Department for Energy Security & Net Zero

Offshore Oil & Gas Licensing

33rd Seaward Round

Habitats Regulations Assessment

Stage 1 – Block and Site Screening

July 2023

Contents

1 Introduction

1.1 Background and overview of plan

The plan/programme covering this (and potential future) seaward licensing rounds has been subject to a Strategic Environmental Assessment (OESEA4), completed in September 2022. 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. Public consultation on OESEA4 concluded on 27th May 2022 and the Government Response was published on 22nd September 2022, which summarised the comments received and provided further clarifications, at which time, the plan/programme was also adopted. The North Sea Transition Authority (NSTA) subsequently decided to offer 931 Blocks or part-Blocks for licensing as part of a 33rd Seaward Licensing Round, launched in October 2022. The 33rd licensing round covers areas of the UK Continental Shelf (UKCS), including, the southern North Sea, central North Sea, northern North Sea, west of Shetland, and the eastern Irish Sea.

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 Oil & Gas Authority (OGA, now operating as NSTA) 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.

The *Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001* (as amended) provide a regulatory regime for certain activities, including oil and gas activities, that could affect Special Protected Areas (SPAs) and Special Areas of Conservation (SACs) in UK territorial seas and on the UKCS[1]. The *Conservation of Offshore Marine Habitats and Species Regulations 2017* cover other relevant activities in offshore waters (i.e. excluding territorial seas). Within territorial seas, the following apply, 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 SPAs and SACs, to comply with its obligations under the relevant regulations, the Department for Energy Security and Net Zero

[1] The Regulations transposed the EU Habitats Directive (92/43/EEC), and are retained EU law under the *European Union (Withdrawal) Act 2018*. Under that Act, at the time of this assessment the Directive remains relevant to interpretation of the meaning and effect of the Regulations.

(formerly the Department for Business, Energy and Industrial Strategy)[2] (the Department) is undertaking a Habitats Regulations Assessment (HRA).

In this HRA, the Department has applied the statutory test, as elucidated by relevant case law[3], 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 33rd Seaward Round may have a significant effect on a relevant site, either individually or in combination[4] with other plans or projects. The screening assessment has been undertaken in accordance with European Commission Guidance (EC 2019) 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 2021[5]), the Marine Policy Statement (HM Government 2011), English Nature report, No. 704 (Hoskin & Tyldesley 2006) and Natural England report NECR205 (Chapman & Tyldesley 2016).

The approach taken to screening has been to identify all relevant sites with the potential to be affected by typical exploration and appraisal activities (work programmes are not yet available as the Round is still open) 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

[2] Note that while certain licensing and related regulatory functions were passed to the Oil and Gas Authority, now operating as the NSTA (a government company wholly owned by the Secretary of State for BEIS) on 1 October 2016, environmental regulatory functions are retained by the Department, and are administered by the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED).
[3] See, in particular, the European Court of Justice case of Waddenzee (C-127/02). At the time of this assessment, this remains relevant to interpretation of the UK's legislation as retained EU case law under the *European Union (Withdrawal) Act 2018*.
[4] 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).
[5] Which states that "listed or proposed Ramsar sites", should receive the same protection as national network sites.

screening assumes that any activity which could follow licensing is undertaken in the absence of mitigation. This approach is consistent with European Court of Justice[6] and UK High Court[7] judgements 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 (AA), 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 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 sites (Section 4)

- The screening assessment including a consideration of in-combination effects (Section 5)

- Summary of conclusions including a list of Blocks where likely significant effects on relevant national site network could not be discounted at the screening stage and for which further assessment (AA) is required before a licence award decision can be made (Section 6 and Appendix B)

A draft of this HRA screening assessment was subject to consultation with the Statutory Nature Conservation Bodies (SNCB) and has been amended as appropriate in light of comments received.

[6] 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 Pleanála 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)

[7] Gladman Developments Ltd. vs. Secretary of State for Housing, Communities and Local Government and Medway Council (https://caselaw.nationalarchives.gov.uk/ewhc/admin/2019/2001).

2 Blocks offered and potential activities

2.1 Blocks offered

The offshore Blocks on offer in the 33rd Seaward Licensing Round 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, the Mid-North Sea High and southern North Sea, and the eastern Irish 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 UKCS are vested in the Crown and the *Petroleum Act 1998* (as amended) gives the NSTA 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 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 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 HRA under the Habitats Regulations.

Several sub-types of Seaward Production Licence (Traditional, Frontier and Promote) were replaced after the 28th Round by the single "Innovate" licence[8]. 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 nine and six years respectively[9]. 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:

- Phase A: geotechnical studies and geophysical data reprocessing (this phase will not involve activities in the field)
- Phase B: acquisition of new seismic data and other geophysical data
- Phase C: exploration and appraisal drilling

Applicants may propose the Phase combination in their submission to the NSTA. Phase A and Phase B are optional and may not be appropriate in certain circumstances, but every

[8] *The Petroleum and Offshore Gas Storage and Unloading Licensing (Amendment) Regulations 2017* amend the Model Clauses to be incorporated in Seaward Production Licences.
[9] Note that the duration of licence terms may be extended subject to clause 7 of the Model Clauses, however, an extension of each term affects the duration of the next, for example, extending the initial term would reduce the duration of the second term by the same amount.

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 NSTA and the applicant. Applicants may choose to spend up to four years on a single Phase in the Initial Term but cannot take more than nine years to progress to the Second Term, and the NSTA has indicated that it expects 33rd Round applicants to request initial term durations of no more than six years, as the areas offered are relatively mature. Failure to complete the work agreed in a Phase, or to commit to the next Phase means the licence ceases and determines, unless the term or phase has been extended by the NSTA.

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 NSTA (in consultation with the Offshore Major Accident 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 safety and environmental policies, awareness of statutory safety and environment provisions, and has safety and 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 applied for and the adjacent areas, and understand the constraints and potential impacts they might have on the proposed work programme.

2.3 Activities that could follow licensing

As part of the licence application process, applicants provide the NSTA with details of the minimum work programmes they propose in the Initial Term. These work programmes are considered along with a range of other factors by the NSTA before arriving at a decision on whether to license the Blocks and to whom. Activities detailed in work programmes may include the purchase, reprocessing or shooting of 2D or 3D seismic data (Phases A and B) and the drilling of wells (Phase C). There are two levels of drilling commitment:

- A Firm Drilling Commitment is a commitment to the NSTA to drill a well. Those applicant's applying to start their Initial Term in Phase C, will make a firm drilling commitment. Firm drilling commitments are preferred on the basis that, if there were no

[10] The Offshore Major Accident Regulator is the Competent Authority comprising OPRED and the Health and Safety Executive (HSE) working in partnership.
[11] Refer to NSTA technical guidance and safety and environmental guidance on applications for the 33rd Round at: https://www.nstauthority.co.uk/licensing-consents/licensing-rounds/offshore-petroleum-licensing-rounds

such commitment, the NSTA 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 relevant activity specific environmental assessments.

- A Drill or Drop (D/D) Drilling Commitment is associated with Phases A and B of the Initial Term. Model Clauses are such that the licence will automatically cease and determine on the expiry of the current Phase unless the licensee commits to a Phase C work programme. Licensee’s must write to the NSTA before the expiry of their licence to continue to Phase C, at which time the well commitment will be firm.

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 NSTA general guidance[12] makes it clear that an award of a Seaward 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 the Department, and there are other regulatory provisions exercised by the Offshore Major Accident 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 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. The NSTA has indicated that a number of Blocks (Table 2.1) are located within four priority cluster areas in the southern North Sea. These clusters are Blocks with known gas reserves and which are close to existing infrastructure, thereby having the potential to be developed quickly. In the absence of any firm development plans, and in advance of any applications for the Blocks being received, this screening has assumed that both seismic survey and a well could be drilled in any of the Blocks. Further consideration of these Blocks will be made in the next stage of assessment (AA).

[12] https://www.nstauthority.co.uk/media/8415/33rd-licensing-round-general-guidance-7-october.pdf

Table 2.1: List of Blocks offered in the 33rd Seaward Licensing Round

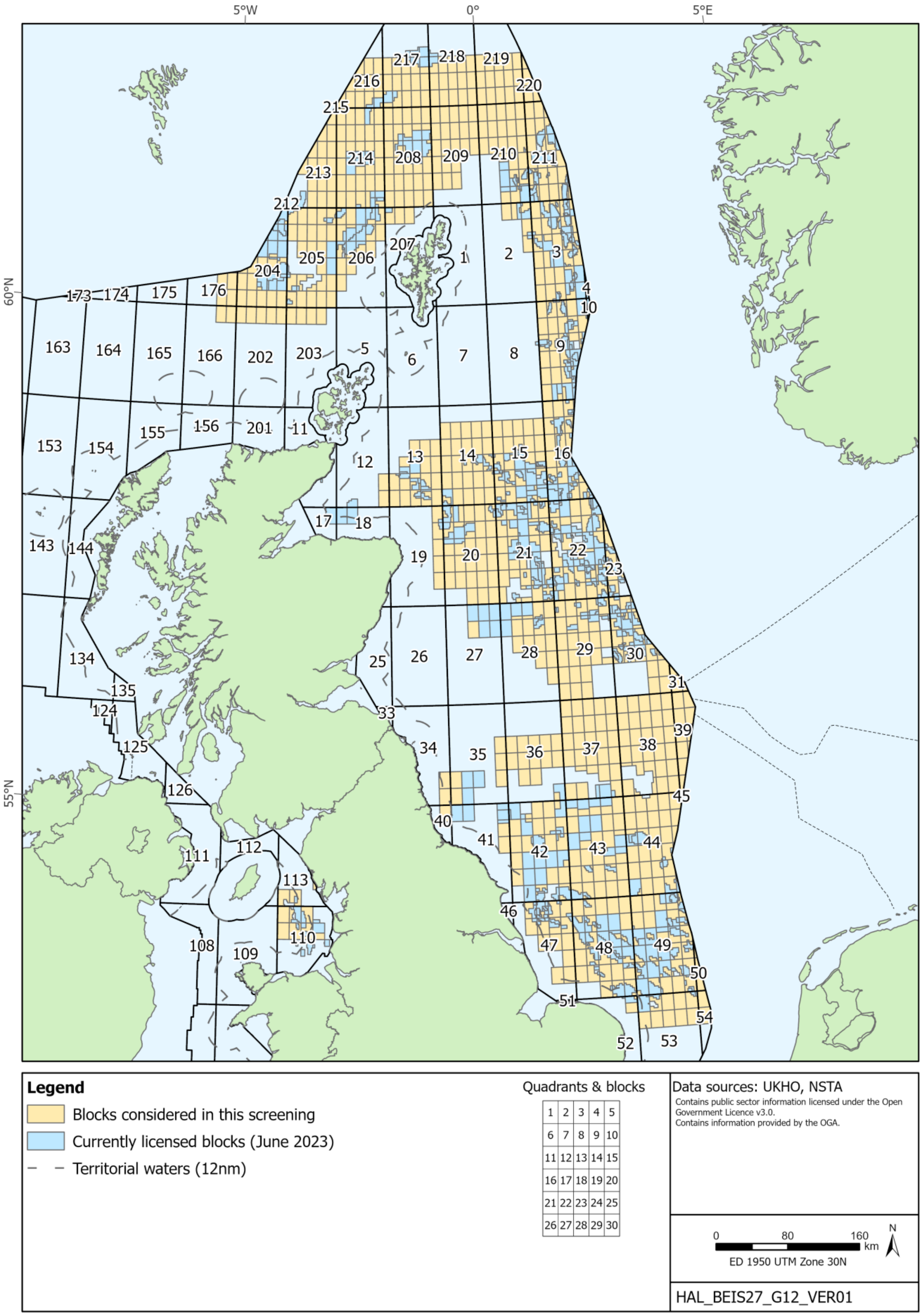
West of Shetland									
166/4	166/5	176/20	176/24	176/25	176/29	176/30	202/1	202/2	202/3
202/4	202/5	203/1	203/2	203/3	203/4	204/5c	204/14a	204/16	204/17
204/18	204/19d	204/20d	204/21	204/22	204/23c	204/26	204/27	204/28	204/29
204/30	205/1b	205/2b	205/3	205/4c	205/5b	205/6	205/7	205/8	205/9
205/10	205/12	205/13	205/14	205/19	205/21c	205/22c	205/23b	205/23c	205/24b
205/25	205/26e	205/27	205/28	205/29	205/30	206/1b	206/1c	206/2	206/4c
206/5a	206/6b	206/7c	206/9b	206/9c	206/10	206/11c	206/11d	206/12b	206/13b
206/14	206/16	206/17	206/21	207/1b	207/2	207/3	208/1	208/2	208/3
208/4	208/5	208/6	208/7a	208/8a	208/9b	208/10b	208/10c	208/11	208/12b
208/13b	208/15b	208/15c	208/16	208/17	208/18b	208/19c	208/20	208/21	208/22
208/23	208/24	208/25	208/26	208/27	208/28	208/29	208/30	209/1	209/2
209/3	209/4	209/5	209/6	209/7	209/8	209/9	209/10	209/11	209/12
209/13	209/14	209/15	209/16	209/17	209/18	209/21	209/22	209/23	210/1
210/2	210/3	210/4	210/5	210/6	210/7	210/8	210/9	210/10	210/11
210/12	210/13	210/14	210/15b	210/18b	210/19	210/20a	210/24c	210/25b	210/28b
210/29d	210/30d	211/1	211/2	211/3	211/6	211/7b	211/8b	211/9	211/11
211/12c	211/13b	211/14b	211/16b	211/17b	211/18d	211/18e	211/19a	211/21b	211/22d
211/23b	211/24a	211/26a	211/26c	211/27	211/28	211/29i	211/29j	211/30b	213/4
213/5	213/8	213/9	213/10	213/12	213/13	213/14	213/15	213/16	213/17
213/18	213/19	213/20	213/23	213/24	213/25	213/28	213/29	213/30	214/1
214/2	214/3	214/4a	214/5	214/6	214/7	214/8	214/9	214/10	214/11
214/12b	214/13b	214/14a	214/15	214/16	214/18b	214/19b	214/20	214/21	214/22
214/23	214/24	214/25	214/26	214/27	214/28a	214/29a	214/30f	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	216/29b	216/30b	216/30c	217/16	217/17	217/18b	217/19b	217/20b	217/21
217/22	217/23	217/24	217/25	217/26b	217/26c	217/27c	217/28	217/29	217/30
218/16b	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					
Northern North Sea									
2/3	2/4c	2/4d	2/5d	2/10a	2/15b	3/1	3/2b	3/2d	3/3c
3/4f	3/4h	3/5b	3/6b	3/7b	3/8c	3/9d	3/9e	3/10c	3/11c
3/11d	3/12a	3/13c	3/14f	3/15f	3/16	3/17a	3/19d	3/20c	3/20d
3/21	3/22	3/23	3/24d	3/24e	3/26	3/27a	3/28c	3/29e	4/21
9/1	9/2d	9/3c	9/3d	9/4	9/6	9/7	9/8b	9/9e	9/9f
9/10a	9/11e	9/11f	9/12d	9/13f	9/13g	9/14c	9/15c	9/15d	9/16
9/17	9/18f	9/21	9/22	9/23a	9/24d	9/26	9/27c	9/28b	10/6b

Central North Sea									
12/25	12/30	13/13	13/14	13/15	13/17a	13/19	13/20	13/21c	13/22c
13/23a	13/23d	13/23e	13/24c	13/25	13/26	13/27	13/28b	13/29c	13/29d
13/30	14/6	14/7	14/8	14/9	14/10	14/11	14/12	14/13	14/14
14/15	14/16	14/17	14/18c	14/19b	14/19c	14/20a	14/20d	14/21	14/22
14/23	14/24	14/25b	14/26c	14/27	14/28	14/29	14/30	15/6	15/7
15/8	15/9	15/10	15/11	15/12	15/13c	15/14	15/15	15/16c	15/16d
15/17b	15/18a	15/18c	15/19a	15/20d	15/20e	15/21d	15/21g	15/21h	15/22b
15/22c	15/23b	15/25c	15/26a	15/27a	15/28a	15/29d	15/29e	15/30c	16/1
16/2	16/3d	16/4	16/6b	16/7d	16/7e	16/7f	16/8b	16/11	16/12c
16/12d	16/13b	16/16	16/17b	16/17d	16/18c	16/21e	16/22b	16/23d	16/24b
16/28c	16/28d	16/29b	16/30	19/5b	19/10b	19/15	19/20	19/25	20/1b
20/1c	20/2d	20/3	20/4	20/5c	20/6d	20/7d	20/8b	20/8c	20/9
20/10	20/11b	20/12b	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	21/1b
21/2a	21/4b	21/5b	21/6a	21/7b	21/9c	21/9e	21/10b	21/10c	21/11
21/12d	21/14a	21/15	21/16	21/17b	21/18e	21/21	21/22b	21/23a	21/24c
21/25c	21/26b	21/27c	21/28c	21/28d	21/29c	21/30e	21/30g	22/1c	22/1d
22/3	22/4b	22/6b	22/7b	22/8b	22/9b	22/10b	22/11c	22/12b	22/13c
22/15c	22/16a	22/18d	22/19d	22/21d	22/22c	22/23c	22/24e	22/24f	22/25e
22/25f	22/26e	22/26f	22/27	22/28b	22/29b	22/30d	23/1	23/6	23/11b
23/16d	23/16e	23/17	23/21b	23/22b	23/26c	23/26f	27/8	28/2b	28/3b
28/4b	28/5	28/7	28/8	28/9b	28/10	28/12	28/13	28/14	28/15
28/19	28/20	28/25	29/1c	29/2a	29/3b	29/4b	29/5a	29/6	29/7b
29/7c	29/8b	29/9a	29/10c	29/10e	29/11	29/12	29/13	29/14	29/15
29/16	29/17	29/18	29/19	29/20b	29/21	29/22	29/23	29/26	29/27
29/28	30/1a	30/2b	30/2e	30/3b	30/3c	30/6c	30/7e	30/7f	30/8b
30/8c	30/11c	30/12e	30/13b	30/13f	30/14c	30/16g	30/16h	30/17c	30/17d
30/17e	30/18b	30/19b	30/20b	30/24	30/25	30/29	30/30	31/21	31/26
31/27									
Mid North Sea High and Southern North Sea									
34/25	34/30	35/15	35/20	35/21	35/25	35/26	36/11	36/12	36/13
36/14	36/15	36/16	36/17	36/18	36/19	36/20	36/22	36/23	36/30c
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	37/17	37/18	37/19	37/20
37/22b	37/23b	37/24	37/25	37/26	37/27	37/30a	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	38/16	38/17	38/18	38/19	38/20	38/21a	38/22a	38/23b
38/24	38/25	38/26	38/27b	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	41/10b

41/15	42/2b	42/3	42/4	42/5c	42/6	42/7a	42/8	42/9b	42/10b
42/11	42/12b	42/13c	42/13d	42/14	42/15b	42/16	42/20a	42/21	42/24
42/25	42/28f	42/28i	42/28j	42/29c	42/30b	42/30c	43/1b	43/2b	43/3b
43/4b	43/5	43/6	43/9	43/10	43/12a*	43/13*	43/14*	43/15b	43/16
43/17*	43/18*	43/19c	43/19d*	43/20c*	43/21*	43/22b	43/22c	43/23	43/24b
43/24c	43/25	43/26b	43/27b	43/27c	43/28	43/29	43/30	44/1	44/2b
44/3b	44/4	44/5	44/6	44/7	44/8	44/9	44/10	44/11c	44/12b
44/13	44/14	44/15	44/16*	44/17*	44/18a	44/19b	44/21	44/22	44/23a
44/24c	44/25*	44/26d	44/27	44/28	44/29a	44/30c	45/1	47/2c	47/3j
47/3k	47/4d	47/5b*	47/7b	47/8a	47/9a	47/10c	47/13	47/14	47/15
47/20	47/24	47/25	48/1*	48/2b*	48/3	48/4	48/5	48/6b	48/6c
48/7d	48/7e	48/10	48/11b	48/12a	48/13b	48/14d	48/15b	48/16	48/17d
48/18c	48/19e	48/20c	48/21	48/22a	48/23c	48/24	48/25c	48/25d	48/28b
48/29b	48/29c	48/30b	48/30c	49/1	49/2	49/3b	49/4f	49/5d	49/6b
49/7	49/9f	49/10e	49/11b	49/12c	49/13a	49/14a	49/15b	49/16d	49/17c
49/18b	49/18c	49/19c	49/20c	49/20d	49/21b	49/21d	49/22d	49/23b	49/23c
49/24b	49/24c	49/25b	49/26b	49/27c	49/28c	49/29	49/30b	50/11	50/16
50/21	50/26	52/5b	52/5c	53/2c	53/3	53/4	53/5c	53/6	53/7
53/8	53/9	53/10	54/1	54/6					
Eastern Irish Sea									
110/1	110/2d	110/3b	110/6	110/7b	110/8b	110/9a	113/24	113/26c	113/27c

Notes: * Block identified as SNS Priority Cluster by NSTA

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



2.3.1 Likely scale of activity

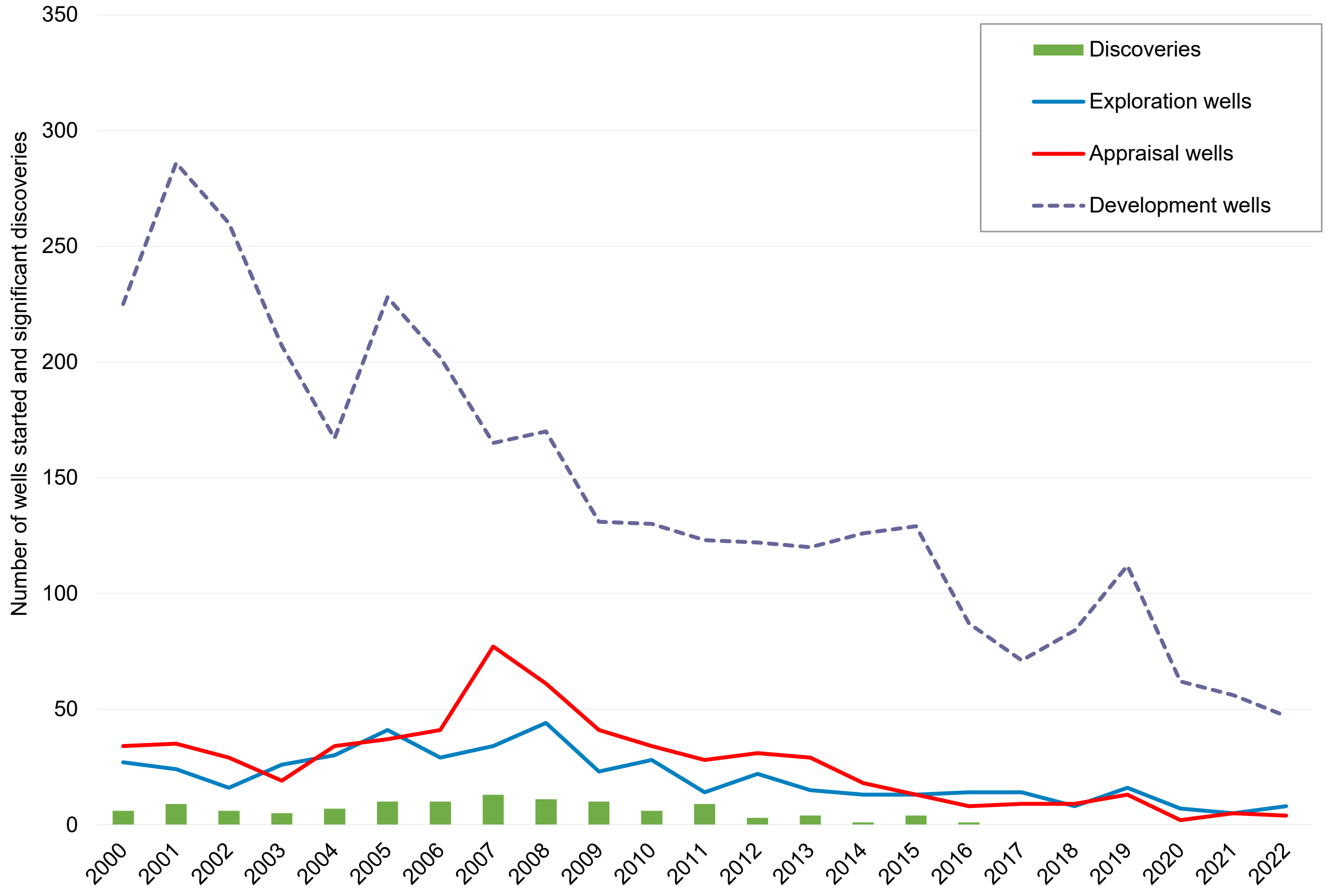
This assessment has been undertaken at the stage at which Blocks are offered for licensing. To place the scale of the 33rd Round in context, recent (i.e. those having taken place in the last 10 years) seaward licensing rounds of the scale of the 33rd Round have attracted applications for between 28% and 33% of the Blocks offered (for the 31st and 32nd Rounds respectively). 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 NSTA 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. 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 33rd Round Blocks.

2.3.2 33rd Round activities considered by the HRA

The nature, extent and timescale of development, if any, which may ultimately result from the licensing of 33rd Round Blocks is unknown, 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. Even where an applicant has applied for a licence to go straight to the Second Term, the nature and scale of any development which might be associated with this licence is highly uncertain. This is because there will be multiple options for development (e.g. subsea tie-back, standalone platform) including export routes (e.g. pipeline to shore, or tie-back to one or more existing host facilities), most of which will not be known in detail until towards the end of the Second Term. 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. 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). This approach is also taken at screening for those Blocks identified by the NSTA as being within the SNS Priority Cluster, since if and until applications are received, the development proposals would be conjecture.

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: NSTA Drilling Activity (January 2023), Significant Offshore Discoveries (October 2018)

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 use 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 the initial term

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 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 injection 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 20 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 $0.001\text{-}0.004km^2$ per rig siting. Mud mats are routinely used in offshore oil and gas, and offshore wind, infrastructure. In particular they tend to be used below templates and pipeline end manifolds to control vertical and lateral movements of the structures, and also on the footings of jacket-type structures to provide on-bottom stability prior to the installation of piles, particularly on s, oft sediments (Dunne & Martin 2017, IFC 2021, Shell 2022, Ørsted 2022). Mud mats are used to distribute the weight of the overlying infrastructure but also control lateral movements (Dunne & Martin 2017). There is the potential to use mud mats for jack-up rig drilling (Stewart 2007) as an alternative to the use of rock placement, though examples are fewer than for fixed infrastructure.
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	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

Potential activity	Description	Assumptions used for assessment
	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-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).	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.
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	A rig site survey typically covers 2-3km^2. The rig site survey vessel may also be used to characterise seabed habitats, biota and

Potential activity	Description	Assumptions used for assessment
	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). Studies (Crocker & Fratantonio 2016, Halvorsen & Heaney 2018 (also see Labak 2019), Pace *et al.* 2021) have sought to understand the acoustic characteristics of example geophysical survey equipment types including through open water testing, which has provided a better understanding of the source levels, frequencies, and potential effects of using this equipment.	background contamination. Survey durations are usually of the order of four or five days.
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 2-3 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).
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 sites

Sites were considered for inclusion/exclusion in the screening process with respect to whether there was an impact pathway[13] between the marine features for which they are designated and potential 33rd Round activities which could arise following licensing (see Table 2.2). Sites considered include relevant designated SACs and SPAs and potential sites for which there is adequate information on which to base an assessment.

In accordance with the National Planning Policy Framework (MHCLG 2021), devolved policy (e.g. Scottish Planning Policy) and Marine Policy Statement (HM Government 2011), the relevant sites considered here include classified and potential SPAs[14], designated and candidate SACs, 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 sites are established during this HRA process, they will be subject to screening and if necessary, included in subsequent AA stages. The sources of site data include the JNCC SAC and SPA summary spreadsheet (version as of 30th September 2022[15]), the NatureScot SiteLink[16] and Natural England Designated Sites View[17]. Interest features and site characteristics were filtered for their coastal and marine relevance. Any sites designated in the future would also be considered as necessary in subsequent project-specific assessments.

The sites included in the screening process cover:

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

A number of 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. Natura 2000 sites in the waters of other states at or adjacent to the UK median line have been considered. All relevant sites are shown in Figures 3.1 to 3.8 with further site details in Appendix A.

