in Section 4.6. Where appropriate, additional Blocks >10km from relevant site boundaries may be screened in.

4.5 Underwater noise effects[40]

The current level of understanding of sources, measurement, propagation, ecological effects and potential mitigation of underwater noise associated with hydrocarbon exploration and production have been extensively reviewed, assessed and updated in each of the successive

[39] http://archive.jncc.gov.uk/pdf/SNorthSea_ConsAdvice.pdf
[40] Note that all underwater noise effects fall within the "underwater noise change" and "vibration" pressure definitions.

offshore energy SEAs (see DECC 2009, 2011, 2016). The following description of noise sources and potential effects builds on these previous publications, augmented with more recent literature sources.

4.5.1 Noise sources and propagation

For all sources of anthropogenic underwater noise, there is now a reasonable body of evidence to quantify sound levels associated with these activities and to understand the likely propagation of these sounds within the marine environment, even in more complex coastal locations (DECC 2016, 2018).

Of those oil and gas activities that generate underwater sound, deep geological seismic survey (2D and 3D) is of primary concern due to the high amplitude, low frequency and impulsive nature of the sound generated over a relatively wide area. Typical 2D and 3D seismic surveys consist of a vessel towing a large airgun array, made up of sub-arrays or single strings of multiple airguns, along with towed hydrophone streamers. Total energy source volumes vary between surveys, most commonly between 1,000 and 8,000 cubic inches, with typical broadband source levels of 248-259 dB re 1μPa (OGP 2011). Most of the energy produced by airguns is low frequency: below 200Hz and typically peaking around 100Hz; source levels at higher frequencies are low relative to that at the peak frequency but are still loud in absolute terms and relative to background levels.

In addition to seismic surveys, relevant sources of impulsive sound are restricted to the smaller volume air-guns and sub-bottom profilers (SBPs) used in site surveys and well evaluation (i.e. Vertical Seismic Profiling, VSP), and also from occasional pile-driving of conductors during drilling (see Table 2.2). Compared to deep geological survey, these smaller volume seismic sources tend to generate sound of lower amplitude, are typically complete within several hours on a single day, are conducted from either a fixed point (VSP) or cover a small area (site surveys). Consequently, the overall magnitude and area of risk from sound effects is considerably smaller than in the case of deep geological seismic surveys.

Electromechanical sources such as ‘pinger’ or ‘chirper’ SBPs, side-scan sonar and multi-beam echosounders (MBES) have narrower beam widths and dominant frequencies much higher than those of air guns[41] such that, even at high amplitudes, the generated sound would be expected to rapidly attenuate and likely not propagate far enough for marine species to be negatively affected by received sound levels. For example, the absorption coefficient alone in seawater is approximately -36dB/km at 100kHz, rising to -61dB at 200kHz (Lurton 2016). SBPs of the ‘boomer’ and ‘sparker’ type do generate a true broadband seismic pulse of low frequency, although the peak pressures produced by these small devices are considerably lower than those generated by airguns. Two recent studies commissioned by the US Bureau of Ocean Energy Management investigated sound generated by equipment commonly used in

[41] It should be noted that airgun (including VSP) and sub-bottom profiling site surveys undertaken in relation to licences issued under the *Petroleum Act 1998* require consent under the *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended), but side-scan sonar and multibeam echosounder surveys only require to be notified to the Regulator (JNCC 2017).

high-resolution geophysical surveys, including electromagnetic sources. Calibrated source levels were measured under controlled conditions in a test tank (Crocker & Fratantonio 2016); acoustic characteristics of several example equipment types tested are provided in Table 4.1.

Table 4.1: Measured acoustic characteristics for example sources used in high-resolution geophysical surveys

Source tested	Category; signal type	Source levels at maximum power tested (dB re 1µPa@1m)[1]		Approximate frequency of dominant energy (kHz)	-3dB beam width (degrees); across track
		$SPL_{peak-peak}$	SEL		
Delta Sparker	SBP ‘sparker’; impulse	206-225	163-185	< 1	n/a
Applied Acoustics 251	SBP ‘boomer’ (single plate); impulse	208-216	166-174	< 4	49-76
EdgeTech 512i	SBP ‘chirper’; chirp	176-191	145-160	3-5	51-80
Reson Seabat 7111	MBES; tone burst	197-233	152-197	100	~160
EdgeTech 4200	Side-scan sonar; tone burst	206-216	165-205	100 or 400	~50 (1.6-2.6 along track)

Notes: 1. Values represent minimum and maximum according to different source configurations (e.g. power level, pulse width or centre frequency); maximum values typically correspond to the highest power level tested. SBP = sub-bottom profiler; MBES = multibeam echosounder. Source: Crocker & Fratantonio (2016).

The test tank experiments were followed by measurements in shallow (≤ 100m depth) open-water environments to investigate sound propagation (Halvorsen & Heaney 2018). Problems were encountered during the open-water testing resulting in a lack of calibration in the reported sound source levels (Labak 2019). The accompanying advice note (Labak 2019) emphasises that these uncalibrated data should not be used to provide source level measurements, and consequently the reported isopleths (summarising sound propagation) should not replace project-specific sound source verifications. A further project to calibrate these measures and provide an expanded assessment of propagation commenced in 2019.

Despite the caveats on the current open-water test results, it is worth noting some general patterns observed. In all test environments, broadband received levels from all MBES, side-scan sonar and SBP ‘chirper’ or ‘boomer’ devices tested were rapidly attenuated with distance from source, with particularly pronounced fall-off for directional sources when the receiver was outside of the source’s main beam. Acoustic signals from the SBP ‘sparkers’ tested showed slightly greater propagation, as would be expected from the lower-frequency impulsive signals these devices produce. The greatest propagation was generally observed at the deepest test site (100m water depth) from sources generating low frequencies (<10kHz) whilst some of the highest frequency sources (>50kHz) experienced such attenuation that they were only weakly detectable or undetected by recording equipment. While acknowledging that these results require refinement, for all the aforementioned devices broadband sound levels recorded a few hundred metres from the source were approximately an order of magnitude lower than the criteria for permanent or temporary hearing loss (Southall *et al*. 2019). These preliminary results, combined with the calibrated source measurements in test tanks, suggest that SBPs and other electromechanical sources used in high-resolution geophysical surveys have a very low potential for significant disturbance of sensitive marine fauna.

Drilling operations and support vessel traffic are sources of continuous noise (non-impulsive), of a comparable amplitude, dominated by low frequencies and of a lower amplitude than deep geological seismic survey. Sound pressure levels of between 120dB re 1μPa in the frequency range 2-1,400Hz (Todd & White 2012) are probably typical of drilling from a jack-up rig, with slightly higher source levels likely from semi-submersible rigs due to greater rig surface area contact with the water column. In general, support and supply vessels (50-100m) are expected to have broadband source levels in the range 165-180dB re 1μPa@1m, with the majority of energy below 1kHz (OSPAR 2009). Additionally, the use of thrusters for dynamic positioning has been reported to result in increased sound generation (>10dB) when compared to the same vessel in transit (Rutenko & Ushchipovskii 2015).

4.5.2 Potential ecological effects

Potential effects of anthropogenic noise on receptor organisms range widely, from masking of biological communication and small behavioural reactions, to chronic disturbance, physiological injury and mortality. While generally the severity of effects tends to increase with increasing exposure to noise, it is important to draw a distinction between effects from physical (including auditory) injury and those from behavioural disturbance. In addition to direct effects, indirect effects may also occur, for example via effects on prey species, complicating the overall assessment of significant effects. Marine mammals, and in particular the harbour porpoise, are regarded as the most sensitive to underwater noise effects therefore it is considered appropriate to focus on marine mammals when assessing risk from underwater noise; however, high amplitude impulsive noise also potentially presents a risk to fish and diving birds.

Marine mammals

The risk of physical injury (hearing loss) from an activity can be assessed by modelling the propagation of sound from an activity and using threshold criteria corresponding to the sound levels at which permanent hearing loss (permanent threshold shift, PTS) would be expected to occur. For marine mammals, the latest SEA (DECC 2016) reflects the injury thresholds criteria developed by Southall *et al.* (2007), including the subsequent update for harbour porpoises in Lepper *et al*. (2014), based on the work by Lucke *et al.* (2009). Since then, NOAA has further updated the acoustic thresholds, including alternative frequency-weighting functions (NMFS 2016, 2018) which were recently adopted as updated criteria thresholds in the peer-reviewed literature (Southall *et al.* 2019). It is recognised that geophysical surveys (primarily 2D and 3D seismic) have the potential to generate sound that exceeds thresholds of injury, but only within a limited range from source (tens to hundreds of metres); for site surveys and VSP, the range from source over which injury may occur will be even smaller. Within this zone, JNCC (2017) guidelines are considered to be sufficient in minimising the risk of injury to marine mammals to negligible levels.

With respect to disturbance, it has proved much more difficult to establish broadly applicable threshold criteria based on exposure alone; this is largely due to the inherent complexity of animal behaviour where the same sound level is likely to elicit different responses depending on an individual's behavioural context and exposure history. For compliance with the Habitat Directive, the guidance for the protection of marine European Protected Species from injury and disturbance (JNCC 2010) recommends that 'disturbance' is interpreted as sustained or chronic disruption of behaviour scoring five or more in the Southall *et al*. (2007) behavioural response severity scale[42]. This is to highlight that a disturbance offence is unlikely to occur from sporadic changes in behaviour with negligible consequences on vital rates and population effects (i.e. trivial disturbance). While it is possible to envisage how some behavioural effects may ultimately influence vital rates, evidence is currently limited. The focus of field studies has been on measuring displacement and changes in vocalisation with the assumption that these may influence vital rates mainly via a reduction in foraging opportunities.

Evidence of the effects of seismic surveys on odontocetes and pinnipeds is limited but of note are studies in the Moray Firth observing responses to a 10 day 2D seismic survey (Thompson *et al.* 2013a). The 2D seismic survey took place in September 2011 and exposed a 200km^2 area to noise throughout that period; peak-to-peak source levels generated by the 470 cubic inch airgun array were estimated to be 242-253 dB re 1 μPa at 1m and are therefore representative of the volume of a typical array used in VSP, and larger than that used in rig-site survey. Within 5-10km from the source, received peak-to-peak SPLs were estimated to be between 165 and 172 dB re 1 μPa, with SELs for a single pulse between 145 and 151 dB re 1 μPa^{2}s. A relative decrease in the density of harbour porpoises within 10km of the survey vessel and a relative increase in numbers at distances greater than 10km was reported; however, these effects were short-lived, with porpoise returning to affected areas within 19 hours after cessation of activities. Overall, it was concluded that while short-term disturbance was induced, the survey did not lead to long-term or broad-scale displacement (Thompson *et al*. 2013a). Further acoustic analyses revealed that for those animals which stayed in proximity to the survey, there was a 15% reduction in buzzing activity associated with foraging or social activity; however, a high level of natural variability in the detection of buzzes was noted prior to survey (Pirotta *et al*. 2014). Passive acoustic monitoring provided evidence of short-term behavioural responses also for bottlenose dolphins, but no measurable effect on the number of dolphins using the Moray Forth SAC could be revealed (Thompson *et al*. 2013b).

As concluded in OESEA3 (DECC 2016), a conservative assessment of the potential for marine mammal disturbance from seismic surveys will assume that firing of airguns will affect individuals within 10km of the source (in keeping with a 10km Effective Deterrence Radius (EDR) suggested by the SNCBs in their joint response to the 31st Round draft AA, March 2019), resulting in changes in distribution and a reduction of foraging activity, but the effect is short-lived. The precautionary criterion applied during initial Block screening (15km from relevant sites) is maintained here to identify the Blocks applied for to be considered with respect to likely significant effects in this assessment (see Section 5.2); this is to reflect the degree of uncertainty and the limited direct evidence available and to allow for a greater potential for disturbance when large array sizes are used.

Evidence on harbour porpoise responses to impact piling during wind-farm construction is also relevant since the impulsive character of the sound generated during piling is comparable with

[42] See Table 4 (p450) of Southall *et al.* (2007) for a full description of response scores.

that from seismic airguns and for assessing in-combination effects with wind farms currently planned or under construction across the North Sea. Empirical studies during the construction of OWFs in the North and Baltic Seas (Carstensen *et al*. 2006, Tougaard *et al*. 2009, Brandt *et al*. 2011, 2018, Dähne *et al.* 2013) have all observed displacement of harbour porpoises in response to pile-driving. The magnitude of the effect (spatial extent and duration) varied between studies as a function of the many factors including exposure level, duration of piling, use of technical mitigation measures and ecological importance of the area. Nonetheless, from the available evidence it has been concluded that impact piling will displace individual harbour porpoises within an area of approximately 20km radius; however, once piling ceases, harbour porpoises are expected to return readily (hours to days) (DECC 2016).

A recently published study by Graham *et al*. (2019) provides evidence of harbour porpoise behavioural responses to pile-driving during construction of the Beatrice offshore wind farm in the Moray Firth. Each turbine base was secured using four 2.2m diameter steel piles, installed with a typical hammer energy of 600-700kJ. Using an array of acoustic loggers moored between 0.4 and 76.5km from piling locations, acoustic detections of porpoise in the 24 hours following the end of piling events (lasting *ca.* 5 hours) were examined relative to detections during a baseline period 24-48 hours prior to the onset of piling. Harbour porpoise were present within the windfarm construction site throughout the construction period. The probability of response (significantly reduced detections) reduced with increasing distance to piling and as the number of locations piled increased: there was a ≥50% probability of a behavioural response at a distance of 7.4km from piling at the start of construction, reducing to 4.0km midway through construction, and 1.3km at the final piling event. Acoustic Deterrent Devices (ADDs) were used prior to almost all piling events examined. While data for piling without ADD use was limited, thereby reducing the ability to distinguish the effects of different sound sources, the results of the study suggest that response levels were increased with ADD use.

Current SNCB advice assumes a distance of 26km as the zone of disturbance for pile-driving (Joint SNCB response to 31st Round draft AA, March 2019). This EDR is particularly precautionary for smaller piles, as no differentiation is made between these (e.g. as used in the oil and gas industry for subsea developments or to set conductors) and monopiles which are typically used for offshore wind. The scale of pin-pile installation for the Beatrice OWF is intermediate between OWF monopile foundations and the piling of conductors/subsea infrastructure, being approximately twice the pile diameter and hammer energy typical of the latter. The associated findings of Graham *et al*. (2019) provided evidence that the probability of harbour porpoise behavioural responses to piling was low at distances >10km and unlikely to exceed 20km, diminished over time, and, in this instance, the 26km EDR for piling appears to be highly conservative. Considering these results relative to the typical pile diameters and hammer energies used in conductor piling, the 15km noise effects criterion applied in this screening is considered to be highly precautionary for harbour porpoise.

At Horns Rev wind farm, off the Danish North Sea coast, a study using satellite telemetry showed that harbour seals were still transiting the site during periods of piling but no conclusive results could be obtained from analysis of habitat use with regard to a change in response to piling (Tougaard *et al*. 2006). Evidence of a response was obtained by Edrén *et al.* (2010) at a haul-out site 4km away from the Danish Nysted windfarm; during piling, numbers hauling out were reduced by 10-60% but the effect was only of short duration since the overall number of seals increased slightly during the whole construction phase. Russell *et al*. (2016) used telemetry data from 23 harbour seals to investigate potential avoidance of seals to the construction of the Lincs wind farm in The Wash off the east coast of England, including pile-driving of mono-pile foundations. While there was no significant displacement during construction as a whole, seal abundance during piling was significantly reduced up to 25km from the piling activity, with a 19-83% (95% confidence intervals) reduction in usage compared to breaks in piling activity. This displacement was shown to be temporary, with seals returning to their non-piling distribution within two hours of the cessation of piling.

Information on the potential effects of other geophysical surveys (e.g. sub-bottom profilers) is limited, with empirical studies of animal responses to such surveys lacking. The most recent OESEA (DECC 2016) concluded that, given the characteristics of the noise sources produced, effects are considered to be negligible but with a high level of uncertainty. Recent laboratory and field studies of the source levels and propagation of a variety of high-resolution geophysical survey sources (see Section 4.5.1) provided evidence to support the conclusion of negligible risk of significant effects from electromagnetic sources, with received levels dropping to below that which might be expected to cause behavioural disturbance within a few hundred metres of the source (Halvorsen & Heaney 2018).

With regard to conductor piling, the low hammer energy, narrow diameter of pipes and short duration of piling, combined with field measurements of sound propagation from this activity (Jiang *et al*. 2015, MacGillivray 2018), and the behavioural responses reported in Graham *et al*. (2019), suggest a very low potential for significant disturbance of marine mammals.

Noise from vessels and drilling activity is audible to marine mammals but are not of the characteristics sufficient to cause injury. Vessel noise may elicit low-level disturbance effects in marine mammals (e.g. changes in vocalisation rates and dive behaviour)[43]; however, such effects are temporary, of limited spatial extent.

Fish

Many species of fish are highly sensitive to sound and vibration and broadly applicable sound exposure criteria have recently been published (Popper *et al.* 2014). Studies investigating fish mortality and organ damage from noise generated during seismic surveys are very limited and results are highly variable, from no effect to long-term auditory damage (reviewed in Popper *et al.* 2014). Behavioural responses and effects on fishing success ("catchability") have been reported following seismic surveys (Pearson *et al.* 1992, Skalski *et al.* 1992, Engås *et al.* 1996, Wardle *et al*. 2001). Potential effects on migratory diadromous fish is an area of significant interest for which empirical evidence is still limited, especially as salmonids and eels are

[43] Note that in studies of animals in the wild it is difficult to determine the relative contribution of noise and physical presence of vessels in the observed responses, with the latter discussed in Section 4.4.6.

sensitive to particle motion (not sound pressure) (Gill & Bartlett 2010). Atlantic salmon *Salmo salar* have been shown through physiological studies to respond to low frequency sounds (below 380Hz), with best hearing at 160Hz (threshold 95 dB re 1 μPa). Harding *et al.* (2016) note a lower sensitivity at 100Hz than previously reported (Hawkins & Johnstone 1978), and greater sensitivity at frequencies of >200Hz, with evidence of some response at 400-800Hz. However, the authors qualify their results with differences in methodological approach, and the use of fish maintained in tanks receiving low frequency ambient sound within the greatest range of sensitivity (<300Hz) for some time in advance of the experiments taking place. The ability of salmon to respond to sound pressure is regarded as relatively poor with a narrow frequency span, a limited ability to discriminate between sounds, and a low overall sensitivity relative to other fish species (Hawkins & Johnstone 1978, cited by Gill & Bartlett 2010, Harding *et al.* 2016).

In addition to considering direct effects on fish as qualifying features of Natura 2000 sites, fish also form important prey items of seabird, marine mammal and fish qualifying features. Fish species of known importance to both diving seabirds and marine mammals in the North Sea include sandeels, pelagic species such as herring and sprat, and young gadoids. Sandeels lack a swim bladder, which is considered to be responsible for their observed low sensitivity to underwater noise (Suga *et al*. 2005) and minor, short-term responses to exposure to seismic survey noise (Hassel *et al*. 2004), although data are limited. By contrast, herring are considered hearing specialists, detecting a broader frequency range than many species. Sprat are assumed to have similar sensitivities to herring due to their comparable morphology, although studies on this species are lacking. Observed responses of herring to underwater noise vary. For example, Peña *et al*. (2013) did not observe any changes in swimming speed, direction, or school size as a 3D seismic vessel slowly approached schools of feeding herring from a distance of 27km to 2km; conversely, Slotte *et al*. (2004) observed herring and other mesopelagic fish to be distributed at greater depth during periods of seismic shooting than non-shooting, and a reduced density within the survey area. Evidence for and against avoidance of approaching vessels by herring has been reported (e.g. Skaret *et al*. 2005, Vabø *et al*. 2002), with the nature of responses believed to be related to the activity of the school at the time.

Following a review of relevant studies, MMS (2004) consider that the “consensus is that seismic airgun shooting can result in reduced trawl and longline catch of several species when the animals receive levels as low as 160dB”. These reduced catches are temporary in nature and likely reflect temporary displacement and/or altered feeding behaviour. No associations of lower-intensity, continuous drilling noise and fishing success have been demonstrated, and large numbers of fish are typically observed around producing installations in the North Sea (e.g. Løkkeborg *et al*. 2002, Fujii 2015) and elsewhere (e.g. Stanley & Wilson 1991).

Diving birds

Direct effects from seismic exploration noise on diving birds could potentially occur through physical damage, or through disturbance of normal behaviour, although evidence for such effects is very limited. Deeper-diving species which spend longer periods of time underwater (e.g. auks) may be most at risk of exposure to high-intensity noise from seismic survey and consequent injury or disturbance, but all species which routinely submerge in pursuit of prey and benthic feeding opportunities (i.e. excluding shallow plunge feeders) may be exposed to anthropogenic noise. A full list of relevant species occurring in the UK is provided in Box 4.1, all of which are qualifying species of one or more relevant sites considered in this HRA (see Appendix A).

Very high amplitude low frequency underwater noise may result in acute trauma to diving seabirds, with several studies reporting mortality of diving birds in close proximity (i.e. tens of metres) to underwater explosions (Yelverton *et al*. 1973, Cooper 1982, Stemp 1985, Danil & St Leger 2011). However, mortality of seabirds has not been observed during extensive seismic operations in the North Sea and elsewhere. While seabird responses to approaching vessels are highly variable, flushing disturbance would be expected to displace most diving seabirds from close proximity to seismic airgun arrays, particularly among species more sensitive to visual disturbance such as scoter, divers and cormorant (Garthe & Hüppop 2004). Therefore, the potential for acute trauma to diving birds from seismic survey is considered to be very low.

Data relating to the potential behavioural disturbance of diving birds due to underwater noise are very limited. The reported in-air hearing sensitivity for a range of diving duck species, red-throated diver and gannet have been tested for tone bursts between frequencies of 0.5-5.7kHz; results revealed a common region of greatest sensitivity from 1-3kHz, with a sharp reduction in sensitivity >4kHz (Crowell e*t al.* 2015). Similar results were observed for African penguin; tests of in-air hearing showed a region of best sensitivity of 0.6-4kHz, consistent with the vocalisations of this species (Wever *et al*. 1969). Testing on the long-tailed duck underwater showed reliable responses to high intensity stimuli (> 117 dB re 1μPa) from 0.5-2.9kHz (Crowell 2014). An underwater hearing threshold for cormorant of 70-75 dB re 1μPa rms for tones at tested frequencies of 1-4kHz has been suggested (Hansen *et al*. 2017). The authors argue that this underwater hearing sensitivity, which is broadly comparable to that of seals and small odontocetes at 1-4kHz, is suggestive of the use of auditory cues for foraging and/or orientation and that cormorant, and possibly other species which perform long dives, are sensitive to underwater sound. The use of acoustic pingers mounted on the corkline of a gillnet in a salmon fishery, emitting regular impulses of sound at *ca.* 2kHz, was associated with a significant reduction in entanglements of guillemot, but not rhinoceros auklet (Melvin *et al*. 1999). In a playback experiment on wild African penguins, birds showed strong avoidance behaviour (interpreted as an antipredator response) when exposed to killer whale vocalisations and sweep frequency pulses, both focussed between 0.5-3kHz (Frost *et al*. 1975).

McCauley (1994) inferred from vocalisation ranges that the threshold of perception for low frequency seismic noise in some species (e.g. penguins, considered as a possible proxy for auk species) would be high, hence individuals might be adversely affected only in close proximity to the source. A study investigated seabird abundance in Hudson Strait (Atlantic seaboard of Canada) during seismic surveys over three years (Stemp 1985). Comparing periods of shooting and non-shooting, no significant difference was observed in abundance of fulmar, kittiwake and thick-billed murre (Brünnich's guillemot). More recently, Pichegru *et al*. (2017) used telemetry data from breeding African penguins to document a shift in foraging distribution concurrent with a 2D seismic survey off South Africa. Pre/post shooting, areas of highest use (indicated by the 50% kernel density distribution) bordered the closest boundary of the seismic survey; during shooting, their distribution shifted away from the survey area, with areas of higher use at least 15km distant to the closest survey line. However, insufficient information was provided on the spatio-temporal distribution of seismic shooting or penguin distribution to determine an accurate displacement distance. It was reported that penguins quickly reverted to normal foraging behaviour after cessation of seismic activities, suggesting a relatively short-term influence of seismic activity on these birds' behaviour and/or that of their prey (Pichegru *et al*. 2017).

These data are limited, but the observed regions of greatest hearing sensitivity for cormorants in water and other diving birds in air are above those low frequencies (i.e. <500Hz) which dominate and propagate most widely from geological survey. While there is some evidence of noise-induced changes in the distribution and behaviour of diving birds in response to impulsive underwater noise, these have been temporary and may be a direct disturbance or reflect a change in prey distribution during that period (possibly as a result of seismic activities).

Box 4.1: Migratory and/or Annex I diving bird species occurring in the UK considered potentially vulnerable to underwater noise effects

Divers and grebes	**Diving ducks**
Great northern diver *Gavia immer*	Pochard *Aythya ferina*
Red-throated diver *Gavia stellata*	Tufted duck *Aythya fuligula*
Black-throated diver *Gavia arctica*	Scaup *Aythya marila*
Little grebe *Tachybaptus ruficollis*	Eider *Somateria mollissima*
Great crested grebe *Podiceps cristatus*	Long-tailed duck *Clangula hyemalis*
Slavonian grebe *Podiceps auritus*	Common scoter *Melanitta nigra*
Seabirds	Velvet scoter *Melanitta fusca*
Manx shearwater *Puffinus puffinus*	Goldeneye *Bucephala clangula*
Gannet *Morus bassanus*	Red-breasted merganser *Mergus serrator*
Cormorant *Phalacrocorax carbo carbo*	Goosander *Mergus merganser*
Shag *Phalacrocorax aristotelis*	
Guillemot *Uria aalge*	
Razorbill *Alca torda*	
Puffin *Fratercula arctica*	

Note: Includes species which are known to engage in pursuit diving or benthic feeding in marine, coastal and estuarine waters at least during part of the year.

4.5.3 Screening criteria for underwater noise effects

With respect to **underwater noise effects**, any Block that is within 15km of a SAC with qualifying features regarded as sensitive to underwater noise (e.g. marine mammals, diving birds and migratory fish) should be screened in. In the context of measurements and modelling for the different sound sources; established injury threshold criteria; and, relevant studies of observed effects, including those in the UKCS, 15km is considered to be a conservative estimate of a maximum distance within which likely significant effects could be expected from the loudest noise sources associated with seismic survey activities. Blocks within 15km of an SPA designated for diving birds (see Box 4.1) should also be screened in.

Blocks and relevant Natura 2000 sites screened in on the basis of underwater noise effects and the relevant Natura 2000 sites are shown in Figures 5.3 (SPAs) and 5.4 (SACs) and listed in Appendix B3. The potential for interactions of mobile qualifying species (primarily seabirds, marine mammals and fish) with exploration and appraisal activities when outside of relevant Natura 2000 site boundaries is considered in Section 4.6. Where appropriate, additional Blocks >15km from relevant site boundaries may be screened in.