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[13] 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, SNCB advice on operations and literature sources etc). Also refer to Section 4.2.
[14] 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.
[15] https://hub.jncc.gov.uk/assets/a3d9da1e-dedc-4539-a574-84287636c898
[16] https://sitelink.nature.scot/home
[17] https://designatedsites.naturalengland.org.uk/

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

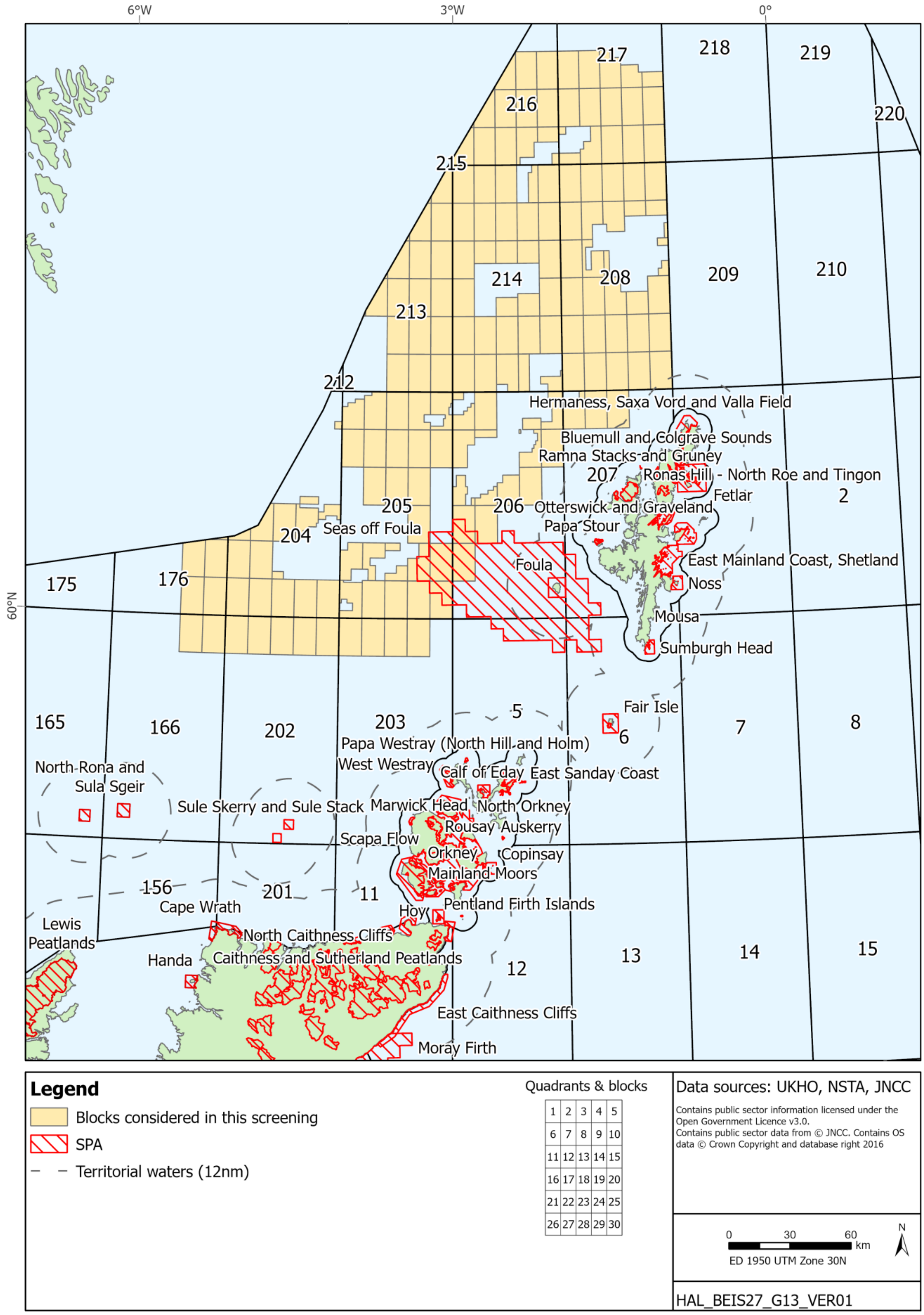


Figure 3.2: SPAs included in the screening process: northern and central North Sea

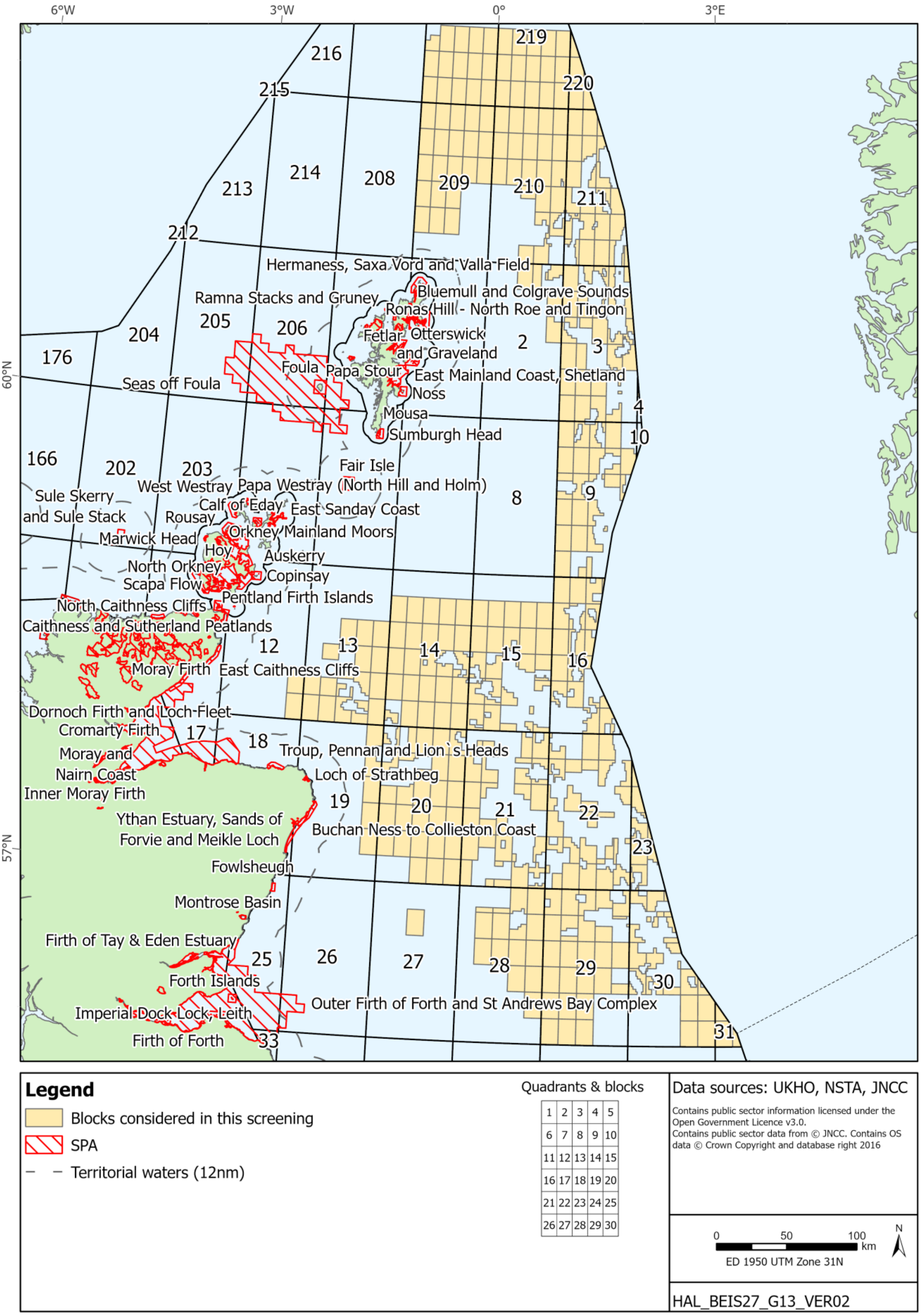


Figure 3.3: SPAs included in the screening process: Mid North Sea High and southern North Sea

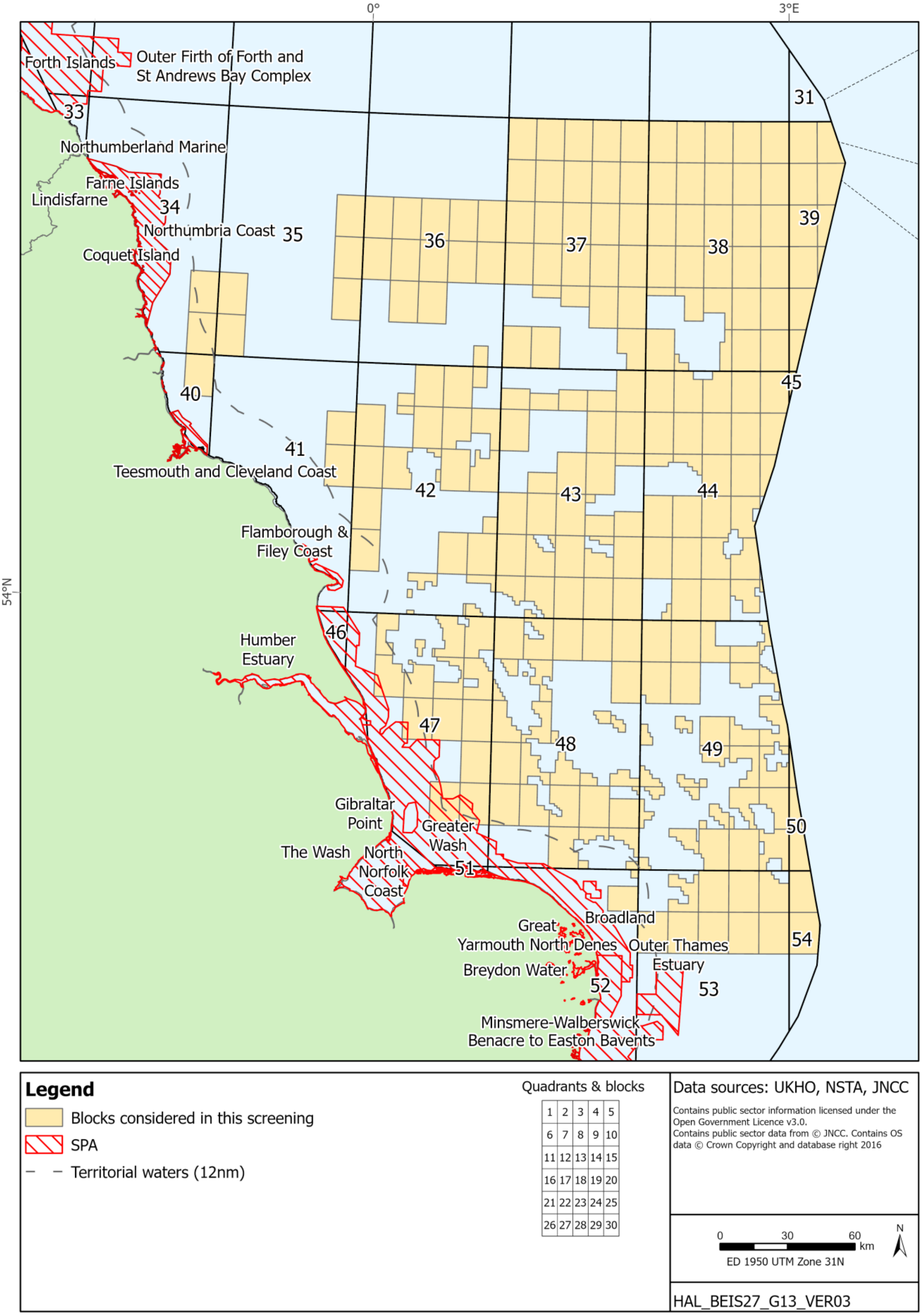


Figure 3.4: SPAs included in the screening process: Irish Sea

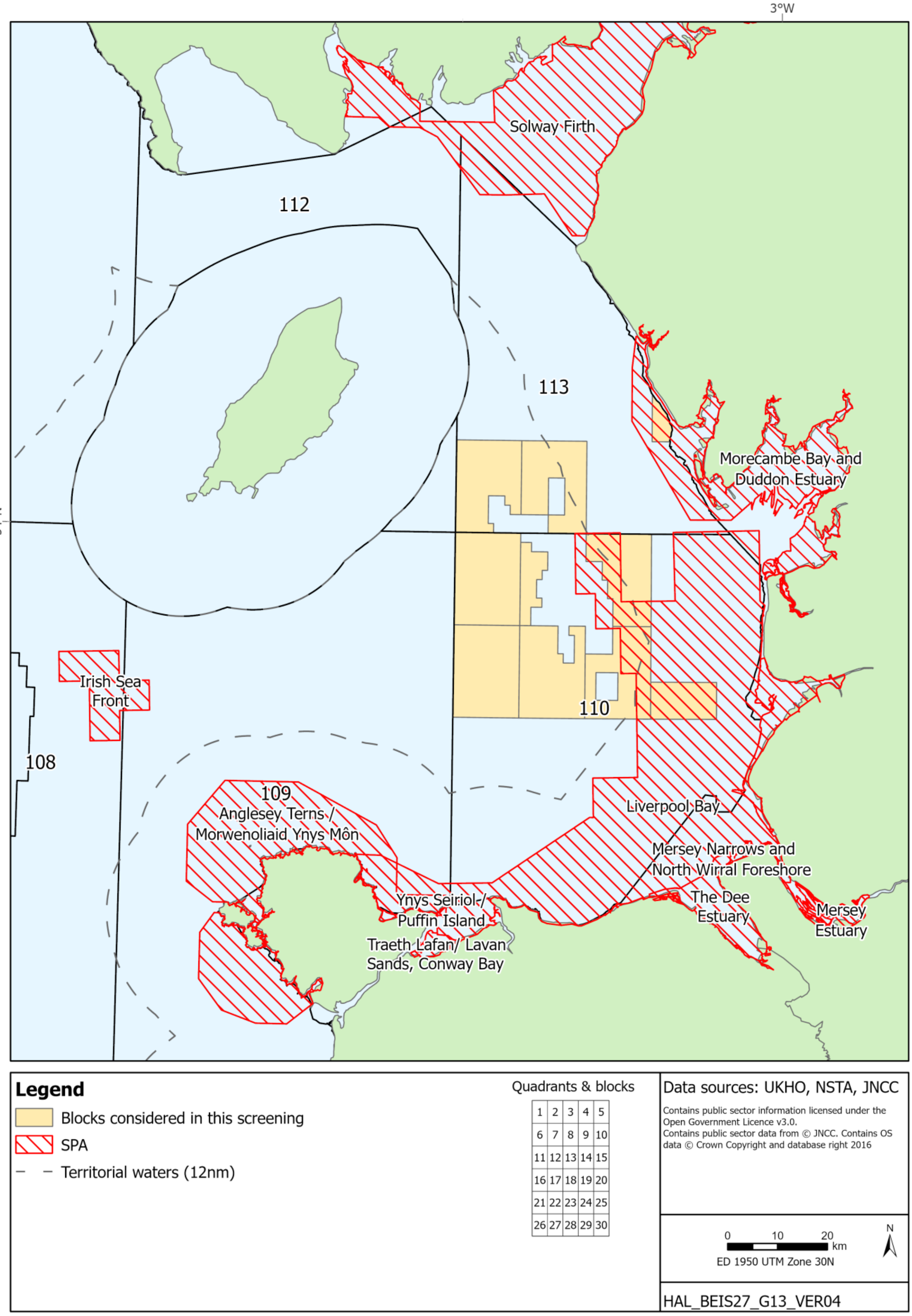


Figure 3.5: SACs included in the screening process: west of Shetland

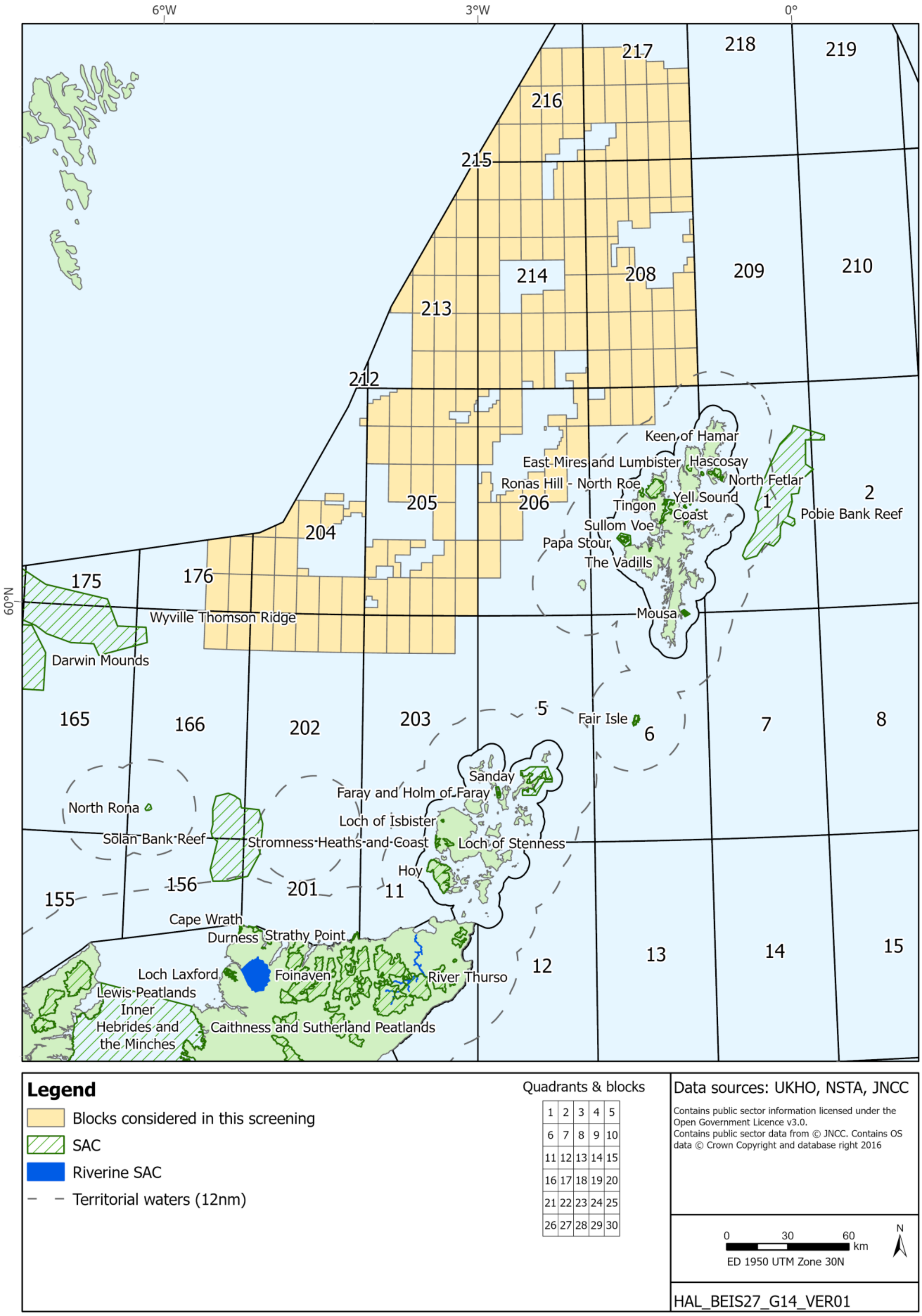


Figure 3.6: SACs included in the screening process: northern and central North Sea

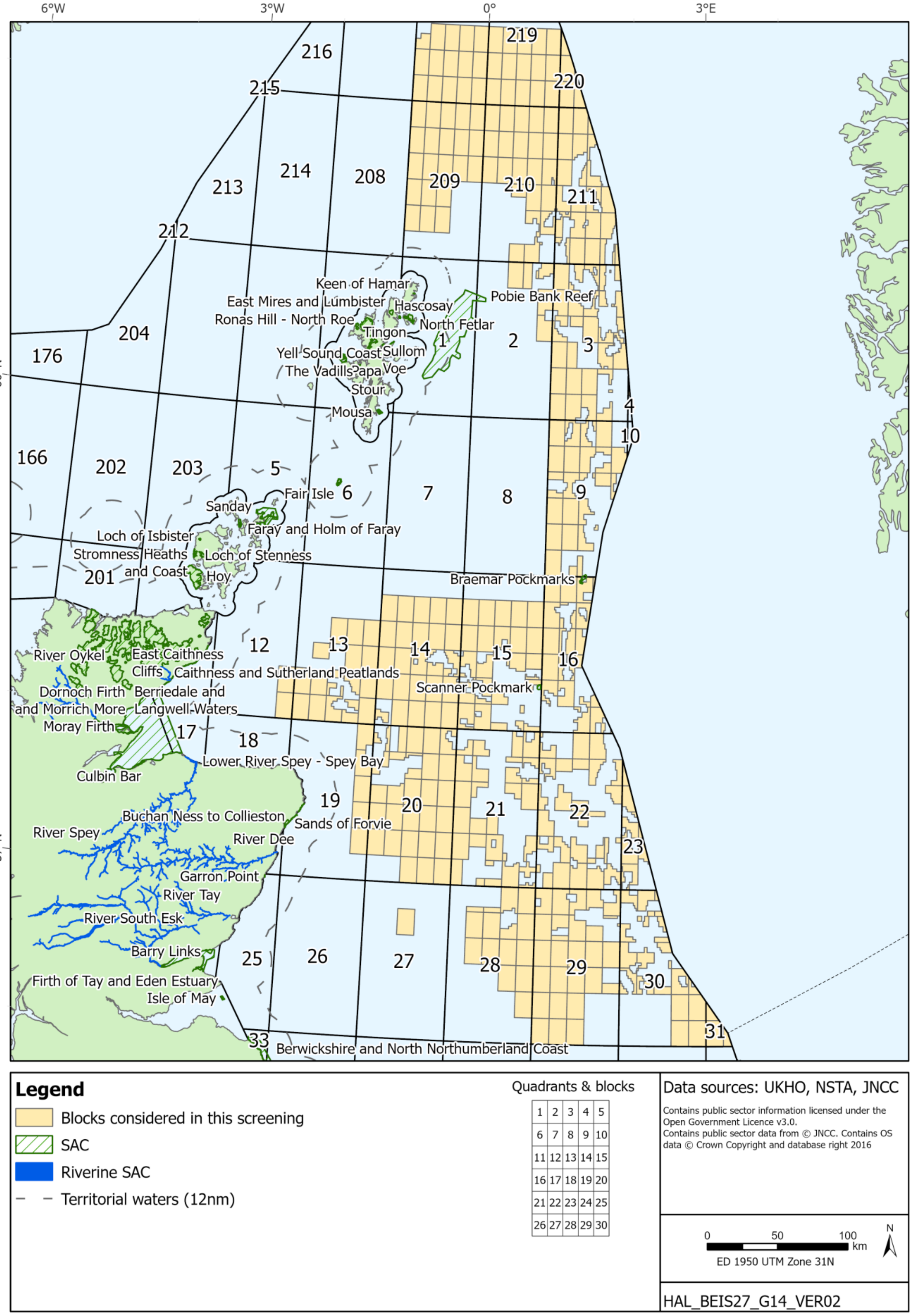


Figure 3.7: SACs included in the screening process: Mid North Sea High and southern North Sea

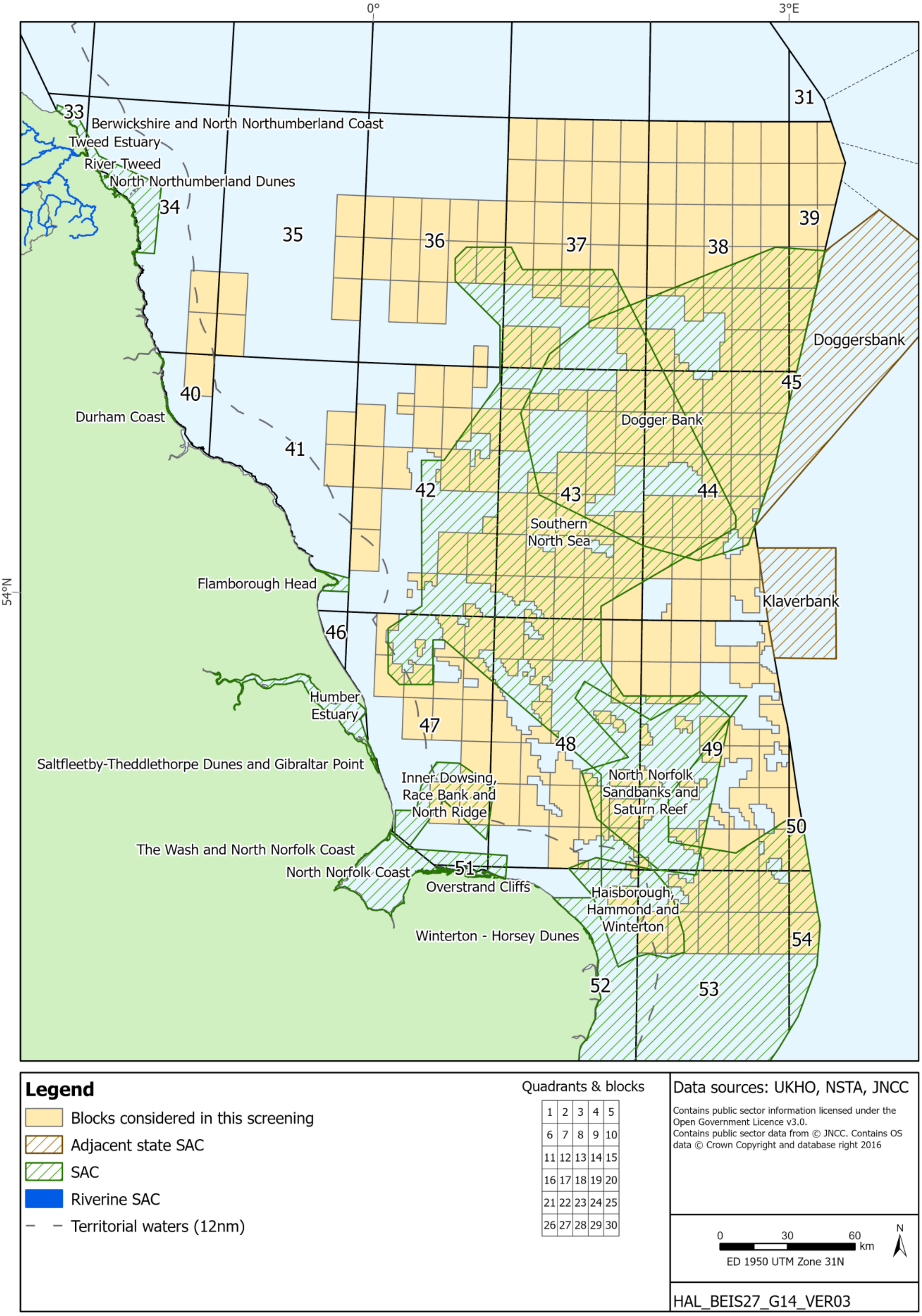
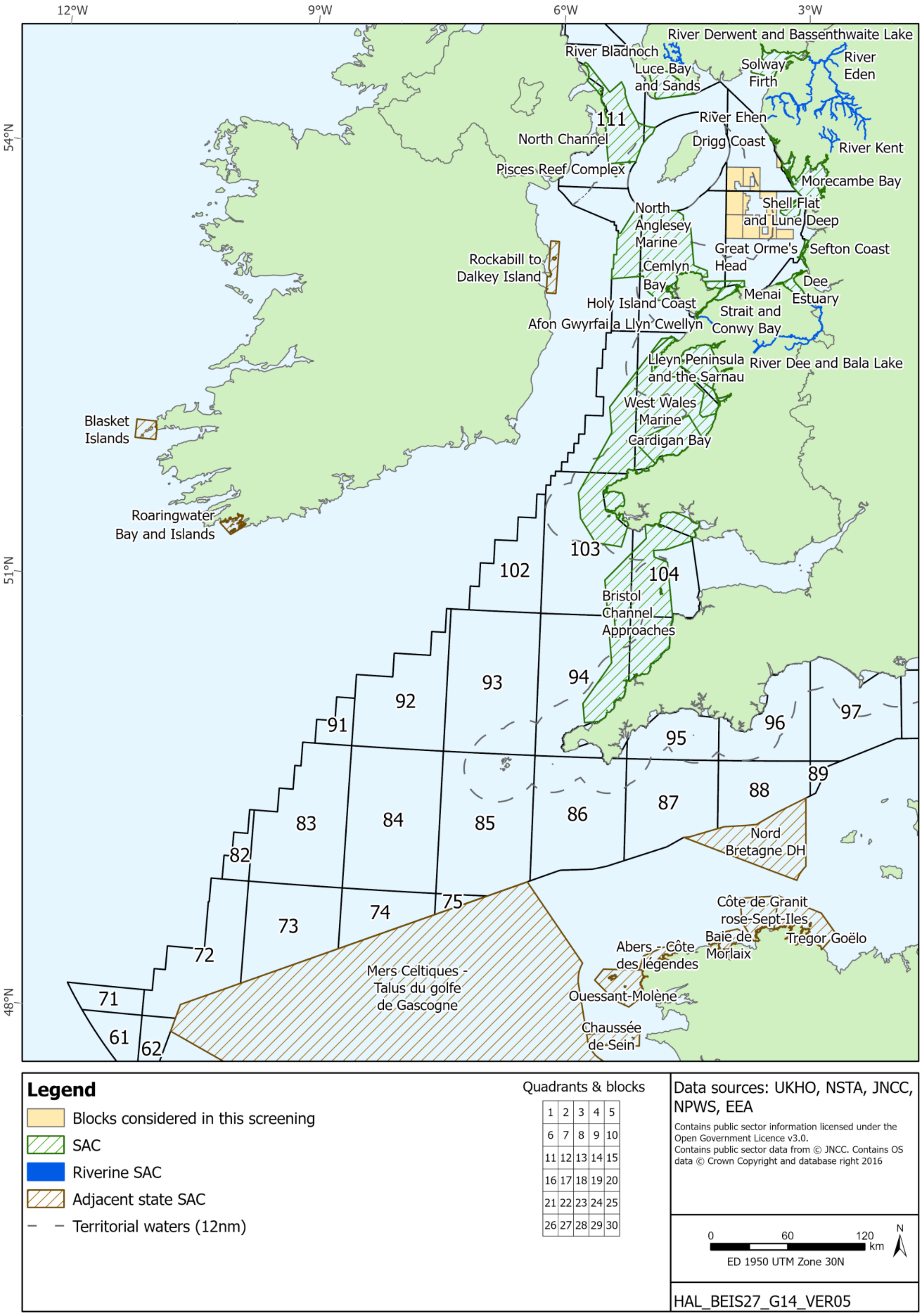


Figure 3.8: SACs included in the screening process: Irish Sea



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 33rd Round are likely to have a significant effect on a relevant conservation site in the national site network, 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 2019) 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 relevant conservation sites in national site network – see Section 2.

- Identify all relevant conservation sites in the national site network 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 the 33rd Round 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 conservation sites in national site network could not be discounted at the screening stage) will be subject to a second stage of HRA, AA, if applied for and before licence award decisions are taken – see Section 6 and Appendix B.

This screening does not assume that the mere potential for interaction between an individual animal which may be associated with a relevant site and any of the Blocks on offer will automatically result in a likely significant effect. Evidence of the potential for species to be present beyond site boundaries is considered in this assessment (Section 4.6), but in the context of realistic assumptions about the nature and scale of activities which could follow licensing (Section 2.3.1 and Table 2.2) and an evidence base covering the sources of effect relevant to those activities and the qualifying features of the relevant sites (Sections 4.4 and 4.5).

4.2 Sources of effect considered in this screening

As outlined in Section 2.3, activities which may be undertaken during the initial term will comprise exploration activities in the form of seismic survey, exploration or appraisal drilling, or other site investigation work including geophysical or geotechnical investigations. The foreseeable interactions from these activities with the potential to result in likely significant effects on relevant 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[18] 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 HRA procedures and tests under the Habitats Regulations.

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*[19], 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 exploration and appraisal activity which is relevant to oil and gas exploration[20], along with a standard description of the activity, pressure benchmarks, and justification text for the activity-pressure interaction (including with reference to source

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

[19] Under this Regulation, advice must be provided by the appropriate nature conservation body to other relevant authorities as to: a national network 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.

[20] E.g. under 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), smothering and siltation rate changes, 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, 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. For example, see: https://designatedsites.naturalengland.org.uk/

information). The relevance of the pressures to site-specific 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[21]. Whilst the matrices provided as part of the advice are informative and identify relevant pressures associated with exploratory drilling, 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 Offshore Energy SEAs (DECC 2016, BEIS 2018, BEIS 2022) 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. 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 exploratory/appraisal 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 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 and the Department's 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 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 or releases, 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 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 the Department, and a range of organisations, and other Government departments are consulted by the Department during the OPEP determination process. The OPEP includes an assessment of spill risk, response arrangements, interface arrangements, training and exercises specific to an

[21] 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.

installation or operation[22]. A comprehensive overview of spill risk on the UKCS from offshore oil & gas activity and related potential environmental effects is provided in OESEA4 (BEIS 2022).

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)[23]. If required, survey reports must be made available to the relevant SNCB 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 the Department'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 BEIS 2022, 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 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 expected to have a significant negative impact would not be permitted.

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. 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).

[22] https://www.hse.gov.uk/omar/guidance/oil-pollution.htm

[23] See BEIS (2021). The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020 – A Guide.

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 (Southall *et al*. 2019).

The Department consults the relevant statutory bodies on the consent applications for advice and a decision on whether to grant consent is only made after careful consideration of their comments. SNCBs 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 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*[24]. The JNCC (2017) guidelines 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 with respect to seismic survey and fish spawning are noted in Section 2 of the Department's Other Regulatory Issues listing[25]. Licensees should also be aware that seasonal concerns may influence the decision whether or not to approve particular activities.

4.4 Physical disturbance and drilling effects

Exploration/appraisal activities may exert the following pressures[26] which have the potential to cause physical disturbance and drilling effects on relevant 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)

[24] 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.

[25] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1114310/Other_Regulatory_Issues_-_Sept_2022.pdf

[26] Following those noted in Section 4.2.

- Contamination (see Section 4.4.4)
- Introduction or spread of non-indigenous species (see Section 4.4.5)
- Visual disturbance (and underwater noise, 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 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 depths of less than 120m). In the deeper waters of the UK 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 spudcans) 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 from the drilling of a 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). Similar results are noted for Lincs wind farm (EGS 2016), with post construction monitoring indicating bathymetric changes to the seabed of up to 1.2m from jack-up depressions, and their infilling over time. 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).

The drilling of the surface hole of a well and installation of the conductor will result in highly localised changes to the substrate below the surface of the seabed. Following drilling, exploration wells are typically plugged and abandoned with the casing being removed to approximately 3m below the seabed. As noted above in relation to depressions from jack-up rig spudcans, some natural infilling and recovery of the seabed would be expected following conductor removal.

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 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 conductor, 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, OESEA3 and OESEA4 (DECC 2009, 2011, 2016 and BEIS 2022, 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). Changes in water quality from increased suspended sediment loads are noted as a pressure relevant to exploration drilling[27], though is justified in relation to vessel use in shallow waters and in ports rather than drilling activities themselves. While drilling activities may results in enhanced turbidity, e.g. from cuttings discharge, these are widely and quickly dispersed and are not likely to impact, for example, shallow plunge diving birds such as terns.

[27] https://hub.jncc.gov.uk/assets/97447f16-9f38-49ff-a3af-56d437fd1951, also see Advice on Operations for SACs SPAs: https://designatedsites.naturalengland.org.uk/; note that changes in suspended solids (water clarity) is generally not noted as a pressure against exploration drilling for SPAs relevant to this assessment.

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, but this is not typical. In soft sediments, rock deposits may cover existing sediments resulting in a physical change of seabed type, and related habitat loss, which in the context of HRA, could lead to a reduction in feature extent that would need to be considered in relation to the site's conservation objectives and conservation status. 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 UKCS, 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[28] 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 (e.g. Henry *et al.* 2018, Mayorga-Adame *et al.* 2022), but this has not been validated by empirical data (ISAB 2018). Phase 2 of the INSITE research aims to tackle gaps in understanding of the role of man-made structures in marine ecosystems and results from this phase of the work were recently summarised in a series of webinars[29]. An additional project has been commissioned to provide a synthesis of evidence relating to manmade structures in the marine environment, building on phases 1 and 2 of the INSITE programme, is also due to complete in the same timeframe as Phase 2[30].

4.4.4 Contamination[31]

In contrast to historic oil based mud (OBM) 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. Although the presence of drilling material at the seabed close to the drilling location (<500m) is often detectable chemically (e.g. Cranmer 1988, Neff *et al.* 1989, Hyland *et al.* 1994, Daan & Mulder 1996, Currie & Isaacs 2005, OSPAR 2009, Bakke *et al.* 2013). Recent studies (e.g. Nguyen *et al.* 2021, Gillett *et al.* 2020, Dijkstra *et al.* 2020, Aagaard-Sørensen *et al.* 2018, Junttila *et al.* 2018) have investigated the spread and effects of WBM discharges on various aspects of seabed ecology including those not typically included in benthic monitoring programmes; the results indicate that, where effects were detected, they were of small spatial scale and relatively short duration. Analysis of UKBenthos data (Henry *et al.* 2017) for 19 installations spanning the northern, central and southern North Sea, suggested strong benthic responses for 12 structures, with 10 having their maximum ecological footprint within 1km of the discharge, and the remaining two within 1.2km, with recovery time varying between zero years (i.e. no effect) to between 6.8 and 8.3 years. The datasets largely reflected the effects of discharged OBM rather than WBMs,

[28] https://www.insitenorthsea.org/
[29] https://insitenorthsea.org/impact
[30] https://insitenorthsea.org/projects/insite-overall-synthesis-project-2021-2023
[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.

and the authors could not disentangle the effects of OBMs and WBMs in terms of persistence with the available data.

Considerable data from oil and gas activities 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 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 (note that this is over 400m deeper than any of the areas on offer in this round). Outside the area of smothering, fine sediment was visible on the seafloor up to at least 250m from the well. After three 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. The use of a ROV has also allowed the detection of small scale changes in benthic fauna in the immediate vicinity of a wellbore in the Norwegian sector of the North Sea, for example Hughes *et al.* (2010) found declines of the density of sea urchin *Gracilechinus acutus* within 50m of a well; such effects are considered temporary and negligible.

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 six 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).

Most studies of ecological effects of drilling discharges have involved soft-sediment species and habitats. Studies of the effects of WBM discharges from three production platforms in 130-210m water depth off California found significant reductions at some stations in the mean abundance of four of 22 hard bottom taxa investigated using photographic quadrats (Hyland *et al.* 1994). These effects were attributed to the physical effects of particulate loading, namely disruption of feeding or respiration, or the burial of settled larvae. The impacts from WBM discharges may be of more concern in areas with sensitive benthic fauna, for example corals and sponges. Laboratory experiments by Allers *et al.* (2013) indicated that cold water coral (*Lophelia pertusa*) fragments were resilient to sedimentation-induced oxygen stress, but if coverage by sediment was complete and lasted long enough, the coral could not recover and died. Such effects can be mitigated in areas of sensitive species presence through site specific controls on whether, and where, drilling discharges are made. Järnegren *et al.* (2017) noted that natural high turbidity events lasting hours or days can occur in areas with adult corals, but based on their experiments suggested that the planktonic larvae of *L. pertusa* were susceptible to damage or mortality from suspensions of drill cuttings which included bentonite.

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 exploration and appraisal 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

The Blocks offered 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 33rd Round licence 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 exploration/appraisal drilling activity (2-3 trips per week, see Table 2.2)

[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

is likely to be insignificant in the context of existing helicopter, military and civilian aircraft activity levels.

Physical disturbance of seaduck and other waterbird flocks by vessel and aircraft traffic associated with oil and gas 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. Divers and sea ducks have been assessed as being the most sensitive species groups to offshore development and associated boat and helicopter traffic. 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[35] recommends for most species a standard displacement buffer of 2km with the exception of the species groups of divers and sea ducks for which JNCC (2022) recommend a 4km displacement buffer. Whilst displacement effects for divers have been detected at greater distances (e.g. 5-7km, Webb 2016; 8km, HiDef 2017; 10-16.5km, Mendel *et al.* 2019, Heinänen *et al.* 2020, APEM 2021; 10km, MacArthur Green 2019; 10-15km, Dorsch *et al.* 2019), and a buffer of 10km is recommended by JNCC (2022), 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/appraisal 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 the Blocks offered 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

[35] https://hub.jncc.gov.uk/assets/9aecb87c-80c5-4cfb-9102-39f0228dcc9a

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 project "Mapping UK shipping density and routes from AIS" (MMO 2014b) and the 2015 national dataset of marine vessel traffic[36] provides relevant shipping density information[37]. 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

[36] https://data.gov.uk/dataset/vessel-density-grid-2015
[37] Note that shipping densities are low over the majority of Blocks with higher densities primarily in coastal waters close to major ports.

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 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[38] 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 site, together with any area within a buffer of 10km from a site where there is a potential interaction between site features and exploration/appraisal activities in the area.

Blocks and relevant sites screened in on the basis of physical and drilling effects are shown in Figures 5.1 to 5.4 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 site boundaries is considered in Section 4.6. Where appropriate, Blocks >10km from relevant site boundaries may be screened in.

4.5 Underwater noise effects[39]

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 offshore energy SEAs (see DECC 2009, 2011, 2016, BEIS 2022). The following description of

[38] https://hub.jncc.gov.uk/assets/206f2222-5c2b-4312-99ba-d59dfd1dec1d#SouthernNorthSea-conservation-advice.pdf
[39] Note that all underwater noise effects fall within the “underwater noise change” and “vibration” pressure definitions.

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, BEIS 2022).

Seismic survey

Of those 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.

Geophysical survey

In addition to seismic surveys, relevant sources of impulsive sound are restricted to the smaller volume air-guns and some 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[40] 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. Ruppel *et al.* (2022) considered most high-resolution geophysical (HRG) sources, with the exception of seismic sources (e.g. boomers, sparkers), to be intermittent and non-impulsive (although see Hartley Anderson Limited 2020 for commentary on lack of clear definition of impulsiveness). Two studies commissioned by the US Bureau of Ocean Energy Management investigated sound generated by equipment commonly used in high-resolution geophysical surveys, including electromagnetic sources. Calibrated source levels were measured under controlled conditions in a test tank (Crocker &

[40] 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).

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] SPLpeak-peak	SEL	Approximate frequency of dominant energy (kHz)	-3dB beam width (degrees); across track
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.

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. Similarly, Ruppel *et al.* (2022) classified most high resolution geophysical sources (e.g. MBES, SSS, hull-mounted SBP, towed SBP and parametric SBP) in Tier 4, considered unlikely to result in incidental take[41] of marine mammals and therefore termed *de minimis*. Some sparker and boomer systems were considered Tier 3, with characteristics that did not meet the *de minimis* category (e.g. some sparkers) or could not be fully evaluated due to lack of information (e.g. some boomers). In an experiment undertaken at the Energy Island lease area in Danish waters, at water depths of ~35m, Pace *et al.* (2021) recorded a peak frequency of a sparker of between 0.2 and 0.8kHz and source levels (SEL) of up to 156.8dB re 1μPa^{2}s, for a station set at 0m from the source. At 100m, 750 and 2km, the source levels reduced to up to 144.1, 136.6 and 123.3dB re 1μPa^2.

Vessel and rig noise

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). 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).

Unexploded ordnance

Encounters with unexploded ordnance (UXO) from past military conflicts or training are possible almost anywhere across the UKCS, however, they are most frequent in the southern North Sea and eastern Irish Sea. To date, clearance of UXO has generally been undertaken by high-order detonation using a charge to destroy the device, but this is a source of loud underwater noise with the potential to generate significant effects for noise sensitive receptors (Robinson *et al*. 2022). Alternative "low-order" approaches (e.g. deflagration) which render the UXO safe but without causing it to explode are available (Robinson *et al*. 2020), and their use is being encouraged (e.g. see BEIS 2022 and the unexploded ordnance clearance joint interim position statement[42]). UXO are generally less frequently encountered during exploration activities, and if they are, there is considerable scope to avoid interaction with any suspected device and avoid the need for disposal. There is limited experience for the need to dispose of UXO related to exploration activities, and it is considered unlikely that disposal would take place as a result of Initial Term activities associated with 33rd Round licensing. UXO disposal is therefore not considered to be a source of likely significant effect and will not be considered further.

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

[41] "Take" as defined under the US Marine Mammal Protection Act 1972 means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal". An incidental take is an unintentional, but not unexpected, taking. Harassment is statutorily defined as, any act of pursuit, torment, or annoyance which has the potential to injure (Level A harassment) or disturb (Level B harassment) a marine mammal or marine mammal stock in the wild. Source: https://www.fisheries.noaa.gov/laws-and-policies/glossary-marine-mammal-protection-act#take-and-incidental-take-under-the-marine-mammal-protection-act

[42] https://www.gov.uk/government/publications/marine-environment-unexploded-ordnance-clearance-joint-interim-position-statement/marine-environment-unexploded-ordnance-clearance-joint-interim-position-statement

(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 applicable 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 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. Hastie *et al.* (2019) notes application of the criteria thresholds typically assumes that the broad characteristics of a source (impulsive or non-impulsive) remains constant throughout its propagation range. However, a range of impulsive characteristics (e.g. peak pressure, signal duration, rise time and kurtosis) are known to vary with distance from source (Hastie *et al*. 2019, von Benda-Beckmann et al. 2022, Guan *et al*. 2022), with Hastie *et al*. (2019) indicating the greatest change within <10km from the source. Given that published thresholds for PTS onset as a result of exposure to impulsive signals are lower than the non-impulsive thresholds in all species groups (Southall *et al*. 2007, 2019), there is the potential that the risk of auditory damage may be overestimated in cases where impulsive signals become non-impulsive with propagation (Hastie *et al.* 2019). Other factors such as duty cycle and the respective recovery periods between signals will also likely influence the risk of hearing damage from repetitive sounds such as from pile driving and seismic surveys (Hastie *et al*. 2019).

With respect to behavioural disturbance of marine mammals, it is more difficult to establish broadly applicable threshold criteria based on exposure alone. This is due, in part, to the challenges encountered in studies of wide-ranging species with complex behaviour, but is largely because many behavioural responses are context-specific (e.g. Gomez *et al*. 2016, Harding *et al*. 2019). 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[43]. 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

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

a reduction in foraging opportunities. It is noted that Southall *et al*. (2021) proposes a revised framework more focused on expected longer term and ultimately population-level consequences of behavioural responses affecting key vital functions (survival, feeding and reproduction).

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 in September 2011 (Thompson *et al.* 2013a). The survey 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). Analysis of ten years of PAM data covering the 2011 seismic survey and pile-driving activities associated with the construction of two offshore windfarms in the Moray Firth in 2017 and 2019 (Fernandez-Betelu *et al*. 2021), revealed potential far-field effects on the coastal bottlenose dolphin population associated with the Moray Firth SAC. Comparing between years, dolphins used Moray Firth inshore areas regularly, albeit the extent of use varied from year to year without any consistent relationship to the impulsive noise generated by offshore activities (which were over 20km (seismic survey), 40km (Moray East) and 50km (Beatrice) from the southern coast). At the smaller temporal scale comparing days in which impulsive noise was present or absent, showed an increase in dolphin detections on the southern coast on days with impulsive noise (whether as a result of an increase in group size or change in vocalisation rate was not possible to determine). This increase was consistent between all three offshore projects suggesting that distant impulsive noise sources may have caused modifications of bottlenose dolphin vocalisations but only over the short term (less than a day).

High frequency sources with central operating frequencies at the upper end of marine mammal hearing ranges or above (e.g. echosounders, side-scan sonar) have been shown to emit energy at lower frequencies audible to most marine mammals (e.g. Risch *et al.* 2017), although at reduced amplitudes and with a small, emitted sound field which is unlikely to cause behavioural effects (Cotter *et al.* 2019). Consideration of the higher frequency signals, typically lower source levels and higher directionality of these and other similar sources has led to the assumption that these would not propagate far enough for marine species to be negatively affected by received levels (Halvorsen & Heaney 2018). Pace *et al.* (2021) considered the cumulative exposure from a typical geophysical survey which incorporated vessel noise, sub-bottom profilers (parametric and sparker), MBES, and SSS with USBL positioning, which indicated that TTS thresholds for the SEL were exceeded <10m from the source for all functional hearing groups (Southall *et al.* 2019) other than very-high frequency cetaceans (333m), which was the only group to exceed PTS thresholds, within a range of 7.2m (90% CI of 502.2m and 16.9m respectively). A precautionary approach has been adopted where it is acknowledged that such sources are within the hearing range of marine mammals and therefore could, in a few cases, cause localised short-term impacts on behaviour or temporary displacement of a small number of individuals (Boebel *et al.* 2005).

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, resulting in changes in distribution and a reduction of foraging activity, but the effect is short-lived. The precautionary criterion applied during initial 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. While the screening criterion (Section 4.5.3) is consistent with the Effective Deterrence Radius (EDR) suggested by SNCBs in relation to harbour porpoise SACs (JNCC 2020), it is not based on the EDR but on a range of available data on the response of multiple species of marine mammal to underwater noise, and is also not used here as an EDR.

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 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, Thompson *et al*. 2020, Benhemma-Le Gall *et al.* 2021, Graham *et al*. 2023, Voß et al. 2023) 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 (BEIS 2022).

Graham *et al.* (2019) investigated harbour porpoise behavioural responses to piling noise using echolocation detectors (C-PODs) and noise recorders during the 10-month foundation installation of a 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 study results suggest that response levels were increased with ADD use. Thompson *et al*. (2020) also reported a strong harbour porpoise behavioural response to ADD mitigation usage prior to piling at Beatrice, noting a 50% chance of response within 21.7km. Interestingly, during the installation of the pin piles at Beatrice, Thompson *et al.* (2020), recorded, contrary to expectation, the highest received noise levels at lower hammer energies during the soft-start period. The authors noted that pin piles of between 35 and 45m were driven to within 2m of the seabed using a submersible hammer in depths of up to 45m. Thus, during soft starts, the entire pile could be within the water column, while at the highest hammer energies, most of the pile was embedded in the sediment. It was suggested that with respect to the installation of pin-pile jackets at deeper offshore windfarm sites, regulators consider limiting initial hammer energies and encourage the use of installation systems that best minimise these.

Graham *et al*. (2023) used a linear array of hydrophone clusters within the Moray East offshore wind farm to determine whether harbour porpoise responded to ADD usage by moving away. During baseline periods, porpoise movements were evenly distributed in all directions. However, animals showed significant directional movement away from sound sources during ADD use and piling soft starts. Evasive responses were reported at distances of up to 7km during ADD use and 9km (the maximum distance between hydrophone clusters and the construction site) during the piling soft start. Alternative acoustic porpoise deterrents (APD) developed to reduce the scale of disturbance produced by traditional ADDs have been tested with Voß *et al*. (2023), reporting a 30-100% decrease in harbour porpoise detection rates at 750m distance during APD operation compared to 6 hours before APD operation. Significantly, reduced detection rates during APD operation were only observed up to about 2.5 km distance. See also recent JNCC review of ADD usage for marine mammal mitigation (McGarry *et al.* 2022).

SNCB advice (e.g. JNCC 2020) assumes a 15km zone of disturbance for conductor pile-driving. 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, and diminished over time. 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 suitably precautionary for harbour porpoise.

At the Danish Horns Rev wind farm, 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 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. 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, Pace *et al.* 2021).

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)[44]; however, such effects are temporary, of limited spatial extent. Benhemma-Le Gall *et al*. (2021) noted with respect to offshore wind farms, that whilst pile-driving produced the highest amplitude noise, active piling occurred for <10% of the time in the 9–10-month piling phases at Beatrice and Moray East. It was noted that whilst responses to these short but intense periods of impulsive noise sources were of greater magnitude, harbour porpoise occurrence and buzzing activity also decreased in response to more chronic exposure to vessel traffic throughout construction. The probability of detecting porpoises and buzzing activity was positively related to the distance from vessel and construction activities, and negatively related to levels of vessel intensity and background noise with displacement observed at up to 12km from pile-driving activities and up to 4km from construction vessels.

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). Slabbekoorn *et al*. (2019) note that there are few good case-studies in the peer-reviewed literature that report on the impact of a seismic survey on the behavioural response of free-ranging fish or the direct impact on local fisheries. 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, Bruce *et al.* 2018). 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 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). The Mickle *et al*. (2018) study of the hearing ability of sea lamprey (*Petromyzon marinus*) reported that, consistent with fish lacking a swim bladder, sea lamprey showed a limited sensitivity to sound, with juveniles detecting tones of 50-300Hz, but not higher frequencies.

In addition to considering direct effects on fish as qualifying features of national network 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.

[44] 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.

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 exists (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. The effect of a seismic survey on the movement behaviour of free-swimming cod in the southern North Sea was investigated by van der Knapp *et al*. (2021). During the experimental survey, tagged cod decreased their activity, with time spent being ‘‘locally active’’ (moving small distances, showing high body acceleration) becoming shorter, and time spent being ‘‘inactive’’ (moving small distances, having low body acceleration) becoming longer. Additionally, diurnal activity cycles were disrupted with lower locally active peaks at dusk and dawn, periods when cod are known to actively feed.

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. Unlike other receptor groups, no dedicated reviews on the effects of noise on diving birds have been undertaken; distillations of available evidence can be found in Hartley Anderson Limited (2020), U.S. Department of the Navy (2020) and the DOSITS website[45]. The exposure of shallow plunge-diving or surface-dipping aquatic birds to underwater noise is likely to be negligible due to the very short period of time they spend underwater (U.S. Department of the Navy 2020). 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

[45] https://dosits.org/animals/sound-reception/how-do-aquatic-birds-hear/

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, Fliessbach *et al*. 2019). 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. An investigation of 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). 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 survey; during shooting, their distribution shifted away from the survey area, with areas of higher use at least 15km from 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 on these birds' behaviour and/or that of their prey (Pichegru *et al*. 2017).

The 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. There is some evidence of noise-induced changes in the distribution and behaviour of diving birds in response to impulsive underwater noise, but these were temporary and may be a direct disturbance or reflect a change in prey distribution (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* Red-throated diver *Gavia stellata* Black-throated diver *Gavia arctica* Little grebe *Tachybaptus ruficollis* Great crested grebe *Podiceps cristatus* Slavonian grebe *Podiceps auritus* **Seabirds** Manx shearwater *Puffinus puffinus* Gannet *Morus bassanus* Cormorant *Phalacrocorax carbo carbo* Shag *Phalacrocorax aristotelis* Guillemot *Uria aalge* Razorbill *Alca torda* Puffin *Fratercula arctica*	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*

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 offered that is within 15km of a SAC with qualifying features regarded as sensitive to underwater noise (e.g. marine mammals 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.

Relevant sites and 33rd Blocks on offer which have been screened in on the basis of underwater noise effects are shown in Figures 5.5 to 5.7 and are 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 site boundaries is considered in Section 4.6. Where appropriate, 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 33rd Round Blocks while those species are outside of their relevant 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 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 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. terns breeding at Lindisfarne SPA or Northumbria Coast SPA and foraging within the Northumberland Marine SPA) 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 off St Kilda SPA, ~16km distant). Consequently, the marine SPA site documentation and additional tagging data (where available) have been examined to identify their known 'source' colony SPAs; where Blocks have been screened in for these marine SPAs based on the screening criteria, they have also been screened in for their linked 'source' SPAs (see Table 4.2). 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 initially screened in which are designated for foraging aggregations of seabirds during the breeding season and their 'source' breeding colony SPAs, or adjacent sites for non-breeding features with likely connectivity

Marine SPA	'Source' breeding colony SPAs (relevant species; distance)
West of Shetland	
Seas off Foula SPA	Foula SPA (multiple breeding seabirds; contiguous)
Central and Northern North Sea	
Northumberland Marine	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)
Southern North Sea	
Greater Wash SPA	North Norfolk Coast SPA (breeding sandwich tern, little tern and common tern; 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)

Marine SPA	'Source' breeding colony SPAs (relevant species; distance)
	Breydon Water SPA (breeding common tern; contiguous)
	Alde-Ore Estuary SPA (breeding little tern; contiguous)
	Benacre to Easton Bavents SPA (breeding little tern; contiguous)
Eastern Irish Sea	
Liverpool Bay SPA	Morecambe Bay & Duddon Estuary SPA (breeding common tern and little tern, adjacent)
	Ribble and Alt Estuaries SPA (breeding common tern, contiguous)
	Mersey Narrows and North Wirral Foreshore SPA (breeding common tern, contiguous)
	The Dee Estuary SPA (breeding common tern and little tern, contiguous)

Notes: includes sites designated for wintering waterbird features which are common with the overlapping/adjoining marine SPA.