4.6 Consideration of mobile species

There is the potential for mobile qualifying species (primarily seabirds, marine mammals and fish) of relevant sites to interact with exploration and appraisal activities which could occur in 32nd Round Blocks while those species are outside of Natura 2000 sites. An overview of the current understanding of the foraging ranges of relevant species is given below, including a discussion of their potential interaction with work programme activities at distance from relevant sites. An important distinction is made in this section between a potential interaction with site features and those exploration and appraisal activities which may follow 32nd Round Licensing, and the potential for likely significant effects (i.e. those which undermine the site's conservation objectives).

4.6.1 Seabirds

Marine SPAs designated for foraging aggregations of seabirds and their 'source' SPAs

Efforts over the past decade to identify important foraging aggregations of seabirds for the purpose of SPA designation (e.g. Kober *et al*. 2010, 2012, Lawson *et al*. 2018) have resulted in a number of designated and proposed marine SPAs. It is recognised that bird aggregations within these marine SPAs may originate from separately designated breeding colony SPAs. In many cases colony SPAs are adjacent to a related marine SPA (e.g. Arctic terns breeding at the Pentland Firth Islands SPA and foraging within the Pentland Firth pSPA) but the seabirds from the colony may also be located some distance away (e.g. seabirds breeding at the Flannan Islands SPA and foraging at the Seas of St Kilda pSPA, ~16km distant). Consequently, the marine SPA site documentation and additional tagging data (where available) have been examined to identify their known 'source' colony SPAs (see Table 4.2); where Blocks have been screened in for these marine SPAs based on the screening criteria, these Blocks have also been screened in for their linked 'source' SPAs. While it is acknowledged that the mean maximum foraging ranges of many seabird species are large, and that there is the theoretical potential for marine SPAs to be used by birds from a large number of colony SPAs, the focus here is on source SPAs from which the majority of birds within the marine SPA are likely to originate, as discussed in the relevant site documentation, or have been shown to be linked through tagging data.

Table 4.2: Marine SPAs designated for foraging aggregations of seabirds during the breeding season and their 'source' breeding colony SPAs

Marine SPA/pSPA	'Source' breeding colony SPAs (relevant species; distance)
West of Shetland and Rockall	
Seas off Foula pSPA	• Foula SPA (multiple breeding seabirds; contiguous)
Seas off St Kilda pSPA	• St Kilda SPA (multiple breeding seabirds; contiguous) • Flannan Isles SPA (multiple breeding seabirds; 16km)
West Coast of the Outer Hebrides pSPA	• Lewis Peatlands SPA (breeding red-throated diver, 8km) • Mointeach Scadabhaigh SPA (breeding red-throated diver, 3km)
Central and Northern North Sea	
Bluemull and Colgrave Sounds pSPA	• Hermaness, Saxa Vord and Valla Field SPA (breeding red-throated diver, 2km) • Otterswick and Graveland SPA (breeding red-throated diver, 6km)
East Mainland Coast pSPA	• Otterswick and Graveland SPA (breeding red-throated diver, 6km)
North Orkney pSPA	• Orkney Mainland Moors SPA (breeding red-throated diver; <1km)
Scapa Flow pSPA	• Hoy (breeding red-throated diver; partial overlap) • Orkney Mainland Moors (breeding red-throated diver; 1km)
Pentland Firth pSPA	• Pentland Firth Islands SPA (breeding Arctic tern; contiguous) • Hoy SPA (breeding Arctic skua & guillemot; partial overlap) • North Caithness Cliffs (breeding guillemot; partial overlap) • Copinsay SPA (breeding guillemot; 5km)
Moray Firth pSPA	• East Caithness Cliffs SPA (breeding shag; partial overlap)
Outer Firth of Forth and St Andrews Bay Complex pSPA	• Firth of Forth Islands SPA (multiple breeding seabirds; partial overlap) • St Abb's Head to Fast Castle SPA (multiple breeding seabirds; partial overlap) • Firth of Tay and Eden Estuary SPA (breeding little tern; partial overlap) [1] • Firth of Forth SPA (breeding sandwich tern; contiguous)[1]
Mid-North Sea High and Southern North Sea	
Northumberland Marine SPA	• Lindisfarne SPA (breeding little tern; contiguous) • Northumbria Coast SPA (breeding little tern; contiguous) • Farne Islands SPA (multiple breeding seabirds; contiguous) • Coquet Island SPA (multiple breeding seabirds; contiguous)
Teesmouth and Cleveland Coast pSPA (extension)	• Teesmouth and Cleveland SPA (breeding little & common tern, non-breeding cormorant (as part of waterbird assemblage); contiguous)
Greater Wash SPA	• North Norfolk Coast SPA (breeding sandwich tern, little tern and common tern; contiguous, non-breeding common scoter (as part of waterbird assemblage); contiguous) • Humber Estuary SPA (breeding little tern, contiguous) • Gibraltar point SPA (breeding little tern, contiguous) • Great Yarmouth North Denes SPA (breeding little tern; contiguous) • Breydon Water SPA (breeding common tern; contiguous) • Outer Thames Estuary SPA (breeding little tern; contiguous, breeding common tern; contiguous, non-breeding red-throated diver; contiguous) • The Wash SPA (breeding little tern; contiguous, non-breeding common scoter; contiguous)
Outer Thames Estuary SPA	• Greater Wash SPA (breeding little tern; contiguous, breeding common tern; contiguous, non-breeding red-throated diver; contiguous) • Great Yarmouth North Denes SPA (breeding little tern; contiguous) • Minsmere-Walberswick SPA (breeding little tern; contiguous) • Breydon Water SPA (breeding common tern; contiguous) • Alde-Ore Estuary SPA (breeding little tern; contiguous) • Benacre to Easton Bavents SPA (breeding little tern; contiguous)

Notes: [1]. Sites also designated for wintering waterbird features which are common with the overlapping/adjoining marine SPA/pSPA.

Data on movements and foraging ranges

Information on the foraging movements of a number of seabird species has increased in recent years, mainly due to advances in satellite and other tracking technologies (e.g. Langston *et al*. 2013, Wakefield *et al*. 2015, 2017, Thaxter *et al*. 2014, 2018, Cleasby *et al*. 2015, Bogdanova *et al*. 2017, Carter *et al*. 2016, Edwards *et al*. 2016, Votier *et al*. 2017). There is generally limited information on foraging areas used by species from particular colonies and to help address this, Thaxter *et al*. (2012) reported on representative breeding season foraging ranges for a range of species.

Table 4.2 provides indicative foraging ranges (mean and mean maximum) travelled for a range of seabird species from a breeding colony to a foraging area. The mean maximum foraging range value has been used here to show possible connectivity to breeding colony SPAs, but bird density will not be continuous throughout this range. Other ways of representing foraging ranges (e.g. the mean, or percentage foraging area derived from kernel analyses) may therefore provide more useful information, where available. Whilst applying mean maximum foraging radius would encompass the majority of a population's home-range area, the overall size of the predicted foraging areas around the colony would potentially make it too large to be a useful management tool, without further refinement using habitat and bathymetric data (Soanes *et al.* 2016). Similarly, the assumption that seabirds are uniformly distributed out to some threshold distance from their colonies, such as their putative maximum foraging range, is unrealistic. Seabird density declines with distance from the colony with density-dependent competition, coastal morphology and habitat preferences (Wakefield *et al*. 2017), for example oceanographic features at which seabirds preferentially forage including shelf-edge fronts, upwelling and tidal-mixing fronts, offshore banks and internal waves, regions of stratification, and topographically complex coastal areas subject to strong tidal flow (Cox *et al.* 2018), resulting in highly non-uniform distributions. While Critchley *et al*. (2018) used a distance-weighted foraging radius approach to project distributions at sea for a wide range of seabird species during the breeding season, the authors recognised the limitations of not considering environmental variables that contribute to such non-uniform distributions noted above.

Table 4.2: Indicative breeding season foraging ranges

Species	Mean maximum[1] (km)	Mean[2] (km)	Confidence level[3]
Eider	80	2.4	Poor
Red-throated diver	9	4.5	Low
Fulmar	400 ± 245.8	47.5 ± 1	Moderate
Manx shearwater	18.3 ± 12.5 & >330	2.3 ±0.8	Moderate
Leach's storm petrel	91.7 ± 27.5	-	Poor
Gannet	229.4 ± 124.3	92.5 ± 59.9	Highest
Cormorant	25 ± 10	5.2 ± 1.5	Moderate

Species	Mean maximum[1] (km)	Mean[2] (km)	Confidence level[3]
Shag	14.5 ± 3.5	5.9 ± 4.7	Moderate
Arctic skua	62.5 ± 17.2	6.4 ± 5.9	Uncertain
Great skua	10.9 ± 3.0 & 86.4	-	Moderate, Poor
Black-headed gull	25.5 ± 20.5	11.4 ± 6.7	Uncertain
Common gull	50	25	Poor
Mediterranean gull	20	11.5	Uncertain
Herring gull	61.1 ± 44	10.5	Moderate
Lesser black-backed gull	141.0 ± 50.8	71.9 ± 10.2	Moderate
Kittiwake	60.0 ± 23.3	24.8 ±12.1	Highest
Sandwich tern	49.0 ± 7.1	11.5 ± 4.7	Moderate
Roseate tern	16.6 ± 11.6	12.2 ± 12.1	Low
Common tern	15.2 ± 11.2	4.5 ± 3.2	Moderate
Arctic tern	24.2 ± 6.3	7.1 ± 2.2	Moderate
Little tern	6.3 ± 2.4	2.1	Low
Guillemot	84.2 ± 50.1	37.8 ± 32.2	Highest
Razorbill	48.5 ± 35.0	23.7 ± 7.5	Moderate
Puffin	105.4 ± 46.0	4	Low

Notes:

1. The maximum range reported in each study averaged across studies.

2. The mean foraging range reported for each colony averaged across all colonies. For tracking studies, this was typically the mean foraging range from all central place foraging trips assessed at the colony.

3. Confidence levels were assigned as follows: highest (based on >5 direct studies); moderate (between 2-5 direct studies); low (indirect measures or only one direct tracking study); uncertain (survey-based estimates); poor (few survey estimates or speculative data available).

Source: Thaxter et al. (2012)

The distribution at sea throughout the year of many of the species in Table 4.2 is summarised in Appendix A1a.6 of the OESEA3 Environmental Report (DECC 2016); in general, they are widely distributed at low densities with areas of moderate or higher density. Within the North Sea, these areas include: the shelf edge for gannet and lesser black-backed gulls; the Dogger Bank for guillemot; the Dutch Bank for herring gull; Fladen Ground for kittiwake; and, the Moray Firth and Aberdeen bank for razorbill (Stone *et al*. 1995). To the north west of the UK, seabird distribution is closely correlated to water depth with more birds found over shallower continental shelves than the deeper oceanic waters. Birds present in the deeper slope and oceanic waters will comprise mainly pelagic species (e.g. fulmar, gannet and kittiwake). Some high density areas are also likely to be transitory, associated with short-lived natural feeding aggregations or attraction to fishing vessels. Wakefield *et al.* (2017) used extensive tracking data and environmental covariates to model the predicted at-sea distribution of four seabird species during the breeding season (shag, guillemot, razorbill and kittiwake), including extrapolations for Seabird 2000 census counts at some 5,500 breeding sites in Britain and Ireland. Seabird density was shown to decline with distance from the colony, with kittiwake distribution being the most diffuse (albeit with discrete high-density areas) and shag the most confined to near-shore waters. While density-dependent competition, coastal morphology and habitat preferences resulted in highly non-uniform distributions, the core areas of use of all four study species overlapped within most of the coastal waters in Scotland, highlighting the importance of this area to these species (Wakefield *et al*. 2017). The data underpinning the modelling exercise were collected during the incubation and the early chick rearing period and therefore may only be representative of this period, and also not reflect non-breeding or immature behaviours (Cleasby *et al.* 2018).

A BEIS-funded three-year telemetry study of gannets from Bempton Cliffs indicated a marked decline in the density of foraging locations with distance from colony, which was the over-riding influence on gannet distribution at-sea during the breeding season (Langston *et al*. 2013). Similarly, Votier *et al*. (2010, 2011) reported that breeding gannets, constrained by the need to regularly return to the nest, foraged less widely than immature birds. Other studies using GPS tracking of breeding gannets have indicated some consistency in the use of foraging areas by individual adults (e.g. Hamer *et al*. 2007, Patrick *et al*. 2015, Wakefield *et al*. 2015). Votier *et al*. (2017) showed that breeding gannets (aged 5+) displayed strong site fidelity, followed similar routes and were faithful to distal points during successive trips. Conversely, immature gannets (aged 2-3) were far more exploratory and lacked route or foraging site fidelity, and failed breeders showed intermediate behaviours. The authors proposed that foraging sites may be learned during exploratory behaviours early in life, which become established with age and experience (see also Grecian *et al*. 2018, Phillips *et al.* 2017).

Aggregations of birds could be present in some of the Blocks on offer while foraging and in the post-breeding period, which for some birds (e.g. auks) includes post-breeding moult when the birds are flightless. These birds are likely to comprise individuals from several colony SPAs in the UK and further afield, spanning several hundred kilometres of coastline. As part of the process of identifying potential Marine Protected Areas, seabird aggregations have been delineated through analysis of the European Seabirds at Sea (ESAS) database (Kober *et al.* 2010, 2012). Forty-two areas were identified for eleven seabird species, covering many of the species highlighted in Table 4.2 (fulmar, Manx shearwater, gannet, shag, great skua, kittiwake, common gull, herring gull, Arctic tern, guillemot and puffin) in both the breeding and the non-breeding seasons. A review of 25 of these areas in light of other independent information was carried out to provide a more robust and complete evidence-base on which to base any future decisions about these areas (note that a number are currently proposed SPAs) (Cook *et al.* 2015). The review also considered whether there was a sound ecological rationale behind each aggregation such as the presence of suitable habitat, proximity to known breeding colonies, or high abundance of prey species in the area. In addition to offshore seabird aggregations, work on inshore wintering waterbird aggregations (e.g. Lawson *et al.* 2015a, b, c, Lawson *et al.* 2018, O'Brien *et al.* 2015), foraging areas for terns (Wilson *et al.* 2014, Parsons *et al.* 2015), foraging areas for red-throated divers (Black *et al.* 2015) and aggregations of shags (Daunt *et al.* 2015) has also contributed to the identification of SPAs[44].

Based on these processes, a number of proposed marine SPAs have recently undergone consultation covering foraging areas during breeding periods as well as wintering areas for

[44] See: https://jncc.gov.uk/about-jncc/how-we-work/jncc-consultations/offshore-spa-consultations/

most of the species identified above. These proposed SPAs have been screened in where appropriate. BEIS will ensure that the HRA process considers the ongoing marine SPAs identification process.

Physical, visual or acoustic disturbance from exploration drilling and seismic survey is not regarded to result in significant effects for SPA features in relation to Blocks beyond those already screened in, as outlined in Sections 4.4 and 4.5. This is due to: the relatively small seabed footprint and transitory nature of rig placement/installation and drilling discharges coupled with the relatively low densities of seabirds in offshore waters; that none of the species that are likely to be present offshore (outside Blocks screened in by the 10km physical disturbance criterion) are particularly vulnerable to disturbance by shipping (Garthe & Hüppop 2004) and are therefore unlikely to be significantly disturbed by the presence and movement of vessels associated with exploration activities. The typically low density of diving birds in offshore areas, and their limited exposure time and likely low sensitivity to underwater noise (see Section 4.5) would indicate that significant disturbance from seismic surveys in Blocks beyond those already screened in by the 15km noise criterion is unlikely.

4.6.2 Marine mammals

Applicable Annex II species include the two species of seal which breed in the UK, the harbour (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) and two cetaceans, the harbour porpoise (*Phocoena phocoena*) and bottlenose dolphin (*Tursiops truncatus*). These species are highly mobile and wide-ranging and will spend time away at considerable distances beyond the boundaries of designated sites. Therefore, there is a need to consider the potential for activities which may follow Block licensing to have effects on site features outside of site boundaries. Such effects are considered for these four marine mammals species in the sections below, distinguishing between short-term disturbance (which is managed under EPS disturbance licences) and likely significant effects in the context of the site conservation objectives.

Seals

The seal management units (MU) currently in use around the UK (indicated on Figures 5.5 and 5.6) were originally formulated in response to requirements of legislative drivers and do not define discrete populations. Given the movement of animals between MUs (Russell *et al*. 2013), especially in the case of grey seals, impacts on animals may have effects at the population level outside the particular MU with which the 'population' is associated (SCOS 2014). For harbour seals, these are broadly similar to OSPAR EcoQO units (OSPAR Ecological Quality Objectives) and supported by ICES advice on assessment units for the Marine Strategy Framework Directive (MSFD) (ICES 2014). For grey seals, ICES has advised for only two assessment units, one for the North Sea and one to combine western Britain, Ireland and Western France. An Inter-Agency Marine Mammal Working Group (IAMMWG 2015) paper on management units for cetaceans in UK waters indicated that an as yet unpublished paper outlining seal MUs was in preparation. Genetic studies suggest differentiation of harbour seals into four main clusters of: southern UK-mainland Europe; northern Ireland-west coast Scotland; east Scotland, Orkney and Shetland; and, Norway (Olsen *et al*. 2017).

Major breeding colonies of grey and harbour seals are protected around the UK as a series of coastal SACs, several of which extend, to varying degrees, into adjacent waters. As central-place foragers, seal colonies and haul-out sites are important not only in the breeding season, but throughout the year through provision of habitat for resting and during moulting periods. Nonetheless, grey and harbour seals are highly mobile marine species which spend extensive periods of time foraging beyond the boundaries of colony SACs (Matthiopoulos *et al*. 2004, Sharples *et al*. 2012, Jones *et al*. 2015). One study estimated that between 21-58% of female grey seals predominately foraged in a different region[45] to that within which they bred (Russell *et al*. 2013), while telemetry and individual recognition (photo-identification) data have revealed the movement of seals, particularly grey seals, between the UK and the waters of adjacent Member States (Jones *et al*. 2015, Brasseur *et al*. 2015).

Models of the at-sea distribution of grey and harbour seals which breed and haul-out around the UK and Ireland have been developed from extensive tagging data combined with population estimates derived from aerial and land-based counts (e.g. Jones *et al*. 2015). The most recent model iterations incorporate data from approximately 300 grey and 300 harbour seal individuals tagged between 1991-2016, are scaled to the estimated population size in 2015, and include updates to analytical approaches to improve the accuracy of estimated distributions (Russell *et al*. 2017). Figures 5.5 and 5.6 show the UK-wide at-sea density of harbour and grey seals respectively in relation to the relevant seal management units; the 32nd Round Blocks offered; and, those Blocks screened in accordance with the criteria for potential underwater noise and physical and drilling effects on sites with qualifying seal species. The usage maps represent the estimated number of seals in each 5x5km grid square at any point in time (Jones *et al*. 2017).

Results show that grey seals use offshore areas (up to 100km from the coast) connected to their haul-out sites by prominent corridors, while harbour seals primarily stay within 50 km of the coastline (Jones *et al*. 2015). For both species, density is greatest in coastal waters adjacent to colonies. The majority of Blocks offered in the 32nd Round do not overlap territorial waters of Scotland, including Orkney and Shetland, or northeast England – areas which comprise some of the most important marine areas for grey and harbour seals in UK and Irish waters. Some of the Blocks offered overlap offshore areas of relatively high seal usage in the southern North Sea which extend from the Humber Estuary SAC and The Wash and North Norfolk Coast SAC, and these are discussed below.

A large area of estimated high density (relative to the majority of UK and Irish waters) of grey seals radiates out from the Humber Estuary SAC (Figure 5.6). While the highest predicted densities of ≥100 seals per grid cell are within c. 12km of the site boundary, densities of 50-100 seals per grid cell extend up to almost 20km from the site boundary. Furthermore, there are several discrete areas of relatively high density (50-100 seals per grid cell) up to c. 60km offshore and over 80km from the site boundary, lying within a larger area of moderate-high

[45] The regions investigated included: Hebrides; northern Scotland (*ca*. Cape Wrath to Rattray Head); east coast (*ca*. Rattray Head to River Tees); and, south-east coast (*ca*. River Tees to Deal) (Russell *et al*. 2013).

relative density (10-50 seals per grid cell) extending from the site. While it is likely that some grey seals occurring in these offshore areas breed at colonies elsewhere on the UK east coast (e.g. Blakeney Point, Farne Islands), due to the area's proximity to the large colony at Donna Nook (at the mouth of the Humber Estuary), and the tracks of individuals seals tagged there connected with these areas, the majority of seals using these waters are likely to be associated with the Humber Estuary SAC. Furthermore, tracks from seals tagged at Donna Nook suggest that this area provides a route for seals in transit to/from foraging patches further offshore, over the Dogger Bank. Consequently, along with Blocks 47/7b and 47/13c (which are within 15km of the site boundary), 25 additional Blocks (42/18, 42/19, 42/20b, 42/22, 42/21, 42/23, 42/27, 42/28e, 42/28g, 42/29b, 42/29c, 42/30b, 42/30c, 42/28f, 42/28h, 47/2b, 47/3g, 47/3i, 47/3j, 47/8e, 47/9e, 47/10e, 47/10f, 47/14b, 47/19) are screened in for further assessment with regard to potential physical and underwater noise effects on the grey seal feature of the Humber Estuary SAC. These 25 Blocks represent those overlapping and immediately adjacent to the area of higher relative density of seals extending from the Humber Estuary (defined as grid cells of ≥10-50 seals per 5x5km). It should be noted that all of these Blocks are also screened-in due to their meeting underwater noise and/or physical effects criteria for other sites.

At a British Isles-level, harbour seals primarily occur in coastal waters and spend only 3% of their time >50km from the coast; however, The Wash is one exception, where harbour seals spend more time farther offshore and have been observed travelling to sandbanks up to 150km offshore (Jones *et al*. 2015). The predicted at-sea usage map for harbour seal reflects this (Figure 5.5), with a large area of higher use (relative to the majority of UK and Irish waters) extending north-east from The Wash, with values of 10-50 seals per 5x5km grid cell up to approximately 100km from the site boundary (Russell *et al*. 2017). From tracks of individual seals tagged at The Wash, and consideration of the distribution of adjacent colonies, it can be assumed that the majority of harbour seals using this offshore area are associated with The Wash and North Norfolk Coast SAC. In consideration of this area of importance to harbour seals, an additional 25 Blocks (47/3j, 47/8e, 47/9e, 47/10e, 47/10f, 47/10g, 47/13c, 47/14b, 47/15b, 47/15e, 47/19, 47/20, 48/1e, 48/6b, 48/6d, 48/7d, 48/7e, 48/11b, 48/12g, 48/13c, 48/17e, 48/17f, 48/18d, 48/18e, 48/23d) are screened in for further assessment with regard to potential physical and underwater noise effects on the harbour seal qualifying feature of The Wash and North Norfolk Coast SAC. These 25 Blocks represent those overlapping and immediately adjacent to the area of higher relative density of seals extending from the Humber Estuary (defined as grid cells of ≥10-50 seals per 5x5km). It should be noted that all of these Blocks are also screened-in due to their meeting underwater noise and/or physical effects criteria for other sites.

Cetaceans

Bottlenose dolphins

Analyses of photo-identification data and some genetic studies have shown that within European waters there are coastal/inshore groups of bottlenose dolphins which are mobile and range over large areas but still show strong site fidelity along defined stretches of coast (see ICES 2013, Quick *et al*. 2014). Robinson *et al*. (2012) reported that some individual dolphins sighted off the east coast of Scotland were sighted in subsequent years off the west coast of Scotland and in Irish waters, although the population identity of these apparently wide-ranging individuals was unknown. Whilst ICES (2013) recognised that in some areas information is incomplete, that distribution may be ephemeral and the animals present likely comprise sympatric populations, they proposed a series of bottlenose dolphin MUs for UK waters; the boundaries of which were finalised by IAMMWG (2015) (Figure 5.7). Within UK waters, the only SACs where bottlenose dolphin is a qualifying feature lie within the Irish Sea and coastal east Scotland MUs.

With regard to the MU for bottlenose dolphin in the coastal regions of east of Scotland (Figure 5.7) and the Moray Firth SAC (the only Natura 2000 site designated for this population), the range of this population extends well beyond the boundaries of the SAC as animals utilise waters off the southern Moray Firth, Grampian and Fife coasts (Cheney *et al*. 2013), and occasional sightings off the coast of northeast England[46]. Quick *et al*. (2014) showed that individual dolphins range up and down the coast, with much spatial and temporal variability in individual movements. Outside of the Moray Firth SAC, dolphins were most frequently encountered in waters less than 20m deep and within 2km of the coast in and around the Tay Estuary as well as along the coast between Montrose and Aberdeen. Further studies of animals occurring between St Andrews Bay and the Tay Estuary have revealed the estimated number of dolphins using this area in summer to have increased from 2009-2015 and represent, on average, 52.5% of the total estimated east coast population (Arso Civil *et al*. 2019).

In recent months, sightings of several distinctive individuals from the coastal east Scotland population have been reported from non-UK waters[47]: one individual was observed of the east coast of Ireland in May 2019 and off southwest Ireland in July 2019 along with another individual from the Scottish east coast population; further, images from a sighting of bottlenose dolphins off the Netherlands coast in July 2019 confirmed the presence of at least four individuals from the Scottish east coast population. All of these individuals were observed in the Moray Firth in summer 2018.

While there are Blocks offered in the 32nd Round off the east coast of Scotland, the these are in offshore waters (> 12nm from the coast) and distant to areas identified as of particular importance for bottlenose dolphins; consequently the Moray Firth SAC has not been screened in for further assessment.

Harbour porpoise

The harbour porpoise is the most common cetacean in UK waters; it is wide-ranging and abundant throughout the UK shelf seas, both coastally and offshore (Reid *et al*. 2003). This species is sighted throughout the year, although peak numbers are generally recorded in summer months from June to October. Since the early 1990s it appears to have become

[46] https://www.seawatchfoundation.org.uk/recentsightings/
[47] https://www.abdn.ac.uk/lighthouse/blog/international-sightings/

much less common around the Northern Isles, while increasing in numbers in the English Channel, southern North Sea and in the Celtic Sea, where few individuals had been previously observed (i.e. SCANS-I 1994) (Hammond *et al*. 2013, 2017; also see Evans *et al.* 2015). In coastal waters they are often encountered close to islands and headlands with strong tidal currents (e.g. Pierpoint 2008); sightings becoming increasingly rare close to the continental shelf edge, with relatively few records in deeper waters beyond the shelf edge (Reid *et al*. 2003). Individuals across the UKCS are part of the north east Atlantic population which is mainly considered to be a single 'continuous' population, even though some degree of genetic differentiation has been observed (Andersen *et al.* 1997, 2001, Tolley *et al.* 2001, Fontaine *et al.* 2007). However, for management and conservation purposes, three distinct UK Management Units have been proposed (IAMMWG 2015); the North Sea, West Scotland and the Celtic & Irish Seas.