Data on movements and foraging ranges

Information on the foraging movements of various 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, Lane *et al.* 2021). Woodward *et al*. (2019) reported representative breeding season foraging ranges for a range of species. While some colony specific data are referred to by Woodward *et al.* (2019), there generally remains limited information on foraging areas used by species from these colonies.

Table 4.3 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.

Waggitt *et al.* (2020) produced monthly maps of modelled seabird distributions for UK seas for 12 seabird species. The model used collated and standardised North-East Atlantic survey data covering the years 1980-2018, with maps covering a broad area of North West European waters. The mapped outputs are instructive in showing a general illustration of relative seabird density and broad-scale distribution, but at this time, lack the precision that would be required to make any interpretation of absolute densities (Waggitt *et al.* 2020). They do, however, represent an alternative approach to understanding the distribution of seabirds throughout the year in the absence of basin-scale seasonal data.

Table 4.3: Indicative breeding season foraging ranges

Species	Mean max (km)[1]	Mean (km)[2]	Confidence level[3]
Eider	21.5	3.2±4.2	Poor
Red-throated diver	9	4.5	Low
Fulmar	542.3±657.9	134.6±90.1	Good
Manx shearwater	1346.8±1018.7	136.1±88.7	Moderate
Leach's storm petrel	n/a	657	Moderate
Gannet	315.2±194.2	120.4±50	Highest
Cormorant	25.6±8.3	7.1±3.8	Moderate
Shag	13.2±10.5	9.2±4.9	Highest
Arctic skua	n/a	2±0.7	Poor
Great skua	443.3±487.9	67±31.5	Uncertain
Black-headed gull	18.5	7	Uncertain
Common gull	50	n/a	Poor
Mediterranean gull	20	11.5	Uncertain
Herring gull	58.8±26.8	14.9±7.5	Good
Lesser black-backed gull	127±109	43.3±18.4	Highest
Kittiwake	156.1±144.5	54.7±50.4	Good
Sandwich tern	34.3±23.3	9±9.2	Moderate
Roseate tern	12.6±10.6	4.1±2.6	Moderate
Common tern	18±8.9	6.4±4.5	Good
Arctic tern	25.7±14.8	6.1±4.4	Good
Little tern	5	3.5	Moderate
Guillemot	55.5±39.7[4]	23.9±21.1[4]	Highest
Razorbill	73.8±48.4[4]	31.2±17.3[4]	Good
Puffin	137.1±128.3	62.4±34.4	Good

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 where data suggests low variability between sites making the ranges more likely to be representative for unsampled sites); good (based >5 direct studies with greater variability in data and a lower confidence that the ranges will be representative for unsampled sites); moderate (between 2-5 direct studies); low (indirect measures or only one direct study); uncertain (survey-based estimates); poor (few survey estimates or speculative data only).

4. Excludes data for Fair Isle where foraging range may have been unusually high as a result of reduced prey availability during the study year.

Source: Woodward *et al.* (2019)

The distribution at sea throughout the year of many of the species in Table 4.3 is summarised in Appendix A1a.6 of the OESEA4 Environmental Report (BEIS 2022); 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), and in the Irish Sea, the Irish Sea Front is important for Manx shearwater, common guillemots, razorbills and gannets.

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 overriding 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). A tagging study at Bass Rock indicated that females made longer foraging trips than males both prior to chick hatching and during chick rearing, though both sexes show a more restricted foraging distribution during the rearing stage (Lane *et al.* 2020).

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 4.3 (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.

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 any of the Blocks on offer 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, MMO 2018, Fliessbach *et al.* 2019) 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 the blocks offered 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 licensing to have effects on site features outside of site boundaries. Such effects are considered for these four marine mammal 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

There are 14 seal management units (SMUs) currently in use around the UK (see Figures 5.5 and 5.6) which were delineated based on a number of factors including the practicalities of surveying the areas, respecting national boundaries and the minimisation of movements between SMUs in the foraging season and between foraging and breeding season (SCOS 2020). Given the movement of animals between MUs (Russell *et al*. 2013), especially by grey seals, impacts on animals may have effects at the population level outside the particular MU with which the 'population' is associated (SCOS 2020). SCOS (2020) notes that harbour seals can likely be split into two metapopulations; Scotland and Northern Ireland, east England, with the latter being part of a wider continental Europe population. Grey seals are much further ranging (see below) suggesting they are part of a bigger European metapopulation.

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[46] to that within which they bred (Russell *et al*. 2013), while telemetry and individual recognition (photo-identification) data have revealed

[46] 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).

the movement of seals, particularly grey seals, between the UK and the waters of adjacent countries (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 (Carter *et al.* 2020, 2022) use a habitat modelling approach incorporating data from approximately 114 grey and 239 harbour seal individuals tagged between 2005 and 2019, counts of seals on land from aerial and ground survey platforms conducted during the annual harbour seal moult in August, and a range of environmental covariates. Figure 4.1 and Figure 4.2 show the mean predicted relative density in UK waters of harbour and grey seals respectively on a 5x5km grid in relation to the relevant seal management units, the 33rd Licence Blocks offered and those already screened consistent with the screening criteria presented in Sections 4.4. and 4.5.

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 (Figure 4.1) show a large area of higher use (relative to the majority of UK and Irish waters) extending north-east from The Wash, with values of >0.1% of the British population per 5x5km grid cell in some areas, and of > 0.01% up to approximately 40km from the site boundary. From tracks of individual seals tagged at The Wash (e.g. see Carter *et al.* 2020), and consideration of the distribution of adjacent colonies, it can be assumed that the majority of harbour seals using this area are associated with The Wash and North Norfolk Coast SAC. It is not considered that any further Blocks should be screened in beyond those already identified on the basis of the distance based screening criteria for potential physical and underwater noise effects.

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. 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 4.2). 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 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, based on the area of higher relative density of seals extending from the Humber Estuary (defined as grid cells of ≥0.025% of the seal population per 5x5km), no further Blocks are screened in for grey seal.

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 (Figure 4.1) show a large area of higher use (relative to the majority of UK and Irish waters) extending north-east from The Wash, with values of >0.1% of the British population per 5x5km grid cell in some areas, and of > 0.01% up to approximately 40km from the site boundary. From tracks of individual seals tagged at The Wash (e.g. see Carter *et al.* 2020), and consideration of the distribution of adjacent colonies, it can be assumed that the majority of harbour seals using this area are associated with The Wash and North Norfolk Coast SAC. It is not considered that any further Blocks should be screened in beyond those already identified on the basis of the distance based screening criteria for potential physical and underwater noise effects.

Figure 4.1: Estimated density of harbour seals in UK waters

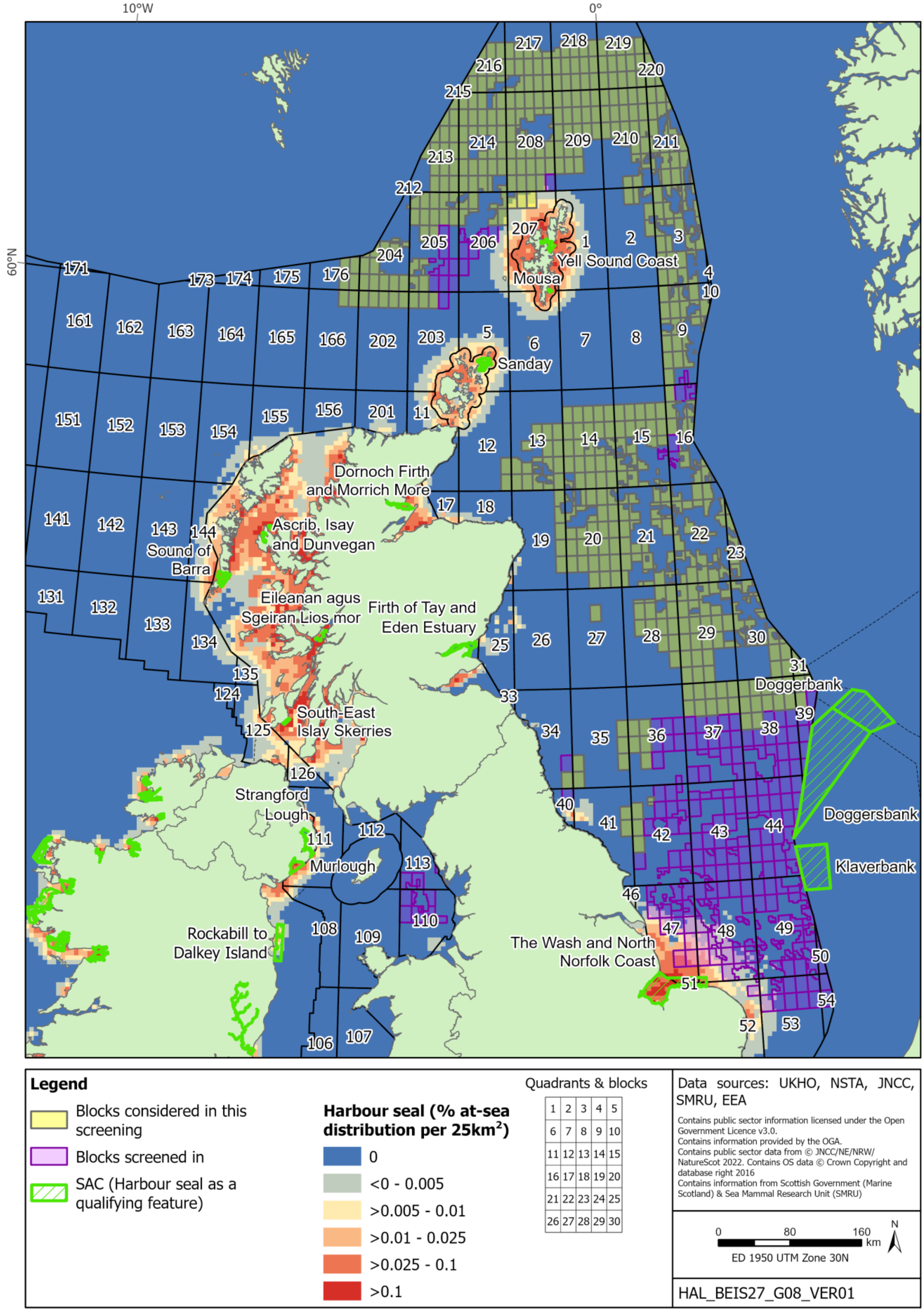
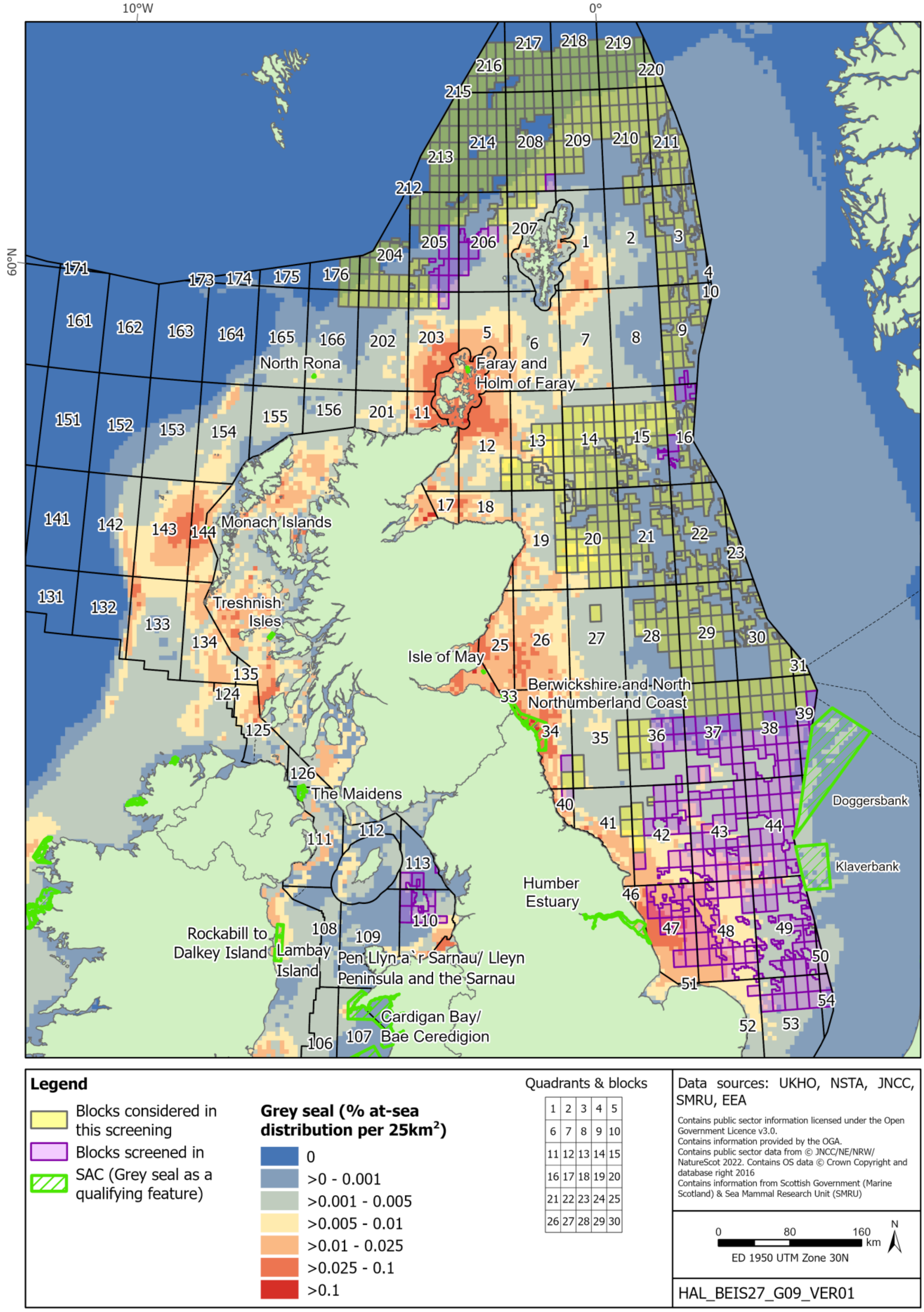


Figure 4.2: Estimated density of grey seals in UK waters



Cetaceans

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). It is seen 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 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 (MUs) have been proposed (IAMMWG 2015, 2021); the North Sea, West Scotland and the Celtic & Irish Seas (Figure 4.3).

Heinänen & Skov (2015) identified discrete and persistent areas of relatively high porpoise density relative to other areas of the UKCS, 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 Special Areas of Conservation (in both inshore and offshore waters) for harbour porpoise were identified primarily based on the work of Heinänen & Skov (2015) in areas for which there was a high level of confidence in the data. These SACs were classified in 2019.

Four of these SACs are within the Celtic and Irish Seas harbour porpoise MU which are: North Channel, North Anglesey Marine, West Wales Marine and Bristol Channel Approaches, and one SAC is located within the North Sea MU (Southern North Sea).

One of the conservation objectives for these sites, that harbour porpoise is a viable component of the site, is concerned with operations that would result in unacceptable levels of impacts on porpoise using the site, defined as those having an impact on favourable conservation status of the population of the species within their natural range. A population for these sites was generated based on SCANS II data (Hammond *et al.* 2013) at the time of designation[47], and was used to grade the populations of the sites relative to the UK management unit populations, however, the animals within the sites are variable, including by season, and are not central place foragers, such that the use of a site population may not be appropriate for its management. The conservation objectives indicate that the reference population for assessments is the MU population within which the SACs are present. In the case of the Celtic and Irish Sea MU, the abundance of animals is estimated to be 62,517 (CV=0.13), or 16,777 (CV=0.2) for the UK sector of the MU. For the North Sea the MU population is estimated to be 346,601 (CV=0.09) or 159,632 (CV=0.12) for the UK sector of the MU (IAMMWG 2022).

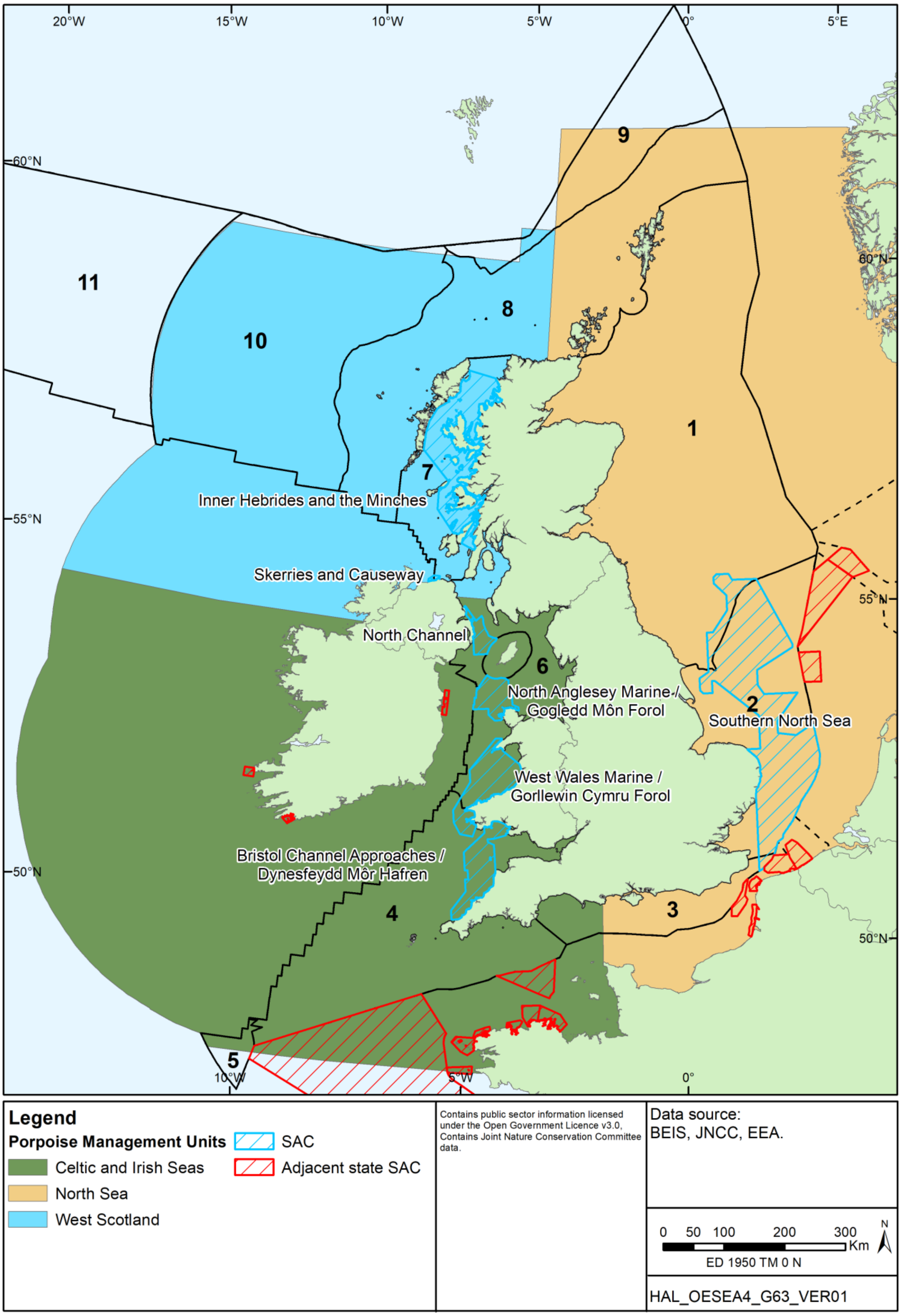
While harbour porpoise are wide-ranging and likely to frequently occur beyond site boundaries (e.g. see Appendix A1.8 of BEIS 2022), these sites encompass large areas of favourable

[47] For example, see the site selection document for North Channel SAC: https://hub.jncc.gov.uk/assets/be0492aa-f1d6-4197-be22-e9a695227bdb#NorthChannel-SAC-Selection-Assessment-Document.pdf and Southern North Sea SAC: https://hub.jncc.gov.uk/assets/206f2222-5c2b-4312-99ba-d59dfd1dec1d#SouthernNorthSea-SAC-selection-assessment-document.pdf

habitat supporting higher densities of the species than other areas of the UKCS, and any interaction with harbour porpoise within the Blocks on offer would be on those which are part of the wider management unit populations. The Department acknowledges NRW's position statement on the use of MMMUs in screening for HRA[48] and other approaches to HRA screening, for example that used in by The Crown Estate in screening sites and related projects for Round 4 wind leasing, however such an approach to screening assumes that the identification of a pathway of effect should be interpreted as a having a likely significant effect on the features related to these pathways. That is not the approach taken here (see Section 4.1). Additionally, this HRA maintains a distinction between the potential for interaction between activities following the licensing of 33rd Round Blocks and individuals outside of site boundaries, and in the case of all cetaceans which are also Annex IV species, such temporary activities are managed by EPS disturbance licences, as referred to in the conservation objectives and advice on operations relating to the above harbour porpoise sites.

[48] https://cdn.cyfoethnaturiol.cymru/media/695250/ps006-mmmus-in-hra-position-statement-may22.pdf

Figure 4.3: Harbour porpoise management units and related SACs in UK and adjacent state waters



Based on available evidence on the distance from noise producing activities or those generating physical disturbance within which effects could occur from exploration activity (Sections 4.4 and 4.5), the distance between the SACs in the Irish and Celtic Seas MU listed above and the Blocks on offer is such that there will be no significant disturbance of the species (i.e. they will not exclude harbour porpoise from the sites), nor will they have an effect on the condition of supporting habitats, processes and availability of prey within those sites[49].

For Southern North Sea SAC, 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. It is not considered necessary to screen in any additional Block-site combinations for harbour porpoise based on the above discussion.

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). Within UK waters, the only SACs where bottlenose dolphin is a qualifying feature lie within the Irish Sea and coastal east Scotland MUs (Figure 4.4).

With regard to the MU for bottlenose dolphin in the coastal regions of east of Scotland and the Moray Firth SAC (the only site designated for this population), the range of this population extends well beyond the boundaries of the SAC as animals use waters off the southern Moray Firth, Grampian and Fife coasts (Cheney *et al*. 2013), with sightings also taking place off the coast of northeast England[50]. 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 2009-2019, and represent, on average, 53% of the total estimated east coast population (Arso Civil *et al*. 2019, 2021).

Sightings of several distinctive individuals from the coastal east Scotland population have also been reported in non-UK waters[51]: 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

[49] Refer to Conservation Objectives 2 and 3: https://hub.jncc.gov.uk/assets/f4c19257-2341-46b3-8e29-49665cd8f3d2#NorthAnglesey-Conservation-Advice.pdf, https://hub.jncc.gov.uk/assets/029e40f3-5f67-4168-b10d-8730f2c40e0a#WWM-conservation-advice.pdf, https://hub.jncc.gov.uk/assets/505b3bab-a974-41e5-991c-c29ef3e01c0a#BCA-ConsAdvice.pdf

[50] https://www.seawatchfoundation.org.uk/recentsightings/; citizenfins: a project combining research and citizen science to improve understanding of bottlenose dolphin movements along east coasts of Scotland and England.

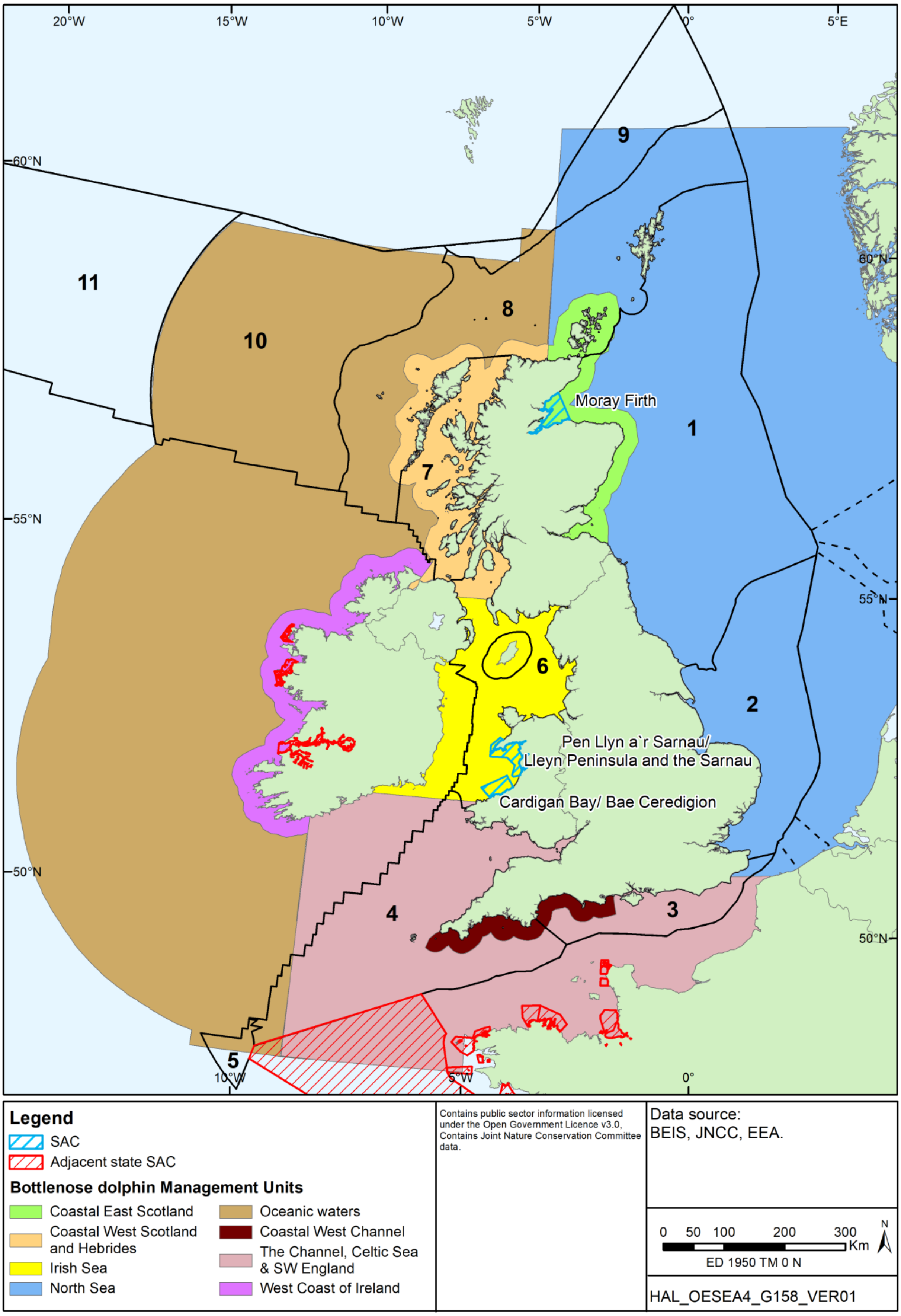
[51] https://www.abdn.ac.uk/lighthouse/blog/international-sightings/

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. The Blocks offered are too distant from the East Coast bottlenose dolphin management unit, the Firth of Tay or north east England for there to be a foreseeable interaction with the bottlenose dolphin population of the Moray Firth SAC.

Bottlenose dolphins are the second most frequently recorded species in the Irish Sea, with a predominantly coastal distribution and particularly high concentrations off west Wales and off the coast of Co. Wexford in southeast Ireland. While effort-related sightings are few in the northern Irish Sea, the species is regularly sighted in summer off the Galloway coast of south-west Scotland and around the Isle of Man (Hammond *et al.* 2005, Baines & Evans 2012). The importance of Cardigan Bay to this species has long been recognised. Relevant SACs for the Irish Sea MU for bottlenose dolphins, which includes the entire Irish Sea, includes the Lleyn Peninsula and the Sarnau SAC and Cardigan Bay SAC to the south of the Blocks on offer, which are both in "favourable" condition (NRW 2018).

The wider movements of dolphins associated with these two sites are not well known, and occasional sightings throughout much of the Irish Sea coast suggest that some animals may range widely throughout the region (Baines & Evans 2012). However, regular sightings at rates comparable to those from land- and vessel-based surveys in Cardigan Bay, combined with extensive matches of individuals with those observed in Cardigan Bay indicate that coastal waters around the north and east coast of Anglesey are important for animals associated with these two SACs (Pesante *et al.* 2008, Baines & Evans 2012, Evans *et al.* 2015). It is apparent that a large proportion of this population spend the winter in waters off north Wales, whilst smaller numbers can be seen in this area throughout the year (Pesante *et al.* 2008). Photo ID has confirmed the waters around the Isle of Man to represent the northern range limit of the Cardigan Bay population (Feingold & Evans 2014), but is likely to extend further (Lohrengel *et al.* 2018). Available information suggests that while some individuals associated with the Cardigan Bay SAC and Llyn Peninsula and Sarnau the SAC may be present in the wider Irish Sea management unit for the species, and within the Blocks on offer, but in smaller numbers relative to the site. Analogous to the information provided in relation to harbour porpoise, this HRA maintains a distinction between the potential for interaction between activities following the licensing of 33rd Round Blocks and individuals outside of site boundaries, and in the case of all cetaceans which are also Annex IV species, such temporary activities are managed by EPS disturbance licences.