Heinänen & Skov (2015) identified discrete and persistent areas of relatively high porpoise density, which were mainly within the Irish Sea and Welsh coastal waters, shelf waters of the North Sea and along the north-west Scottish coast. Six candidate Special Areas of Conservation (cSACs) (in both inshore and offshore waters) for harbour porpoise were identified, all of which were submitted to the European Commission by January 2017 and have now been designated as Special Areas of Conservation (SACs). For one of the harbour porpoise SACs (Southern North Sea), multiple relevant Blocks have been screened-in through the criteria for potential physical and drilling or acoustic effects, as have Blocks relevant to the Doggersbank SAC and Klaverbank SAC in neighbouring Dutch waters.

While harbour porpoise are a wide-ranging species and are likely to frequently occur beyond site boundaries, these sites encompass large areas of favourable habitat supporting higher densities of the species than other areas of the UKCS. Considering this, in addition to the buffer provided by the screening criteria, and maintaining a distinction between the potential for interaction between activities following the licensing of Blocks and site features outside of site boundaries (e.g. short-term disturbance, which is managed under EPS disturbance licences) and likely significant effects in the context of the site conservation objectives, it is not considered necessary to screen in any additional Block-site combinations for harbour porpoise.

4.6.3 Fish

Of those fish listed under Annex II of the EC Habitats Directive, only Atlantic salmon, sea lamprey and river lamprey are qualifying species of sites relevant to the 32nd Round Blocks.

Given their widespread and transient presence offshore, potential exploration activity in the 32nd Round Blocks away from the coast is unlikely to have a significant effect on relevant sites. Consequently, no additional Blocks to those already screened in on the basis of physical disturbance or noise effects have been identified for further assessment.

4.6.4 Conclusion

Whilst individuals of the mobile species discussed above could potentially interact with work programme activities associated with the Initial Term (see Section 2.2) for Blocks other than those already screened in using the criteria set out in Sections 4.4 and 4.5, and those additional Blocks identified in the southern North Sea above, significant effects on the populations of sites relating to such species, and therefore the conservation status of such sites, are not considered likely. This is due to the combination of:

- The small physical footprint of activities and their transitory nature.
- The likely scale of potential activity (i.e. number of licences applied for and awarded, and actual activity which follows, see Section 2.3.1), and the duration of the initial term (up to 9 years) within which activity could take place.
- The likely relative density of relevant features in relation to activities which could take place.

4.7 In-combination effects

This screening assessment includes the potential for in-combination effects resulting from the interaction of exploration/appraisal activities in 32nd Round Blocks with activities resulting from other marine plans, programmes and activities to lead to likely significant effects on European sites.

Marine planning has a key role in informing strategic and project level spatial considerations, with the Marine Policy Statement indicating, *"Marine Plans should reflect and address, so far as possible, the range of activities occurring in, and placing demands on, the plan area. The Marine Plan should identify areas of constraint and locations where a range of activities may be accommodated. This will reduce real and potential conflict, maximise compatibility between marine activities and encourage co-existence of multiple uses."*

Currently, there are 11 marine plan areas within English inshore and offshore regions and marine plans have been adopted for four of these, the East Inshore and Offshore and South Inshore and Offshore plans. Marine plans are presently in development for the other seven areas, all of which are due to be complete by 2021. The Scottish National Marine Plan was adopted in March 2015 and subsequent regional planning has been proposed for a further 11 inshore areas. To date, whilst the marine plans acknowledge the potential interactions between activities and map these, indicate key resource areas and provide policy context in relation to potential activity interactions, they are not spatially prescriptive and therefore provide a limited indication of the location of possible future development.

The uncertainty over the scale and timing of activities which could follow licensing of 32nd Round Blocks and the activities resulting from other plans and programmes is recognised. Using a GIS, the 32nd Round Blocks (distinguishing those screened in and screened out following the application of the criteria given in Section 4.3-4.5) are considered in the context of areas of activity and proposals for a range of marine activities/potential activities including:

- Existing oil and gas licences (Figure 5.8)
- Leases/licences or Agreement for Leases for hydrocarbon gas storage (Figure 5.8)
- Existing oil and gas infrastructure (Figure 5.8)

- Marine renewable energy developments, zones and related cables/cable agreement areas (Figure 5.9)
- Marine aggregate extraction (Figure 5.9)
- Shipping density (Figures 5.10 and 5.11)
- Fisheries

GIS outputs are included for each of the above showing the spatial relationship to SPAs and SACs and a text based consideration is made of the potential for in-combination effects leading to likely significant effects on European sites (see Section 5).

5 Screening

5.1 Screening of potential effects of 32nd Round Block activities

The screening of the various sources of impact from exploration and appraisal activities which could follow licensing of the 32nd Round Blocks (as described in Section 4) were applied to the relevant European sites and considered in the context of mobile species when not within site boundaries. This led to the identification of a number of Blocks for which likely significant effects on European sites could not be discounted at the screening stage. Figures 5.1-5.7 illustrate these initial screening results as paired maps showing the Blocks and sites which have been screened in.

The Blocks screened in at this stage are listed in Table 5.1.

Table 5.1: List of Blocks initially screened in

West of Shetland									
165/5	166/1	166/2	166/7	175/29	175/30	176/26	203/4	205/15	205/18
205/20	205/28	205/29	205/30	206/11c	206/12b	206/13c	206/14b		
Central and Northern North Sea									
9/27b	9/28c	9/29b	15/19c	15/20e	15/24	15/25d	16/4	16/21e	
Mid-North Sea High and Southern North Sea									
34/25	36/23	36/30b	37/11	37/12	37/13	37/14	37/15	37/16	38/13
38/14	38/15	38/18	38/19	38/20	38/24	38/25	38/28b	38/29	38/30
39/7	39/11	39/12	39/16	39/17	39/21	39/26	40/5	42/5b	42/7b
42/8a	42/13b	42/17	42/18	42/19	42/20b	42/21	42/22	42/23	42/27
42/28e	42/28f	42/28g	42/28h	42/29b	42/29c	42/30b	42/30c	43/1	43/2b
43/5	43/6	43/9	43/11	43/12b	43/13a	43/14c	43/18a	43/19a	43/20
43/22b	43/22c	43/24c	43/25	43/26b	43/27b	43/28	43/29	43/30	44/1
44/2b	44/3b	44/4	44/5	44/8a	44/9	44/10	44/13b	44/14	44/15
44/16	44/17	44/18b	44/19b	44/21	44/22	44/23a	44/23b	44/24d	44/25
44/26	44/28	44/29a	44/30b	45/1	47/2b	47/3g	47/3i	47/3j	47/7b
47/8e	47/9e	47/10e	47/10f	47/10g	47/13c	47/14b	47/15b	47/15e	47/19
47/20	47/24	47/25	48/1e	48/2c	48/3	48/4	48/5	48/6b	48/6d
48/7d	48/7e	48/9	48/10b	48/11b	48/12g	48/13c	48/14b	48/14c	48/15c
48/17e	48/17f	48/18d	48/18e	48/19d	48/21b	48/22d	48/23d	48/24c	48/25c
48/25d	48/28b	48/29b	48/29c	48/30b	48/30c	49/1	49/2	49/3	49/4e
49/5d	49/6b	49/6c	49/7	49/8b	49/9b	49/9e	49/10e	49/11c	49/12d
49/13	49/14a	49/15b	49/16b	49/17b	49/18b	49/18c	49/19c	49/19d	49/20c
49/21d	49/21e	49/22b	49/23b	49/23c	49/24b	49/24c	49/25c	49/26b	49/27c
49/28c	49/28e	49/29b	49/30b	50/16	50/21	50/26	52/5b	52/5c	53/2c
53/3	53/4	53/5d	53/6	53/7	53/8b	53/9b	53/10b	53/11	53/12
53/13b	53/14c	53/15b	53/16	53/17	53/18	53/19	53/20	54/1a	54/6b
54/11b	54/16								

5.2 Screening for potential in-combination effects

All blocks offered as part of the 32nd Round, including those screened in (Table 5.1), were considered further in terms of the potential for likely significant effects to arise from activities following licensing, in-combination with those from other marine activities. Relevant marine activities were identified based on those referred to in Appendix 1h of OESEA3 (DECC 2016, see also BEIS 2018)[48] and where it was considered that a relevant pathway of in-combination effect was present. The sources of in-combination effect are regarded to be largely related to physical disturbance and underwater noise, and in the context of those areas being offered for licensing, any such effects are expected to be primarily from other offshore energy activity, specifically offshore wind in the Mid-North Sea High and Southern North Sea area. The area to the west of Shetland, central and northern North Sea have a comparatively low density of activity.

Figure 5.8 illustrates the spatial relationship between existing oil and gas licences, agreements for lease (AfL) for gas storage and carbon dioxide storage, the relevant European sites, as well as the 32nd Round Blocks. Existing controls on exploration and appraisal operations, and their likely intensity as outlined in Section 2, suggest that significant in-combination effects of existing licensed areas and those proposed for licensing in the 32nd Seaward Licensing Round on European sites are not likely. Additionally, based on the lack of or limited spatial overlap of other licences and infrastructure, the documented scale of effects from production operations together with existing controls on exploration and appraisal operations (see Section 4.3), significant in-combination effects on European sites are not likely to occur.

Operators are planning for the decommissioning of a number of fields in 32nd Round areas, or are implementing decommissioning plans which involve offshore activities (e.g. for well plug and abandonment and facility removal)[49]. This includes plans for fields and related infrastructure in quadrants 3 (Ninian North), 14 (Athena, Goldeneye), 16 (Brae and East Brae), 20 (Ettrick & Blackbird), 29 (Curlew), 30 (Janice), 44 (Tyne South, Schooner and Ketch), 48 (Pickerill, Guinevere, Audrey), 49 (LOGGS and Viking facilities, Thames, Windermere), 211 (Brent, Dunlin), some of which are adjacent to or coincide with Natura 2000 sites, exclusively in the southern North Sea. These include the Dogger Bank SAC, Southern North Sea SAC, North Norfolk Sandbanks and Saturn Reef SAC and Haisborough, Hammond and Winterton SAC. 32nd Round Blocks within and adjacent to these sites have already been screened in to the second stage of HRA where the potential for significant cumulative and in-combination effects on European sites from the above and any further decommissioning programmes would be assessed.

The AfL for the Rough gas storage facility is located adjacent to Block 47/8e. Production from the site continues, but storage has now ceased, with decommissioning likely soon after. When

[48] Relevant marine planning portals for England and Scotland were also referred to, in addition to other sources of the latest spatial data on marine activities including data.gov.uk and EMODnet
[49] See: https://www.gov.uk/guidance/oil-and-gas-decommissioning-of-offshore-installations-and-pipelines and https://itportal.ogauthority.co.uk/eng/fox/path/PATH_REPORTS/pdf

considered in the context of the nature and scale of potential activities associated with 32nd Round Block licensing, the limited offshore facilities and operations associated with Rough are unlikely to result in significant in-combination effects. The Deborah gas storage AfL is located adjacent to Blocks 48/29b, 49/30b and 49/30c, however there are no current plans in place to take forward any project and no significant effects are therefore foreseeable.

Two AfL and carbon dioxide appraisal and storage licence areas cover parts of 32nd Round Blocks on offer. The Acorn licence/lease area covers parts of Blocks 13/24c, 13/25, 13/30a, 14/26b, 14/27, 19/5b, 20/2, 20/3b, and currently has an initial term lasting until November 2022 to allow for the characterisation of the storage site. The second carbon storage lease/licence area is held by National Grid. The OGA have restricted the offer of Blocks in this area due to the presence of the lease/licence[50], however there remains some overlap of the AfL area with parts of Blocks 42/19, 42/20b, 42/29b, 42/30b, 43/22c, 43/26b and 43/27b. While uncertainty remains about the potential for a future project to use the related Endurance store, there has been renewed interest in carbon dioxide storage in the southern North Sea, emphasised by recent funding through the CCUS Innovation Programme[51]. In view of the likely scale of exploration activity that could result from 32nd Round licensing, Block restrictions already in place by the OGA for the Endurance licence and a lack of firm project plans or timescales for the offshore storage projects, significant in-combination effects are not considered likely.

Figure 5.9 shows marine renewable energy development areas, relevant European sites and the 32nd Round Blocks. A number of Blocks overlap with renewable energy developments (either planned or operational), and with European sites. For example Blocks overlap with projects associated with the Dogger Bank (Creyke Beck A and B and Teesside Lackenby A and B), Hornsea (Projects One, Two, Three and Four), and East Anglia (Norfolk Vanguard and Boreas, East Anglia One and Three) wind farm areas. All of these wind farms overlap with the Southern North Sea SAC and/or Dogger Bank SAC. Blocks offered also overlap a number of operational wind farms and proposed extensions which are within or in close proximity to a number of SACs and SPAs. These include the Humber Gateway (Greater Wash SPA), Race Bank (Inner Dowsing, Race Bank & North Ridge SAC), and Sheringham Shoal and Dudgeon. Several Blocks overlap the Triton Knoll wind farm which has been consented and is relatively close to both the Greater Wash SPA and Inner Dowsing, Race Bank & North Ridge SAC. Additionally, either wind farm cable lease areas (e.g. for the Dogger Bank, Hornsea and East Anglia wind farms) or proposed corridors (Hornsea Project Four[52]) traverse a number of 32nd Round Blocks on offer.

A draft HRA has been published for consultation as part of a review of consents for offshore wind farms identified to have a likely significant effect on the Southern North Sea SAC, the

[50] https://data-ogauthority.opendata.arcgis.com/datasets/oga-restrictedblocks-ed50
[51] https://www.gov.uk/government/publications/call-for-ccus-innovation/ccus-innovation-programme-selected-projects, in particular the projects led by C-Capture and OGCI.
[52] https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/hornsea-project-four-offshore-wind-farm-generating-stations/?ipcsection=docs, https://hornseaprojects.co.uk/Hornsea-Project-Four/Documents-Library/Formal-Consultation

conclusions of which are that, with agreed mitigation measures, the construction of the wind farms assessed (including Dudgeon, Hornsea Project One and Two, East Anglia One, Triton Knoll, and Dogger Bank Creyke Beck A and B, Teesside A and B) will not result in an adverse effect on site integrity, including in-combination with oil and gas related activity, in particular seismic survey[53]. This draft report, and any final version, will be considered as part of the in-combination effects assessment of the second stage of HRA where appropriate. For other relevant wind farms including Hornsea Project One and East Anglia One, separate HRA processes were undertaken by the MMO that concluded there would be no adverse effects on the integrity of the Southern North Sea SAC, subject to mitigation. Wind farms which are in the pre-application stage (e.g. Hornsea Project Four) will also be subject to HRA in due course.

As noted in Section 2.3, the potential scale of exploration activity which is likely to follow the licensing of any of the 32nd Round Blocks is significantly less than that suggested by the number of Blocks offered. The highly conservative approach to screening in of Blocks and related sites for further assessment will allow the potential for in-combination effects with wind farms to be assessed as part of any 32nd Round AA, should relevant Blocks be applied for.

Leasing rounds for further offshore wind are presently in planning for Scottish[54] and English[55] waters. The Scottish Government are in the process of identifying plan option areas which will be part of consultation exercises related to separate SEA and HRA processes[56]. Draft areas of search for offshore wind in Scottish waters have been identified as part of the 2018 scoping exercise for the Scottish sectoral offshore wind plan. In keeping with the Scottish National Marine Plan policy RENEWABLES 1, on adoption, proposals for future offshore wind are likely to be made in these areas. A number of the draft areas of search overlap 32nd Round Blocks in the central and northern North Sea (particularly those Blocks in quads 209, 210, 211, 13, 14, 21 and 28), and also to the West of Shetland (quad 208), and include proposed deep-water areas for potential floating offshore wind development (see Figure 5.9). For the purposes of this HRA, it is noted that these areas are yet to be finalised, the draft sectoral plan is yet to complete its formal SEA process, and the timing and nature of any subsequent development is unknown and are unlikely to take place within the timing of 32nd Round activities. Therefore likely significant in-combination effects have not been identified.

Potential extensions to eight existing offshore wind farm projects were announced by The Crown Estate in October 2018, covering an additional 3.4GW of new capacity[57]. Three of these proposed extensions are partly within Blocks offered in the 32nd Round including those for Race Bank, Sheringham Shoal and Dudgeon with proposed installed capacities of 573MW,

[53] https://www.gov.uk/government/consultations/southern-north-sea-review-of-consents-draft-habitats-regulations-assessment-hra
[54] https://www.crownestatescotland.com/media-and-notices/news-media-releases-opinion/october-planned-for-scotlands-offshore-wind-launch
[55] https://www.thecrownestate.co.uk/en-gb/what-we-do/on-the-seabed/energy/offshore-wind-potential-new-leasing/
[56] https://consult.gov.scot/marine-scotland/offshore-wind-scoping/
[57] https://www.thecrownestate.co.uk/en-gb/media-and-insights/news/2018-the-crown-estate-completes-initial-assessment-of-offshore-wind-extension-applications/

317MW and 402MW respectively (see Figure 5.9). The extensions were subject to a plan level HRA undertaken by The Crown Estate, which concluded that seven of the eight projects could progress subject to further site investigation and assessment under the *Planning Act 2008*. It was concluded that adverse effects on the integrity of Inner Dowsing, Race Bank and North Ridge SAC from the Race Bank extension could not be ruled out, and so this extension will not be taken forward. For the other extensions assessed at the plan level, a cable route protocol to avoid or reduce significant effects from physical disturbance is proposed which must be adhered to. In addition, individual project-level HRAs are required, to consider effects for example, on red-throated diver, sandwich tern and lesser black-backed gull which could not be considered in detail at the plan level due to the uncertainty about wind farm design details and the scale of impacts. Any subsequent proposal would be subject to project-specific permitting, which would include further HRA as appropriate.

This screening has already identified a number of sites which should be subject to Appropriate Assessment in relation to those Blocks offered which overlap the proposed wind farm extensions, including The Wash and North Norfolk Coast SAC and Greater Wash SPA. Any further information relating to the proposed windfarm extensions will be considered as part of the in-combination effects assessment of the second stage of HRA where appropriate. Plans for further leasing by The Crown Estate for England are currently being progressed, and it is expected that further offshore wind leasing will be launched in autumn 2019[58]. As with the above extensions, any further information on this will be considered as part of the in-combination effects assessment of the second stage of HRA. For both sets of further wind leasing, the potential for in-combination effects is limited by the low potential for overlap in the timing of OWF construction and exploration following award of any licence in the 32nd Round.

A range of cables traverse blocks offered in the 32nd Round, both electricity grid interconnectors and telecommunications cables. The surface area of these is extremely small, and they are well-charted features which are avoided by oil and gas operators, including during exploration. A range of interconnector projects are either in planning, or at an early stage of development, which are of relevance to the 32nd Round Blocks[59]. These include: North Sea Link (Blocks in Quads 22, 23, 28, 34 and 35) and NorthConnect (Blocks in Quads 15, 16, 19 and 20), Shetland HVDC Link (Blocks in Quads 6 and 12). The Havfrue telecommunications cable, proposed to connect Denmark with the United States and Ireland, would traverse a number of quadrants in the northern North Sea and the West of Shetland. To date only a scoping report has been prepared for the UK section of this proposal[60].

While these project have proposed installation and commissioning dates within the timeframe in which offshore activities associated with the initial term of 32nd Round licences could take place (2020-2022), some remain at a pre-planning or feasibility stage (e.g. Shetland HVDC

[58] https://www.thecrownestate.co.uk/en-gb/what-we-do/on-the-seabed/energy/offshore-wind-potential-new-leasing/
[59] Note that the majority of these are Projects of Common Interest, see: http://ec.europa.eu/energy/sites/ener/files/technical_document_3rd_list_with_subheadings.pdf
[60] http://marine.gov.scot/node/15979

Link). Others are yet to be spatially defined (e.g. Neuconnect, Ice Link) and so cannot be considered at this stage. It is not considered that any additional Blocks or sites should be screened in due to the potential for interaction with these proposals. Where appropriate these proposals will be considered in more detail in relation to those Blocks already screened into the second stage of HRA.

Marine aggregate extraction areas, relevant European sites and the 32nd Round Blocks are shown in Figure 5.9. A number of Blocks overlap licensed aggregate extraction production areas in the southern North Sea; Blocks 47/13c, 47/19, 47/20, 47/24, 49/6b, 49/7, 49/12d and 49/16b. All of these Blocks have been screened in to the second stage of HRA. Should any of these Blocks be applied for, the potential for significant in-combination effects on European sites with these areas would be assessed.

Figures 5.10 and 5.11 illustrate the spatial relationship between the density of navigation in UK waters, relevant European sites and the 32nd Round Blocks. The 32nd Round Blocks coincident with areas of elevated navigation density in or in proximity to European sites (where potential significant in-combination effects could occur) have already been screened in to the second stage of HRA where this consideration will be made.

Commercial fishing occurs throughout UK waters and effort data provides a strategic level proxy of fisheries activity across the UKCS. However, it is noted that activity is seasonally and annually variable, and collated data includes most but not all fishing activity. Fishing and particularly bottom trawling has historically contributed to seabed disturbance over extensive areas, and was identified as an ongoing problem in the UK initial assessment for MSFD[61]. The updated UK assessment, which was subject to consultation between May and June 2019, indicates that while there have been some improvements in commercial fish stocks, there remain issues such that Good Environmental Status (GES) will not be achieved by 2020[62]. This is in keeping with an earlier request by the UK for an exemption to achieving GES by 2020 due to the time it would take stocks to respond to measures to be implemented by the UK. Specific to the consideration of conservation sites, the initial assessment of 2012 noted that depending on the nature of future measures (e.g. in relation to MPA management in the wider environment and within MPAs[63]), the effects of fisheries are likely to be reduced and therefore some improvement in benthic habitats could be expected[64]. The management of fisheries in relation to Article 6 of the Habitats Directive is fundamentally different to other activities such as offshore energy development, and a revised approach to the management of

61 https://www.gov.uk/government/publications/marine-strategy-part-one-uk-initial-assessment-and-good-environmental-status
62 https://consult.defra.gov.uk/marine/updated-uk-marine-strategy-part-one/
63 For example, see the MMO strategic management table for MPAs: https://www.gov.uk/government/publications/marine-protected-areas-strategic-management-table and measures proposed by the Scottish Government: https://www.gov.scot/Topics/marine/marine-environment/mpanetwork/SACmanagement
64 https://www.gov.uk/government/publications/marine-strategy-part-three-uk-programme-of-measures

commercial fisheries in European sites[65] has sought to implement steps to ensure that they are managed in accordance with Article 6.

In England management is presently coordinated between the Inshore Fisheries and Conservation Authorities and the Marine Management Organisation for sites within 12nm (note that any measure which may influence vessels of other Member States can only be adopted after consultation with the Commission, other Member States and the Regional Advisory Councils), and by Scottish Ministers in Scottish waters. For offshore sites, measures are required to be proposed by the European Commission in accordance with the Common Fisheries Policy[66]. In relation to specific sites of relevance to this HRA, management proposals for the Dogger Bank were drawn up by the Dogger Bank Steering Group which included a number of zones which would be closed for beam trawl, bottom/otter trawl, dredges and semi-pelagic trawl fisheries. A fisheries joint management proposal was agreed in early 2017 and was followed by a Joint Recommendation process submission to the European Commission. Similarly, a number of management measures incorporating the prohibition of demersal towed or static gears in areas of Annex I habitat have been proposed for the Wyville-Thomson Ridge SAC, Braemar Pockmarks SAC and Scanner Pockmark SAC[67], or have been implemented, as in the Darwin Mounds SAC.

Whilst fishing may be linked to historical disturbance to site features, and presents an ongoing risk to these, future management measures should limit the potential for in-combination effects with other activities, particularly when considered in the context of existing controls which are available to avoid effects on sites from exploration activity (see Section 4.3), and other activities including offshore renewables which are subject to statutory environmental impact assessment and where appropriate, an HRA. All Blocks in, or within 10km of sites designated for Annex I habitats have been screened in to the second stage of HRA, when the potential for significant cumulative and in-combination effects on European sites would be assessed.

For activity-specific assessments, it is the licensee's responsibility to identify potential in-combination effects and undertake early engagement with other stakeholders.

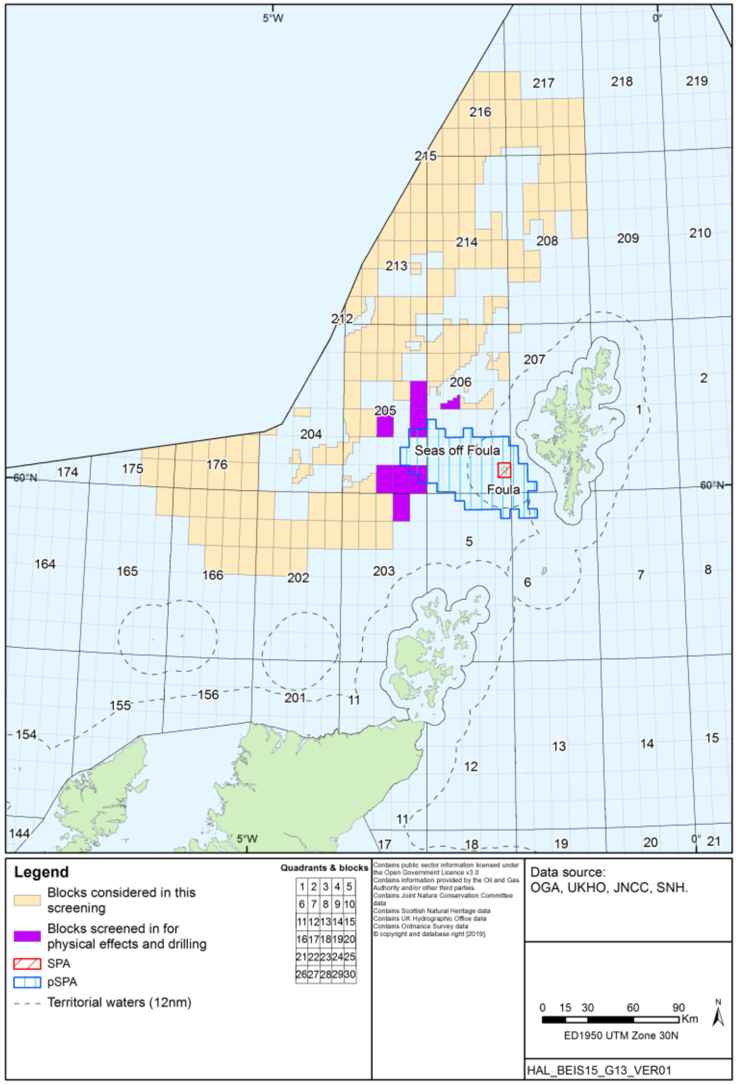
[65] https://www.gov.uk/government/publications/revised-approach-to-the-management-of-commercial-fisheries-in-european-marine-sites-overarching-policy-and-delivery

[66] Also refer to Regulation (EU) No. 1380/2013 on the Common Fisheries Policy. Note the approach to the management of fisheries in UK waters may change within the timescale of the 32nd Round depending on the nature of the UK's exit from the EU.