Figure 4.4: Bottlenose dolphin management units and related SACs in UK and adjacent state waters



4.6.3 Fish

Of those fish listed under Annex II of the Habitats Directive, only Atlantic salmon, sea lamprey and river lamprey are qualifying species of sites relevant to the 33rd Round blocks on offer.

Given their widespread and transient presence offshore, potential exploration activity in the 33rd 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 duration of the initial term (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 a consideration of the potential for in-combination effects to result for relevant sites from the interaction of exploration/appraisal activities associated with the 33rd Licence Round, with other marine plans, programmes and activities.

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."* Marine plans have been adopted in England and Scotland which cover all of the 33rd Round Blocks on offer. To date, whilst the marine plans acknowledge the potential interactions between activities and map these, indicate key resource areas and provide policy context and direction in relation to potential activity interactions, they are not spatially prescriptive and provide a limited indication of the location of possible future development, how co-location may be accommodated, or any form of activity prioritisation. The uncertainty over the scale and timing of activities which could follow licensing of 33rd Round Blocks and the activities resulting from other plans and programmes is recognised. Using a GIS, the 33rd Round Blocks offered are considered in the context of areas of activity and proposals for a range of marine activities/potential activities including:

- Oil and gas licences, and oil and gas infrastructure (Figure 5.8 and Figure 5.9),
- Leases/licences or Agreements for Lease for hydrocarbon and carbon gas storage (Figure 5.8 and Figure 5.9)
- Marine renewable energy developments, zones and related cables/cable agreement areas, and offshore interconnectors (Figure 5.10 and Figure 5.11)
- Telecommunications cables (Figure 5.10 and Figure 5.11)
- Marine aggregate extraction (Figure 5.10 and Figure 5.11)
- Shipping density (Figure 5.12)
- 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 national network sites (see Section 5).

5 Screening

5.1 Screening of potential effects of 33rd Round Block activities

The screening of the sources of impact from exploration and appraisal activities which could follow licensing of the 33rd Round Blocks (as described in Section 4) were applied to the relevant SPA and SAC sites and considered in the context of mobile species when not within site boundaries. This led to the identification of a number of site/Block combinations for which likely significant effects could not be discounted at the screening stage. Figure 5.1 to Figure 5.7 illustrate these initial screening results as paired maps showing the Blocks offered 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									
203/4	205/14	205/19	205/23b	205/23c	205/24b	205/25	205/28	205/29	205/30
206/11c	206/11d	206/12b	206/13b	206/14	206/16	206/17	206/21	208/30	
Central and Northern North Sea									
9/27c	9/28b	15/20d	15/25c	16/2	16/16	16/3d	16/4	16/21e	
Southern North Sea									
34/25	36/13	36/14	36/15	36/18	36/19	36/20	36/23	36/30c	37/11
37/12	37/13	37/14	37/15	37/16	37/17	37/18	37/19	37/20	37/22b
37/23b	37/24	37/25	37/26	37/27	37/30a	38/13	38/14	38/15	38/16
38/17	38/18	38/19	38/20	38/21a	38/22a	38/23b	38/24	38/25	38/26
38/27b	38/28b	38/29	38/30	39/7	39/11	39/12	39/16	39/17	39/21
39/26	40/5	42/3	42/4	42/5c	42/8	42/9b	42/10b	42/12b	42/13c
42/13d	42/14	42/15b	42/20a	42/21	42/24	42/25	42/28f	42/28i	42/28j
42/29c	42/30b	42/30c	43/2b	43/3b	43/4b	43/5	43/6	43/9	43/10
43/12a*	43/13*	43/14*	43/15b	43/16	43/17*	43/18*	43/19c	43/19d*	43/1b
43/20c*	43/21*	43/22b	43/22c	43/23	43/24b	43/24c	43/25	43/26b	43/27b
43/27c	43/28	43/29	43/30	44/1	44/2b	44/3b	44/4	44/5	44/6
44/8	44/9	44/10	44/11c	44/12b	44/13	44/14	44/15	44/16*	44/17*
44/18a	44/19b	44/21	44/22	44/23a	44/24c	44/25*	44/26d	44/27	44/28
44/29a	44/30c	44/7	45/1	47/2c	47/3j	47/3k	47/4d	47/5b*	47/7b
47/8a	47/9a	47/10c	47/13	47/14	47/15	47/20	47/24	47/25	48/1*
48/2b*	48/3	48/4	48/5	48/6b	48/6c	48/7d	48/7e	48/10	48/11b
48/12a	48/13b	48/14d	48/15b	48/16	48/17d	48/18c	48/19e	48/20c	48/21
48/22a	48/23c	48/24	48/25c	48/25d	48/28b	48/29b	48/29c	48/30b	48/30c
49/1	49/2	49/3b	49/4f	49/5d	49/6b	49/7	49/9f	49/10e	49/11b
49/12c	49/13a	49/14a	49/15b	49/16d	49/17c	49/18b	49/18c	49/19c	49/20c
49/21b	49/21d	49/22d	49/23b	49/23c	49/24b	49/24c	49/25b	49/26b	49/27c
49/28c	49/29	49/30b	50/16	50/21	50/26	52/5b	52/5c	53/3	53/4
53/5c	53/6	53/7	53/8	53/9	53/10	53/2c	54/1	54/6	

Eastern Irish Sea									
110/1	110/2d	110/3b	110/6	110/7b	110/8b	110/9a	113/24	113/26c	113/27c

Notes: * Block identified as SNS Priority Cluster by NSTA

5.2 Screening for potential in-combination effects

All blocks offered as part of the 33rd Seaward Licensing Round, including those screened in (above), 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 OESEA4 (BEIS 2022)[52] 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 Blocks being offered for licensing, any such effects are expected to be primarily from other offshore energy activity, specifically offshore wind in the eastern Irish Sea, and central and southern North Sea.

Figure 5.8 and Figure 5.9 illustrate the spatial relationship between existing oil and gas licences, Agreements for Lease (AfL) for carbon dioxide storage and gas storage licences, the relevant sites, as well as the 33rd Round Blocks on offer. Existing controls on exploration and appraisal operations, and their likely intensity (see Section 2), suggest that significant in-combination effects of existing licensed areas and those proposed for licensing in the 33rd Round on relevant sites are not likely. Based on the lack of or limited spatial overlap of other licences and oil and gas 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 national network sites are not likely to occur.

The oil industry is planning the decommissioning of mature oil and gas fields that overlap a number of 33rd Round Blocks, or are implementing decommissioning plans which involve offshore activities (e.g. for well plug and abandonment and infrastructure removal)[53]. This includes plans for fields and related infrastructure in areas where blocks have been offered, including those in quadrants 9 (Frigg, Harding), 14 (Athena, Goldeneye), 16 (Brae and East Brae), 29 (Curlew), 30 (Janice), 43 (Cavendish), 44 (Tyne South, Schooner and Ketch), 47/48 (Pickerill, Guinevere, Audrey, Anglia, Amethyst, Hewett), 49 (LOGGS and Viking/Vulcan//Valiant/Vanguard/Indefatigable facilities, Wenlock, Thames, Windermere, Leman), and 110 (Morecambe). Some of these projects are adjacent to or coincide with relevant sites. These include Liverpool Bay SPA, Southern North Sea SAC, Dogger Bank SAC, North Norfolk Sandbanks and Saturn Reef SAC and Haisborough, Hammond and Winterton SAC. All of these sites have already been screened in to the second stage of HRA where the potential for significant in-combination effects from the above, and any further decommissioning programmes, would be assessed.

The lease/licence covering the Rough gas storage facility is adjacent to Blocks 47/3k and 47/8a. Storage ceased at the field 2017, but a new licence to store gas was approved in July

52 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
53 See: https://www.gov.uk/guidance/oil-and-gas-decommissioning-of-offshore-installations-and-pipelines and https://www.nstauthority.co.uk/supply-chain/energy-pathfinder/

2022[54], and storage is once more taking place. The current phase of activity only involves storage using existing wells, pipelines and installations. A gas storage licence was awarded in April 2023 covering the depleted Bains gas field in Block 110/3b in the eastern Irish Sea; the proposed work programme is only for desk based studies. Given the limited offshore facilities and operations associated with Rough, and the absence of information on potential future field operations relevant to the Bains gas storage licence, significant in-combination effects are unlikely in the context of the nature and scale of potential activities associated with 33rd Round Block licensing.

A number of Blocks overlap part or all of existing carbon dioxide storage licences (Eastern Irish Sea, Southern North Sea) or licences provisionally awarded as part of the 1st carbon dioxide storage licensing round (central North Sea and southern North Sea), see Figure 5.8 and Figure 5.9. Of the licences already issued in the southern North Sea, the work programmes for CS001, CS005, CS006, CS007, indicate that a Storage Permit should be applied for by 2024, 2025, 2027, 2029 respectively. For licence CS004, located in the Irish Sea, a permit application is to be made by 2024. The storage permit application can only be made once the storage site has been appropriately characterised and assessed, and the design concept for the project has been selected (i.e. appraisal activities have concluded). At this stage, the timing and nature of any development in these licence areas is not known, and the potential for interaction with 33rd Round activities is limited in terms of the scale of the licence areas relative to exploration/appraisal activity for both oil and gas, and carbon dioxide storage, and also temporally, as such activities are short-term (Table 2.2) and could occur within a relatively large time period (e.g. up to nine years for an Initial Term). In the southern North Sea, a number of the licence areas and provisional awards following the 1st carbon dioxide storage round overlap with sites including the Dogger Bank SAC, Southern North Sea SAC, the North Norfolk Sandbanks and Saturn Reef SAC, the Greater Wash SPA, Inner Dowsing, Race Bank and North Ridge SAC, and Haisborough, Hammond and Winterton SAC, which are either sensitive to the effects of physical disturbance/presence or underwater noise. A number of site features (e.g. the Annex I sandbanks within Dogger Bank SAC, North Norfolk Sandbanks and Saturn Reef SAC, and Inner Dowsing, Race Bank and North Ridge SAC) are judged to be in unfavourable condition, and there is the potential for likely in-combination effects from physical disturbance. All of these sites have already been screened in for further consideration in the AA for the 33rd Round, subject to relevant Blocks being applied for (see Appendix B). The potential for in-combination effects of 33rd Round licensing with carbon dioxide storage licensing will be considered further in the AA.

Figure 5.10 and Figure 5.11 show marine renewable energy development areas, relevant sites and the 33rd Round Blocks. A number of the Blocks overlap with renewable energy developments (either planned or operational), and with relevant sites, particularly in the southern North Sea and eastern Irish Sea. For example, a number of Blocks overlap the Dogger Bank A, B C and Sofia projects, Hornsea projects One, Two, Three and Four, Race Bank, Triton Knoll, Sheringham and Dudgeon (including extensions), Norfolk Vanguard and Boreas, and East Anglia Three, Walney and West of Duddon Sands. Additionally, Blocks partly overlap all of the preferred Round 4 projects in the southern North Sea and Irish Sea. Many of these wind farms are relevant to sites which have been screened in for further assessment, including Dogger Bank SAC, Southern North Sea SAC, Inner Dowsing, Race Bank and North Ridge SAC, Greater Wash SPA and North Norfolk Sandbanks and Saturn Reef SAC, and Liverpool Bay SPA. Proposed cable corridors for a number of projects (e.g.

[54] https://www.nstauthority.co.uk/licensing-consents/gas-storage-and-unloading/, https://www.nstauthority.co.uk/news-publications/news/2022/nsta-awards-rough-gas-storage-licence-to-centrica-offshore-uk-ltd-in-first-stage-of-potential-reopening/

Hornsea Project Three) cross 33rd Round Blocks on offer and relevant sites. Wind farm HRA at the plan (Round 4[55], 2017 wind farm extensions[56]) and project (Hornsea Project Three[57]) level have identified adverse effects for sites including the Dogger Bank SAC and North Norfolk Sandbanks and Saturn Reef SAC from permanent changes to the habitat extent and distribution, requiring mitigation and compensatory measures, or in the case of the 2017 extensions, the decision not to progress the Race Bank extension project. For the other extensions assessed at the plan level, a cable route protocol to avoid or reduce significant effects from physical disturbance was 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. As noted above, the condition of Annex I habitats including sandbanks and reefs relating to the above sites (e.g. Dogger Bank SAC, North Norfolk Sandbanks and Saturn Reef SAC) are unfavourable, with impacts from demersal fishing, aggregate extraction, and offshore energy related activity, noted as contributing factors. While progress is being made on reducing the fisheries pressures on these sites (see below), should a drilling commitment be made for any of the Blocks offered in relation to these sites, there is the potential for in-combination effects. This will be considered in the 33rd Round AA, once the blocks applied for and related indicative works programmes are known.

A HRA has been published as part of a review of consents (RoC) for offshore wind farms identified to have a likely significant effect on the Southern North Sea SAC, the conclusions of which are that, with agreed mitigation measures, the construction of wind farms (including Dudgeon, Hornsea Project One and Two, East Anglia One, Triton Knoll, and Dogger Bank A, B, C and Sofia) will not result in an adverse effect on site integrity, including in-combination with oil and gas related activity, in particular seismic survey[58]. This will be considered as part of the in-combination effects assessment of the second stage of HRA where appropriate, and the Southern North Sea SAC has been screened in for a number of the Blocks offered (Figure 5.3 and Figure 5.7). Relevant wind farm development consent applications submitted following this RoC are expected to be subject to HRA in due course. A RoC process has also commenced for SPAs[59] which include sites and projects of relevance to this assessment (and in particular offshore wind) in the Irish Sea and southern North Sea, including Liverpool Bay SPA and the Greater Wash SPA. The screening stage of the HRA has been concluded and the AA process is ongoing.

Leasing rounds for further offshore wind are presently in planning in parts of Scottish waters[60] and are relevant to this HRA. The Scottish Government are in the process of progressing the

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[55] https://www.marinedataexchange.co.uk/details/3582/2022-the-crown-estate-2020-offshore-wind-round-4-plan-habitats-regulations-assessment/
[56] https://www.marinedataexchange.co.uk/details/628/2019-the-crown-estate-2017-offshore-wind-extensions-plan-habitats-regulations-assessment-hra/
[57] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-003267-EN010080%20Hornsea%20Three%20-%20Habitats%20Regulations%20Assessment.pdf and see: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010080/EN010080-003646-Hornsea%20Three%20SBIP%20Letter%20-%2013%2004%2022.pdf
[58] https://www.gov.uk/government/consultations/southern-north-sea-review-of-consents-draft-habitats-regulations-assessment-hra
[59] https://www.gov.uk/government/consultations/review-of-consents-for-major-energy-infrastructure-projects-and-special-protection-areas, https://www.gov.uk/government/publications/review-of-consents-for-major-energy-infrastructure-projects
[60] https://www.gov.scot/publications/initial-plan-framework-sectoral-marine-plan-offshore-wind-innovation-targeted-oil-gas-decarbonisation-intog/

Sectoral Marine Plan for Offshore Wind for Innovation and Targeted Oil and Gas Decarbonisation (INTOG). A number of areas of search were identified and subject to consultation, with the plan targeting future offshore wind leasing specifically to help decarbonise offshore oil and gas production. 13 projects were offers exclusivity agreements following the closure of the leasing round, and a number of these overlap Blocks in the central North Sea which have not been screened in (Figure 5.10). The timing and nature of any developments that follow the signing of exclusivity agreements for the INTOG projects are unknown but likely significant in-combination effects have not been identified at this stage.

The cable routes which may be used to take power to shore for future offshore wind farms are highly uncertain. The Offshore Transmission Network Review (OTNR) was initiated in 2020 and has the aim of coordinating offshore grid connections and having a more strategic approach to offshore transmission that is considered holistically with the onshore network to deliver greater coordination and reduce cumulative effects[61]. The review has three work streams covering Early Opportunities, the Pathway to 2030 and the Enduring Regime. The Holistic Network Design (HND) is part of the Pathway to 2030 work stream and was published in July 2022. The HND largely relates to projects which are at an early development stage, including those from Round 4 and ScotWind leasing, and some in the Celtic Sea. While the HND includes recommendations for the optimal transmission network, the detailed network design will provide more information on the specific routes for offshore cabling. There is insufficient detail at present to meaningfully consider the in-combination effects of potential future cable routes for projects at an early consenting stage.

This screening has already identified a number of sites which should be subject to AA for those Blocks offered which overlap a number of proposed or operating wind farms. Any further information relating to the proposed Round 4 wind farms or updates to any other wind farm in the planning process will be considered as part of the in-combination effects assessment of the second stage of HRA, AA, where appropriate.

A range of cables traverse 33rd Round Blocks offered, which include renewables export cables, electricity interconnectors and telecommunications cables (Figure 5.10 and Figure 5.11). The surface area of these is extremely small, and they are well-charted features which are readily avoided during exploration or appraisal activities. A range of interconnector projects are either in planning, or at an early stage of development or are under construction, which are of relevance. These include NorthConnect (Blocks in Quads 15, 16, 19 and 20), Eastern HVDC Link (Blocks in Quads 41 and 42), Viking Link (Blocks in Quads 43, 44, 47 and 48) and the Continental Link multi-purpose interconnector (the details of this project are not yet well defined but may interact with Blocks offered off the Yorkshire coast). While these projects have proposed installation and commissioning dates within the timeframe in which offshore activities associated with the initial term of any licences awarded could take place, some remain at a pre-planning or feasibility stage (e.g. Continental Link). It is not considered that any additional Blocks on offer 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 sites and Blocks offered are shown in Figure 5.11. A number of Blocks overlap licensed aggregate extraction production areas in the southern

[61] https://www.gov.uk/government/groups/offshore-transmission-network-review

North Sea, including those in Quad 47, 48, 49, 52, 53 and 110[62]. Should any of the Blocks in these quads which overlap or are adjacent to aggregate production, option or exploration areas be applied for, the potential for significant in-combination effects on national network sites with these areas would be assessed.

Figure 5.12 illustrates the spatial relationship between the density of navigation in UK waters, relevant sites and the 33rd Round Blocks on offer. The Blocks coincident with areas of elevated navigation density in or in proximity to relevant 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 publicly available data does not include all fishing activity. Fishing and particularly bottom trawling has historically contributed to seabed disturbance over extensive areas. The updated UK assessment as part of the UK Marine Strategy indicated that while there have been some improvements in commercial fish stocks, there remain issues such that Good Environmental Status (GES) will not be achieved on target[63]. 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[64], also see the proposed updated programme of measures for the UK's Marine Strategy[65]), the effects of fisheries are likely to be reduced and therefore some improvement in benthic habitats could be expected[66]. A number of byelaws have recently been imposed on conservation sites which effectively prohibit the use of certain gears in all or part of certain SACs, including the Dogger Bank SAC and The Inner Dowsing, Race Bank and North Ridge SAC[67]. It is noted that the MMO are pursuing further fisheries restrictions through bylaws for certain conservation sites/features, which is subject to a call for evidence[68]; of most relevance to this assessment is the North Norfolk Sandbanks and Saturn Reef SAC. Similarly, a number of management measures incorporating the prohibition of demersal towed or static gears in areas of Annex I habitat have been previously proposed for sites in Scottish waters, including the Scanner Pockmark SAC and Braemar Pockmarks 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/appraisal activity (see Section 4.3), and

62 See also the 2021/22 marine aggregate tender round for which a number of preferred areas have been identified. These are provisional subject to the outcome of HRA. https://www.thecrownestate.co.uk/en-gb/media-and-insights/news/2022-the-crown-estate-confirms-areas-selected-for-202122-marine-aggregates-tender-round/

63 https://www.gov.uk/government/publications/marine-strategy-part-one-uk-updated-assessment-and-good-environmental-status

64 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

65 https://www.gov.uk/government/consultations/marine-strategy-part-three-programme-of-measures

66 https://www.gov.uk/government/publications/marine-strategy-part-three-uk-programme-of-measures

67 https://www.gov.uk/government/publications/the-inner-dowsing-race-bank-and-north-ridge-special-area-of-conservation-specified-areas-prohibited-fishing-gears-byelaw-2022, https://www.gov.uk/government/publications/the-dogger-bank-special-area-of-conservation-specified-area-bottom-towed-fishing-gear-byelaw-2022

68 https://www.gov.uk/guidance/marine-conservation-byelaws#new-mmo-byelaws https://consult.defra.gov.uk/mmo/call-for-evidence-stage-2/

other activities including offshore renewables which are subject to statutory environmental impact assessment and where appropriate, an HRA. All of the Blocks offered in, or within 10km of sites designated for Annex I habitats, have been screened in to the second stage of HRA, where the potential for significant cumulative and in-combination effects on national network 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.

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

West of Shetland **Mid North Sea High and Southern North Sea**

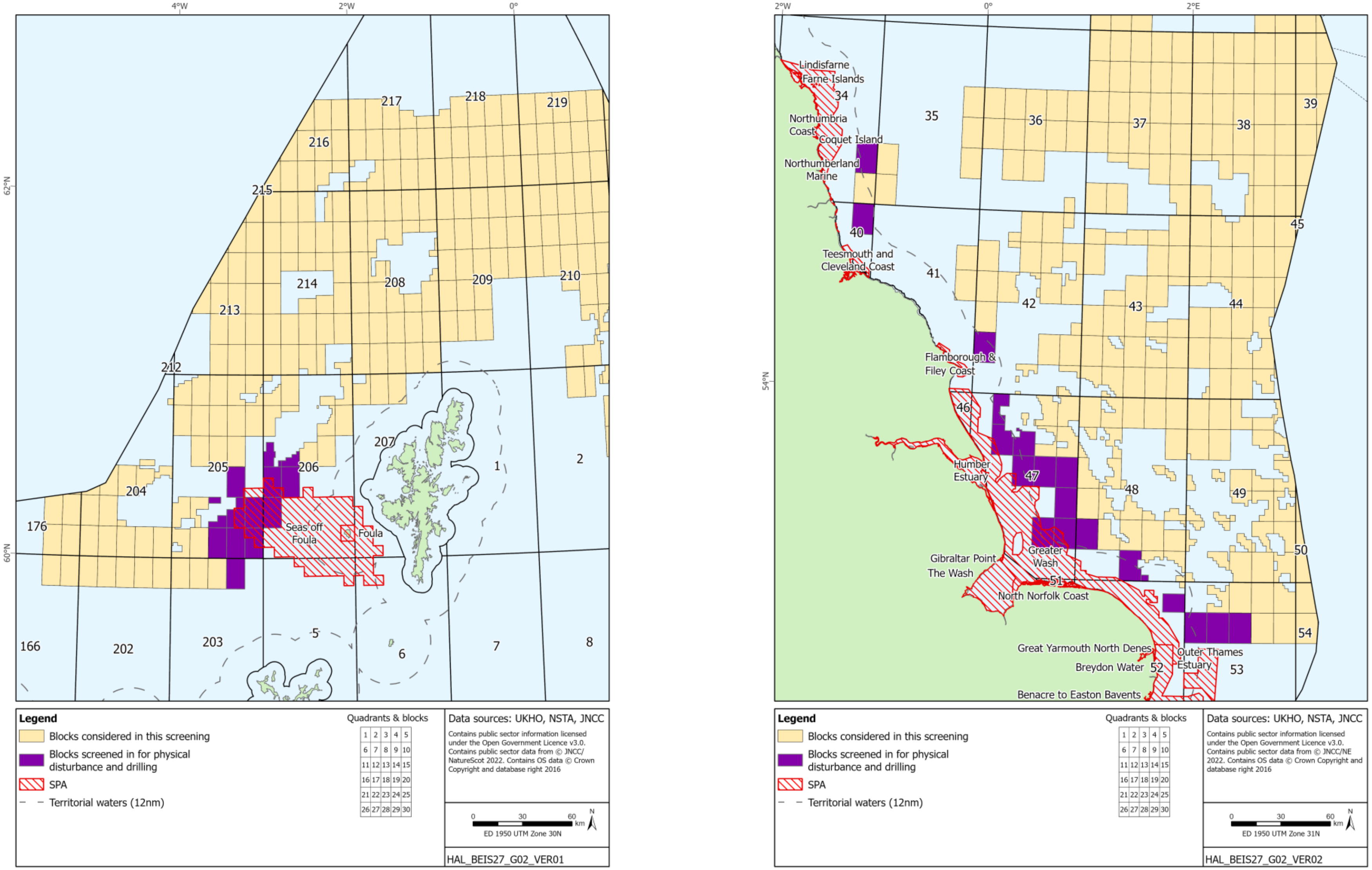


Figure 5.2: Physical and drilling effects – Blocks offered and SPAs screened in: Irish Sea

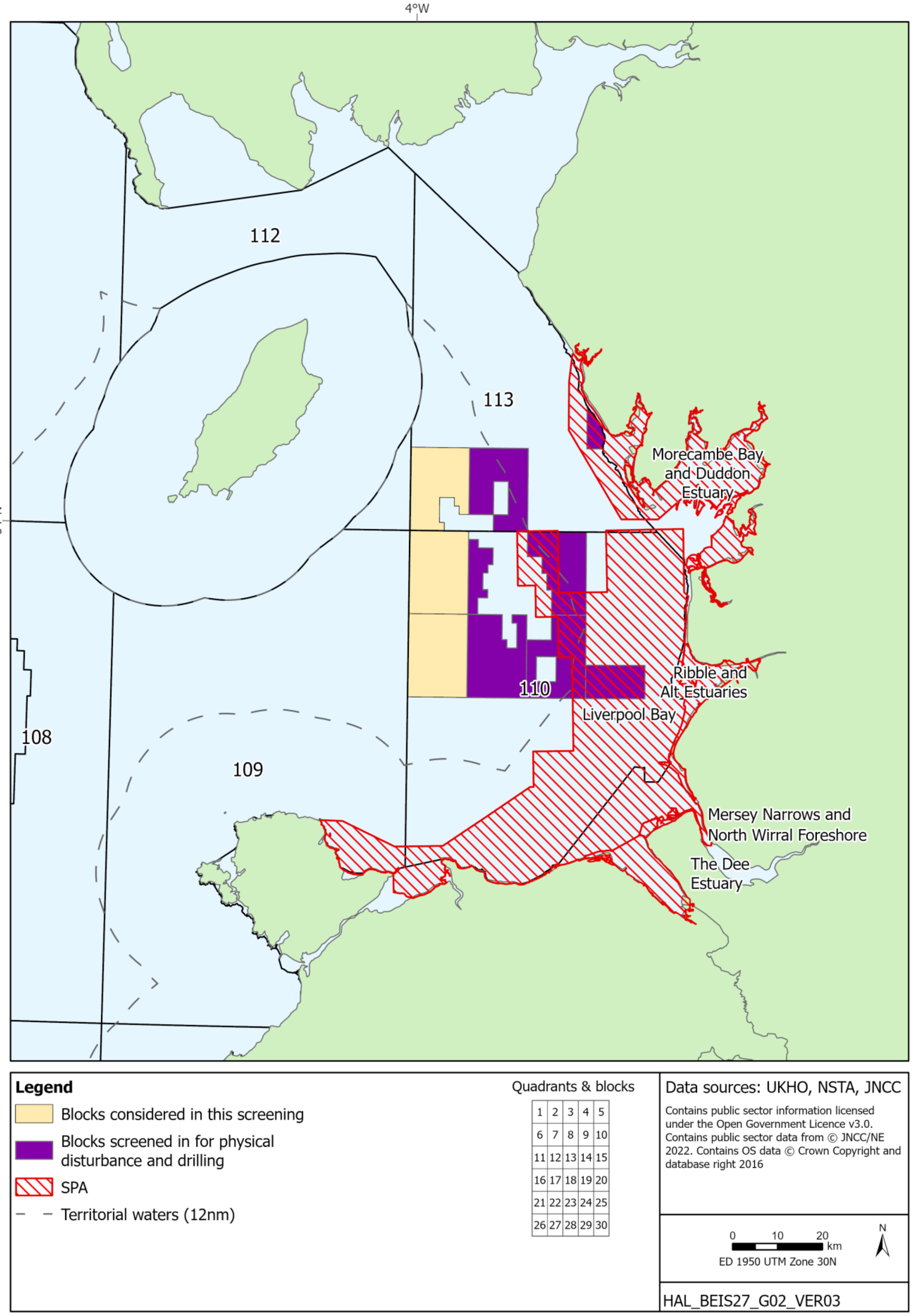
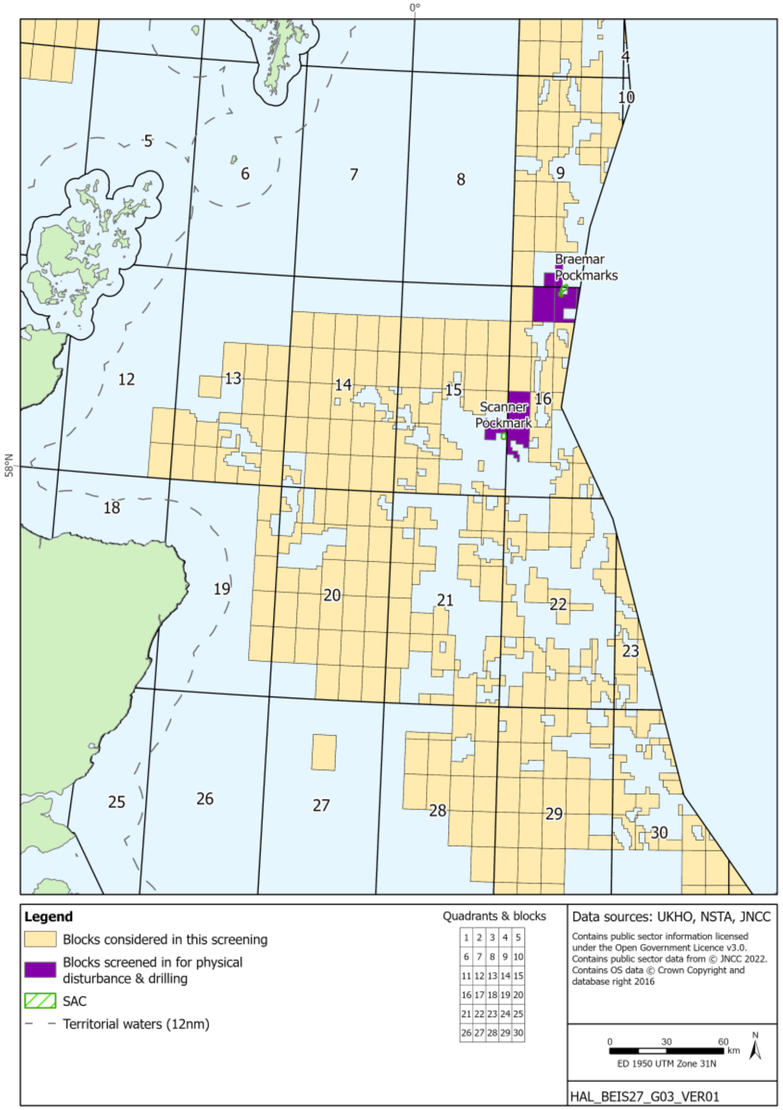