[67] https://www2.gov.scot/Topics/marine/marine-environment/mpanetwork/SACmanagement/Offshore2017

Figure 5.1: Physical and drilling effects – Blocks and SPAs screened in

West of Shetland



Mid-North Sea High and Southern North Sea

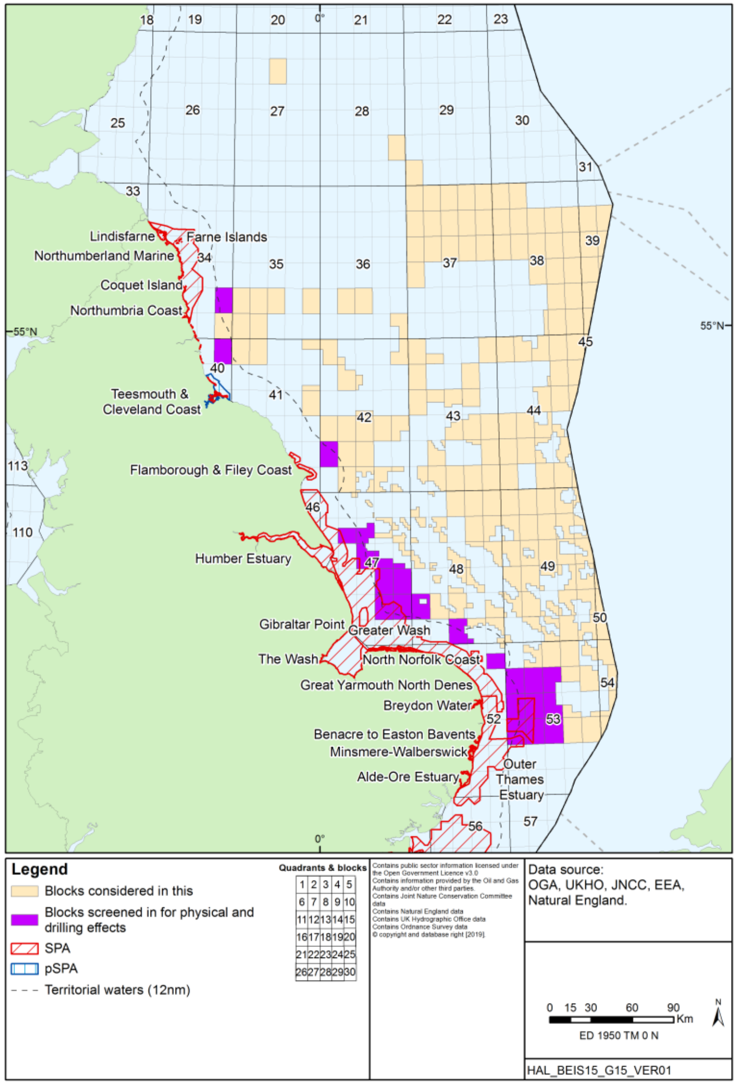
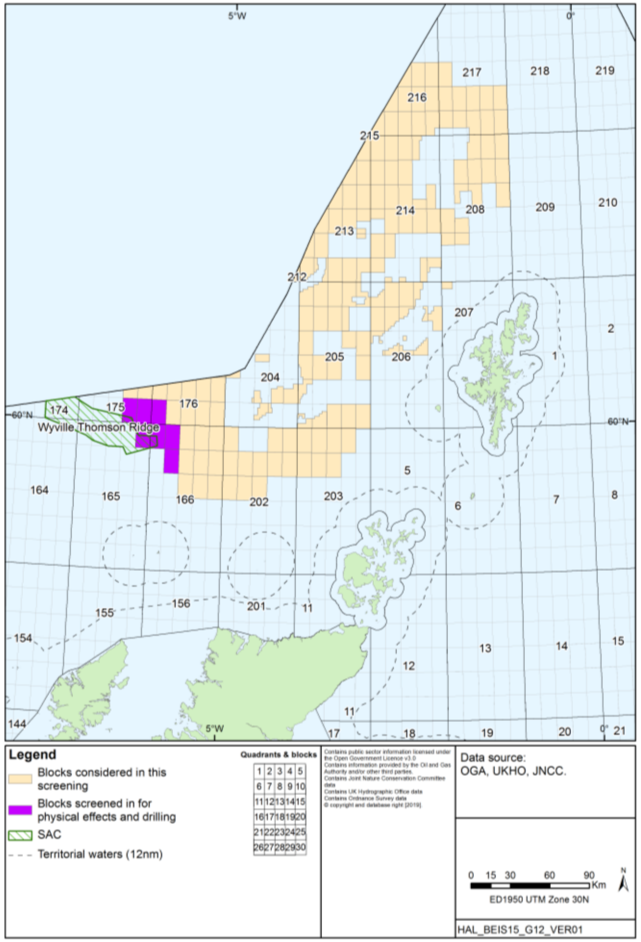
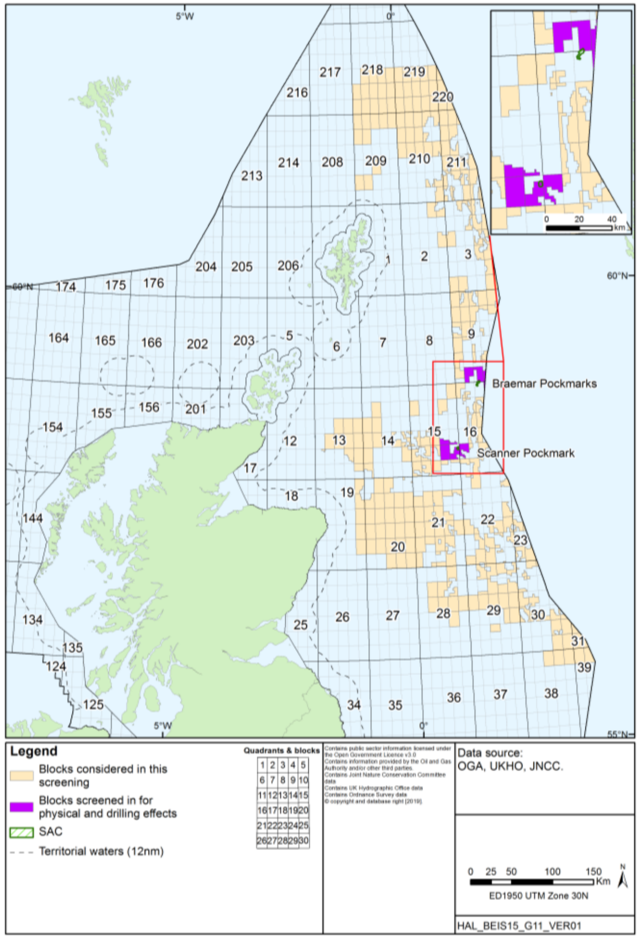


Figure 5.2: Physical and drilling effects – Blocks and SACs screened in

West of Shetland



Central and Northern North Sea



Mid-North Sea High and Southern North Sea

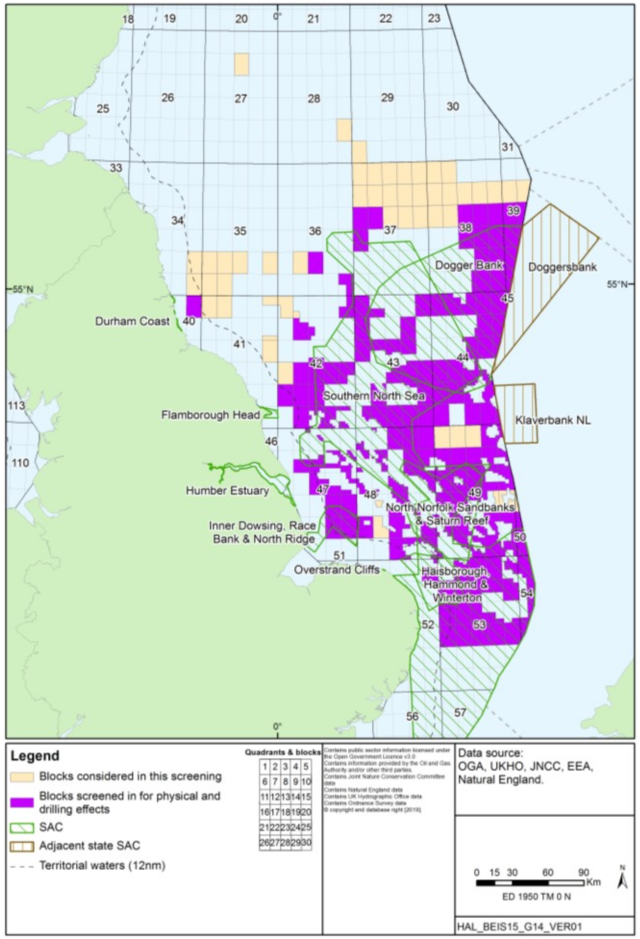
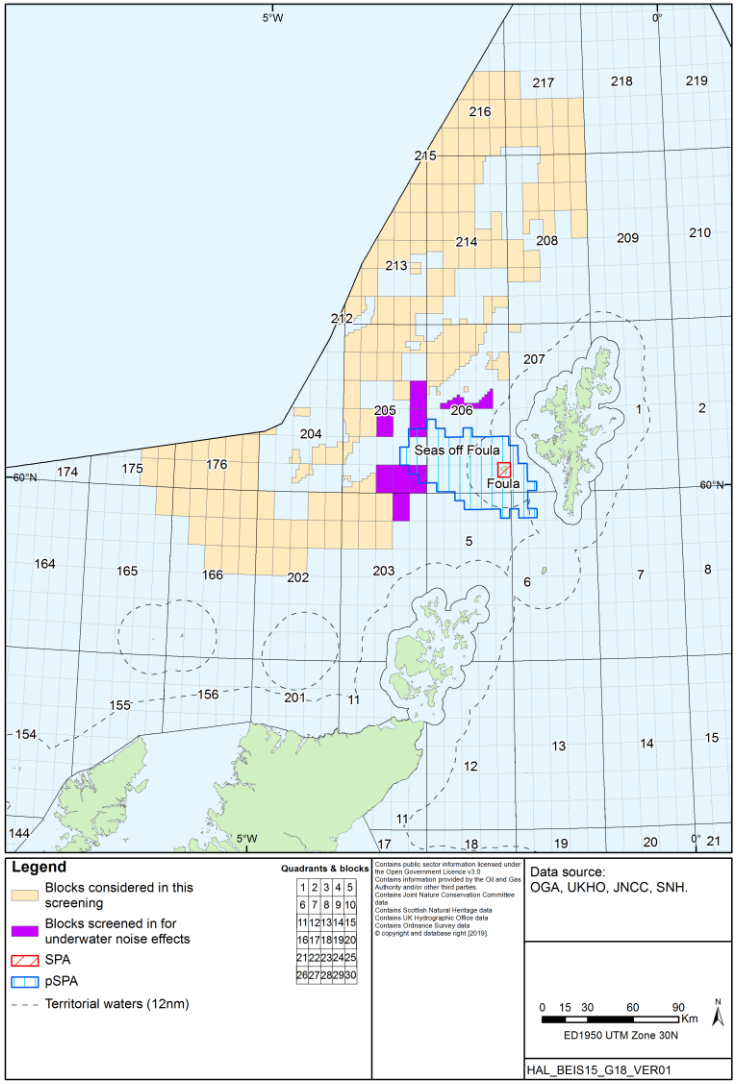


Figure 5.3: Underwater noise effects – Blocks and SPAs screened in

West of Shetland



Mid-North Sea High and Southern North Sea

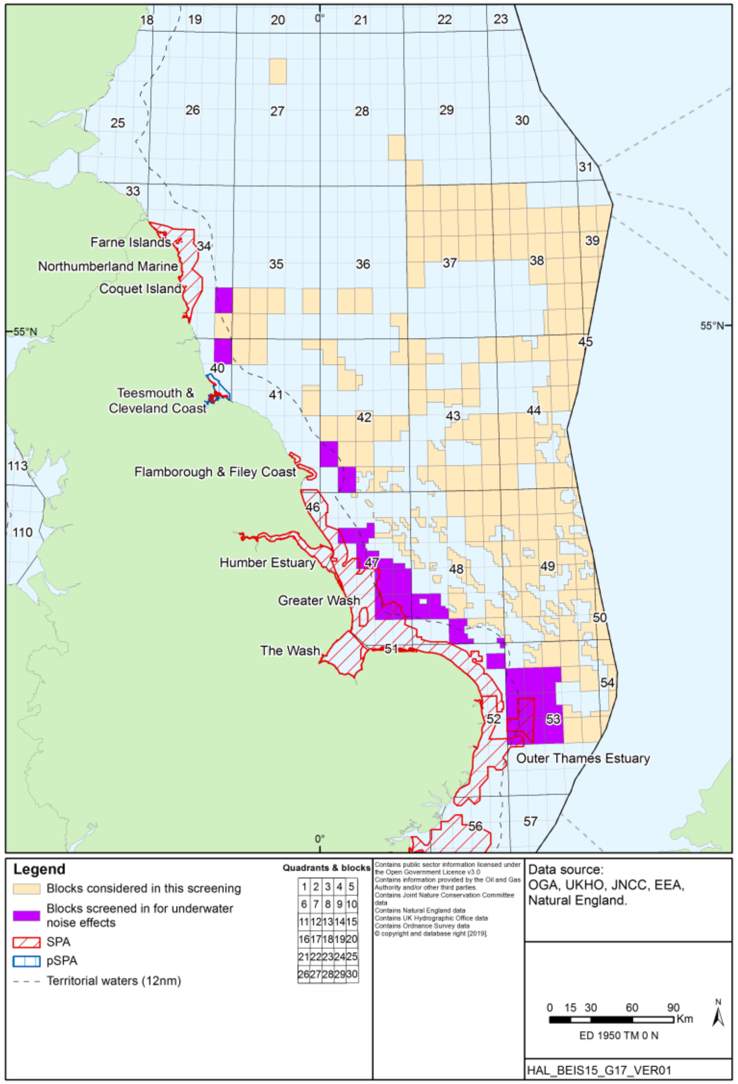


Figure 5.4: Underwater noise effects – Blocks and SACs screened in

Mid-North Sea High and Southern North Sea

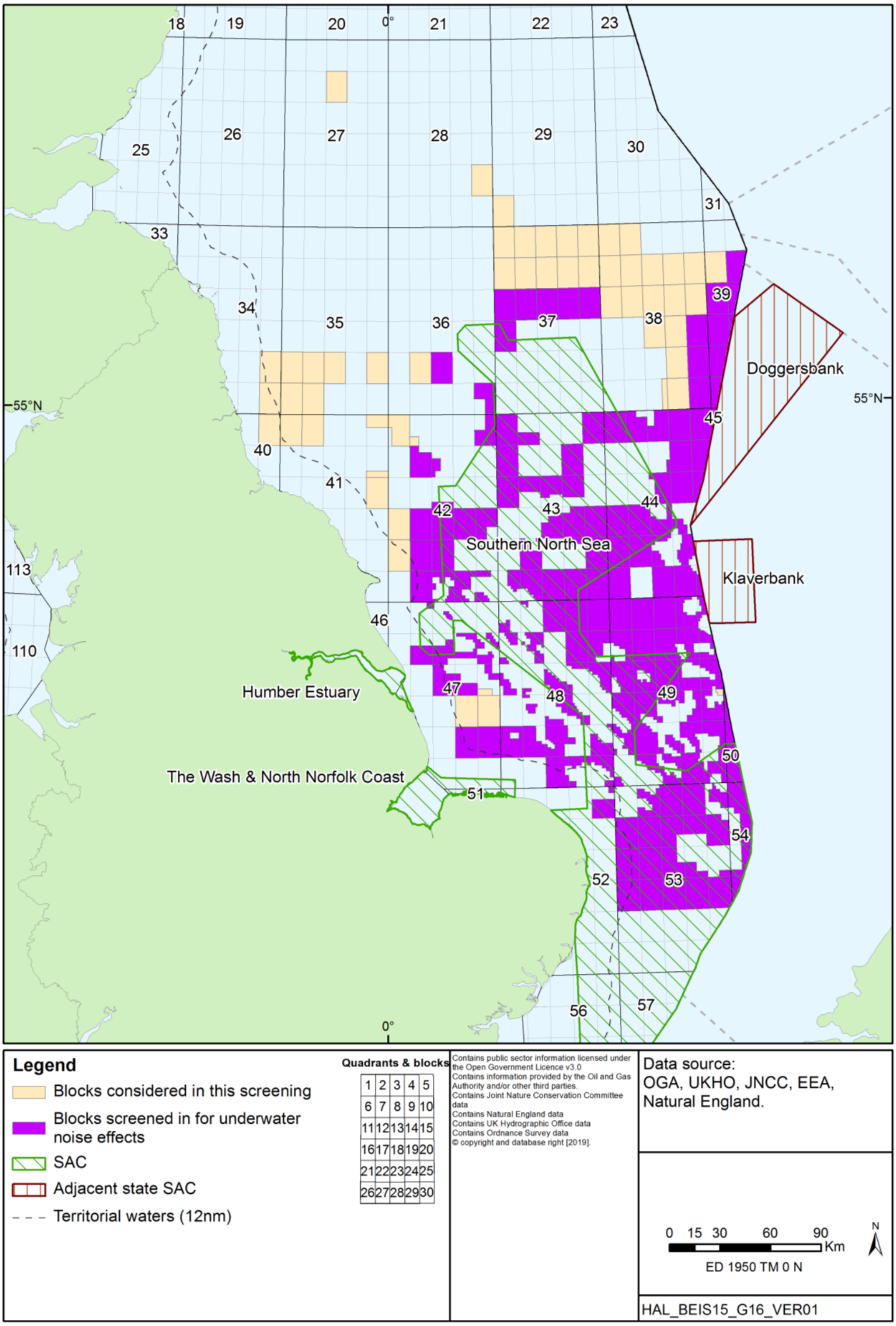


Figure 5.5: Estimated total density of harbour seals in UK waters

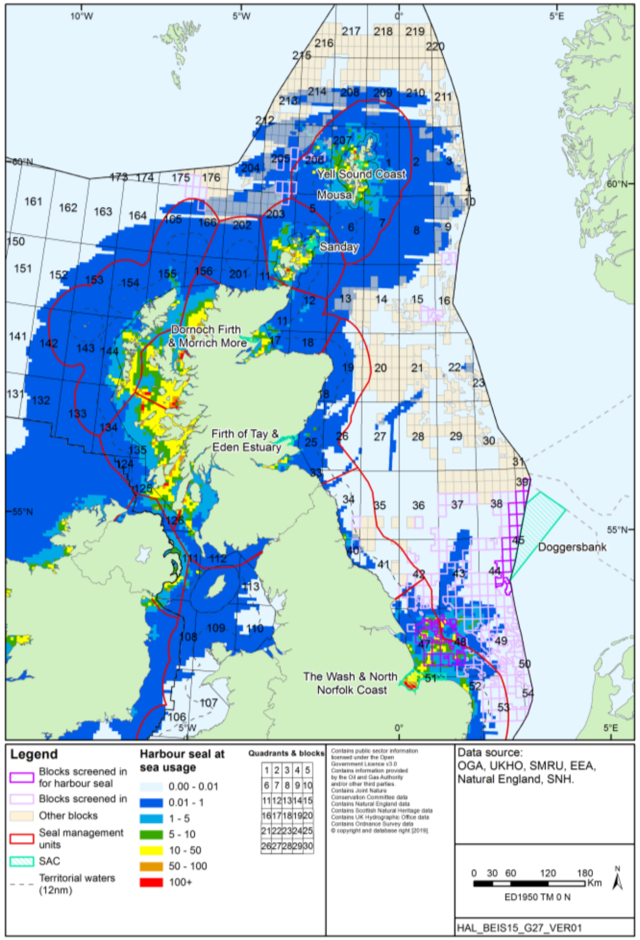


Figure 5.6: Estimated total density of grey seals in UK waters

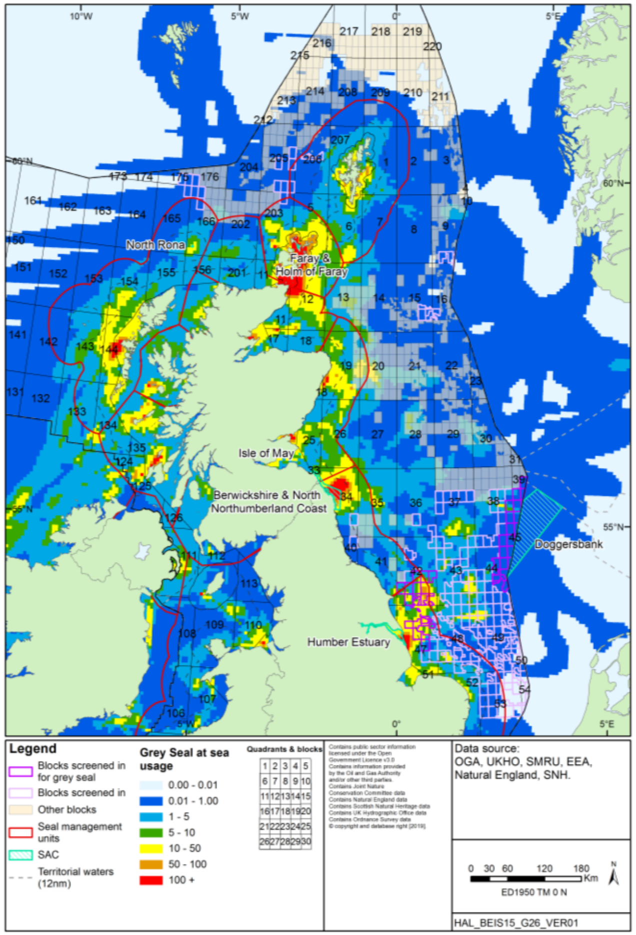


Figure 5.7: Bottlenose dolphin management units in the UK

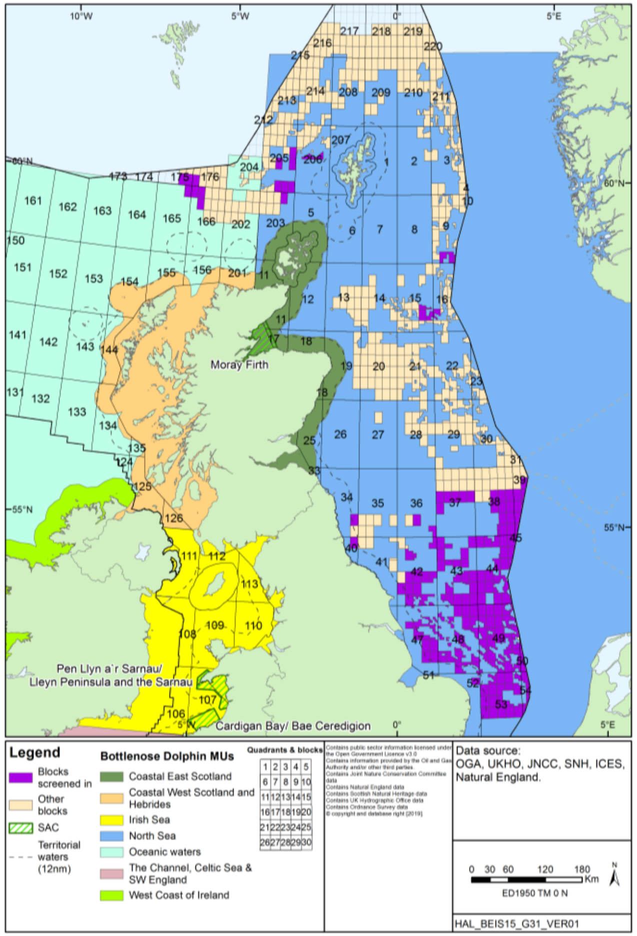


Figure 5.8: Existing oil and gas licences and infrastructure, Agreements for Lease, SACs, SPAs and 32nd Round Blocks

West of Shetland **Central and Northern North Sea** **Mid-North Sea High and Southern North Sea**

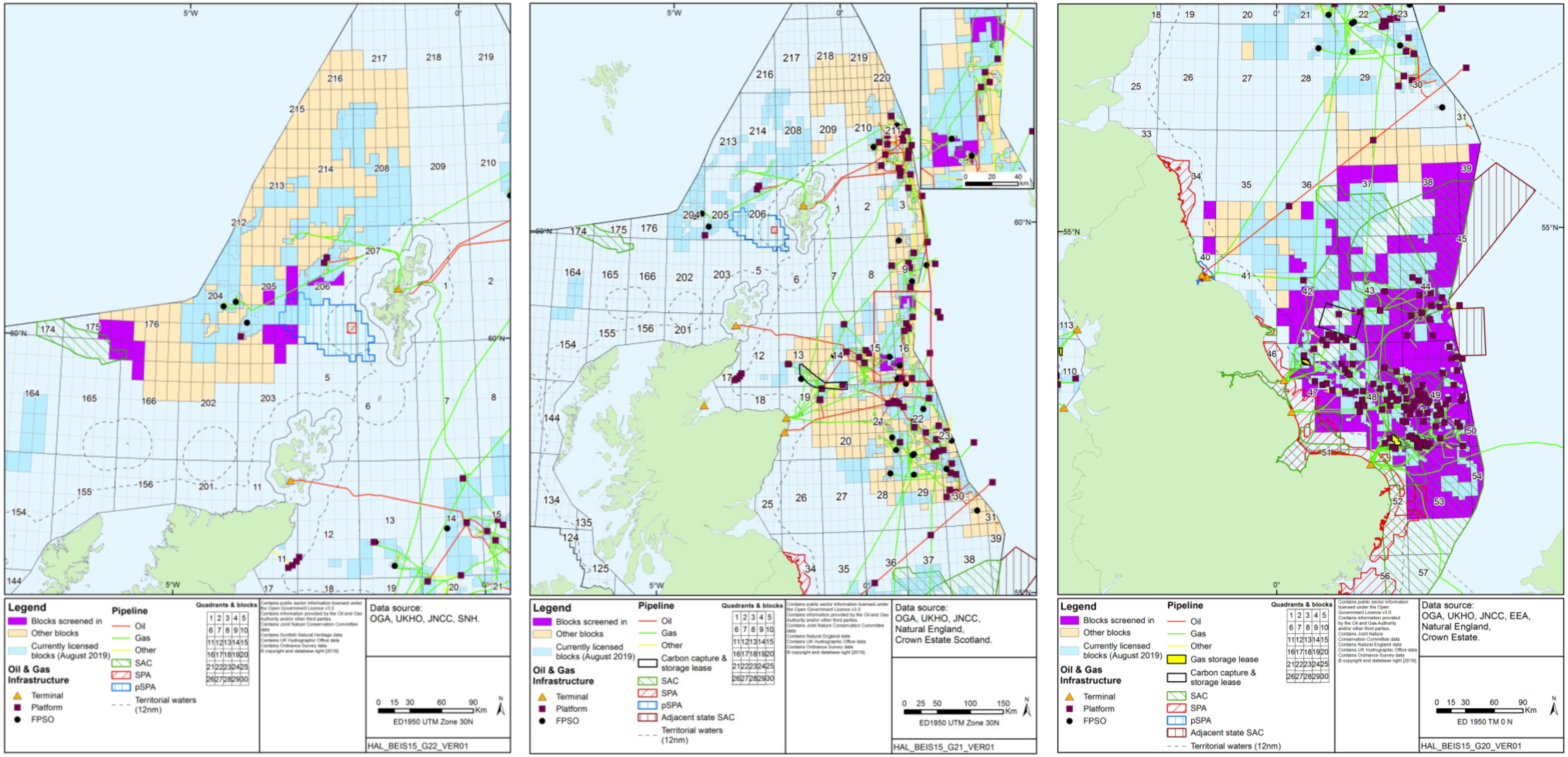


Figure 5.9: Marine renewable energy, aggregate extraction, SPAs, SACs and 32nd Round Blocks

West of Shetland | **Central and Northern North Sea** | **Mid-North Sea High and Southern North Sea**

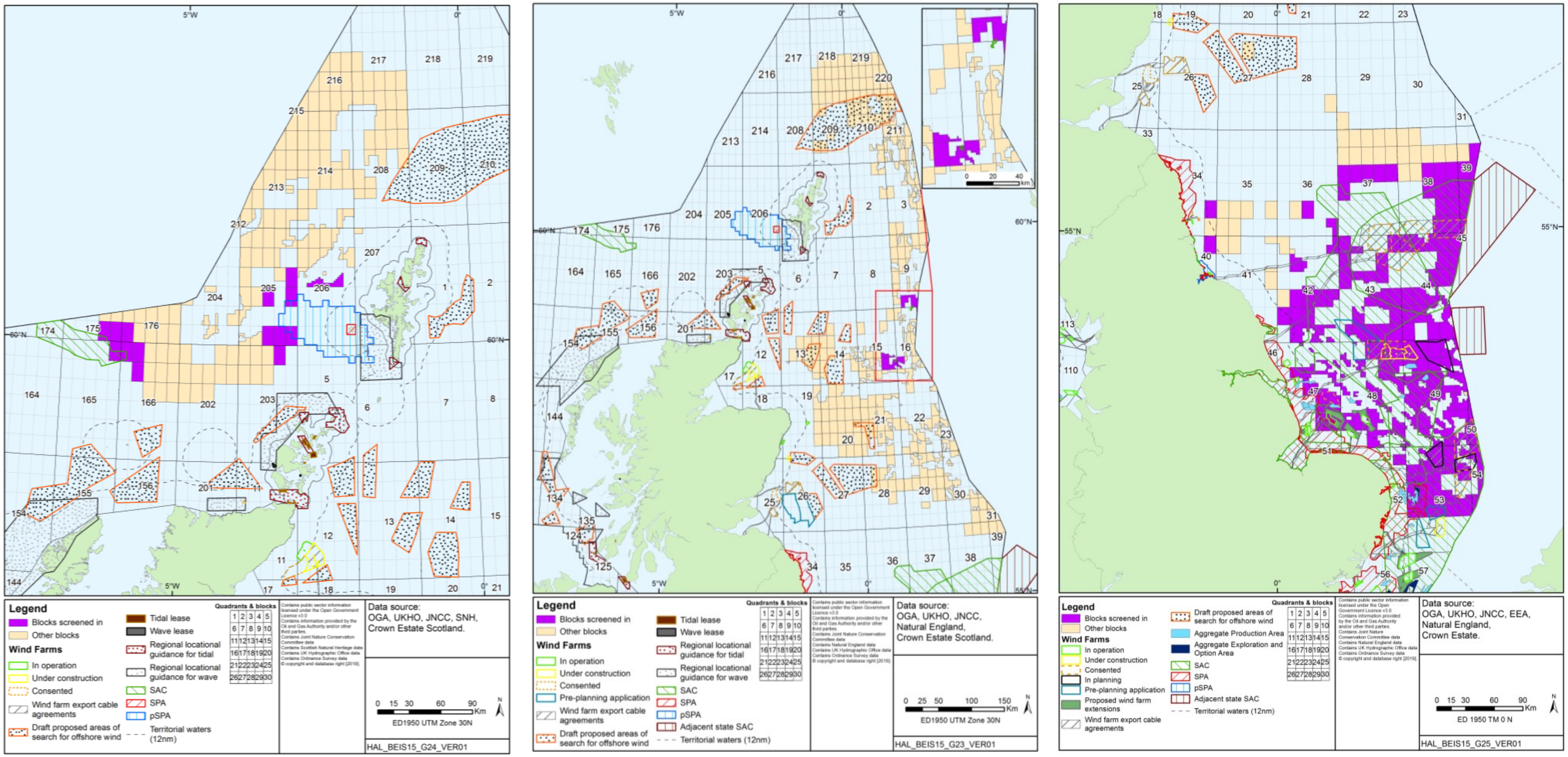


Figure 5.10: Navigation density, SPAs and 32nd Round Blocks

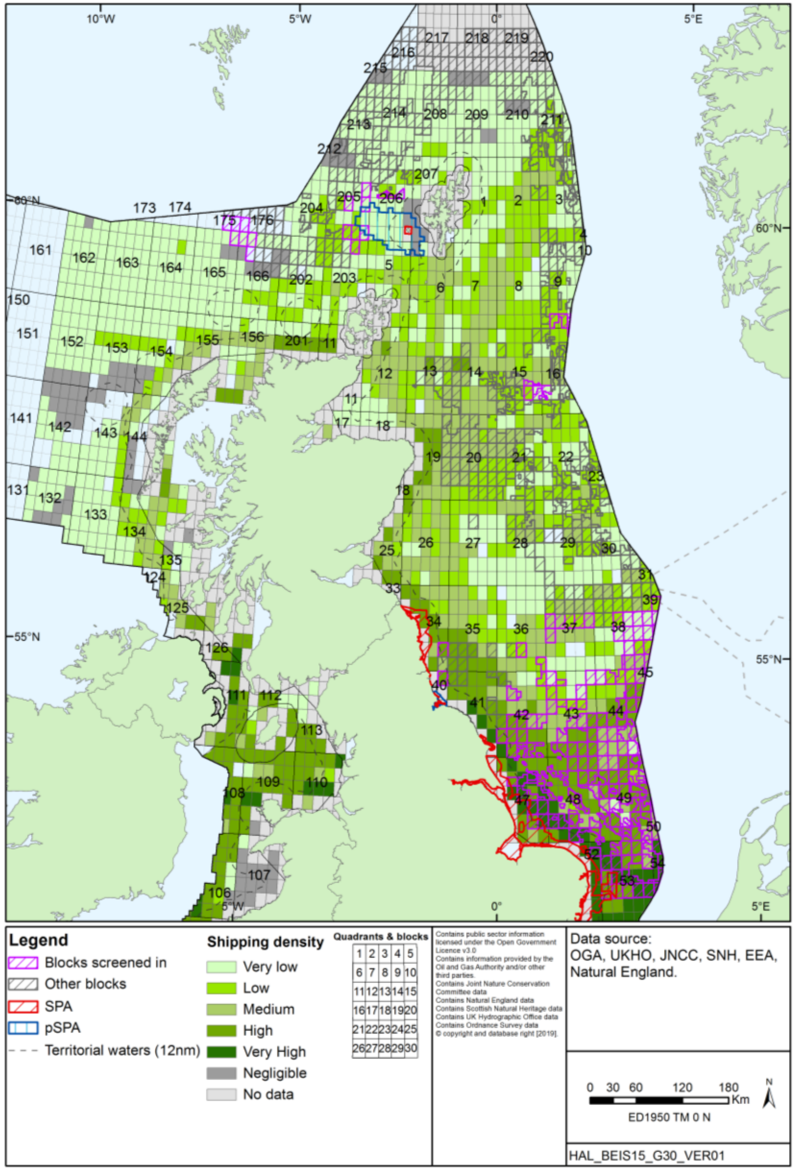
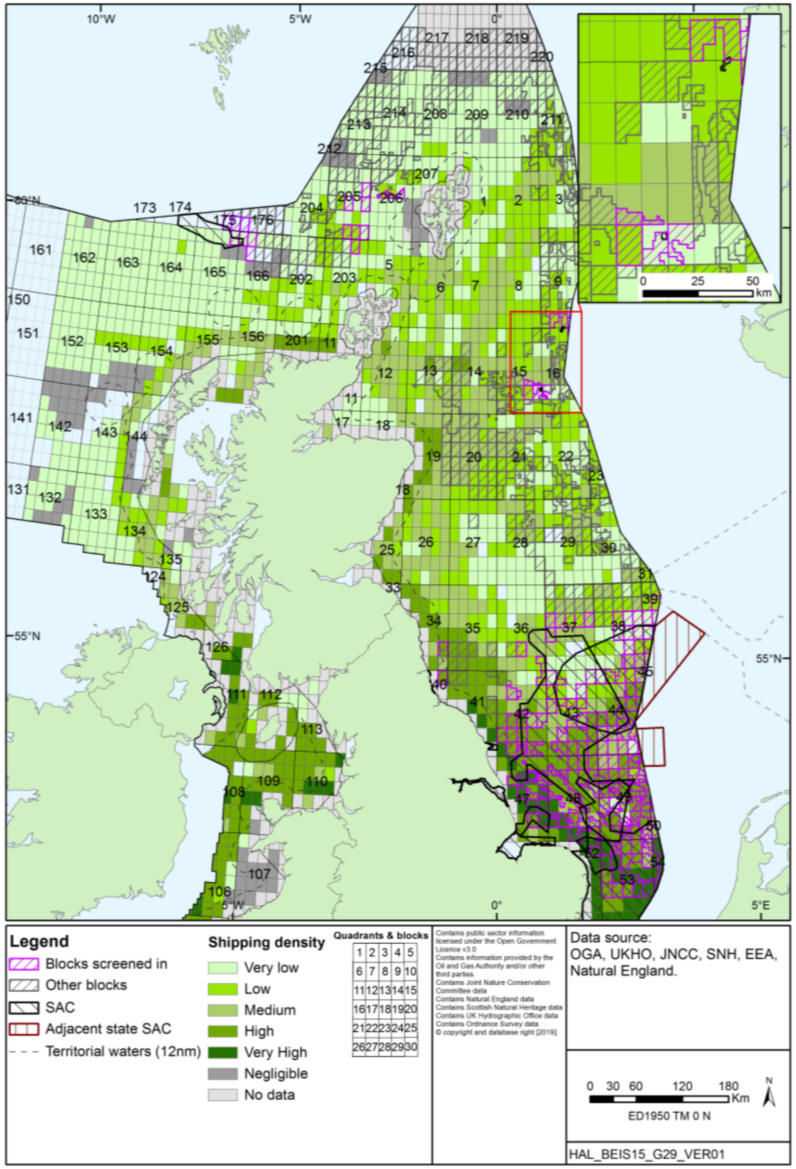


Figure 5.11: Navigation density, SACs and 32nd Round Blocks

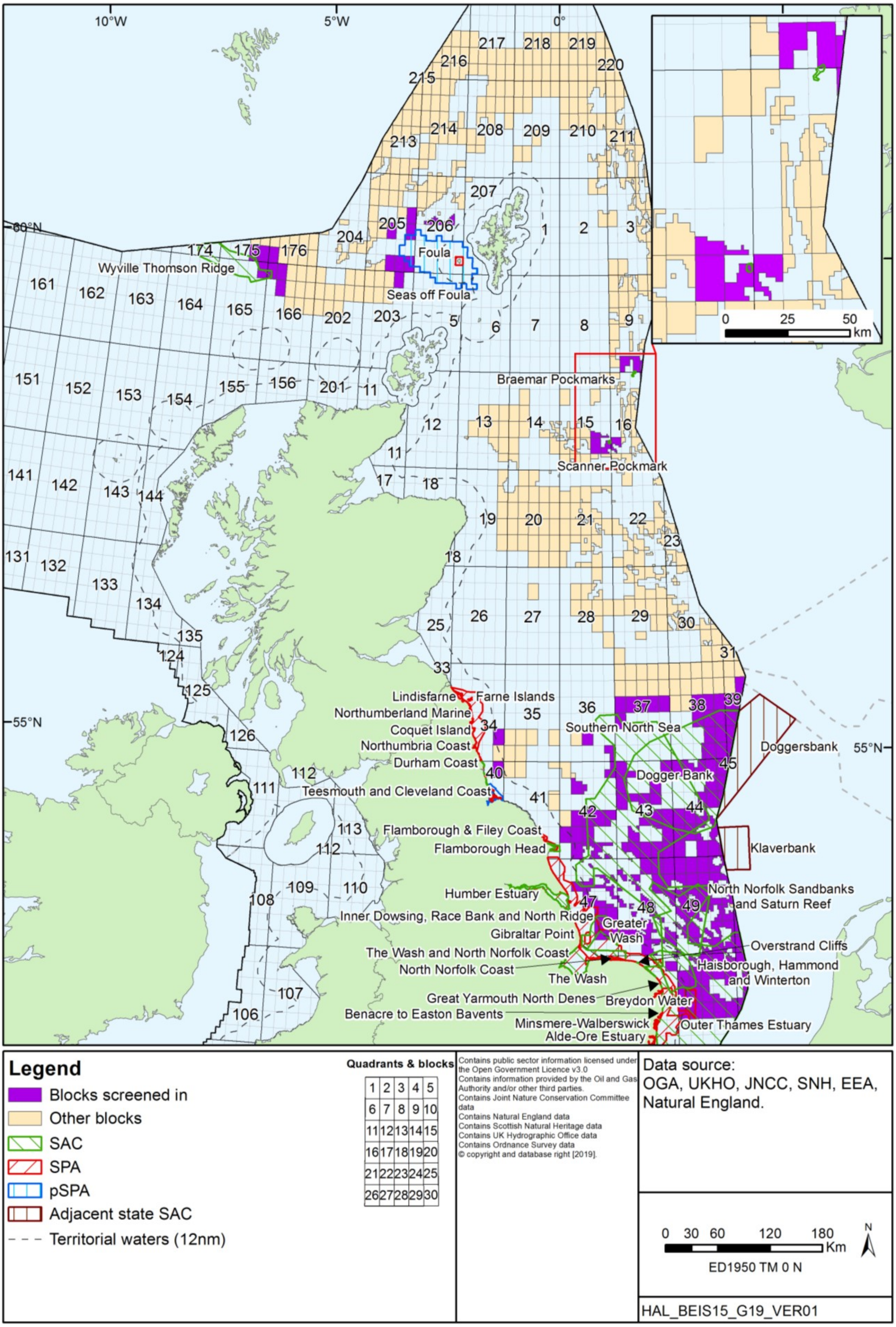


6 Conclusion

This screening assessment is based on the Blocks offered in the 32nd Round and has considered the likelihood for significant effects on Natura 2000 sites from exploration/appraisal activities that could follow licensing of Blocks. The screening, which does not take account of mitigation, concluded that for the majority of the Blocks, licensing would not have the potential to cause significant effects on Natura 2000 site(s). However, based on the screening results a number of Blocks on offer and relevant sites may be subject to a second stage of HRA, Appropriate Assessment, if licences are applied for and prior to decisions on the grant of such licences. These Blocks are listed in Table 5.1 and Appendix B (which lists the Blocks and relevant sites according to the criteria by which they were screened in), and are shown in Figure 6.1 with the relevant sites.

As described in Section 1.1, the award of a licence does not constitute any form of approval for activities to take place in the Blocks, nor does it confer any exemption from other legal or regulatory requirements. Offshore activities are subject to a range of statutory permitting and consenting requirements, including, where relevant, activity-specific Appropriate Assessment (AA) under Article 6(3) of the Habitats Directive (Directive 92/43/EC). Even where a site/interest feature has been screened out at plan level, the potential for likely significant effects on any relevant site would need to be revisited at the project level, once project plans are known. New relevant site designations, new information on the nature and sensitivities of interest features within sites, and new information about effects including in-combination effects may be available to inform future project level HRA.

Figure 6.1: 32nd Round Blocks and sites for which a 2nd Stage of HRA may be undertaken



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Appendix A – The Designated Sites

A1 Introduction

The following maps and tables show the locations of potentially relevant European sites and their qualifying features with respect to the Blocks offered as part of the 32nd Seaward Licensing Round.

The primary sources of site data were the latest JNCC SAC and SPA summary data[68] and interest features and site characteristics were filtered for their coastal and marine relevance. The websites of the relevant Statutory Nature Conservation Bodies (SNCBs) were also reviewed to verify and augment site information including Scottish Natural Heritage (SNH)[69] and Natural England[70,71].

The sites in this Appendix are ordered thus:

A2 Coastal and marine Special Protection Areas

A3 Coastal and marine Special Areas of Conservation

A4 Sites in the adjacent waters of other member states

A5 Ramsar sites

[68] Version as of 26th January 2019 - https://hub.jncc.gov.uk/assets/a3d9da1e-dedc-4539-a574-84287636c898

[69] http://gateway.snh.gov.uk/sitelink/index.jsp

[70] http://publications.naturalengland.org.uk/category/6490068894089216

[71] https://www.gov.uk/government/collections/conservation-advice-packages-for-marine-protected-areas

A2 Coastal and Marine Special Protection Areas

Special Protection Areas (SPAs) are protected sites classified in accordance with Article 4 of the EC Birds Directive (2009/147/EC). Sites are classified for rare and vulnerable birds and for regularly occurring migratory birds. The SPAs included in this section are coastal sites selected for the presence of one or more of the bird species listed in Box A.1 (below).

A number of marine SPAs, some of which provide marine extensions to existing sites, are presently at the proposed stage in Scottish inshore and offshore waters having undergone public consultation in 2016 and early 2017[72]. Further consultation on the sites[73] is presently underway, the outcome of which will be reflected in any further HRA. Additionally the Teesmouth and Cleveland Coast extension pSPA was subject to consultation[74] in 2018, and is presently under ministerial consideration. Relevant SPAs in the adjacent waters of another Member State (Germany, Netherlands), see Maps A.3-A.5) are listed and described separately in Section A4. All relevant SPAs are included on Maps A.1 to A.5.

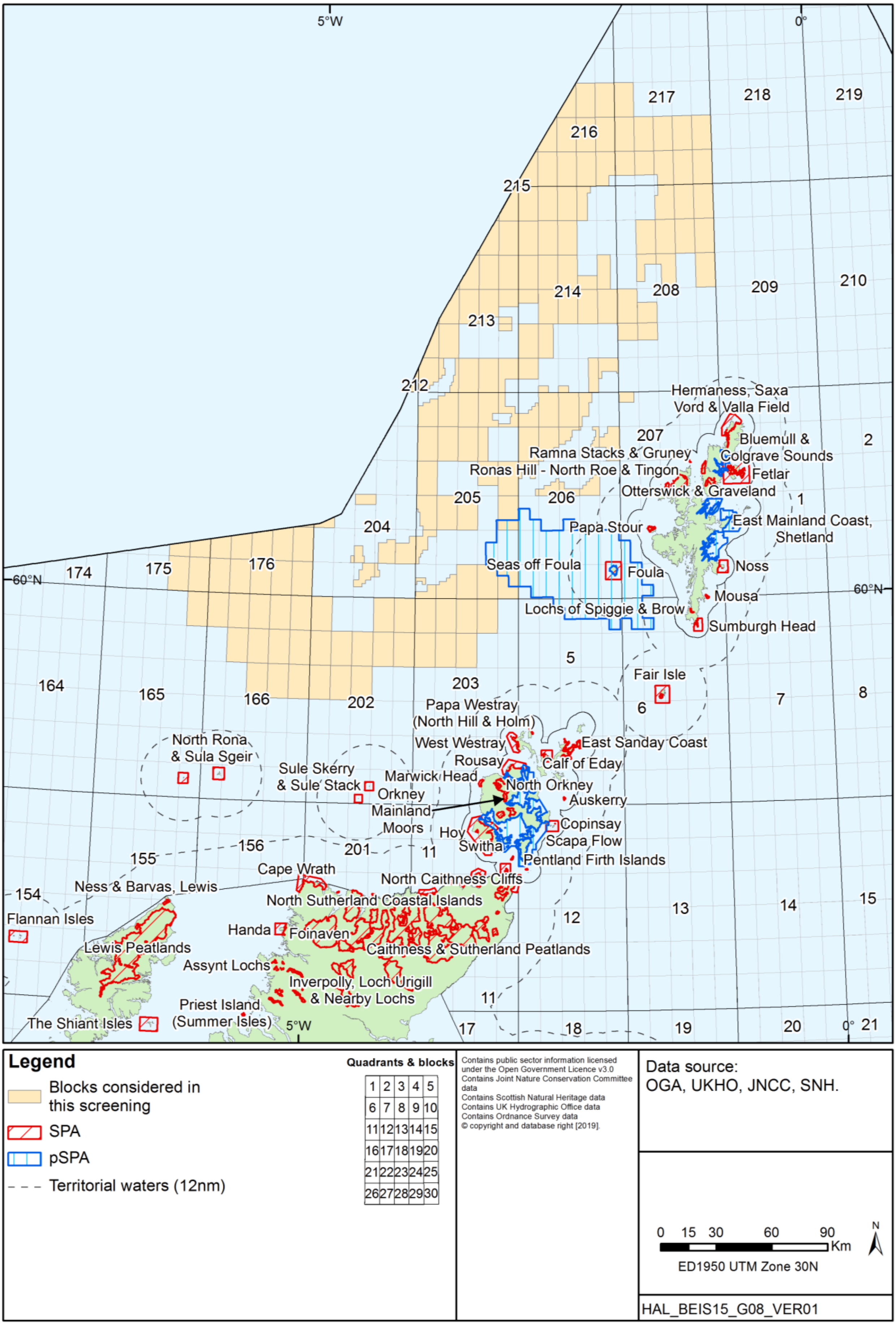
Box A.1: Migratory and/or Annex I bird species for which SPAs are selected in the UK

Divers and grebes	**Waders**
Great northern diver *Gavia immer*	Oystercatcher *Haematopus ostralegus*
Red-throated diver *Gavia stellata*	Avocet *Recurvirostra avosetta*
Black-throated diver *Gavia arctica*	Stone curlew *Burhinus oedicnemus*
Little grebe *Tachybaptus ruficollis*	Ringed plover *Charadrius hiaticula*
Great crested grebe *Podiceps cristatus*	Dotterel *Charadrius morinellus*
Slavonian grebe *Podiceps auritus*	Golden plover *Pluvialis apricaria*
	Grey plover *Pluvialis squatarola*
Seabirds	Lapwing *Vanellus vanellus*
Fulmar *Fulmarus glacialis*	Knot *Calidris canutus*
Manx shearwater *Puffinus puffinus*	Sanderling *Calidris alba*
Storm petrel *Hydrobates pelagicus*	Purple sandpiper *Calidris maritima*
Leach's petrel *Oceanodroma leucorhoa*	Dunlin *Calidris alpina alpina*
Gannet *Morus bassanus*	Ruff *Philomachus pugnax*
Cormorant *Phalacrocorax carbo carbo*	Snipe *Gallinago gallinago*
Shag *Phalacrocorax aristotelis*	Black-tailed godwit *Limosa limosa* (breeding)
Guillemot *Uria aalge*	Black-tailed godwit *Limosa limosa islandica* (non-breeding)
Razorbill *Alca torda*	Bar-tailed godwit *Limosa lapponica*
Puffin *Fratercula arctica*	Whimbrel *Numenius phaeopus*
	Curlew *Numenius arquata*
Gulls, terns and skuas	Redshank *Tringa totanus*
Arctic skua *Stercorarius parasiticus*	Greenshank *Tringa nebularia*
	Wood sandpiper *Tringa glareola*

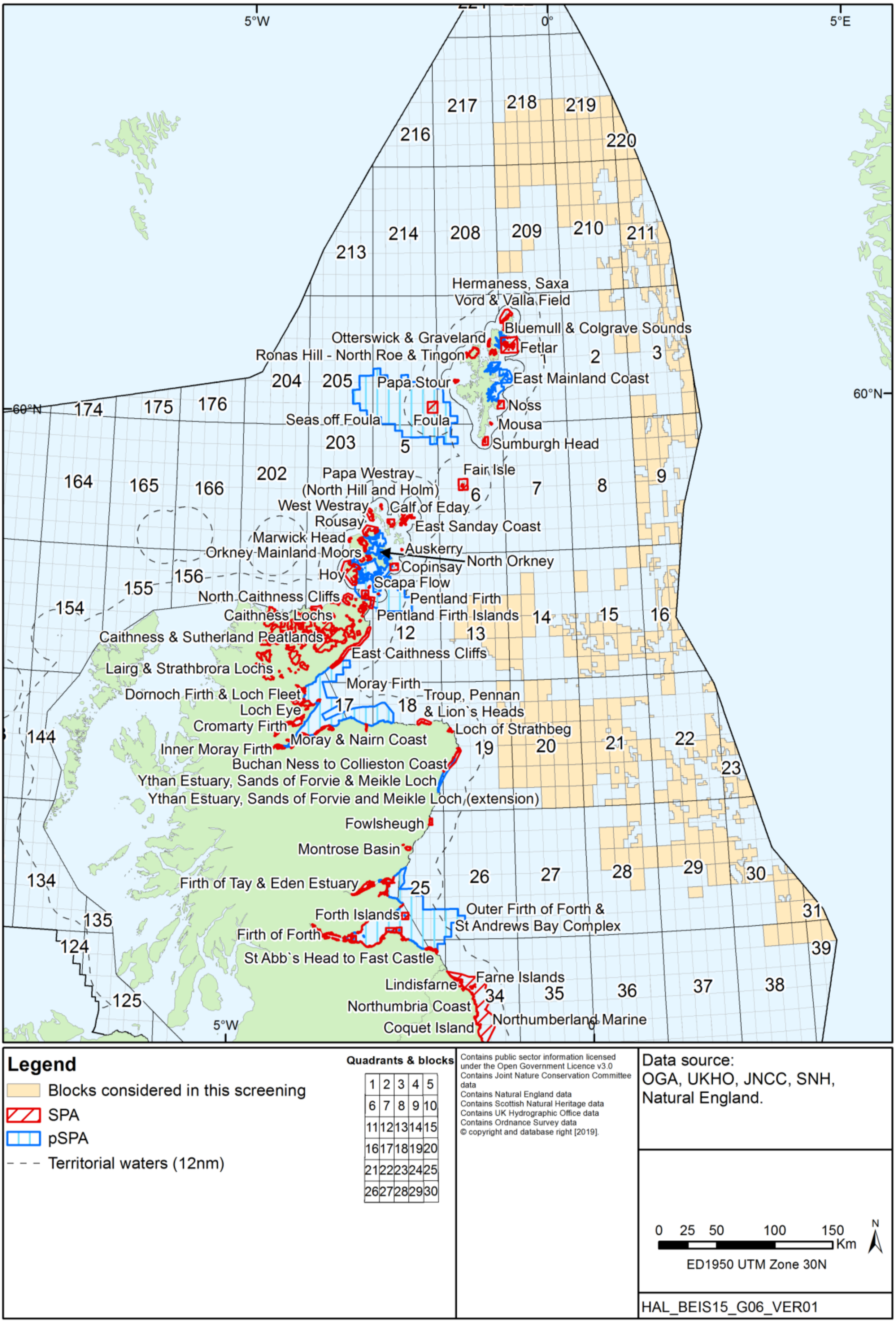
72 http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/proposed-marine-spas/
73 https://consult.gov.scot/marine-scotland/sea-and-site-classification/
74 https://www.gov.uk/government/consultations/teesmouth-and-cleveland-coast-special-protection-area-extension-how-to-comment