Figure 5.3: Physical and drilling effects – Blocks offered and SACs screened in

Central North Sea



Mid North Sea High and Southern North Sea

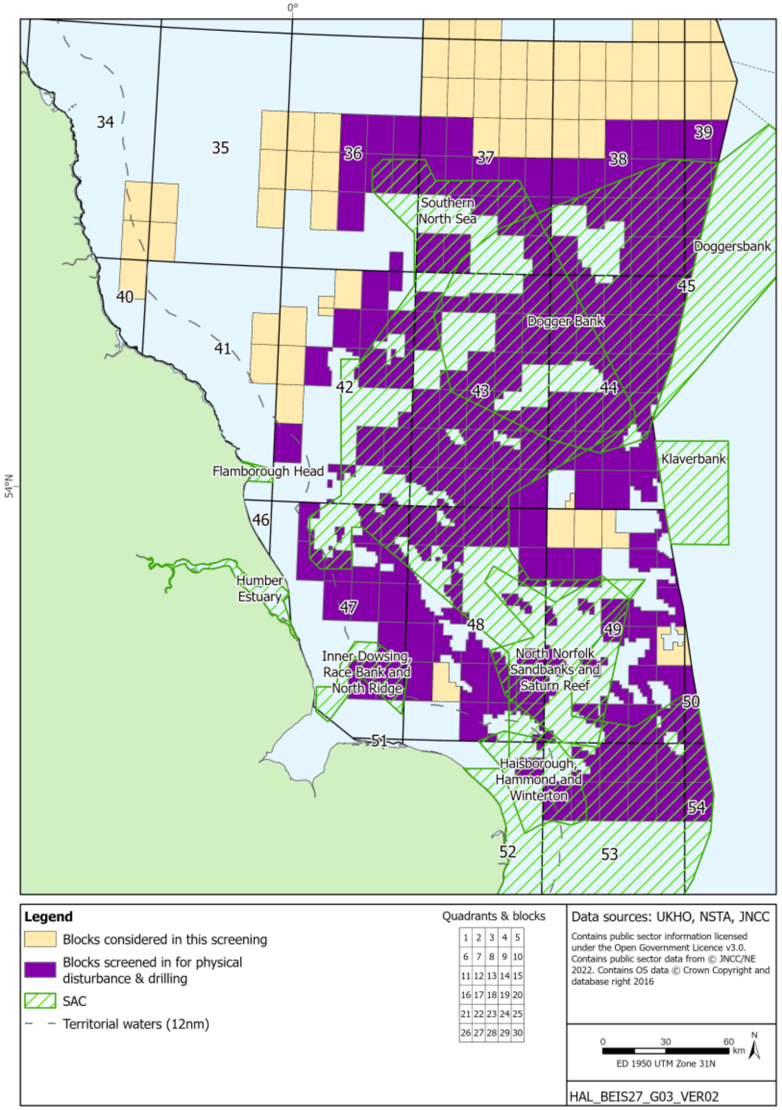


Figure 5.4: Physical and drilling effects – Blocks offered and SACs screened in: Irish Sea

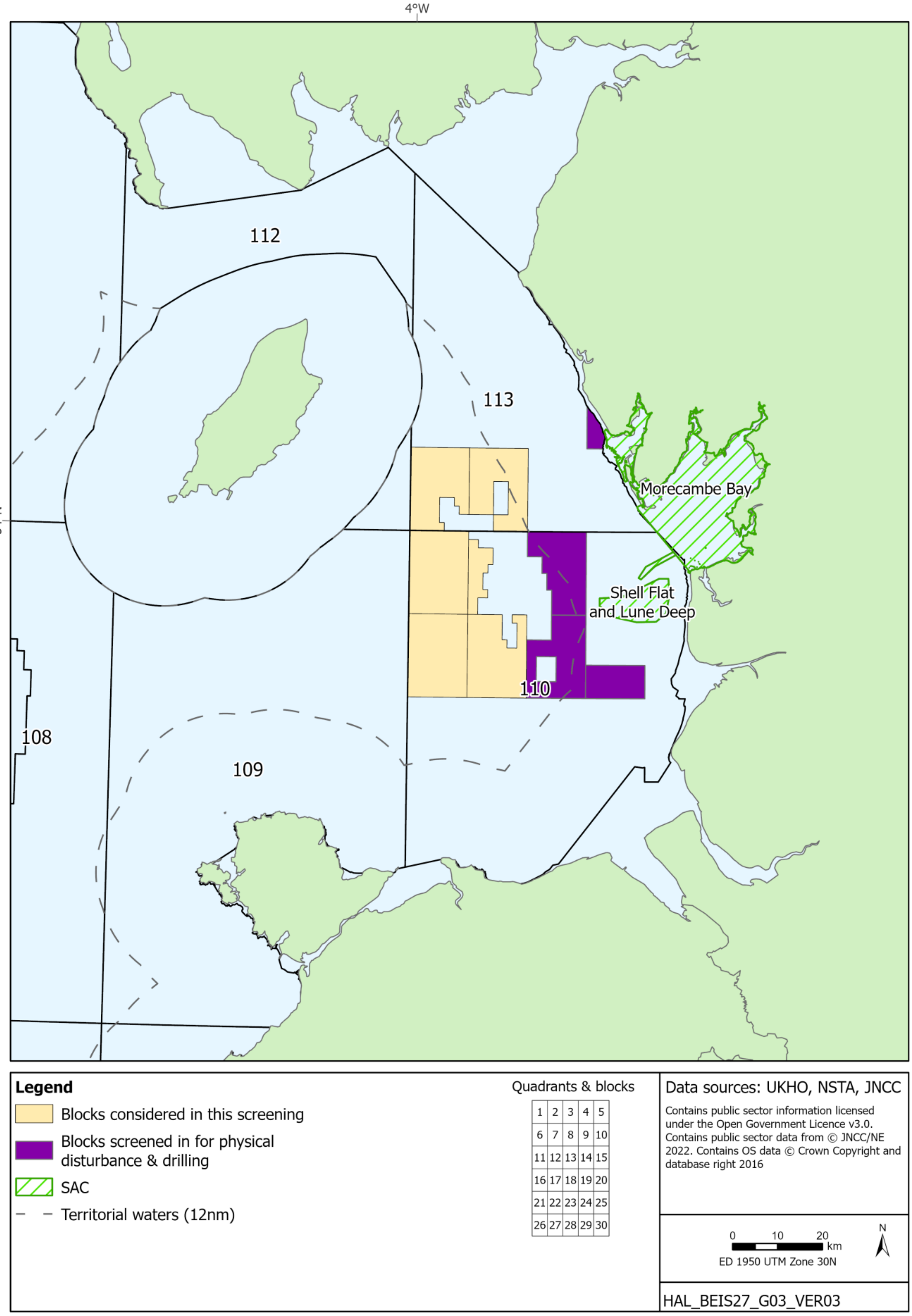
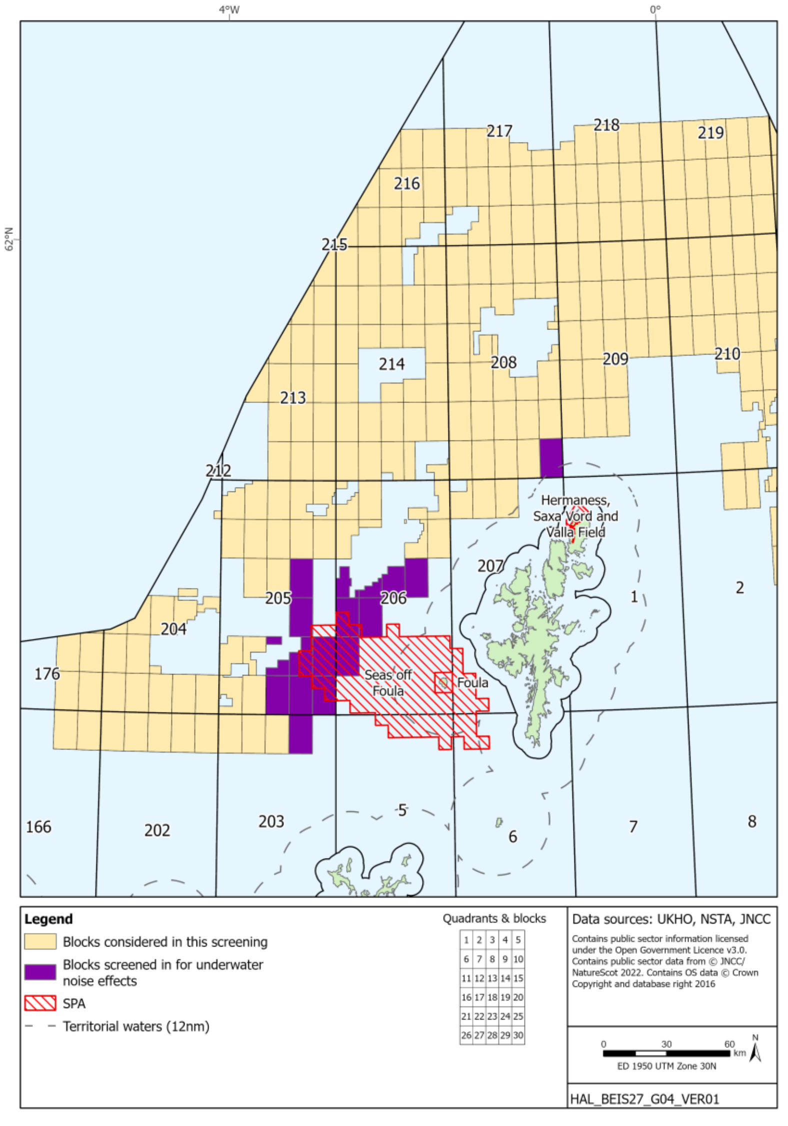


Figure 5.5: Underwater noise effects – Blocks offered and SPAs screened in

West of Shetland



Mid North Sea High and Southern North Sea

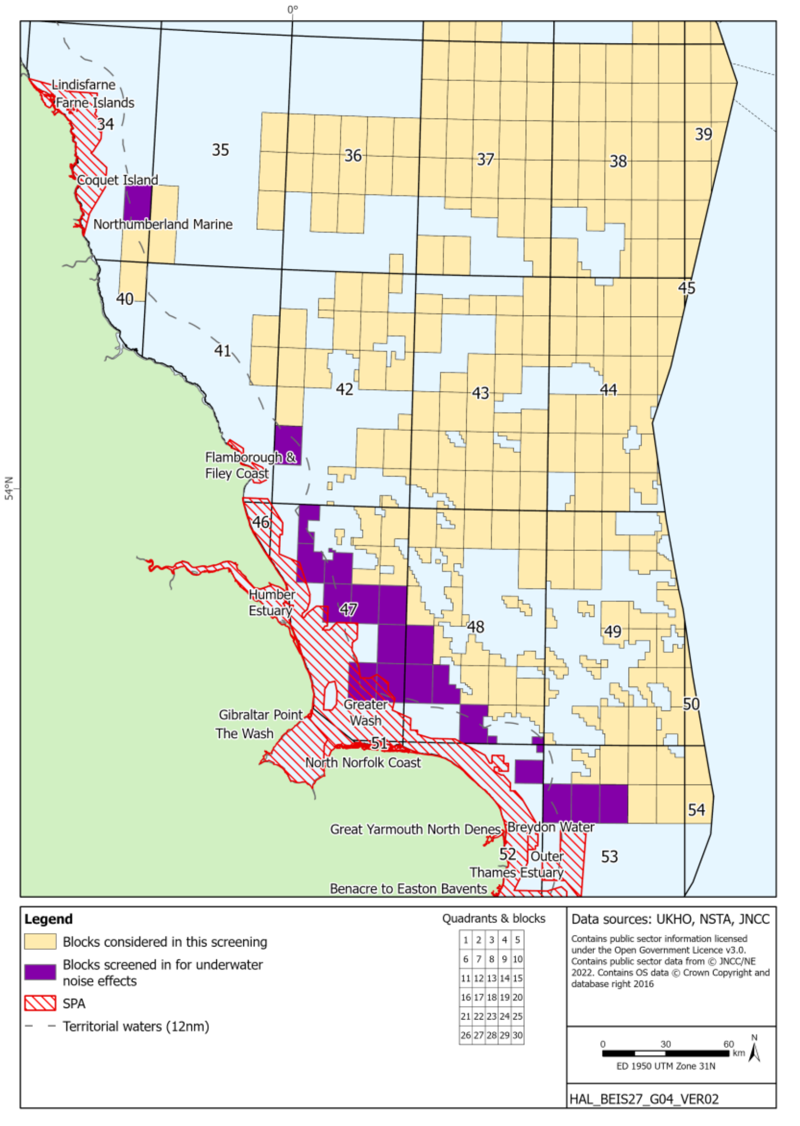


Figure 5.6: Underwater noise effects – Blocks offered and SPAs screened in: Irish Sea

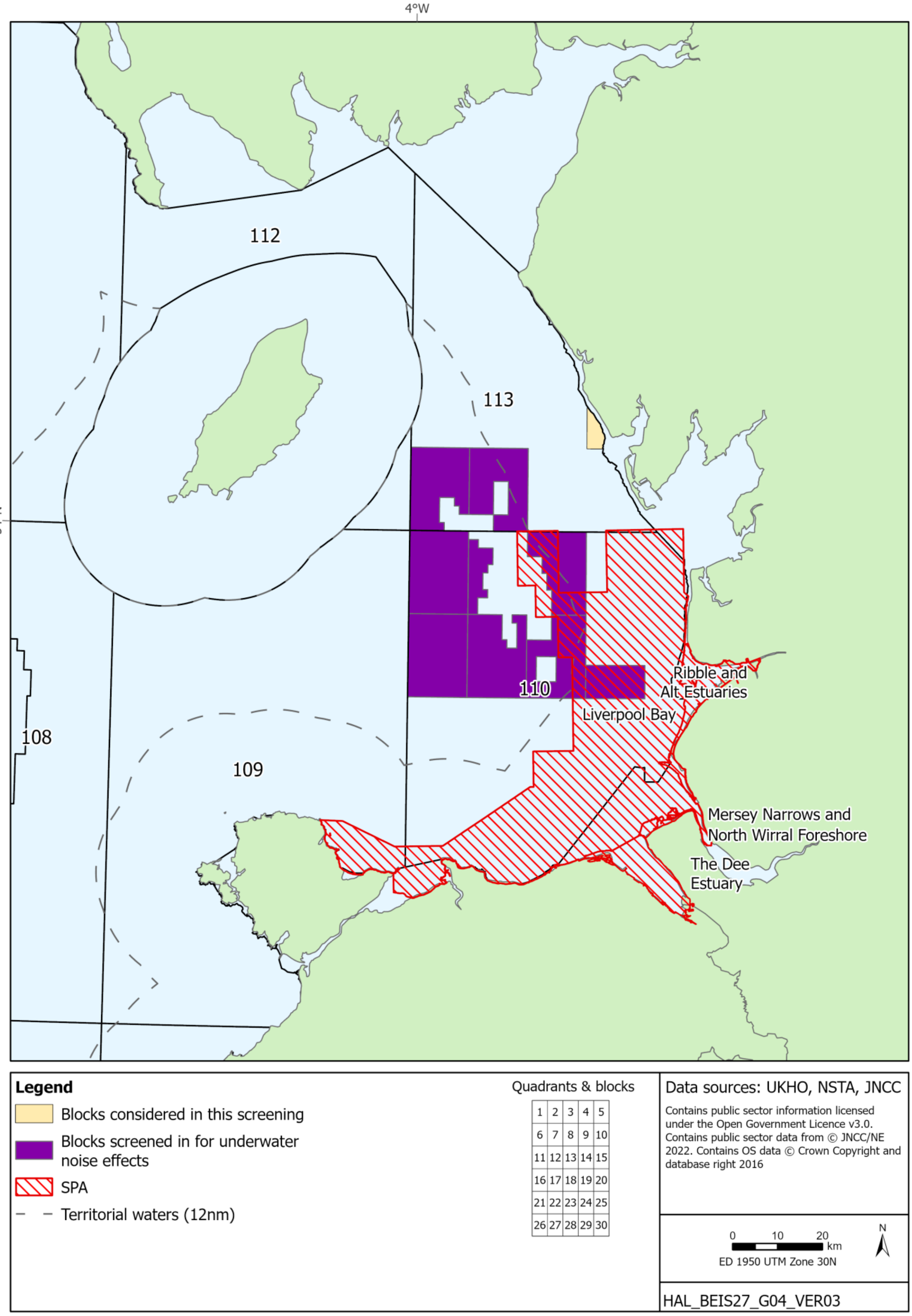


Figure 5.7: Underwater noise effects – Blocks offered and SACs screened in Mid North Sea High and southern North Sea

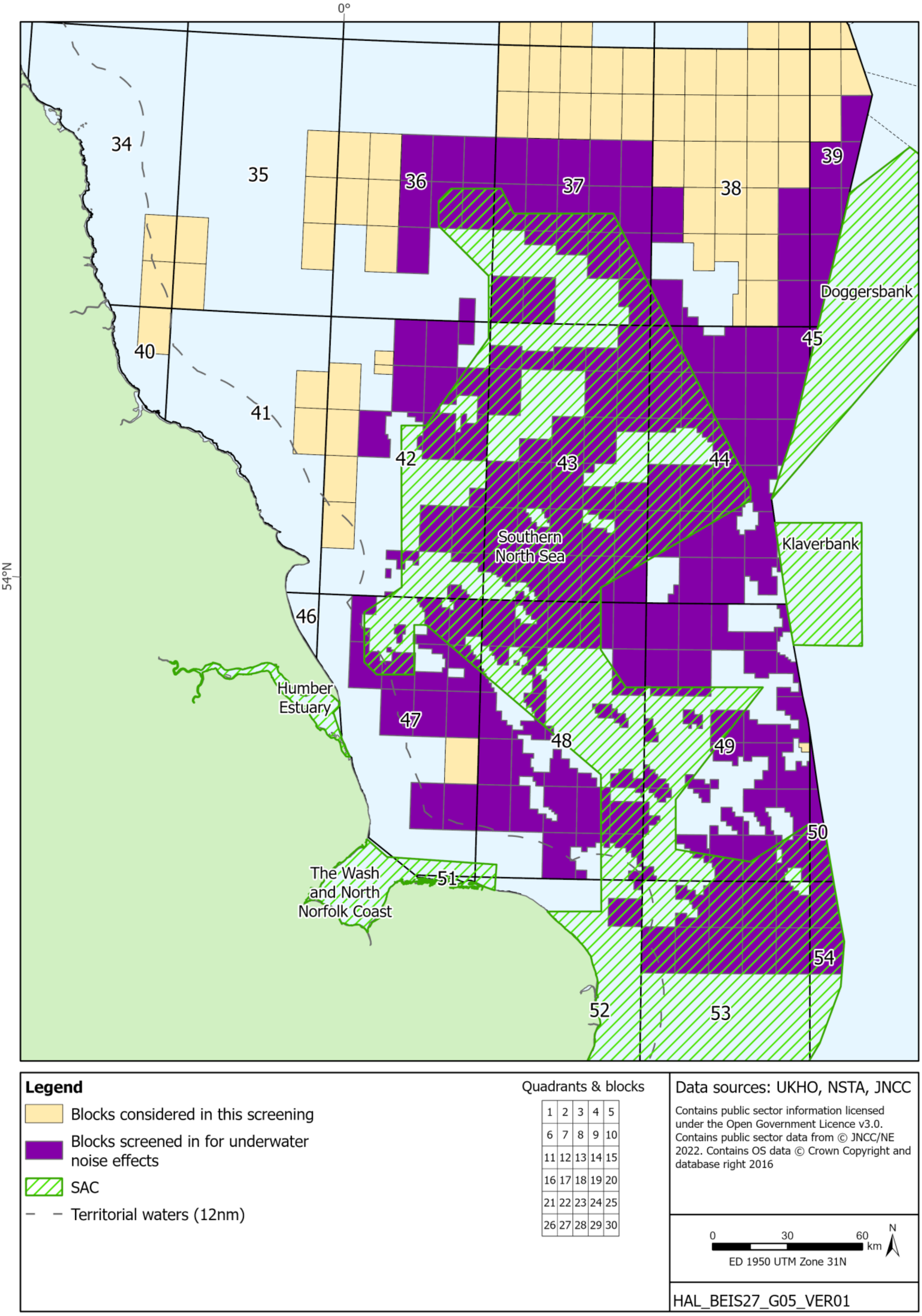


Figure 5.8: Existing oil and gas infrastructure, carbon and gas storage licences, SACs, SPAs and 33rd Round Blocks

West of Shetland | **Central North Sea**

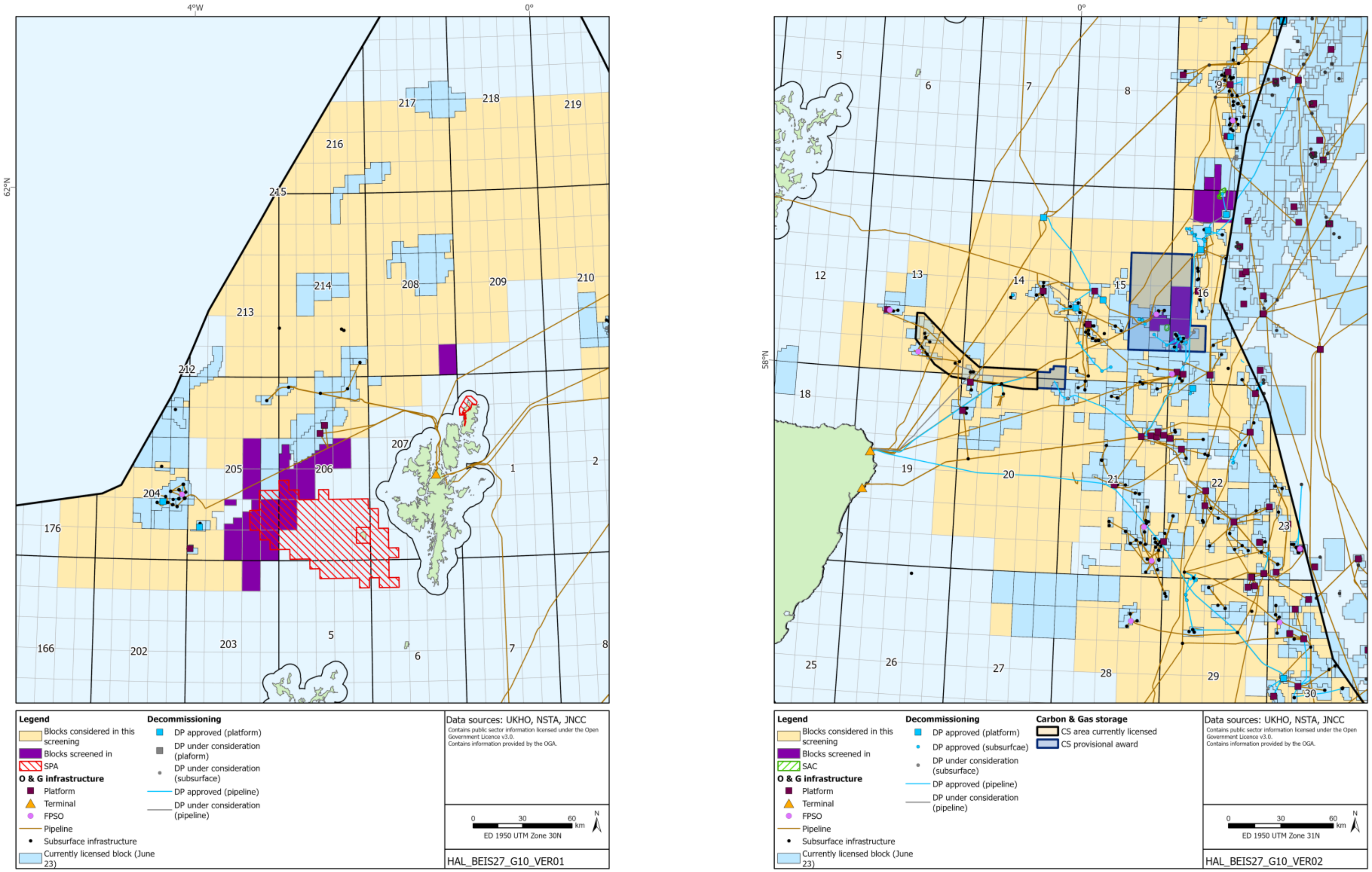


Figure 5.9: Existing oil and gas infrastructure, carbon and gas storage licences, SACs, SPAs and 33rd Round Blocks