Great skua *Stercorarius skua* Mediterranean gull *Larus melanocephalus* Black-headed gull *Chroicocephalus ridibundus* Common gull *Larus canus* Lesser black-backed gull *Larus fuscus* Herring gull *Larus argentatus* Great black-backed gull *Larus marinus* Kittiwake *Rissa tridactyla* Sandwich tern *Thalasseus sandvicensis* Roseate tern *Sterna dougallii* Common tern *Sterna hirundo* Arctic tern *Sterna paradisaea* Little tern *Sternula albifrons* **Crakes and rails** Corncrake *Crex crex* **Birds of prey and owls** Marsh harrier *Circus aeruginosus* Hen harrier *Circus cyaneus* Golden eagle *Aquila chrysaetos* Osprey *Pandion haliaetus* Merlin *Falco columbarius* Peregrine *Falco peregrinus* Short-eared owl *Asio flammeus* **Other bird species** Fair Isle wren *Troglodytes troglodytes fridariensis* Chough *Pyrrhocorax pyrrhocorax*	Turnstone *Arenaria interpres* Red-necked phalarope *Phalaropus lobatus* **Waterfowl** Bewick's swan *Cygnus columbianus bewickii* Whooper swan *Cygnus cygnus* Pink-footed goose *Anser brachyrhynchus* Greenland white-fronted goose *Anser albifrons flavirostris* Greater white-fronted goose *Anser albifrons albifrons* Icelandic greylag goose *Anser anser* Greenland barnacle goose *Branta leucopsis* Svalbard barnacle goose *Branta leucopsis* Dark-bellied brent goose *Branta bernicla bernicla* Canadian light-bellied brent goose *Branta bernicla hrota* Svalbard light-bellied brent goose *Branta bernicla hrota* Shelduck *Tadorna tadorna* Wigeon *Anas penelope* Gadwall *Anas strepera* Teal *Anas crecca* Mallard *Anas platyrhynchos* Pintail *Anas acuta* Shoveler *Anas clypeata* Pochard *Aythya ferina* Tufted duck *Aythya fuligula* Scaup *Aythya marila* Eider *Somateria mollissima* Long-tailed duck *Clangula hyemalis* Common scoter *Melanitta nigra* Velvet scoter *Melanitta fusca* Goldeneye *Bucephala clangula* Red-breasted merganser *Mergus serrator* Goosander *Mergus merganser*

Map A.1: Location of SPAs – West of Shetland



Map A.2: Location of SPAs – central and northern North Sea



Map A.3: Location of SPAs – Mid-North Sea High and Southern North Sea

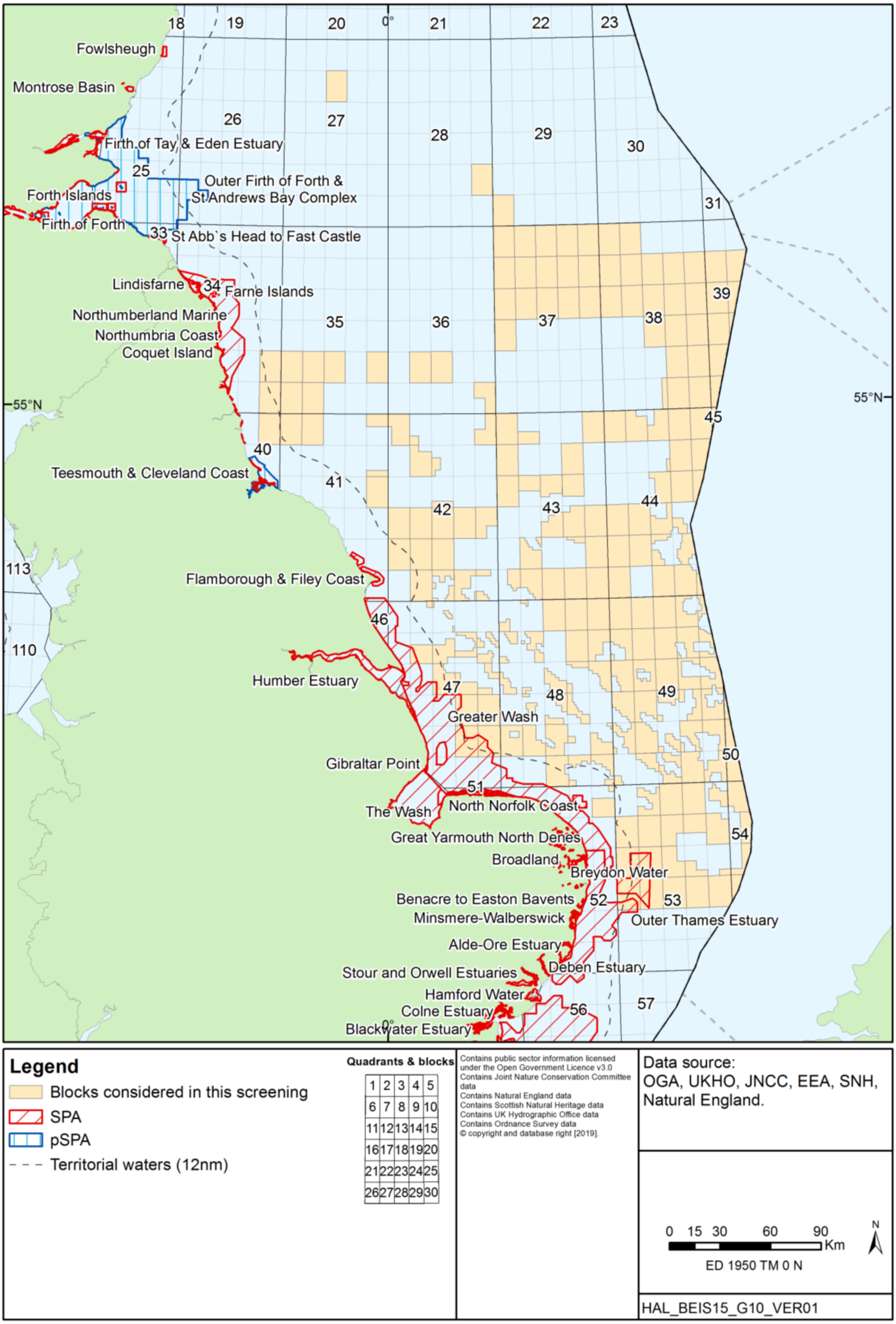


Table A.1: SPAs and their Qualifying Features

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[75]
WEST OF SHETLAND				
Flannan Isles SPA	5832.82	Breeding: Leach's petrel	N/A	Breeding: Seabirds
Lewis Peatlands SPA	58959.88	Breeding: Black-throated diver Golden eagle Golden plover Merlin Red-throated diver	Breeding: Dunlin Greenshank	N/A
Ness & Barvas, Lewis SPA	647.54	Breeding: Corncrake	N/A	N/A
The Shiant Isles SPA	6935.65	Over winter: Barnacle goose	Breeding: Razorbill Puffin Shag	Breeding: Seabirds
Priest Island (Summer Isles) SPA	132.02	Breeding: Storm petrel	N/A	N/A
Assynt Lochs SPA	1158.19	Breeding: Black-throated diver	N/A	N/A
Inverpolly, Loch Urigill and Nearby Lochs SPA	1937.05	Breeding: Black-throated diver	N/A	N/A
Handa SPA	3205.61	N/A	Breeding: Guillemot Razorbill	Breeding: Seabirds
Foinaven SPA	21082.64	Breeding: Golden eagle	N/A	N/A
Cape Wrath SPA	6734.48	N/A	N/A	Breeding: Seabirds
North Sutherland Coastal Islands SPA	223.46	Over winter: Barnacle goose	N/A	N/A
Caithness & Sutherland Peatlands SPA	145312.97	Breeding: Black-throated diver Golden eagle Golden plover Hen harrier Merlin Red-throated diver Short-eared owl Wood sandpiper	Breeding: Dunlin	N/A
North Caithness Cliffs SPA	14628.77	Breeding: Peregrine	Breeding: Guillemot	Breeding: Seabird
North Rona and Sula Sgeir SPA	6850.58	Breeding: Storm petrel Leach's petrel	Breeding: Gannet Guillemot	Breeding: Seabirds
Sule Skerry & Sule Stack SPA	3909.45	Breeding: Leach's storm petrel Storm petrel	Breeding: Gannet Puffin	Breeding: Seabird

[75] A seabird assemblage of international importance: the area regularly supports at least 20,000 seabirds. Or, a wetland of international importance: the area regularly supports at least 20,000 waterfowl.

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[75]
Hoy SPA	18123.91	Breeding: Peregrine Red-throated diver	Breeding: Great skua	Breeding: Seabirds
Orkney Mainland Moors SPA	5342.44	Breeding: Hen harrier Red-throated diver Short-eared owl Over winter: Hen harrier	N/A	N/A
Marwick Head SPA	475.54	N/A	Breeding: Guillemot	Breeding: Seabirds
Rousay SPA	5480.84	Breeding: Arctic tern	N/A	Breeding: Seabirds
Papa Westray (North Hill and Holm) SPA	245.94	Breeding: Arctic tern	N/A	N/A
West Westray SPA	3780.16	Breeding: Arctic tern	Breeding: Guillemot	Breeding: Seabirds
Calf of Eday SPA	2671.77	N/A	N/A	Breeding: Seabirds
East Sanday Coast SPA	1508.2	N/A	Over winter: Purple sandpiper Turnstone	N/A
North Orkney pSPA	22695.17	Breeding: Red-throated diver Over winter: Great northern diver Slavonian grebe	Over winter: Eider Long-tailed duck Velvet scoter Red-breasted merganser Shag	N/A
Auskerry SPA	103.11	Breeding: Arctic tern Storm petrel	N/A	N/A
Copinsay SPA	3607.7	N/A	N/A	Breeding: Seabirds
Scapa Flow pSPA	37065.53	Breeding: Red-throated diver Over winter: Great northern diver Black-throated diver Slavonian grebe	Over winter: Shag Eider Long-tailed duck Goldeneye Red-breasted merganser	N/A
Pentland Firth Islands SPA	170.0	Breeding: Arctic tern	N/A	N/A
Switha SPA	57.0	Over winter: Barnacle goose	N/A	N/A
Fair Isle SPA	6825.1	Breeding: Arctic tern Fair Isle wren	Breeding: Guillemot	Breeding: Seabirds
Sumburgh Head SPA	2478.91	Breeding: Arctic tern	N/A	Breeding: Seabirds
Lochs of Spiggie and Brow SPA	140.66	Over winter: Whooper swan	N/A	N/A
Seas off Foula pSPA	341215	N/A	Breeding: Great skua	Breeding: Seabirds Over winter: Seabirds

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[75]
Foula SPA	7985.49	Breeding: Arctic tern Leach's petrel Red-throated diver	Breeding: Great skua Guillemot Puffin Shag	Breeding: Seabirds
Papa Stour SPA	569.6	Breeding: Arctic tern	N/A	N/A
Ronas Hill-North Roe and Tingon SPA	5474.35	Breeding: Red-throated diver	Breeding: Great skua	N/A
Ramna Stacks and Gruney SPA	11.66	Breeding: Leach's petrel	N/A	N/A
Hermaness, Saxa Vord and Valla Field SPA	6832.36	Breeding: Red-throated diver	Breeding: Gannet Great skua Puffin	Breeding: Seabirds
Bluemull and Colgrave Sounds pSPA	3823.27	Breeding: Red-throated diver	N/A	N/A
Fetlar SPA	16964.69	Breeding: Arctic tern Red-necked phalarope	Breeding: Dunlin Great skua Whimbrel	Breeding: Seabirds
Otterswick and Graveland SPA	2239.59	Breeding: Red-throated diver	N/A	N/A
East Mainland Coast, Shetland pSPA	25646.67	Breeding: Red-throated diver Over winter: Great northern diver Slavonian grebe	Over winter: Eider Long-tailed duck Red-breasted merganser	N/A
Noss SPA	3338.38	N/A	Breeding: Gannet Great skua Guillemot	Breeding: Seabirds
Mousa SPA	196.85	Breeding: Arctic tern Storm petrel	N/A	N/A
CENTRAL AND NORTHERN NORTH SEA				
Hermaness, Saxa Vord and Valla Field SPA	6832.36	Breeding: Red-throated diver	Breeding: Gannet Great skua Puffin	Breeding: Seabirds
Fetlar SPA	16964.69	Breeding: Arctic tern Red-necked phalarope	Breeding: Dunlin Great skua Whimbrel	Breeding: Seabirds
Otterswick and Graveland SPA	2239.59	Breeding: Red-throated diver	N/A	N/A
Ronas Hill-North Roe and Tingon SPA	5474.35	Breeding: Red-throated diver	Breeding: Great skua	N/A
Papa Stour SPA	569.6	Breeding: Arctic tern	N/A	N/A
East Mainland Coast, Shetland pSPA	25646.67	Breeding: Red-throated diver Over winter: Great northern diver Slavonian grebe	Over winter: Eider Long-tailed duck Red-breasted merganser	N/A

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[75]
Bluemull and Colgrave Sounds pSPA	3823.27	Breeding: Red-throated diver	N/A	N/A
Noss SPA	3338.38	N/A	Breeding: Gannet Great skua Guillemot	Breeding: Seabirds
Mousa SPA	196.85	Breeding: Arctic tern Storm petrel	N/A	N/A
Sumburgh Head SPA	2478.91	Breeding: Arctic tern	N/A	Breeding: Seabirds
Fair Isle SPA	6825.1	Breeding: Arctic tern Fair Isle wren	Breeding: Guillemot	Breeding: Seabirds
Papa Westray (North Hill and Holm) SPA	245.94	Breeding: Arctic tern	N/A	N/A
West Westray SPA	3780.16	Breeding: Arctic tern	Breeding: Guillemot	Breeding: Seabirds
East Sanday Coast SPA	1508.2	N/A	Over winter: Purple sandpiper Turnstone	N/A
Calf of Eday SPA	2671.77	N/A	N/A	Breeding: Seabirds
Foula SPA	7985.49	Breeding: Arctic tern Leach's petrel Red-throated diver	Breeding: Great skua Guillemot Puffin Shag	Breeding: Seabirds
Seas off Foula pSPA	341215	N/A	Breeding: Great skua	Breeding: Seabirds Over winter: Seabirds
Rousay SPA	5480.84	Breeding: Arctic tern	N/A	Breeding: Seabirds
North Orkney pSPA	22695.17	Breeding: Red-throated diver Over winter: Great northern diver Slavonian grebe	Over winter: Eider Long-tailed duck Velvet scoter Red-breasted merganser Shag	N/A
Marwick Head SPA	475.54	N/A	Breeding: Guillemot	Breeding: Seabirds
Orkney Mainland Moors SPA	5342.44	Breeding: Hen harrier Red-throated diver Short-eared owl Over winter: Hen harrier	N/A	N/A
Auskerry SPA	103.11	Breeding: Arctic tern Storm petrel	N/A	N/A
Copinsay SPA	3607.7	N/A	N/A	Breeding: Seabirds
Hoy SPA	18123.91	Breeding: Peregrine Red-throated diver	Breeding: Great skua	Breeding: Seabirds

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[75]
Scapa Flow pSPA	37065.53	Breeding: Red-throated diver Over winter: Great northern diver Black-throated diver Slavonian grebe	Over winter: Shag Eider Long-tailed duck Goldeneye Red-breasted merganser	N/A
Pentland Firth Islands SPA	170.0	Breeding: Arctic tern	N/A	N/A
Pentland Firth pSPA	97325	Breeding: Arctic tern	N/A	Breeding: Seabirds
Caithness & Sutherland Peatlands SPA	145312.97	Breeding: Black-throated diver Golden eagle Golden plover Hen harrier Merlin Red-throated diver Short-eared owl Wood sandpiper	Breeding: Dunlin	N/A
North Caithness Cliffs SPA	14628.77	Breeding: Peregrine	Breeding: Guillemot	Breeding: Seabird
East Caithness Cliffs SPA	11696.37	Breeding: Peregrine	Breeding: Razorbill Herring gull Shag Kittiwake Guillemot	Breeding: Seabird
Caithness Lochs SPA	1381.65	Over winter: Greenland white-fronted goose Whooper swan	Over winter: Greylag goose	N/A
Lairg and Strathbrora Lochs SPA	286.14	Breeding: Black-throated diver	N/A	N/A
Moray Firth pSPA	176235.95	Over winter: Great northern diver Red-throated diver Slavonian grebe	Breeding: Shag Over winter: Scaup Eider Long-tailed duck Common scoter Velvet scoter Common goldeneye Red-breasted merganser Shag	N/A
Dornoch Firth and Loch Fleet SPA	7856.54	Breeding: Osprey Over winter: Bar-tailed godwit	Over winter: Greylag goose Wigeon	Over winter: Waterfowl
Loch Eye SPA	204.88	Over winter: Whooper swan	Over winter: Greylag goose	N/A
Cromarty Firth SPA	3247.95	Breeding: Common tern Osprey Over winter: Bar-tailed godwit Whooper swan	Over winter: Greylag goose	Over winter: Waterfowl

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[75]
Inner Moray Firth SPA	2290.25	Breeding: Common tern Osprey Over winter: Bar-tailed godwit	Over winter: Greylag goose Red-breasted merganser Redshank	N/A
Moray and Nairn Coast SPA	2325.67	Breeding: Osprey Over winter: Bar-tailed godwit	Over winter: Greylag goose Pink-footed goose Redshank	Over winter: Waterfowl
Troup, Pennan and Lion's Heads SPA	3365.2	N/A	Breeding: Guillemot	Breeding: Seabirds
Loch of Strathbeg SPA	616.26	Breeding: Sandwich tern Over winter: Whooper swan	Over winter: Teal Greylag goose Pink-footed goose Goldeneye	Over winter: Waterfowl
Buchan Ness to Collieston Coast SPA	5400.76	N/A	N/A	Breeding: Seabirds
Ythan Estuary, Sands of Forvie and Meikle Loch SPA	1014.62	Breeding: Common tern Little tern Sandwich tern	Over winter: Pink-footed goose	Over winter: Waterfowl
Ythan Estuary, Sands of Forvie and Meikle Loch pSPA (extension)	6051.39	Breeding: Sandwich tern Little tern	N/A	N/A
Fowlsheugh SPA	1303.23	N/A	Breeding: Guillemot Kittiwake	Breeding: Seabirds
Montrose Basin SPA	981.19	N/A	Over winter: Greylag goose Knot Pink-footed goose Oystercatcher Redshank	Over winter: Waterfowl
Firth of Tay and Eden Estuary SPA	6947.62	Breeding: Little tern Marsh harrier Over winter: Bar-tailed godwit	Over winter: Greylag goose Pink-footed goose Redshank	Over winter: Waterfowl
Outer Firth of Forth and St Andrews Bay Complex pSPA	272068.09	Breeding: Common tern Arctic tern Over-winter: Red-throated diver Little gull Slavonian grebe	Breeding: Shag Gannet Over-winter: Eider	Breeding: Seabirds Over winter: Seabirds Waterfowl
Firth of Forth Islands SPA	9795	Breeding: Roseate tern Common tern Sandwich tern Arctic tern	Breeding: Puffin Lesser black-backed gull Gannet Shag	Breeding: Seabirds

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[75]
Firth of Forth SPA	6317.69	Over winter: Red-throated diver Bar-tailed godwit Golden plover Slavonian grebe Oystercatcher On passage: Sandwich tern	Over winter: Pink-footed goose Turnstone Knot Shelduck Redshank	Over winter: Waterfowl
St Abb's Head to Fast Castle SPA	1736.75	N/A	N/A	Breeding: Seabirds
Lindisfarne SPA	3671.03	Breeding: Little tern Roseate tern Over winter: Bar-tailed godwit Golden plover Whooper swan	On passage: Ringed plover Over winter: Grey plover Greylag goose Light-bellied brent goose Sanderling Wigeon Dunlin Ringed plover Long-tailed duck Red-breasted merganser Eider Shelduck	N/A
Farne Islands SPA	101.23	Breeding: Arctic tern Common tern Sandwich tern	Breeding: Guillemot	Breeding: Seabirds
Northumberland Marine SPA	88687	Breeding: Sandwich tern Common tern Arctic tern Roseate tern Little tern	Breeding: Puffin Guillemot	Breeding: Seabirds
Northumbria Coast SPA	1097.44	Breeding: Little tern Arctic tern	Over winter: Purple sandpiper Turnstone	N/A
Coquet Island SPA	19.78	Breeding: Arctic tern Common tern Roseate tern Sandwich tern	N/A	Breeding: Seabirds
Teesmouth and Cleveland Coast SPA	1251.51	Breeding: Little tern On passage: Sandwich tern	On passage: Redshank Over winter: Knot	Over winter: Waterfowl
Teesmouth and Cleveland Coast pSPA (extension)	12226.28	Breeding: Avocet Sandwich tern Common tern On passage: Ruff	On passage: Knot Redshank	Over winter: Waterfowl
MID-NORTH SEA HIGH AND SOUTHERN NORTH SEA				
Fowlsheugh SPA	1303.23	N/A	Breeding: Guillemot Kittiwake	Breeding: Seabirds

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[75]
Montrose Basin SPA	981.19	N/A	Over winter: Greylag goose Knot Pink-footed goose Oystercatcher Redshank	Over winter: Waterfowl
Outer Firth of Forth and St Andrews Bay Complex pSPA	272068.09	Breeding: Common tern Arctic tern Over-winter: Red-throated diver Little gull Slavonian grebe	Breeding: Shag Gannet Over-winter: Eider	Breeding: Seabirds Over winter: Seabirds Waterfowl
Firth of Forth Islands SPA	9795	Breeding: Roseate tern Common tern Sandwich tern Arctic tern	Breeding: Puffin Lesser black-backed gull Gannet Shag	Breeding: Seabirds
Firth of Forth SPA	6317.69	Over winter: Red-throated diver Bar-tailed godwit Golden plover Slavonian grebe Oystercatcher On passage: Sandwich tern	Over winter: Pink-footed goose Turnstone Knot Shelduck Redshank	Over winter: Waterfowl
Firth of Tay and Eden Estuary SPA	6947.62	Breeding: Little tern Marsh harrier Over winter: Bar-tailed godwit	Over winter: Greylag goose Pink-footed goose Redshank	Over winter: Waterfowl
St Abb's Head to Fast Castle SPA	1736.75	N/A	N/A	Breeding: Seabirds
Lindisfarne SPA	3671.03	Breeding: Little tern Roseate tern Over winter: Bar-tailed godwit Golden plover Whooper swan	On passage: Ringed plover Over winter: Grey plover Greylag goose Light-bellied brent goose Sanderling Wigeon Dunlin Ringed plover Long-tailed duck Red-breasted merganser Eider Shelduck	N/A
Farne Islands SPA	101.23	Breeding: Arctic tern Common tern Sandwich tern	Breeding: Guillemot	Breeding: Seabirds
Northumberland Marine SPA	88687	Breeding: Sandwich tern Common tern Arctic tern Roseate tern Little tern	Breeding: Puffin Guillemot	Breeding: Seabirds

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[75]
Northumbria Coast SPA	1097.44	Breeding: Little tern Arctic tern	Over winter: Purple sandpiper Turnstone	N/A
Coquet Island SPA	19.78	Breeding: Arctic tern Common tern Roseate tern Sandwich tern	N/A	Breeding: Seabirds
Teesmouth and Cleveland Coast SPA	1251.51	Breeding: Little tern On passage: Sandwich tern	On passage: Redshank Over winter: Knot	Over winter: Waterfowl
Teesmouth and Cleveland Coast pSPA (extension)	12226.28	Breeding: Avocet Sandwich tern Common tern On passage: Ruff	On passage: Knot Redshank	Over winter: Waterfowl
Flamborough and Filey Coast SPA	8039.6	N/A	Breeding: Kittiwake Gannet Guillemot Razorbill	Breeding: Seabirds
Hornsea Mere SPA	232.25	N/A	Breeding: Mute swan Over winter: Gadwall	N/A
Humber Estuary SPA	37630.24	Breeding: Bittern Marsh harrier Avocet Little tern Over winter: Bittern Avocet Hen harrier Bar-tailed godwit Golden plover On passage: Ruff	Over winter: Dunlin Knot Shelduck Black-tailed godwit Redshank On passage: Knot Dunlin Black-tailed godwit Redshank	Non-breeding: Waterfowl
Gibraltar Point SPA	422.2	Breeding: Little tern Over winter: Bar-tailed godwit	Over winter: Grey plover Sanderling	
Greater Wash SPA	344267	Breeding: Little tern Sandwich tern Common tern Over winter: Little gull Red-throated diver	Over winter: Common scoter	N/A

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[75]
The Wash SPA	62044.14	Breeding: Common tern Little tern Over winter: Bewick's swan Bar-tailed godwit	Over winter: Pintail Wigeon Gadwall Pink-footed goose Turnstone Dark-bellied brent goose Goldeneye Sanderling Dunlin Knot Oystercatcher Black-tailed godwit Common scoter Curlew Grey plover Shelduck Redshank	Over winter: Waterfowl
North Norfolk Coast SPA	7862.27	Breeding: Avocet Bittern Common tern Little tern Marsh harrier Sandwich tern Over winter: Avocet	Over winter: Wigeon Pink-footed goose Dark-bellied brent goose Knot	Over winter: Waterfowl
Broadland SPA	5508.88	Breeding: Bittern Marsh harrier Over winter: Hen harrier Bewick's swan Whooper swan	Over winter: Gadwall	N/A
Great Yarmouth North Denes SPA	160.37	Breeding: Little tern	N/A	N/A
Outer Thames Estuary SPA	392451.66	Breeding: Little tern Common tern Over winter: Red-throated diver	N/A	N/A
Breydon Water SPA	1203.5	Breeding: Common tern Over winter: Bewick's swan Avocet Golden plover On passage: Ruff	Over winter: Lapwing	Over winter: Waterfowl
Benacre to Easton Bavents SPA	470.6	Breeding: Bittern Little tern Marsh harrier	N/A	N/A

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[75]
Minsmere-Walberswick SPA	2019.11	Breeding: Bittern Nightjar Marsh harrier Avocet Little tern Over winter: Hen harrier	Breeding: Shoveler Teal Gadwall Over winter: Shoveler Gadwall Greater white-fronted goose	N/A
Alde-Ore Estuary SPA	2403.5	Breeding: Marsh harrier Avocet Little tern Sandwich tern Over winter: Ruff Avocet	Breeding: Lesser black-backed gull Over winter: Redshank	N/A
Deben Estuary SPA	981.08	Over winter: Avocet	Over winter: Dark-bellied brent goose	N/A
Stour and Orwell Estuaries SPA	3667.37	Breeding: Avocet	Over winter: Pintail Dark-bellied brent goose Dunlin Knot Black-tailed godwit Grey plover Redshank On passage: Redshank	Over winter: Waterfowl
Hamford Water SPA	3532.55	Breeding: Little tern Over winter: Avocet	Over winter: Teal Dark-bellied brent goose Ringed plover Black-tailed godwit Grey plover Shelduck Redshank	N/A

A3 Coastal and Marine Special Areas of Conservation

This section includes coastal and marine Special Areas of Conservation (SAC) which contain one or more of the Annex I habitats listed in Box A.2 (below) or Annex II qualifying marine species. Relevant SACs in the waters of adjacent Member States (the Netherlands, France, Germany and the Republic of Ireland) are listed in Section A4. All relevant SACs are included on Maps A.6 to A.10.

Abbreviations for the Annex I habitats used in SAC site summaries (Tables A.2 to A.4) are listed in Box A.2. Common names of Annex II species are used in SAC site summaries with corresponding scientific names listed in Box A.3.

Box A.2: Annex I habitat abbreviations used in site summaries

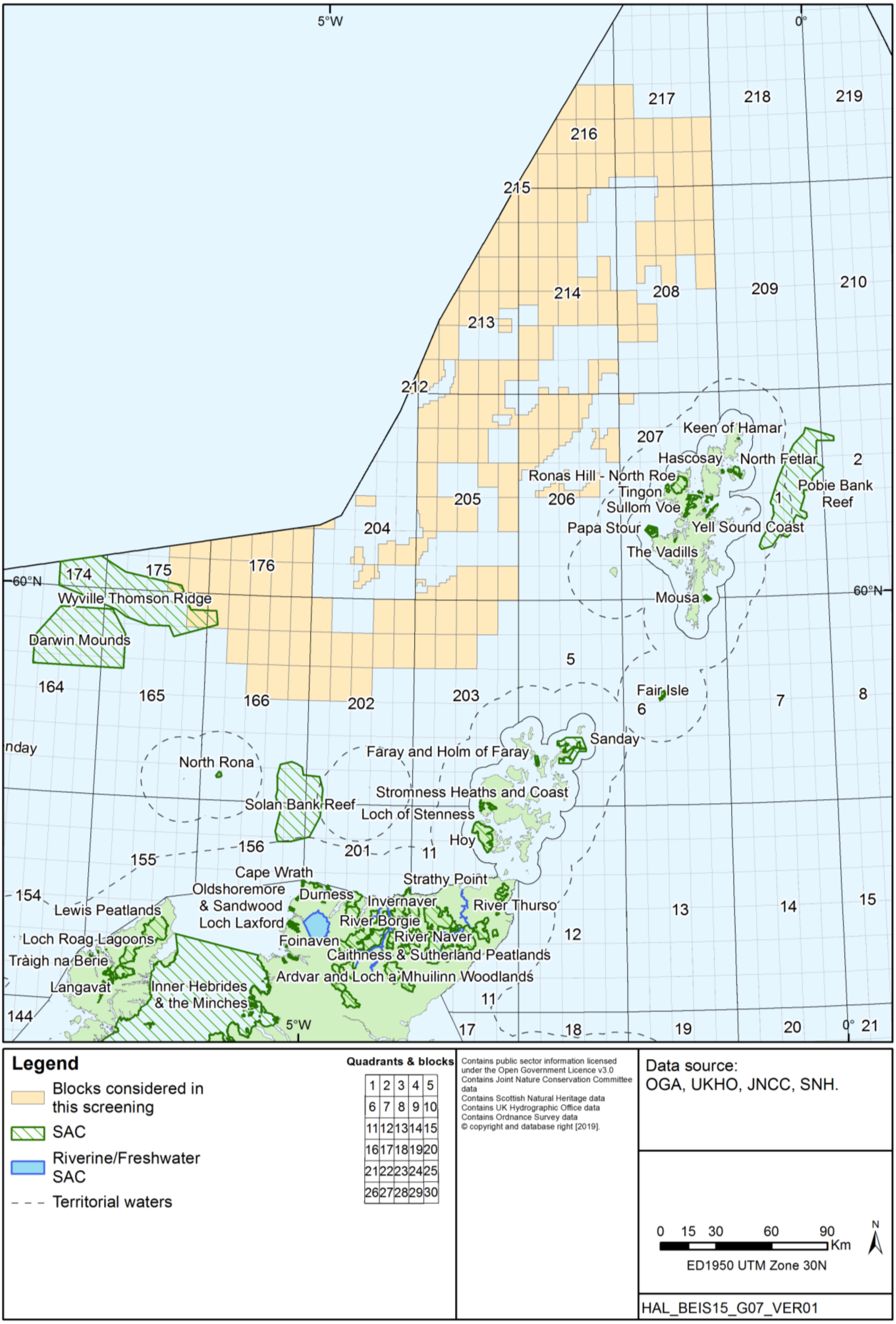
Annex I habitat (abbreviated)	Annex I habitat(s) (full description)
Bogs	Blanket bogs * Priority feature Transition mires and quaking bogs Depressions on peat substrates of the *Rhynchosporion* Active raised bogs * Priority feature Degraded raised bogs still capable of natural regeneration Bog Woodland * Priority feature
Coastal dunes	Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") Fixed coastal dunes with herbaceous vegetation ("grey dunes") * Priority feature Humid dune slacks Embryonic shifting dunes Decalcified fixed dunes with *Empetrum nigrum* * Priority feature Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) * Priority feature Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*) Coastal dunes with *Juniperus* spp. Dunes with *Hippophae rhamnoides* Fixed dunes with herbaceous vegetation (`grey dunes`) * Priority feature
Coastal lagoons	Coastal lagoons * Priority feature
Estuaries	Estuaries
Fens	Alkaline fens Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* * Priority feature Petrifying springs with tufa formation (*Cratoneurion*) * Priority feature
Forest	Western acidic oak woodland Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) * Priority feature *Taxus baccata* woods of the British Isles *Priority feature *Tilio-Acerion* forests of slopes, screes and ravines * Priority feature Old sessile oak woods and *Ilex* and *Blechnum* in the British Isles Old sessile oak woods with *Quercus robur* on sandy plains

Annex I habitat (abbreviated)	Annex I habitat(s) (full description)
Grasslands	Alpine and subalpine calcareous grasslands Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels Siliceous alpine and boreal grasslands Species-rich *Nardus* grassland, on siliceous substrates in mountain areas (and submountain areas in continental Europe) * Priority feature Alpine pioneer formations of the *Caricion bicoloris-atrofuscae* * Priority feature Calaminarian grasslands of the *Violetalia calaminariae* *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*) (important orchid sites) * Priority feature
Heaths	Northern Atlantic wet heaths with *Erica tetralix* European dry heaths Alpine and Boreal heaths Dry Atlantic coastal heaths with *Erica vagans*
Inlets and bays	Large shallow inlets and bays
Limestone pavements	Limestone pavements * Priority feature
Machairs	Machairs
Mudflats and sandflats	Mudflats and sandflats not covered by seawater at low tide
Reefs	Reefs
Rocky slopes	Calcareous rocky slopes with chasmophytic vegetation Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*) Siliceous rocky slopes with chasmophytic vegetation
Running freshwater	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
Saltmarsh and salt meadows	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) *Salicornia* and other annuals colonising mud and sand *Spartina* swards (*Spartinion maritimae*)
Sandbanks	Sandbanks which are slightly covered by sea water all the time
Scree	Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*) Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*)
Scrub	*Juniperus communis* formations on heaths or calcareous grasslands Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)
Sea caves	Submerged or partially submerged sea caves
Sea cliffs	Vegetated sea cliffs of the Atlantic and Baltic Coasts
Standing freshwater	Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* Natural dystrophic lakes and ponds Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)
Vegetation of drift line	Annual vegetation of drift lines
Vegetation of stony banks	Perennial vegetation of stony banks

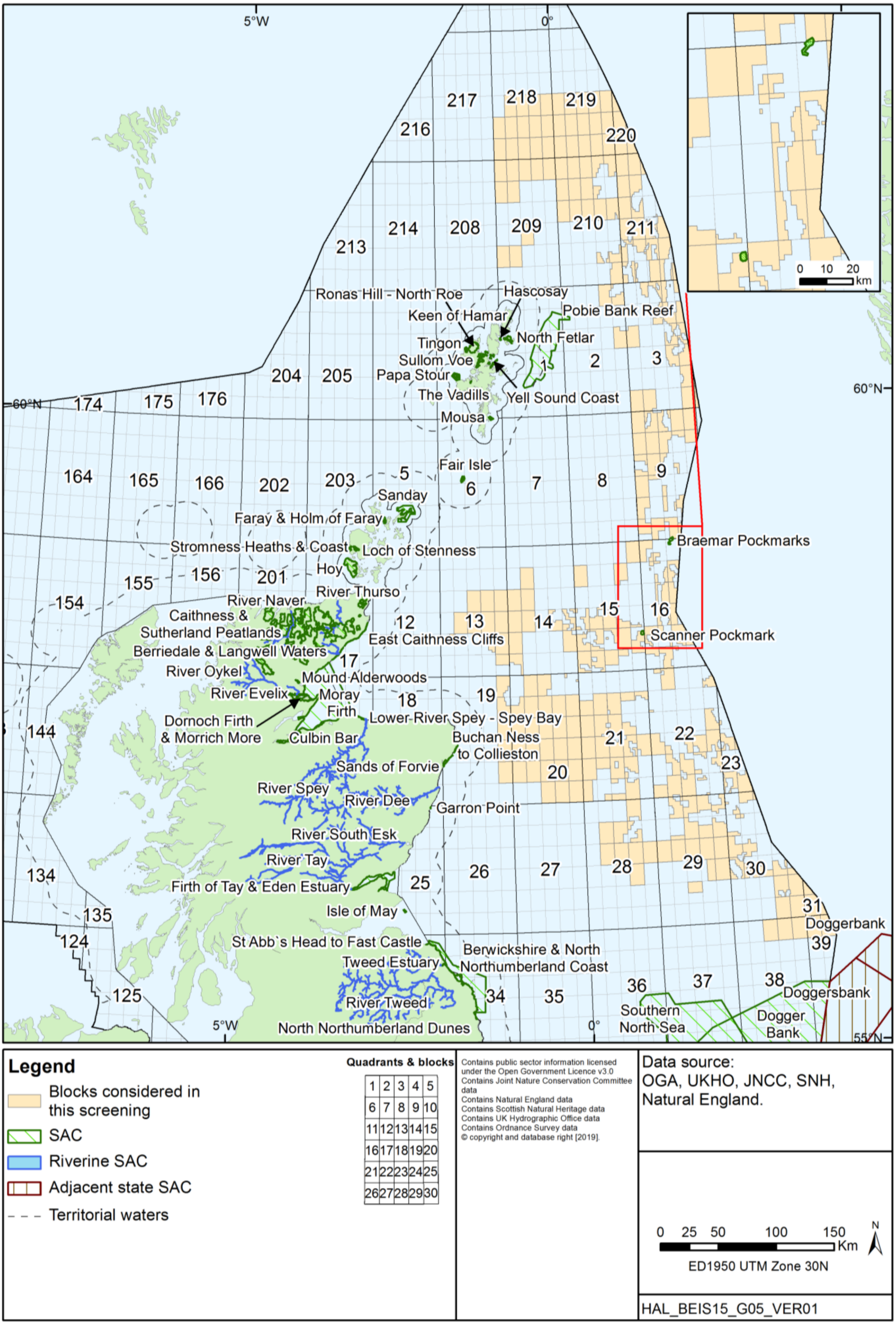
Box A.3: Annex II species common names used in site summaries and scientific names

Group	Annex II species common name (scientific name)
Plants	marsh saxifrage (*Saxifraga hirculus*) petalwort (*Petalophyllum ralfsii*) floating water-plantain (*Luronium natans)* shore dock (*Rumex rupestris)*
Invertebrates	marsh fritillary butterfly (*Euphydryas (Eurodryas, Hypodryas) aurinia*) freshwater pearl mussel (*Margaritifera margaritifera*) slender naiad (*Najas flexilis*) narrow-mouthed whorl snail (*Vertigo angustior*) white-clawed (or Atlantic stream) crayfish (*Austropotamobius pallipes*) Fisher's estuarine moth (*Gortyna borelii lunata)*
Amphibians	great crested newt (*Triturus cristatus)*
Fish	sea lamprey (*Petromyzon marinus)* brook lamprey (*Lampetra planeri)* river lamprey (*Lampetra fluviatilis)* Atlantic salmon (*Salmo salar)* bullhead (*Cottus gobio)*
Mammals	grey seal (*Halichoerus grypus*) harbour seal (*Phoca vitulina*) otter (*Lutra lutra*) harbour porpoise (*Phocoena phocoena*) bottlenose dolphin (*Tursiops truncatus*)

Map A.6: Location of SACs – West of Shetland



Map A.7: Location of SACs – central and northern North Sea



Map A.8: Location of SACs – Mid-North Sea High and Southern North Sea

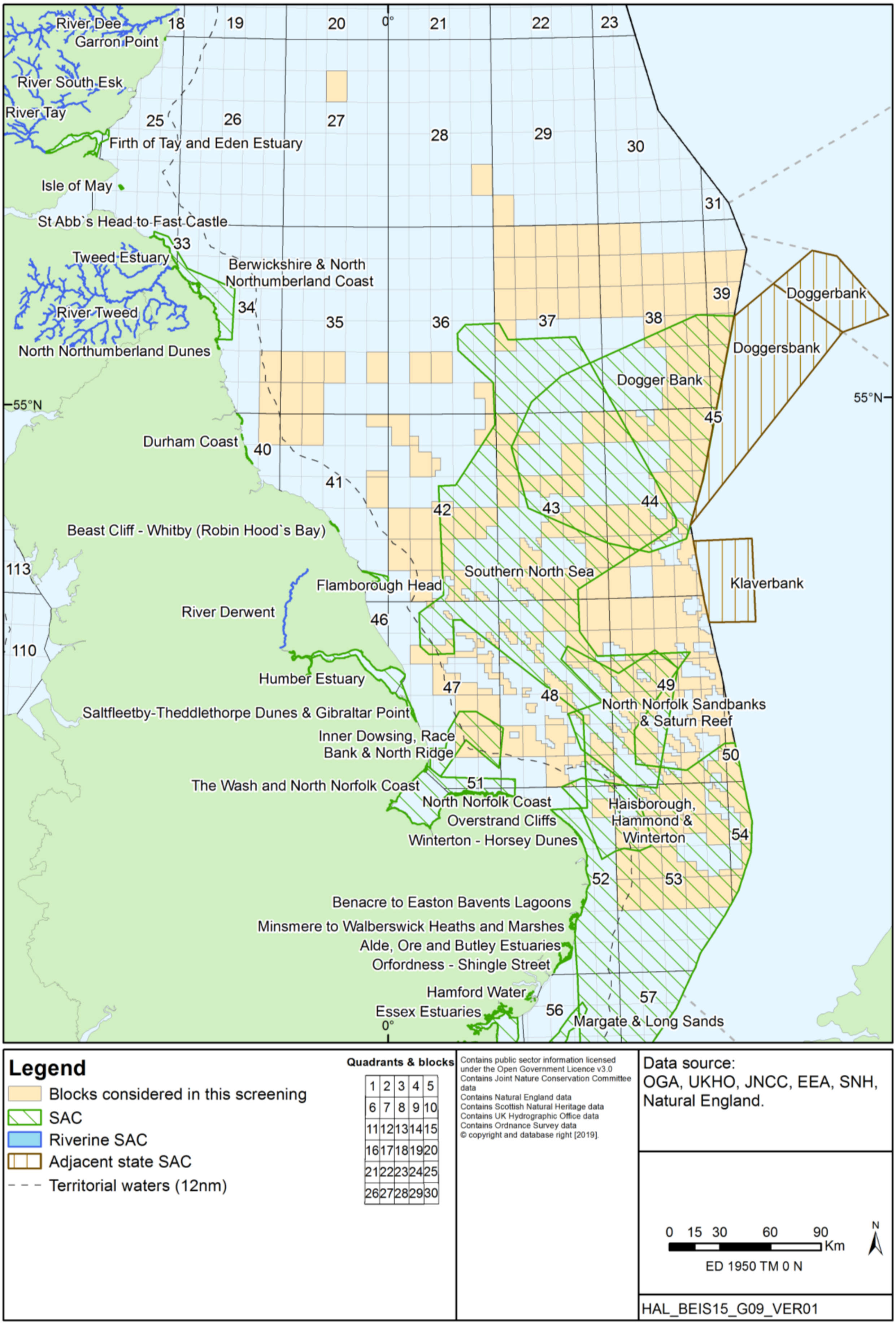


Table A.2: SACs and their Qualifying Features

Site Name	Area (ha)	Annex I Habitat Primary	Annex I Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
WEST OF SHETLAND					
Langavat SAC	1471.42	N/A	N/A	Atlantic salmon	N/A
Tràigh na Berie SAC	153.54	Machairs	N/A	N/A	N/A
Loch Roag Lagoons SAC	43.14	Coastal lagoons	N/A	N/A	N/A
Lewis Peatlands SAC	27955.02	Standing freshwater Bogs	Heaths Bogs	N/A	Otter
Inner Hebrides and the Minches SAC	1380199	N/A	N/A	Harbour porpoise	N/A
Ardvar and Loch a`Mhuilinn Woodlands SAC	808.1	Forest	N/A	N/A	Freshwater pearl mussel Otter
Foinaven SAC	14853.66	Standing freshwater Heaths Grasslands Scree Rocky slopes	Grasslands Bogs Rocky slopes	N/A	Freshwater pearl mussel Otter
Loch Laxford SAC	1214.54	Inlets and bays	Reefs	N/A	N/A
Oldshoremore and Sandwood SAC	446.2	Coastal dunes Machairs	Coastal dunes	N/A	N/A
Cape Wrath SAC	1009.75	Sea cliffs	N/A	N/A	N/A
Durness SAC	1213.8	Coastal dunes Standing freshwater Grasslands Limestone pavements	Coastal dunes Heaths Grasslands Fens	N/A	Otter
Invernaver SAC	287.67	Coastal dunes Heaths Grasslands	Coastal dunes Fens	N/A	N/A
River Borgie SAC	33.92	N/A	N/A	Freshwater pearl mussel	Atlantic salmon Otter
Strathy Point SAC	207	Sea cliffs	N/A	N/A	N/A
River Naver SAC	1044.15	N/A	N/A	Freshwater pearl mussel Atlantic salmon	N/A
Caithness and Sutherland Peatlands SAC	143561.47	Standing freshwater Bogs	Heaths Bogs	Otter Marsh saxifrage	N/A
River Thurso SAC	348.25	N/A	N/A	Atlantic salmon	N/A
Hoy SAC	9501.27	Sea cliffs Standing freshwater Heaths Bog	Heaths Fens Rocky slopes	N/A	N/A
Loch of Stenness SAC	792.59	Coastal lagoons	N/A	N/A	N/A
Stromness Heaths and Coast SAC	638.26	Sea cliffs Heaths	Fens	N/A	N/A
Faray and Holm of Faray SAC	781.33	N/A	N/A	Grey seal	N/A
Sanday SAC	10976.97	Reefs	Sandbanks Mudflats and sandflats	Harbour seal	N/A
Solan Bank Reef SAC	85593	Reefs	N/A	N/A	N/A
North Rona SAC	628.53	N/A	Reefs Sea cliffs Sea caves	Grey seal	N/A
Wyville Thomson Ridge SAC	173995	Reefs	N/A	N/A	N/A
Darwin Mounds SAC	137726	Reefs	N/A	N/A	N/A
Fair Isle SAC	561.05	Sea cliffs	Heaths	N/A	N/A
Mousa SAC	529.74	N/A	Reefs Sea caves	Harbour seal	N/A
The Vadills SAC	62.42	Coastal lagoons	N/A	N/A	N/A

Site Name	Area (ha)	Annex I Habitat Primary	Annex I Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
Sullom Voe SAC	2691.43	Inlets and bays	Coastal lagoons Reefs	N/A	N/A
Papa Stour SAC	2072.9	Reefs Sea caves	N/A	N/A	N/A
Ronas Hill – North Roe SAC	4903.57	Standing freshwater Heaths Bogs	Heaths Scree	N/A	N/A
Tingon SAC	570.78	Bogs	Standing freshwater	N/A	N/A
Hascosay SAC	164.19	Bogs	N/A	N/A	Otter
Keen of Hamar SAC	39.87	Grasslands Scree	Heaths	N/A	N/A
North Fetlar SAC	1585.18	Heaths Fens	N/A	N/A	N/A
Yell Sound Coast SAC	1544.44	N/A	N/A	Otter Harbour seal	N/A
Pobie Bank Reef SAC	96575	Reefs	N/A	N/A	N/A
CENTRAL AND NORTHERN NORTH SEA					
Pobie Bank Reef SAC	96575	Reefs	N/A	N/A	N/A
Hascosay SAC	164.19	Bogs	N/A	N/A	Otter
Yell Sound Coast SAC	1544.44	N/A	N/A	Otter Harbour seal	N/A
North Fetlar SAC	1585.18	Heaths Fens	N/A	N/A	N/A
Sullom Voe SAC	2691.43	Inlets and bays	Coastal lagoons Reefs	N/A	N/A
Mousa SAC	529.74	N/A	Reefs Sea caves	Harbour seal	N/A
The Vadills SAC	62.42	Coastal lagoons	N/A	N/A	N/A
Papa Stour SAC	2072.9	Reefs Sea caves	N/A	N/A	N/A
Tingon SAC	570.78	Bogs	Standing freshwater	N/A	N/A
Ronas Hill – North Roe SAC	4903.57	Standing freshwater Heaths Bogs	Heaths Scree	N/A	N/A
Keen of Hamar SAC	39.87	Grasslands Scree	Heaths	N/A	N/A
Fair Isle SAC	561.05	Sea cliffs	Heaths	N/A	N/A
Sanday SAC	10976.97	Reefs	Sandbanks Mudflats and sandflats	Harbour seal	N/A
Faray and Holm of Faray SAC	781.33	N/A	N/A	Grey seal	N/A
Stromness Heaths and Coast SAC	638.26	Sea cliffs Heaths	Fens	N/A	N/A
Loch of Stenness SAC	792.59	Coastal lagoons	N/A	N/A	N/A
Hoy SAC	9501.27	Sea cliffs Standing freshwater Heaths Bog	Heaths Fens Rocky slopes	N/A	N/A
East Caithness Cliffs SAC	457.48	Sea cliffs	N/A	N/A	N/A
Caithness and Sutherland Peatlands SAC	143561.47	Standing freshwater Bogs	Heaths Bogs	Otter Marsh saxifrage	N/A
River Naver SAC	1044.15	N/A	N/A	Freshwater pearl mussel Atlantic salmon	N/A
River Thurso SAC	348.25	N/A	N/A	Atlantic salmon	N/A

Site Name	Area (ha)	Annex I Habitat Primary	Annex I Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
Berriedale and Langwell Waters SAC	58.25	N/A	N/A	Atlantic salmon	N/A
Moray Firth SAC	151273.99	N/A	Sandbanks	Bottlenose dolphin	N/A
Mound Alderwoods SAC	299.52	Forest	N/A	N/A	N/A
River Oykel	921.46	N/A	N/A	Freshwater pearl mussel	Atlantic salmon
River Evelix	23.6	N/A	N/A	Freshwater pearl mussel	N/A
Dornoch Firth and Morrich More SAC	8701.22	Estuaries Mudflats and sandflats Saltmarsh and salt meadows Coastal dunes	Sandbanks Reefs	Otter Harbour seal	N/A
Culbin Bar SAC	580.99	Vegetation of stony banks	Saltmarsh and salt meadows Coastal dunes	N/A	N/A
Lower River Spey - Spey Bay SAC	654.26	Vegetation of stony banks Forests	N/A	N/A	N/A
River Spey SAC	5759.72	N/A	N/A	Freshwater pearl mussel Sea lamprey Atlantic salmon Otter	N/A
Buchan Ness to Collieston SAC	206.03	Sea cliffs	N/A	N/A	N/A
Sands of Forvie SAC	735.48	Coastal dunes	N/A	N/A	N/A
River Dee SAC	2334.48	N/A	N/A	Freshwater pearl mussel Atlantic salmon Otter	N/A
Garron Point SAC	15.01	N/A	N/A	Narrow-mouthed whorl snail	N/A
River South Esk SAC	471.85	N/A	N/A	Freshwater pearl mussel Atlantic salmon	N/A
River Tay SAC	9461.63	N/A	Standing freshwater	Atlantic salmon	Sea lamprey Brook lamprey River lamprey Otter
Firth of Tay and Eden Estuary SAC	15441.63	Estuaries	Sandbanks Mudflats and sandflats	Harbour seal	N/A
Isle of May SAC	356.64	N/A	Reefs	Grey seal	N/A
St Abb's Head to Fast Castle SAC	122.63	Sea cliffs	N/A	N/A	N/A
River Tweed SAC	3742.65	Running freshwater	N/A	Atlantic salmon Otter	Sea lamprey Brook lamprey River lamprey
Tweed Estuary SAC	156.24	Estuaries Mudflats and sandflats	N/A	N/A	Sea lamprey River lamprey
Berwickshire and North Northumberland Coast SAC	65226.12	Mudflats and sandflats Inlets and Bays Reefs Sea caves	N/A	Grey seal	N/A