Mid North Sea High and southern North Sea **Irish Sea**

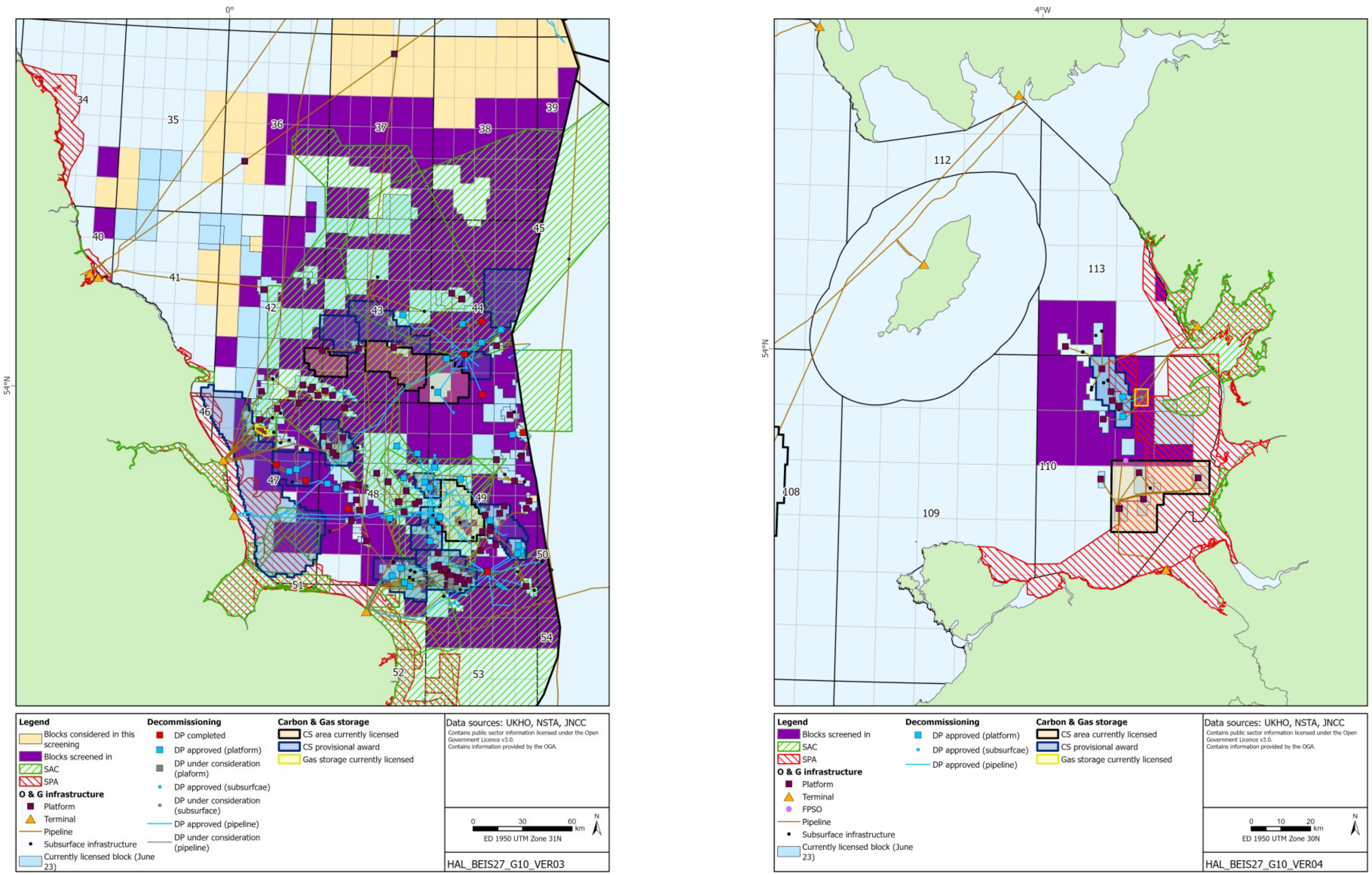
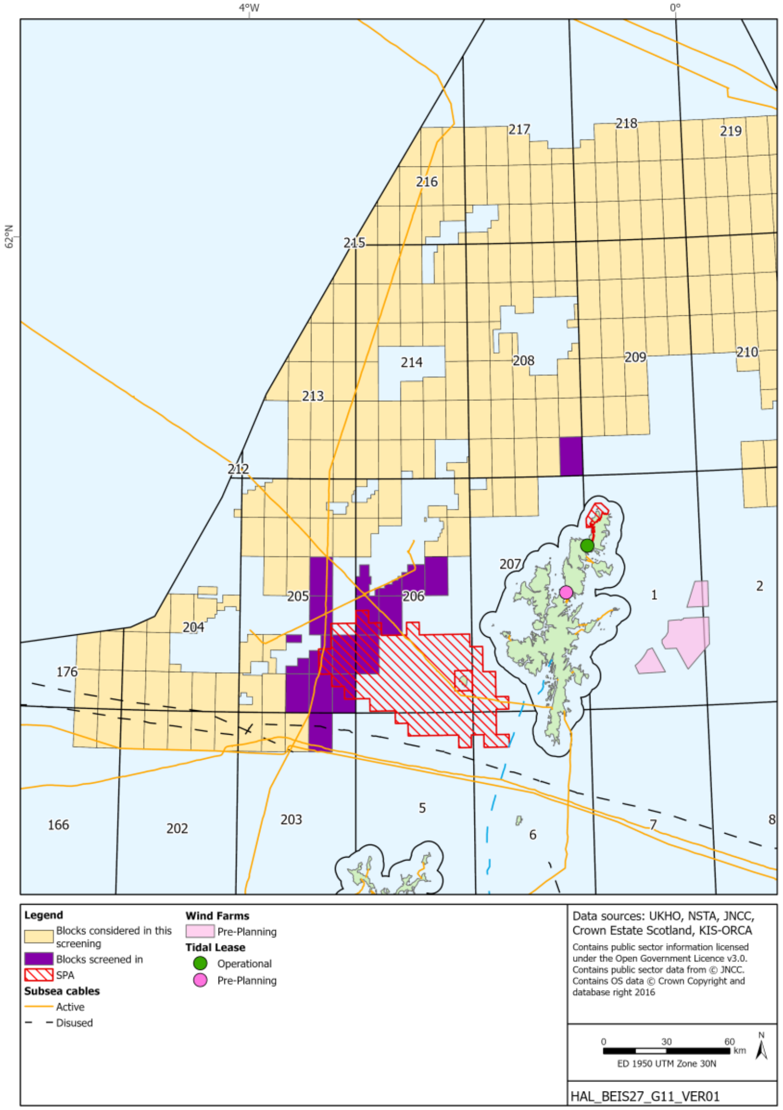


Figure 5.10: Marine renewable energy, aggregate extraction, SPAs, SACs and 33rd Round Blocks

West of Shetland



Central North Sea

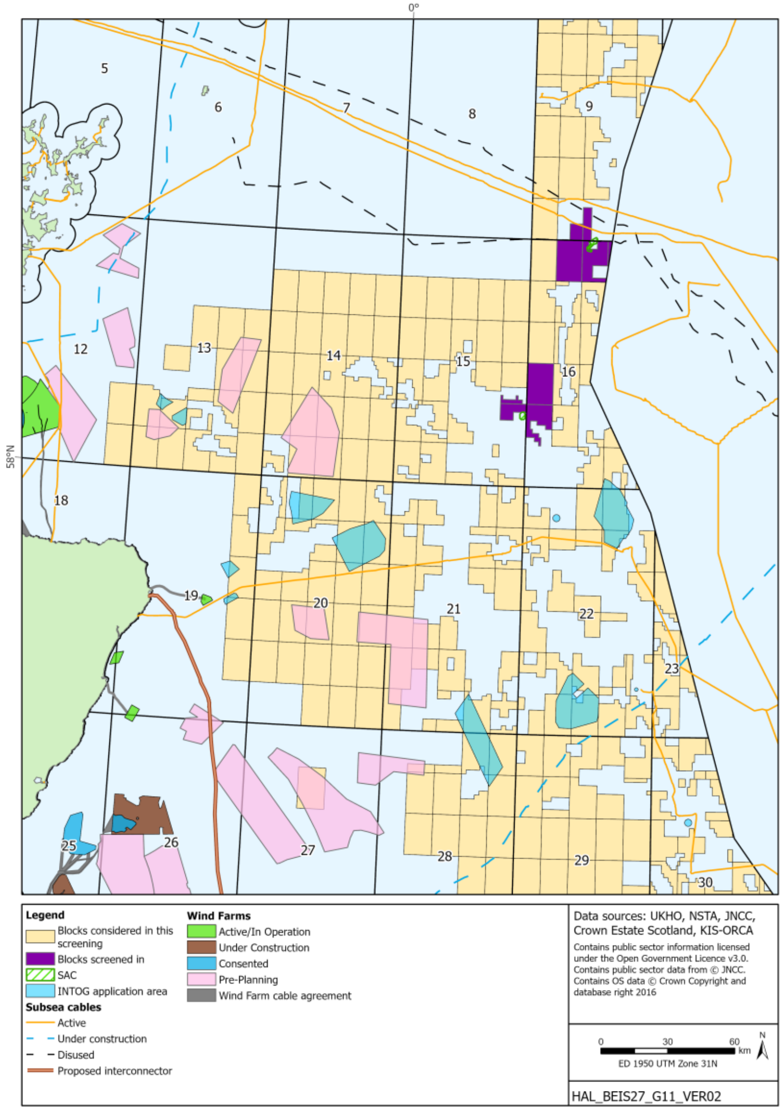
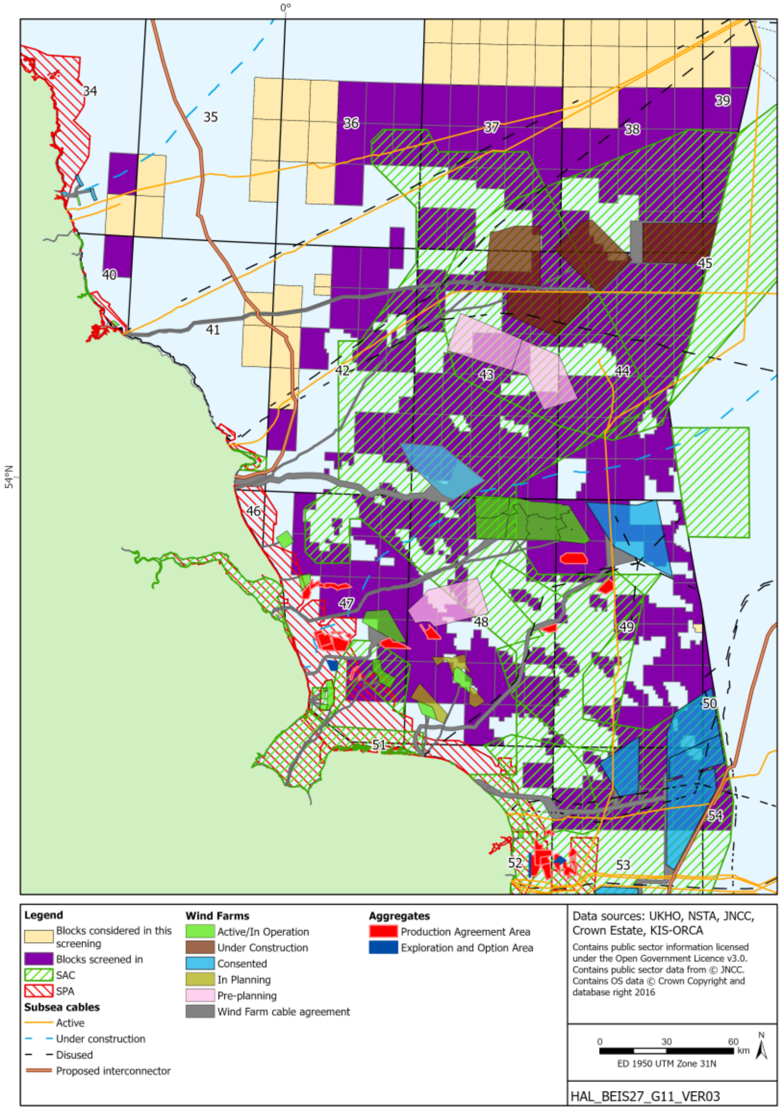


Figure 5.11: Marine renewable energy, aggregate extraction, SPAs, SACs and 33rd Round Blocks

Mid North Sea High and southern North Sea



Irish Sea

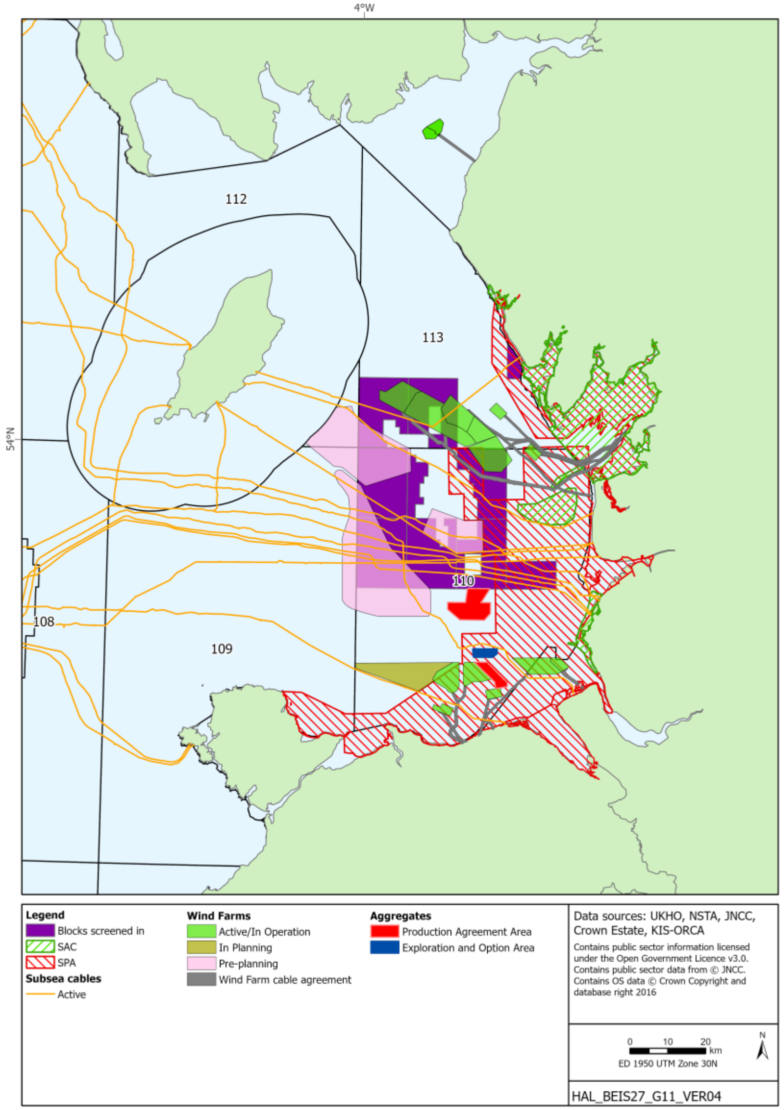
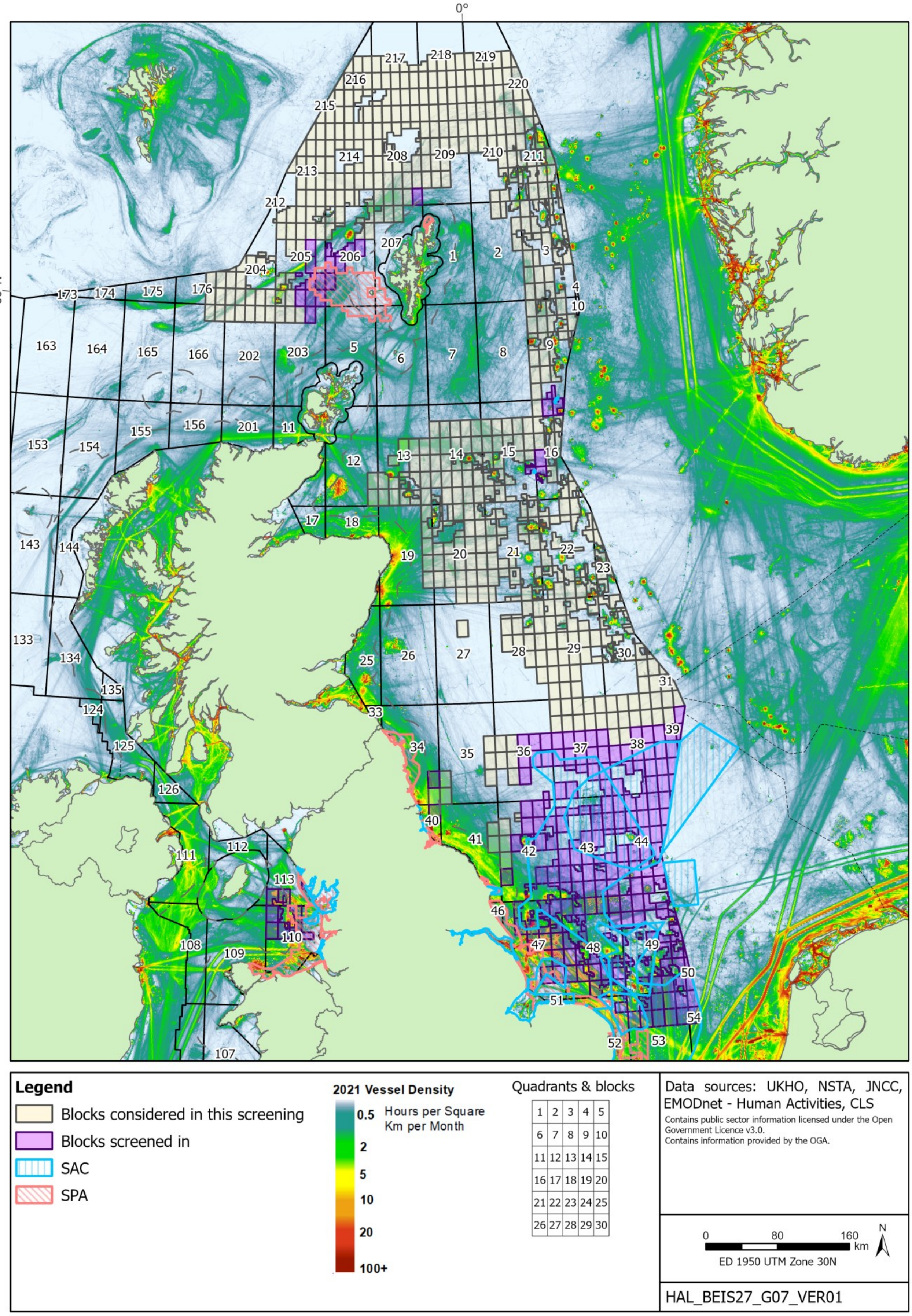


Figure 5.12: Navigation density, SPAs and 33rd Round Blocks

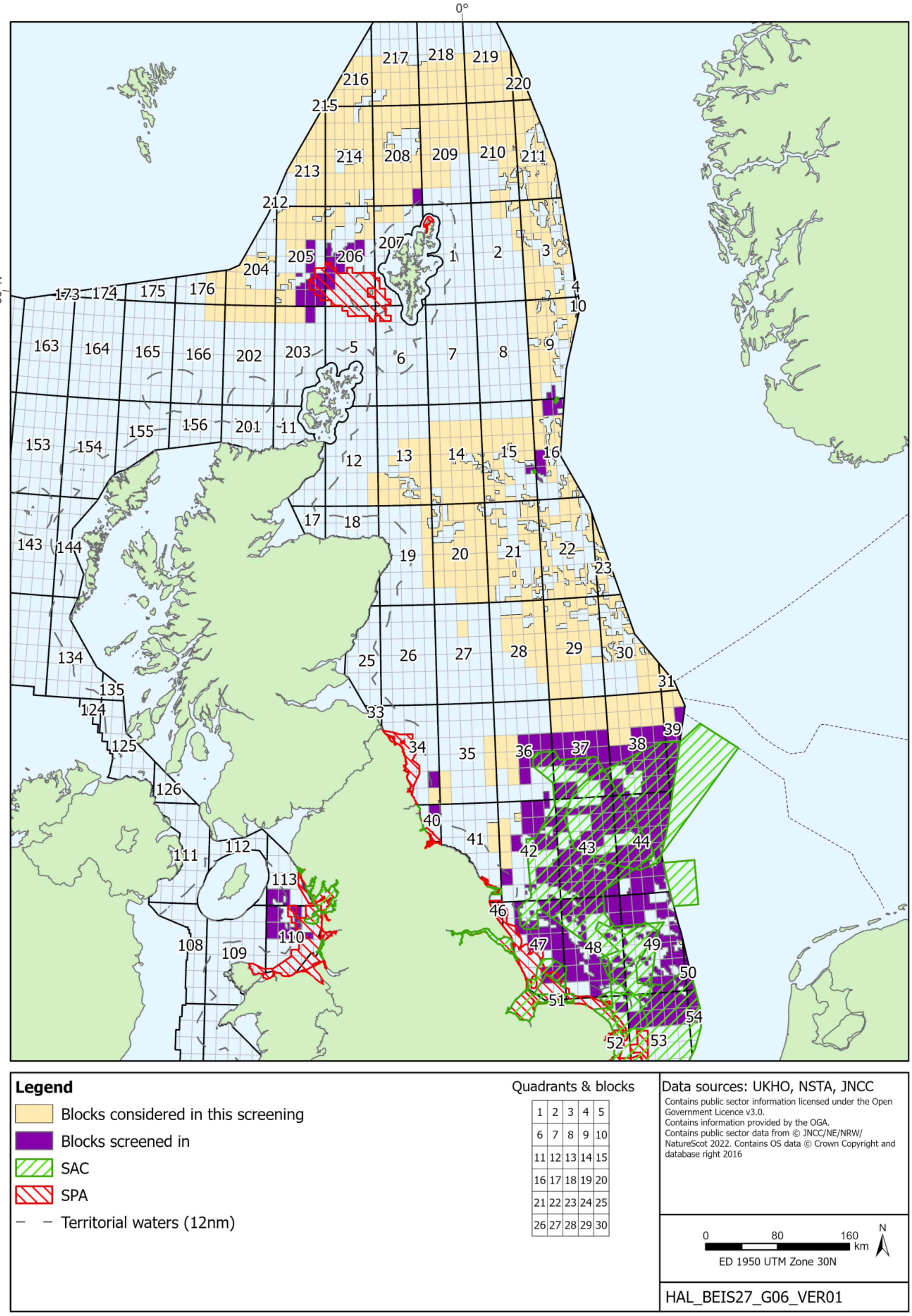


6 Conclusion

This screening assessment of the Blocks offered in the 33rd Round has considered the likelihood for significant effects on relevant conservation sites in the national site network from exploration/appraisal activities that could follow licensing of these Blocks. The screening, which does not take account of mitigation, concluded that a number of Blocks on offer and relevant sites may be subject to a second stage of HRA, AA, if licences are applied for and prior to decisions on the grant of such licences. These Blocks are listed in Section 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 together 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 AA. 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: 33rd 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 sites and their qualifying features with respect to the Blocks offered as part of the 33rd Seaward Licensing Round.

The primary sources of site data were the latest JNCC SAC and SPA summary data[69] 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 NatureScot[70] and Natural England[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

[69] Version as of 30th September 2022 - https://hub.jncc.gov.uk/assets/a3d9da1e-dedc-4539-a574-84287636c898

[70] https://sitelink.nature.scot/home

[71] http://publications.naturalengland.org.uk/category/6490068894089216, https://www.gov.uk/government/collections/conservation-advice-packages-for-marine-protected-areas, https://designatedsites.naturalengland.org.uk/

A2 Coastal and Marine Special Protection Areas

Special Protection Areas (SPAs) are protected sites classified for rare and vulnerable birds and for regularly occurring migratory birds. The SPAs included in this section are marine and coastal sites selected for the presence of one or more of the bird species listed in Box A.1 (below). All relevant SPAs are included on Maps A.1 to A.4.

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

Divers and grebes

Great northern diver *Gavia immer*
Red-throated diver *Gavia stellata*
Black-throated diver *Gavia arctica*
Little grebe *Tachybaptus ruficollis*
Great crested grebe *Podiceps cristatus*
Slavonian grebe *Podiceps auritus*

Seabirds

Fulmar *Fulmarus glacialis*
Manx shearwater *Puffinus puffinus*
Storm petrel *Hydrobates pelagicus*
Leach's petrel *Oceanodroma leucorhoa*
Gannet *Morus bassanus*
Cormorant *Phalacrocorax carbo carbo*
Shag *Phalacrocorax aristotelis*
Guillemot *Uria aalge*
Razorbill *Alca torda*
Puffin *Fratercula arctica*

Gulls, terns and skuas

Arctic skua *Stercorarius parasiticus*
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*

Waders

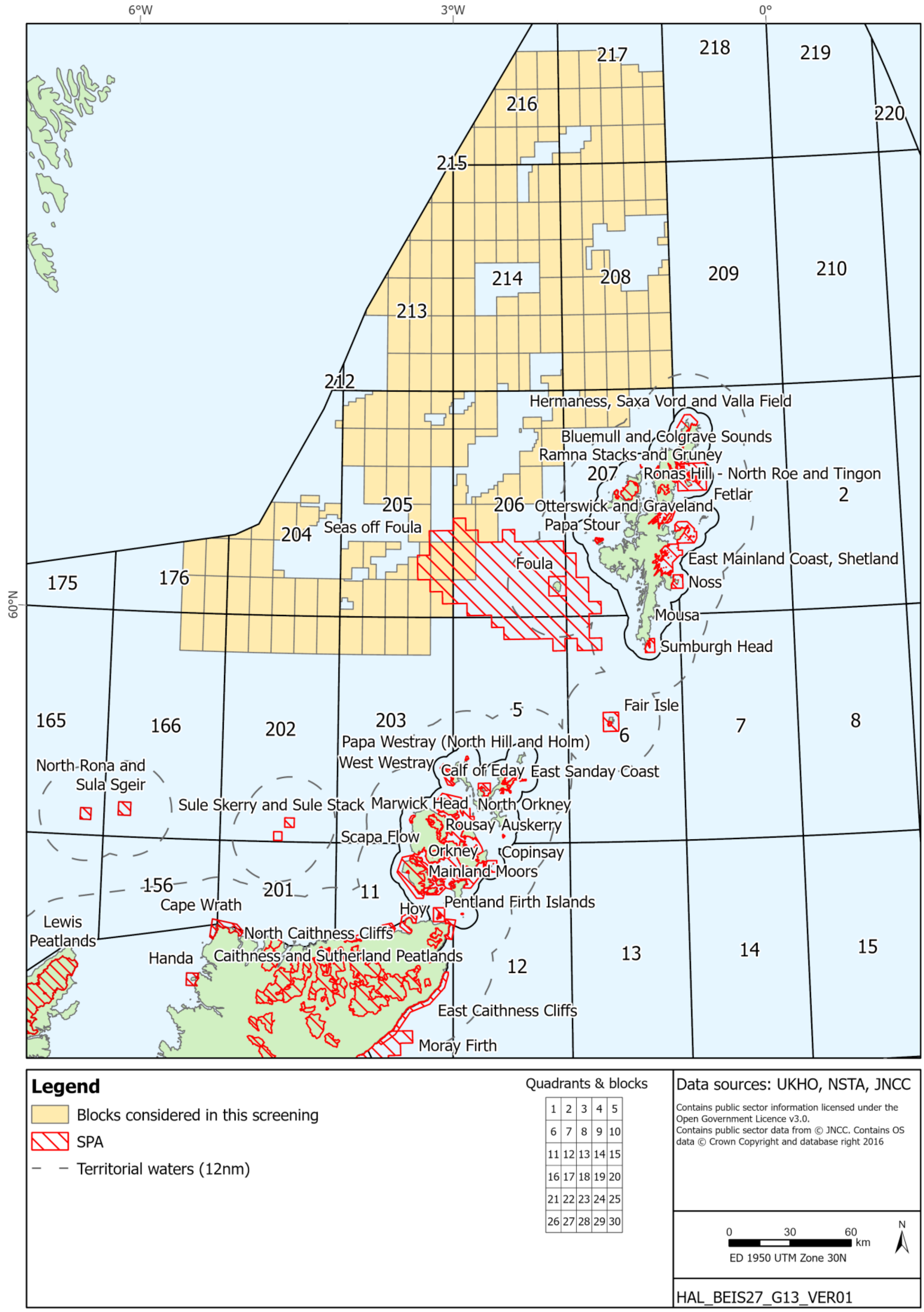
Oystercatcher *Haematopus ostralegus*
Avocet *Recurvirostra avosetta*
Stone curlew *Burhinus oedicnemus*
Ringed plover *Charadrius hiaticula*
Dotterel *Charadrius morinellus*
Golden plover *Pluvialis apricaria*
Grey plover *Pluvialis squatarola*
Lapwing *Vanellus vanellus*
Knot *Calidris canutus*
Sanderling *Calidris alba*
Purple sandpiper *Calidris maritima*
Dunlin *Calidris alpina alpina*
Ruff *Philomachus pugnax*
Snipe *Gallinago gallinago*
Black-tailed godwit *Limosa limosa* (breeding)
Black-tailed godwit *Limosa limosa islandica* (non-breeding)
Bar-tailed godwit *Limosa lapponica*
Whimbrel *Numenius phaeopus*
Curlew *Numenius arquata*
Redshank *Tringa totanus*
Greenshank *Tringa nebularia*
Wood sandpiper *Tringa glareola*
Turnstone *Arenaria interpres*
Red-necked phalarope *Phalaropus lobatus*