Site Name	Area (ha)	Annex I Habitat Primary	Annex I Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
North Northumberland Dunes SAC	1127.27	Coastal dunes	N/A	Petalwort	N/A
Southern North Sea SAC	3695054	N/A	N/A	Harbour porpoise	N/A
Dogger Bank SAC	1233115	Sandbanks	N/A	N/A	N/A
Durham Coast SAC	389.61	Sea cliffs	N/A	N/A	N/A
Braemar Pockmarks SAC	1143	Submarine structures made by leaking gases	N/A	N/A	N/A
Scanner Pockmark SAC	674	Submarine structures made by leaking gases	N/A	N/A	N/A
MID-NORTH SEA HIGH AND SOUTHERN NORTH SEA					
River Dee SAC	2334.48	N/A	N/A	Freshwater pearl mussel Atlantic salmon Otter	N/A
Garron Point SAC	15.01	N/A	N/A	Narrow-mouthed whorl snail	N/A
River South Esk SAC	471.85	N/A	N/A	Freshwater pearl mussel Atlantic salmon	N/A
River Tay SAC	9461.63	N/A	Standing freshwater	Atlantic salmon	Sea lamprey Brook lamprey River lamprey Otter
Firth of Tay and Eden Estuary SAC	15441.63	Estuaries	Sandbanks Mudflats and sandflats	Harbour seal	N/A
Isle of May SAC	356.64	N/A	Reefs	Grey seal	N/A
St Abb's Head to Fast Castle SAC	122.63	Sea cliffs	N/A	N/A	N/A
River Tweed SAC	3742.65	Running freshwater	N/A	Atlantic salmon Otter	Sea lamprey Brook lamprey River lamprey
Tweed Estuary SAC	156.24	Estuaries Mudflats and sandflats	N/A	N/A	Sea lamprey River lamprey
Berwickshire and North Northumberland Coast SAC	65226.12	Mudflats and sandflats Inlets and Bays Reefs Sea caves	N/A	Grey seal	N/A
North Northumberland Dunes SAC	1127.27	Coastal dunes	N/A	Petalwort	N/A
Southern North Sea SAC	3695054	N/A	N/A	Harbour porpoise	N/A
Dogger Bank SAC	1233115	Sandbanks	N/A	N/A	N/A
Durham Coast SAC	389.61	Sea cliffs	N/A	N/A	N/A
Beast Cliff - Whitby (Robin Hood's Bay) SAC	265.48	Sea cliffs	N/A	N/A	N/A
Flamborough Head SAC	6320.87	Reefs Sea cliffs Sea caves	N/A	N/A	N/A
River Derwent SAC	397.87	Running freshwater	N/A	River lamprey	Sea lamprey Bullhead Otter

Site Name	Area (ha)	Annex I Habitat Primary	Annex I Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
Humber Estuary SAC	36657.15	Estuaries Mudflats and sandflats	Sandbanks Saltmarsh and salt meadows Coastal lagoons Coastal dunes	N/A	River lamprey Sea lamprey Grey seal
Inner Dowsing, Race Bank and North Ridge SAC	84514	Sandbanks Reefs	N/A	N/A	N/A
Saltfleetby - Theddlethorpe Dunes and Gibraltar Point SAC	967.65	Coastal dunes	Coastal dunes	N/A	N/A
The Wash and North Norfolk Coast SAC	107718	Sandbanks Mudflats and sandflats Inlets and bays Reefs Saltmarsh and salt meadows	Coastal lagoons	Harbour seal	Otter
North Norfolk Coast SAC	3148.6	Coastal lagoons Vegetation of stony banks Saltmarsh and salt meadows Coastal dunes	N/A	N/A	Otter Petalwort
Overstrand Cliffs SAC	30.02	Sea cliffs	N/A	N/A	N/A
North Norfolk Sandbanks and Saturn Reef SAC	360341	Sandbanks Reefs	N/A	N/A	N/A
Haisborough, Hammond and Winterton SAC	146759	Sandbanks Reefs	N/A	N/A	N/A
Winterton - Horsey Dunes SAC	426.96	Coastal dunes	Coastal dunes	N/A	N/A
Benacre to Easton Bavents Lagoons SAC	326.7	Coastal lagoons	N/A	N/A	N/A
Minsmere to Walberswick Heaths and Marshes SAC	1256.57	Vegetation of drift lines Heaths	Vegetation of stony banks	N/A	N/A
Alde, Ore and Butley Estuaries SAC	1632.63	Estuaries	Mudflats and sandflats Saltmarsh and salt meadows	N/A	N/A
Orfordness-Shingle Street SAC	888	Coastal lagoons Vegetation of drift lines Vegetation of stony banks	N/A	N/A	N/A
Hamford Water SAC	50.34	N/A	N/A	Fisher's estuarine moth	N/A

A4 Sites in waters of other member states

Relevant sites in adjacent states are highlighted in the previous Table A.2 as well as listed separately in Table A.3 below. Offshore sites in the Netherlands (shown on Map A.3) were considered in this screening assessment.

Table A.4: SAC sites in the adjacent waters of other Member States

Site Name	Area (ha)	Annex 1 Habitat	Annex II Species
CENTRAL AND NORTHERN NORTH SEA; AND MID-NORTH SEA HIGH AND SOUTHERN NORTH SEA			
Doggerbank SAC (Germany)	169895	Sandbanks	Harbour porpoise Harbour seal
Doggersbank SAC (Netherlands)	473500	Sandbanks	Grey seal Harbour seal Harbour porpoise
Klaverbank SAC (Netherlands)	153900	Reefs	Grey seal Harbour seal Harbour porpoise

A5 Ramsar sites

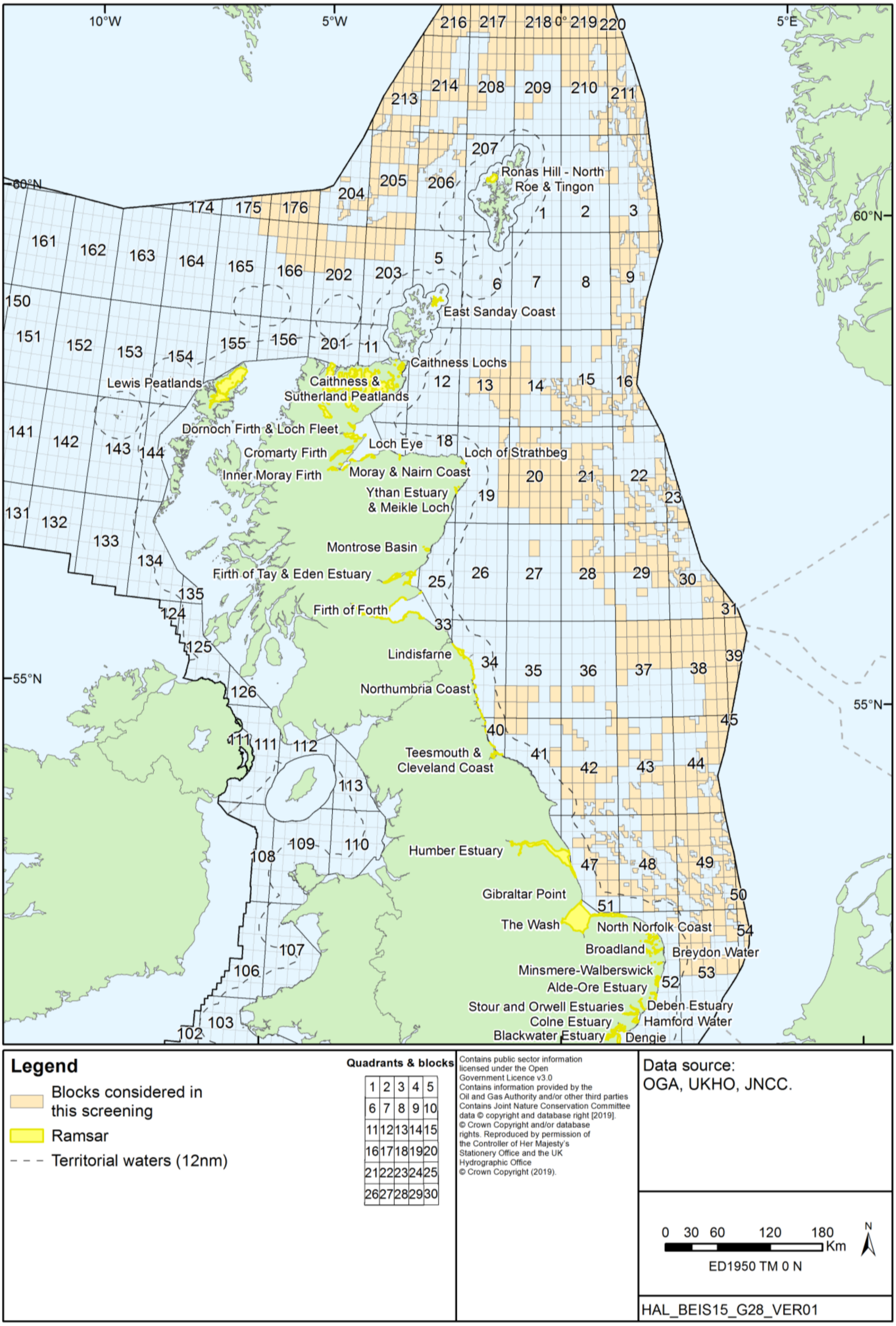
The coastal Ramsar sites listed in Table A.5 and shown on Map A.11 are also SPAs and/or SACs (although site boundaries are not always strictly coincident and a Ramsar site may comprise one or more Natura 2000 sites), see tabulation below.

Table A.5: Coastal Ramsar sites and corresponding Natura 2000 sites

Ramsar Name	SPA Name	SAC Name
West of Shetland		
Lewis Peatlands	Lewis Peatlands	Lewis Peatlands Langavat
Ronas Hill – North Roe and Tingon	Ronas Hill - North Roe and Tingon	Tingon Ronas Hill - North Roe
East Sanday Coast	East Sanday Coast	Sanday
Caithness Lochs	Caithness Lochs	-
Caithness and Sutherland Peatlands	Caithness and Sutherland Peatlands	Caithness and Sutherland Peatlands
Central and Northern North Sea		
Ronas Hill – North Roe and Tingon	Ronas Hill - North Roe and Tingon	Tingon Ronas Hill - North Roe
East Sanday Coast	East Sanday Coast	Sanday
Caithness Lochs	Caithness Lochs	-
Caithness and Sutherland Peatlands	Caithness and Sutherland Peatlands	Caithness and Sutherland Peatlands
Dornoch Firth and Loch Fleet	Moray Firth pSPA Dornoch Firth and Loch Fleet	Dornoch Firth and Morrich More Moray Firth
Cromarty Firth	Cromarty Firth	Moray Firth
Inner Moray Firth	Moray Firth pSPA Inner Moray Firth	Moray Firth
Loch Eye	Loch Eye	-
Moray & Nairn Coast	Moray Firth pSPA Moray and Nairn Coast	Culbin Bar Moray Firth Lower River Spey - Spey Bay River Spey
Loch of Strathbeg	Loch of Strathbeg	-
Ythan Estuary & Meikle Loch	Ythan Estuary, Sands of Forvie and Meikle Loch SPA Ythan Estuary, Sands of Forvie and Meikle Loch (extension) pSPA	Sands of Forvie
Montrose Basin	Montrose Basin	River South Esk
Firth of Tay & Eden Estuary	Outer Firth of Forth and St Andrews Bay Complex pSPA Firth of Tay & Eden Estuary	Firth of Tay and Eden Estuary
Firth of Forth	Outer Firth of Forth and St Andrews Bay Complex pSPA Firth of Forth Forth Islands	-
Lindisfarne	Northumbria Coast Lindisfarne Northumberland Marine	North Northumberland Dunes Berwickshire and North Northumberland Coast
Northumbria Coast	Northumbria Coast Teesmouth and Cleveland Coast Northumberland Marine Teesmouth and Cleveland Coast pSPA	Durham Coast North Northumberland Dunes Berwickshire and North Northumberland Coast

Ramsar Name	SPA Name	SAC Name
Mid-North Sea High and Southern North Sea		
Montrose Basin	Montrose Basin	River South Esk
Firth of Tay & Eden Estuary	Outer Firth of Forth and St Andrews Bay Complex pSPA Firth of Tay & Eden Estuary	Firth of Tay and Eden Estuary
Firth of Forth	Outer Firth of Forth and St Andrews Bay Complex pSPA Firth of Forth Forth Islands	-
Lindisfarne	Northumbria Coast Lindisfarne Northumberland Marine	North Northumberland Dunes Berwickshire and North Northumberland Coast
Northumbria Coast	Northumbria Coast Teesmouth and Cleveland Coast Northumberland Marine Teesmouth and Cleveland Coast pSPA	Durham Coast North Northumberland Dunes Berwickshire and North Northumberland Coast
Teesmouth & Cleveland Coast	Teesmouth and Cleveland Coast Teesmouth and Cleveland Coast pSPA	-
Humber Estuary	Humber Estuary	Humber Estuary Saltfleetby-Theddlethorpe Dunes and Gibraltar Point
Gibraltar Point	Gibraltar Point The Wash	Saltfleetby–Theddlethorpe Dunes and Gibraltar Point The Wash and North Norfolk Coast
The Wash	Gibraltar Point North Norfolk Coast The Wash	The Wash and North Norfolk Coast
North Norfolk Coast	North Norfolk Coast The Wash	North Norfolk Coast The Wash and North Norfolk Coast
Broadland	Broadland	The Broads
Breydon Water	Breydon Water	-
Minsmere-Walberswick	Minsmere–Walberswick	Minsmere to Walberswick Heaths and Marshes
Alde-Ore Estuary	Alde–Ore Estuary	Alde, Ore and Butley Estuaries Orfordness – Shingle Street
Hamford Water	Hamford Water	Hamford Water
Deben Estuary	Deben Estuary	-
Stour & Orwell Estuaries	Stour & Orwell Estuaries	-
Colne Estuary	Colne Estuary	Essex Estuaries
Blackwater Estuary	Blackwater Estuary	Essex Estuaries

Map A.11: Location of coastal Ramsar sites



Appendix B – Blocks and sites screened in

B1 Introduction

The following tables list those 32nd Round Blocks and sites which have been screened in following application of the screening process described in Section 4. The Blocks and sites are listed according to the criteria by which they were screened in:

- Physical disturbance and drilling (Section 4.4, also see Figures 5.1 and 5.2)
- Underwater noise (Section 4.5, also see Figures 5.3 and 5.4)

These Blocks and sites will be subject to a second stage of HRA, Appropriate Assessment, if Blocks are applied for and before licensing decisions are taken.

B2 Physical disturbance and drilling

West of Shetland								
SPAs								
Seas off Foula pSPA	203/4	205/15	205/18	205/20	205/28	205/29	205/30	206/11c
	206/12b							
Foula SPA	203/4	205/15	205/18	205/20	205/28	205/29	205/30	206/11c
	206/12b							
SACs								
Wyville Thomson Ridge SAC	165/5	166/1	166/2	166/7	175/29	175/30	176/26	
Central and Northern North Sea								
SACs								
Braemar Pockmarks SAC	9/27b	9/28c	9/29b	16/4				
Scanner Pockmark SAC	15/19c	15/20e	15/24	15/25d	16/21e			
Mid-North Sea High and Southern North Sea								
SPAs								
Northumberland Marine SPA	34/25							
Lindisfarne SPA	34/25							
Northumbria Coast	34/25	40/5						
Farne Islands SPA	34/25							
Coquet Island SPA	34/25							
Teesmouth and Cleveland Coast pSPA (extension)	40/5							
Teesmouth and Cleveland Coast SPA	40/5							
Flamborough & Filey Coast SPA	42/21							
Greater Wash SPA	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20	47/24
	47/25	48/21b	48/28b	48/29c	52/5b	53/6	53/7	53/8b
	53/11	53/12	53/13b	53/16	53/17	53/18		
Humber Estuary SPA	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20	47/24
	47/25	48/21b	48/28b	48/29c	52/5b	53/6	53/11	53/16
North Norfolk Coast SPA	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20	47/24
	47/25	48/21b	48/28b	48/29c	52/5b	53/6	53/11	53/16
Gibraltar point SPA	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20	47/24
	47/25	48/21b	48/28b	48/29c	52/5b	53/6	53/11	53/16
Great Yarmouth North Denes SPA	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20	47/24
	47/25	48/21b	48/28b	48/29c	52/5b	53/6	53/7	53/8b
	53/11	53/12	53/13b	53/16	53/17	53/18		
Breydon Water SPA	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20	47/24
	47/25	48/21b	48/28b	48/29c	52/5b	53/6	53/7	53/8b
	53/11	53/12	53/13b	53/16	53/17	53/18		

The Wash SPA	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20	47/24
	47/25	48/21b	48/28b	48/29c	52/5b	53/6	53/11	53/16
Outer Thames Estuary SPA	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20	47/24
	47/25	48/21b	48/28b	48/29c	52/5b	53/6	53/7	53/8b
	53/11	53/12	53/13b	53/16	53/17	53/18		
Minsmere-Walberswick SPA	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20	47/24
	47/25	48/21b	48/28b	48/29c	52/5b	53/6	53/7	53/8b
	53/11	53/12	53/13b	53/16	53/17	53/18		
Alde-Ore Estuary SPA	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20	47/24
	47/25	48/21b	48/28b	48/29c	52/5b	53/6	53/7	53/8b
	53/11	53/12	53/13b	53/16	53/17	53/18		
Benacre to Easton Bavents SPA	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20	47/24
	47/25	48/21b	48/28b	48/29c	52/5b	53/6	53/7	53/8b
	53/11	53/12	53/13b	53/16	53/17	53/18		
SACs								
Dogger Bank SAC	38/13	38/14	38/15	38/18	38/19	38/20	38/24	38/25
	38/28b	38/29	38/30	39/11	39/12	39/16	39/17	39/21
	39/26	42/5b	43/1	43/2b	43/5	43/6	43/9	43/11
	43/12b	43/13a	43/14c	43/18a	43/19a	43/20	43/24c	43/25
	44/1	44/3b	44/4	44/5	44/8a	44/9	44/10	44/13b
	44/14	44/15	44/16	44/17	44/18b	44/19b	44/21	44/22
	44/23a	44/23b	44/24d	44/25	44/28	44/2b	45/1	
Doggersbank SAC (Netherlands)	38/25	38/30	39/11	39/12	39/16	39/17	39/21	39/26
	44/5	44/9	44/10	44/14	44/15	44/19b	44/24d	45/1
Durham Coast SAC	40/5							
Flamborough Head SAC	42/21							
Haisborough, Hammond and Winterton SAC	48/28b	48/29b	48/29c	48/30b	48/30c	49/26b	52/5b	52/5c
	53/2c	53/3	53/6	53/7	53/8b	53/11	53/12	53/13b
Humber Estuary SAC	42/18	42/19	42/20b	42/22	42/21	42/23	42/27	42/28e
	42/28g	42/29b	42/29c	42/30b	42/30c	42/28f	42/28h	47/2b
	47/3g	47/3i	47/3j	47/7b	47/8e	47/9e	47/10e	47/10f
	47/14b	47/19						
Inner Dowsing, Race Bank and North Ridge SAC	47/14b	47/15e	47/19	47/20	47/24	47/25	48/21b	
Klaverbank SAC (Netherlands)	44/19b	44/24d	44/25	44/29a	44/30b	49/4e	49/5d	49/9b
	49/10e							
North Norfolk Sandbanks and Saturn Reef SAC	48/3	48/4	48/9	48/10b	48/13c	48/14b	48/14c	48/15c
	48/18d	48/18e	48/19d	48/23d	48/24c	48/25c	48/25d	48/28b
	48/29b	48/30b	48/30c	49/6b	49/6c	49/7	49/8b	49/9b
	49/9e	49/11c	49/12d	49/13	49/14a	49/16b	49/17b	49/18b
	49/18c	49/19c	49/21d	49/21e	49/22b	49/23b	49/23c	49/24b
	49/24c	49/26b	49/27c	49/28c	49/28e	52/5c	53/2c	53/3
Overstrand Cliffs SAC	48/28b							
Southern North Sea SAC	36/23	36/30b	37/11	37/12	37/16	42/5b	42/7b	42/8a
	42/13b	42/17	42/18	42/19	42/20b	42/22	42/23	42/27

	42/28e	42/28f	42/28g	42/28h	42/29b	42/29c	42/30b	42/30c
	43/1	43/2b	43/5	43/6	43/9	43/11	43/12b	43/13a
	43/14c	43/18a	43/19a	43/20	43/22b	43/22c	43/24c	43/25
	43/26b	43/27b	43/28	43/29	43/30	44/1	44/2b	44/3b
	44/8a	44/13b	44/14	44/16	44/17	44/18b	44/19b	44/21
	44/22	44/23a	44/23b	44/24d	44/26	47/2b	47/3g	47/3i
	47/3j	47/7b	47/8e	47/9e	47/10e	47/10f	47/10g	47/13c
	47/15b	48/1e	48/2c	48/3	48/4	48/5	48/6b	48/6d
	48/7d	48/7e	48/9	48/10b	48/11b	48/12g	48/13c	48/14b
	48/14c	48/15c	48/17e	48/18d	48/18e	48/19d	48/23d	48/24c
	48/25c	48/25d	48/28b	48/29b	48/29c	48/30b	48/30c	49/6b
	49/6c	49/7	49/8b	49/9b	49/9e	49/10e	49/11c	49/12d
	49/13	49/14a	49/15b	49/16b	49/17b	49/18b	49/18c	49/19c
	49/21d	49/21e	49/22b	49/23b	49/23c	49/24b	49/24c	49/25c
	49/26b	49/27c	49/28c	49/28e	49/29b	49/30b	50/21	50/26
	52/5b	52/5c	53/2c	53/3	53/4	53/5d	53/6	53/7
	53/8b	53/9b	53/10b	53/11	53/12	53/13b	53/14c	53/15b
	53/16	53/17	53/18	53/19	53/20	54/1a	54/6b	54/11b
	54/16							
The Wash and North Norfolk Coast SAC	47/3j	47/8e	47/9e	47/10e	47/10f	47/10g	47/13c	47/14b
	47/15b	47/15e	47/19	47/20	48/1e	48/6b	48/6d	48/7d
	48/7e	48/11b	48/12g	48/13c	48/17e	48/17f	48/18d	48/18e
	48/23d							

B3 Underwater noise

West of Shetland								
SPAs								
Seas off Foula pSPA	203/4	205/15	205/18	205/20	205/28	205/29	205/30	206/11c
	206/12b	206/13c	206/14b					
Foula SPA	203/4	205/15	205/18	205/20	205/28	205/29	205/30	206/11c
	206/12b	206/13c	206/14b					
Mid-North Sea High and Southern North Sea								
SPAs								
Northumberland Marine SPA	34/25							
Farne Islands SPA	34/25							
Coquet Island SPA	34/25							
Flamborough & Filey Coast SPA	42/21							
Greater Wash SPA	42/27	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20
	47/24	47/25	48/21b	48/22d	48/28b	48/29c	48/30c	52/5b
	52/5c	53/6	53/7	53/8b	53/11	53/12	53/13b	53/16
	53/17							
The Wash SPA	42/27	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20
	47/24	47/25	48/21b	48/22d	48/28b	48/29c	48/30c	52/5b
	52/5c	53/6	53/7	53/8b	53/11	53/12	53/13b	53/16
	53/17							
North Norfolk Coast SPA	42/27	47/7b	47/8e	47/13c	47/14b	47/15e	47/19	47/20
	47/24	47/25	48/21b	48/22d	48/28b	48/29c	48/30c	52/5b
	52/5c	53/6	53/7	53/8b	53/11	53/12	53/13b	53/16
	53/17							
Humber Estuary SPA	47/7b	47/13c						
Outer Thames Estuary SPA	53/6	53/7	53/8b	53/11	53/12	53/13b	53/16	53/17
	53/18							
Teesmouth and Cleveland Coast SPA	40/5							
Teesmouth and Cleveland Coast Extension pSPA	40/5							
SACs								
Doggersbank SAC (Netherlands)	38/20	38/25	38/30	39/7	39/11	39/12	39/16	39/17
	39/21	39/26	44/4	44/5	44/9	44/10	44/13b	44/14
	44/15	44/18b	44/19b	44/23a	44/24d	45/1		
Humber Estuary SAC	42/18	42/19	42/20b	42/22	42/21	42/23	42/27	42/28e
	42/28g	42/29b	42/29c	42/30b	42/30c	42/28f	42/28h	47/2b
	47/3g	47/3i	47/3j	47/7b	47/8e	47/9e	47/10e	47/10f
	47/13c	47/14b	47/19					
Klaverbank SAC (Netherlands)	44/18b	44/19b	44/23a	44/24d	44/25	44/28	44/29a	44/30b
	49/4e	49/5d	49/9b	49/10e				
Southern North Sea	36/23	36/30b	37/11	37/12	37/13	37/14	37/15	37/16

SAC	42/5b	42/7b	42/8a	42/13b	42/17	42/18	42/19	42/20b
	42/22	42/23	42/27	42/28e	42/28f	42/28g	42/28h	42/29b
	42/29c	42/30b	42/30c	43/1	43/2b	43/5	43/6	43/9
	43/11	43/12b	43/13a	43/14c	43/18a	43/19a	43/20	43/22b
	43/22c	43/24c	43/25	43/26b	43/27b	43/28	43/29	43/30
	44/1	44/2b	44/3b	44/8a	44/9	44/13b	44/14	44/15
	44/16	44/17	44/18b	44/19b	44/21	44/22	44/23a	44/23b
	44/24d	44/26	44/28	47/2b	47/3g	47/3i	47/3j	47/7b
	47/8e	47/9e	47/10e	47/10f	47/10g	47/13c	47/14b	47/15b
	48/1e	48/2c	48/3	48/4	48/5	48/6b	48/6d	48/7d
	48/7e	48/9	48/10b	48/11b	48/12g	48/13c	48/14b	48/14c
	48/15c	48/17e	48/17f	48/18d	48/18e	48/19d	48/23d	48/24c
	48/25c	48/25d	48/28b	48/29b	48/29c	48/30b	48/30c	49/1
	49/2	49/3	49/4e	49/6b	49/6c	49/7	49/8b	49/9b
	49/9e	49/10e	49/11c	49/12d	49/13	49/14a	49/15b	49/16b
	49/17b	49/18b	49/18c	49/19c	49/19d	49/20c	49/21d	49/21e
	49/22b	49/23b	49/23c	49/24b	49/24c	49/25c	49/26b	49/27c
	49/28c	49/28e	49/29b	49/30b	50/16	50/21	50/26	52/5b
	52/5c	53/2c	53/3	53/4	53/5d	53/6	53/7	53/8b
	53/9b	53/10b	53/11	53/12	53/13b	53/14c	53/15b	53/16
	53/17	53/18	53/19	53/20	54/1a	54/6b	54/11b	54/16
The Wash and North Norfolk Coast SAC	47/3j	47/8e	47/9e	47/10e	47/10f	47/10g	47/13c	47/14b
	47/15b	47/15e	47/19	47/20	47/24	47/25	48/1e	48/6b
	48/6d	48/7d	48/7e	48/11b	48/12g	48/13c	48/17e	48/17f
	48/18d	48/18e	48/21b	48/22d	48/23d			

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