Waterfowl

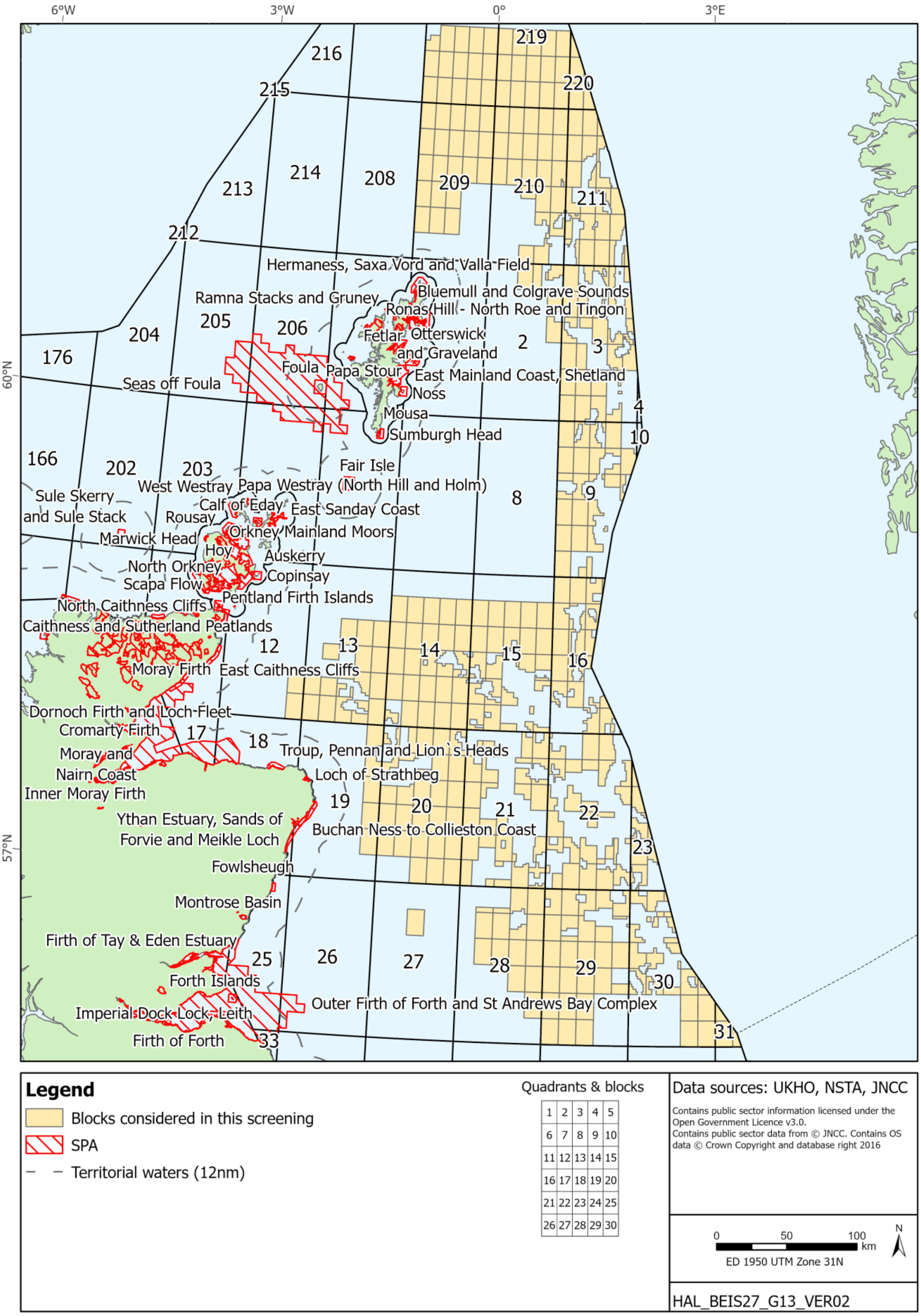
Bewick's swan *Cygnus columbianus bewickii*
Whooper swan *Cygnus*
Pink-footed goose *Anser brachyrhynchus*
Greenland white-fronted goose *Anser albifrons flavirostris*
Greater white-fronted goose *Anser albifrons albifrons*
Icelandic greylag goose *Anser anser*
Greenland barnacle goose *Branta leucopsis*
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*

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*	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*

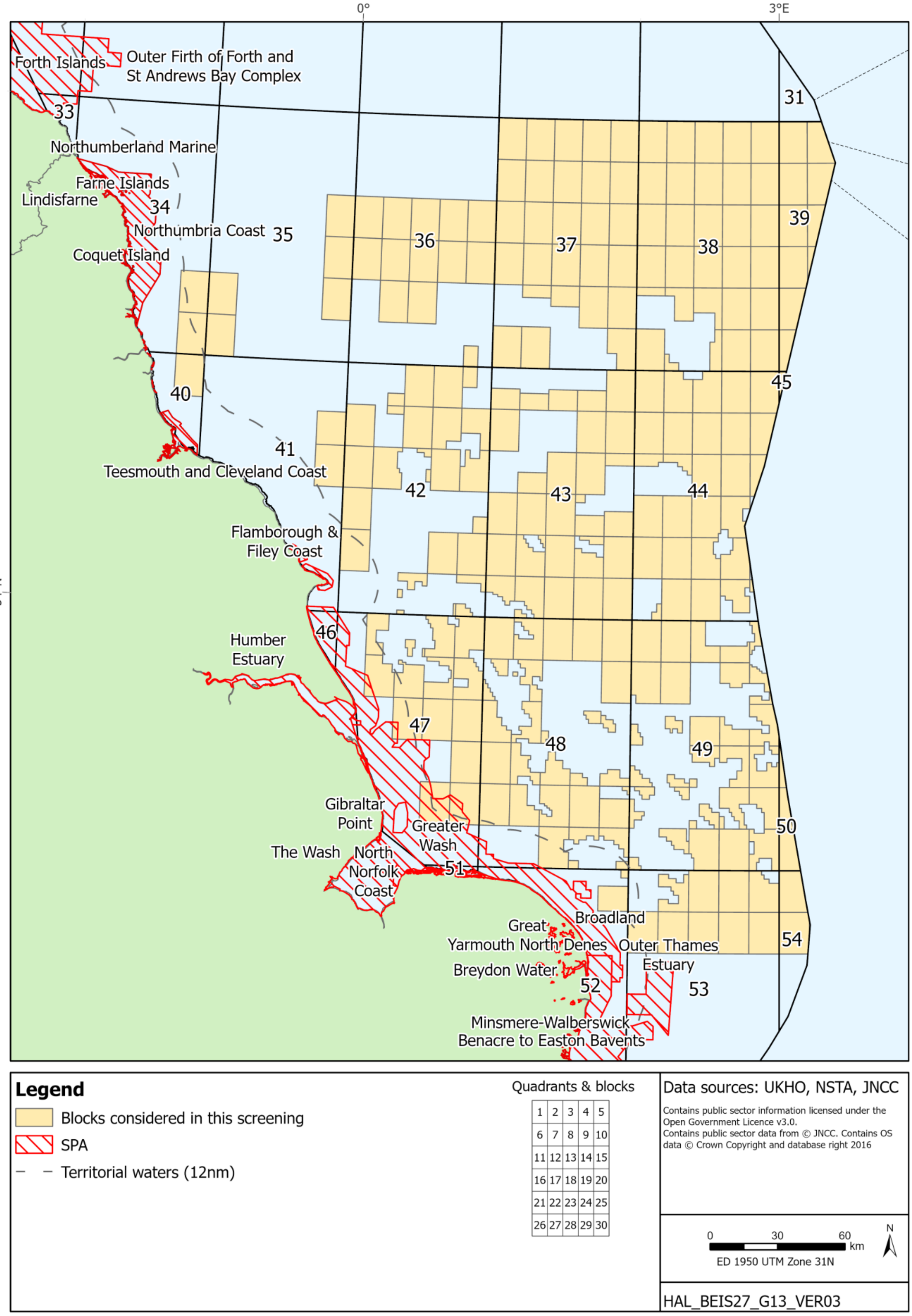
Map A.1: Location of SPAs – West of Shetland



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



Map A.4: Location of SPAs –Irish Sea

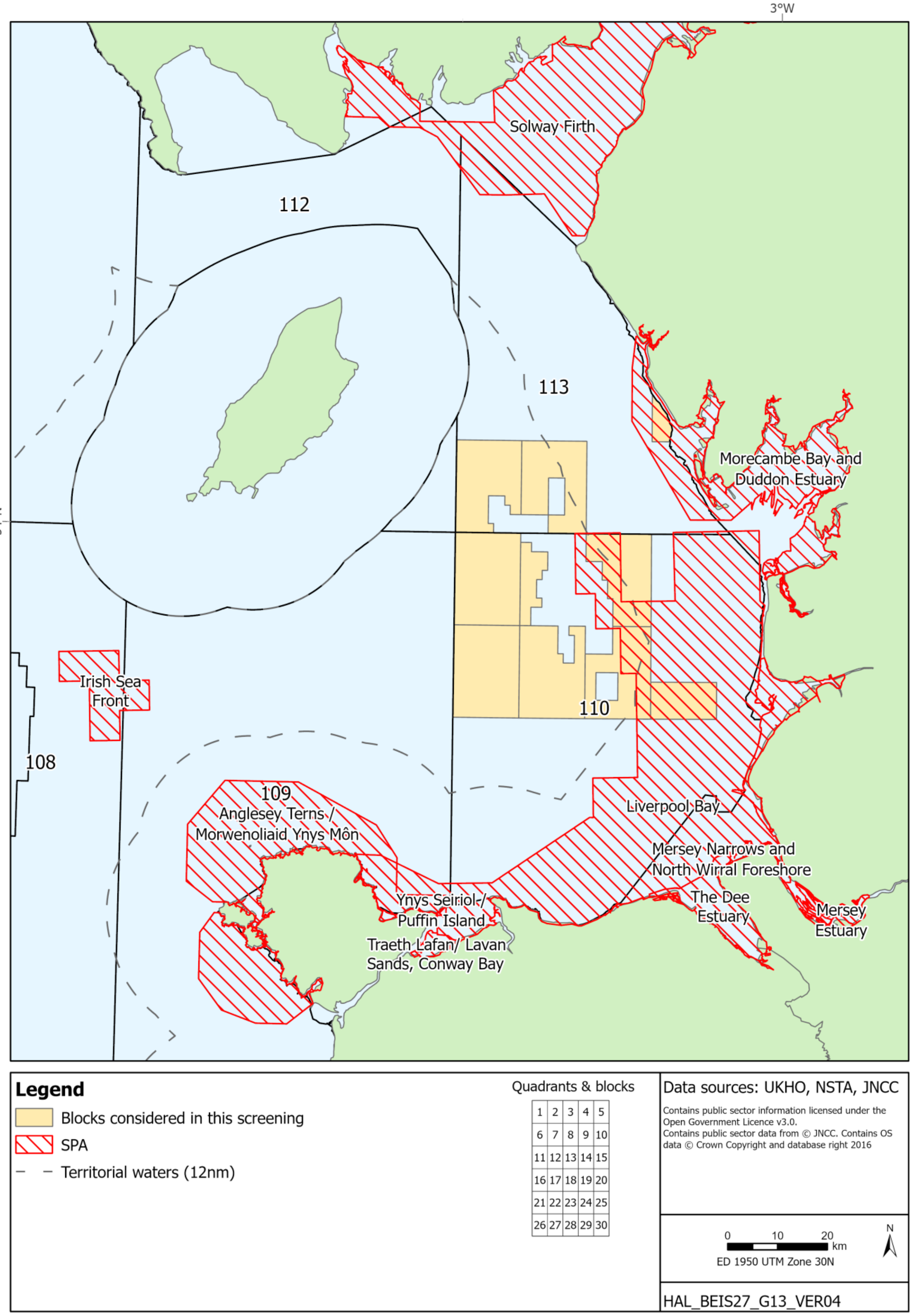


Table A.1: SPAs and their Qualifying Features

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[72]
WEST OF SHETLAND				
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
Handa SPA	3205.61	N/A	Breeding: Guillemot Razorbill	Breeding: Seabirds
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
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

[72] 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[72]
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 SPA	22695.17	Breeding: Red-throated diver Over winter: Great northern diver Slavonian grebe	Over winter: Velvet scoter	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 SPA	37065.53	Breeding: Red-throated diver Over winter: Great northern diver Black-throated diver Slavonian grebe	Over winter: Shag Eider Long-tailed duck 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 SPA	341215	N/A	Breeding: Great skua	Breeding: Seabirds Over winter: Seabirds
Foula SPA	7985.49	Breeding: Arctic tern Leach's petrel Red-throated diver	Breeding: Great skua Guillemot Puffin Shag	Breeding: Seabirds
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

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[72]
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 SPA	23333.23	Breeding: Red-throated diver Over winter: Great northern diver Slavonian grebe	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
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	Breeding: Ringed plover	N/A
East Mainland Coast, Shetland SPA	25646.67	Breeding: Red-throated diver Over winter: Great northern diver Slavonian grebe	N/A	N/A
Bluemull and Colgrave Sounds SPA	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	Breeding: Arctic skua	N/A

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[72]
West Westray SPA	3780.16	Breeding: Arctic tern	Breeding: Guillemot	Breeding: Seabirds
East Sanday Coast SPA	1508.2	Over winter: Bar-tailed godwit	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 SPA	341215	N/A	Breeding: Great skua	Breeding: Seabirds Over winter: Seabirds
Rousay SPA	5480.84	Breeding: Arctic tern	N/A	Breeding: Seabirds
North Orkney SPA	22695.17	Breeding: Red-throated diver Over winter: Great northern diver Slavonian grebe	Over winter: Velvet scoter	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
Scapa Flow SPA	37065.53	Breeding: Red-throated diver Over winter: Great northern diver Black-throated diver Slavonian grebe	Over winter: Shag Eider Long-tailed duck Red-breasted merganser	N/A
Pentland Firth Islands SPA	170.0	Breeding: Arctic tern	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 Dunlin	Breeding: Common scoter Greenshank Wigeon	N/A

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[72]
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
Moray Firth SPA	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
Cromarty Firth SPA	3247.95	Breeding: Common tern Osprey Over winter: Bar-tailed godwit Whooper swan	Over winter: Greylag goose	Over winter: Waterfowl
Inner Moray Firth SPA	2290.25	Breeding: Common tern Osprey Over winter: Bar-tailed godwit	Over winter: Greylag goose Red-breasted merganser Redshank	Over winter: Waterfowl
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 Kittiwake Fulmar Razorbill Herring gull	Breeding: Seabirds
Loch of Strathbeg SPA	616.26	Breeding: Sandwich tern Over winter: Whooper swan Barnacle goose	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

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[72]
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
Fowlsheugh SPA	1303.23	N/A	Breeding: Guillemot Kittiwake	Breeding: Seabirds
Montrose Basin SPA	981.19	N/A	Over winter: Pink-footed goose Greylag goose Shelduck Wigeon Eider Oystercatcher Redshank Knot Dunlin	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 SPA	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 SPA	6317.69	Over winter: Red-throated diver Bar-tailed godwit Golden plover Slavonian grebe 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	3671.04	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 Redshank Common scoter	Over winter: Waterfowl

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[72]
Farne Islands SPA	101.23	Breeding: Arctic tern Common tern Sandwich tern Roseate tern	Breeding: Guillemot	Breeding: Seabirds
Northumberland Marine SPA	88498	Breeding: Sandwich tern Common tern Arctic tern Roseate tern Little tern	Breeding: Puffin Guillemot	Breeding: Seabirds
Northumbria Coast SPA	1097.45	Breeding: Little tern Arctic tern	Over winter: Purple sandpiper Turnstone	N/A
Coquet Island SPA	19.91	Breeding: Arctic tern Common tern Roseate tern Sandwich tern	N/A	Breeding: Seabirds
Teesmouth and Cleveland Coast SPA	12210.62	Breeding: Avocet Sandwich tern Common tern Little tern On passage: Ruff	On passage: Knot Redshank	Over winter: Waterfowl
MID NORTH SEA HIGH AND SOUTHERN NORTH SEA				
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	N/A

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[72]
Greater Wash SPA	353577.86	Breeding: Little tern Sandwich tern Common tern Over winter: Little gull Red-throated diver	Over winter: Common scoter	N/A
The Wash SPA	62211.66	Breeding: Common tern Little tern Over winter: Bewick's swan	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 Bar-tailed godwit	Over winter: Waterfowl
North Norfolk Coast SPA	7886.79	Breeding: Avocet Bittern Common tern Little tern Marsh harrier Sandwich tern Montagu's harrier Over winter: Avocet	Over winter: Wigeon Pink-footed goose Dark-bellied brent goose Knot	Over winter: Waterfowl
Broadland SPA	5502.338	Breeding: Bittern Marsh harrier Over winter: Hen harrier Bewick's swan Whooper swan Ruff	Over winter: Gadwall Wigeon Shoveler	N/A
Great Yarmouth North Denes SPA	149.19	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

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[72]
Breydon Water SPA	1202.94	Breeding: Common tern Over winter: Bewick's swan Avocet Golden plover On passage: Ruff	Over winter: Lapwing	Over winter: Waterfowl
IRISH SEA				
Loch of Inch and Torrs Warren SPA	2110.5	Non-breeding: Greenland white-fronted goose Hen harrier	N/A	N/A
Solway Firth SPA	135749.34	Non-breeding: Red-throated diver Whooper swans Barnacle geese Golden plover Bar-tailed godwit	Non-breeding: Pink-footed goose Pintail Scaup Oystercatcher Knot Curlew Redshank On passage: Ringed plover	Over winter: Waterfowl
Morecambe Bay & Duddon Estuary SPA	66899	Breeding: Common tern Sandwich tern Little tern Over winter: Whooper swan Little egret Golden plover Ruff Bar-tailed godwit Mediterranean gull	Breeding: Lesser black-backed gull Herring gull On passage: Pink-footed goose Shelduck Oystercatcher Ringed plover Grey plover Knot Sanderling Dunlin Black-tailed godwit Curlew Pintail Turnstone Redshank Lesser black-backed gull	Any season: Seabird Any season: Waterfowl

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[72]
Ribble and Alt Estuaries SPA	12412.31	Breeding: Common tern Ruff Over winter: Bar-tailed godwit Bewick's swan Golden plover Whooper swan	Breeding: Lesser black-backed gull Black-headed gull On passage: Ringed plover Sanderling Redshank Whimbrel Over winter: Pintail Teal Wigeon Pink-footed goose Scaup Sanderling Dunlin Knot Oystercatcher Black-tailed godwit Common scoter Curlew Cormorant Grey plover Shelduck Redshank Lapwing	Breeding: Seabirds Over winter: Waterfowl
Mersey Narrows and North Wirral Foreshore SPA	2078.41	Breeding: Common tern On passage: Little gull Common tern Over winter: Bar-tailed godwit	Over winter: Knot	Over winter: Waterfowl
Mersey Estuary SPA	5023.35	Over winter: Golden plover	On passage: Redshank Over winter: Dunlin Pintail Redshank Shelduck Teal Black-tailed godwit	Over winter: Waterfowl
The Dee Estuary SPA	14291.56	Breeding: Common tern Little tern On passage: Sandwich tern Over winter: Bar-tailed godwit	On passage: Redshank Over winter: Pintail Teal Dunlin Knot Oystercatcher Black-tailed godwit Curlew Grey plover Shelduck Redshank	Over winter: Waterfowl

Site Name	Area (ha)	Article 4.1 Species	Article 4.2 Migratory Species	Article 4.2 Assemblages[72]
Liverpool Bay SPA	252757.73	Breeding: Little tern Common tern Over winter: Red-throated diver Little gull	Over winter: Common scoter	Over winter: Waterfowl
Traeth Lafan/ Lavan Sands, Conway Bay SPA	2703.13	N/A	Over winter: Oystercatcher Curlew On passage: Great crested grebe	N/A
Ynys Seiriol / Puffin Island SPA	31.32	N/A	Breeding: Cormorant	N/A
Anglesey Terns / Morwenoliaid Ynys Môn SPA	101931.08	Breeding: Roseate tern Common tern Arctic tern Sandwich tern	N/A	N/A
Irish Sea Front SPA	18000	N/A	Breeding: Manx shearwater	N/A
Glannau Ynys Gybi/Holy Island Coast SPA	604.39	Over winter: Chough	N/A	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 are listed in Section A4. All relevant SACs are included on Maps A.5 to A.8.

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

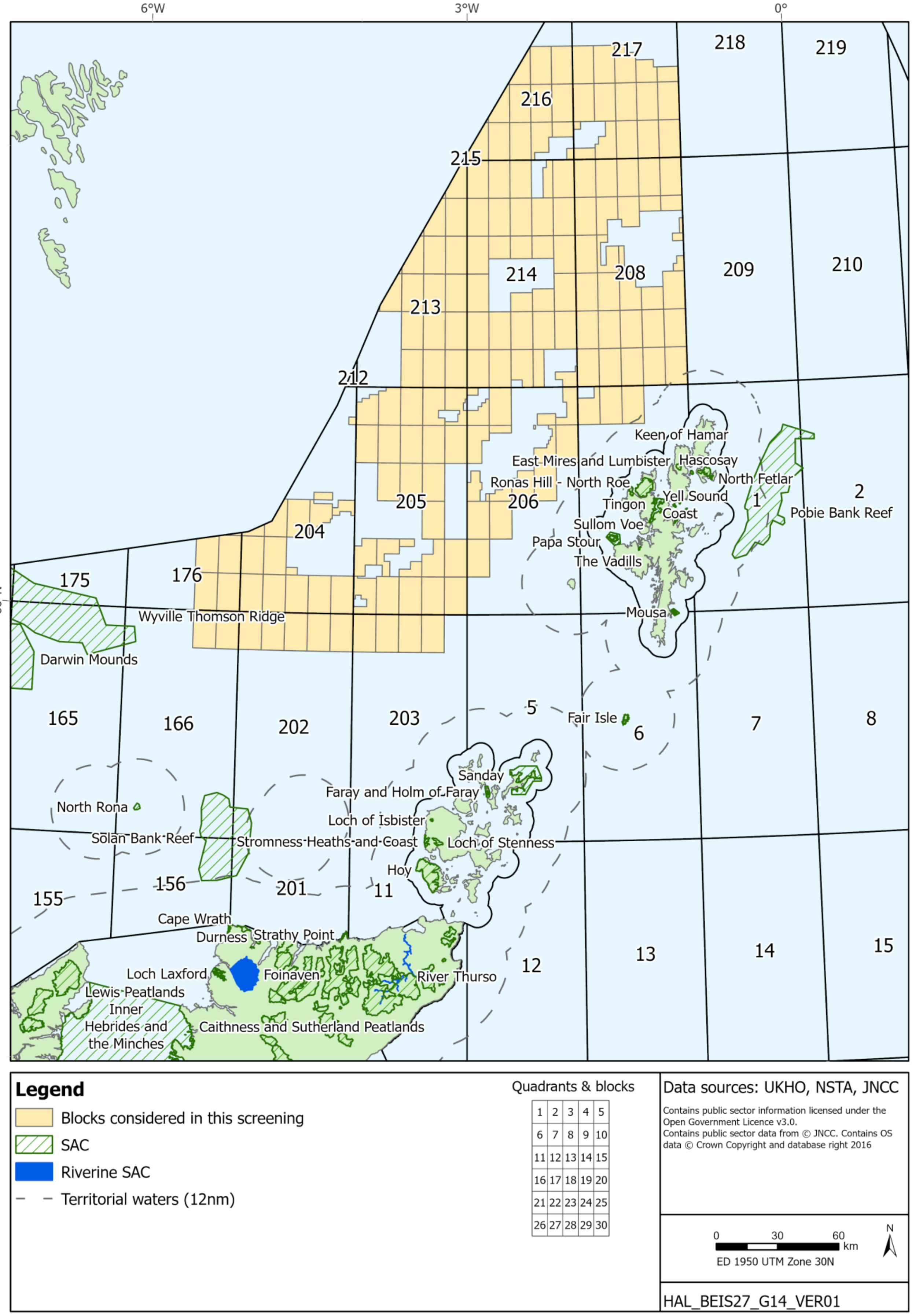
Annex I habitat (abbreviated)	Annex I habitat(s) (full description)
Bogs	Blanket bogs * Priority feature Transition mires and quaking bogs Depressions on peat substrates of the *Rhynchosporion* Active raised bogs * Priority feature Degraded raised bogs still capable of natural regeneration Bog Woodland * 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

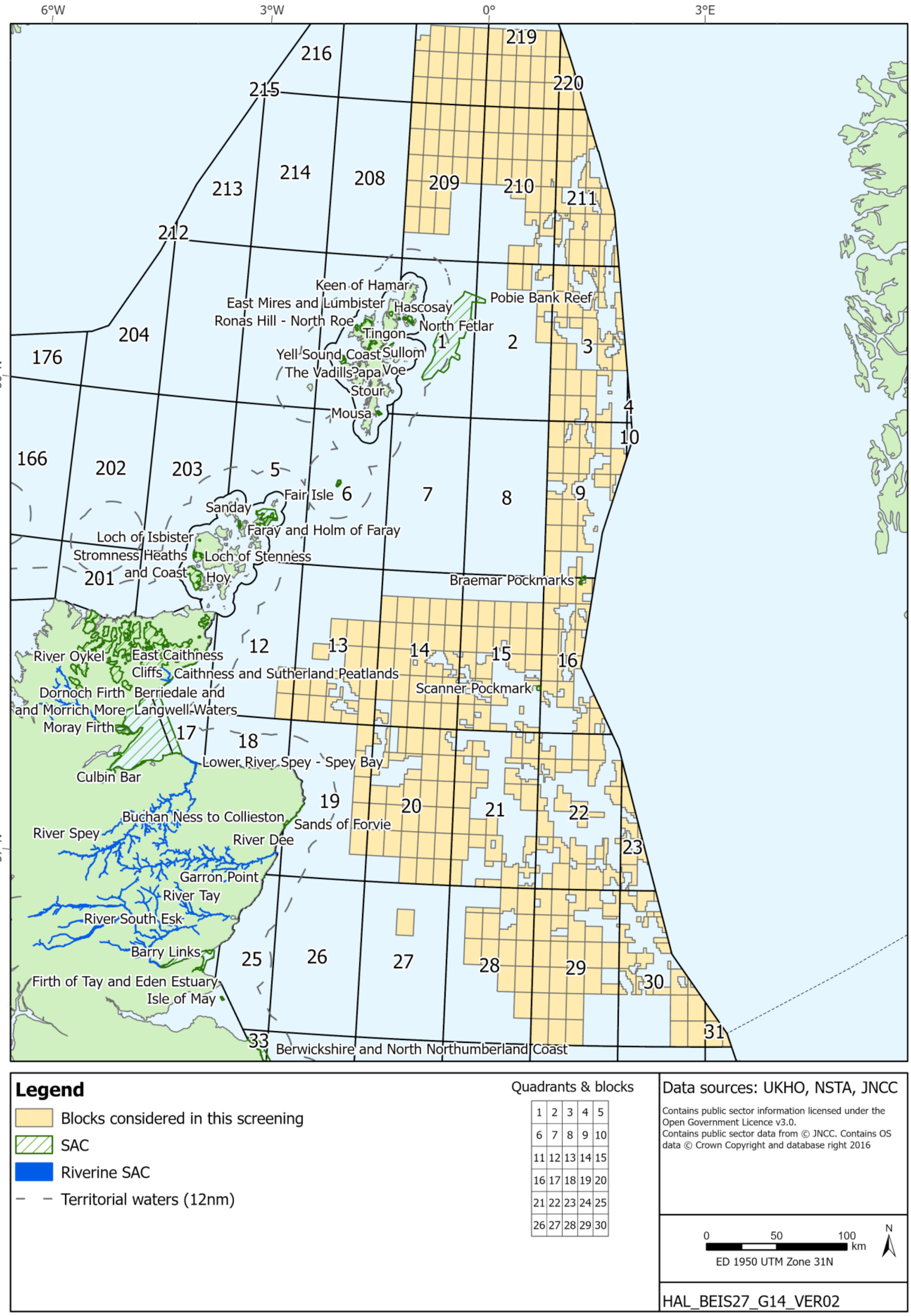
Box A.3: Annex II species common names used in site summaries and scientific names

Group	Annex II species common name (scientific name)
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*)

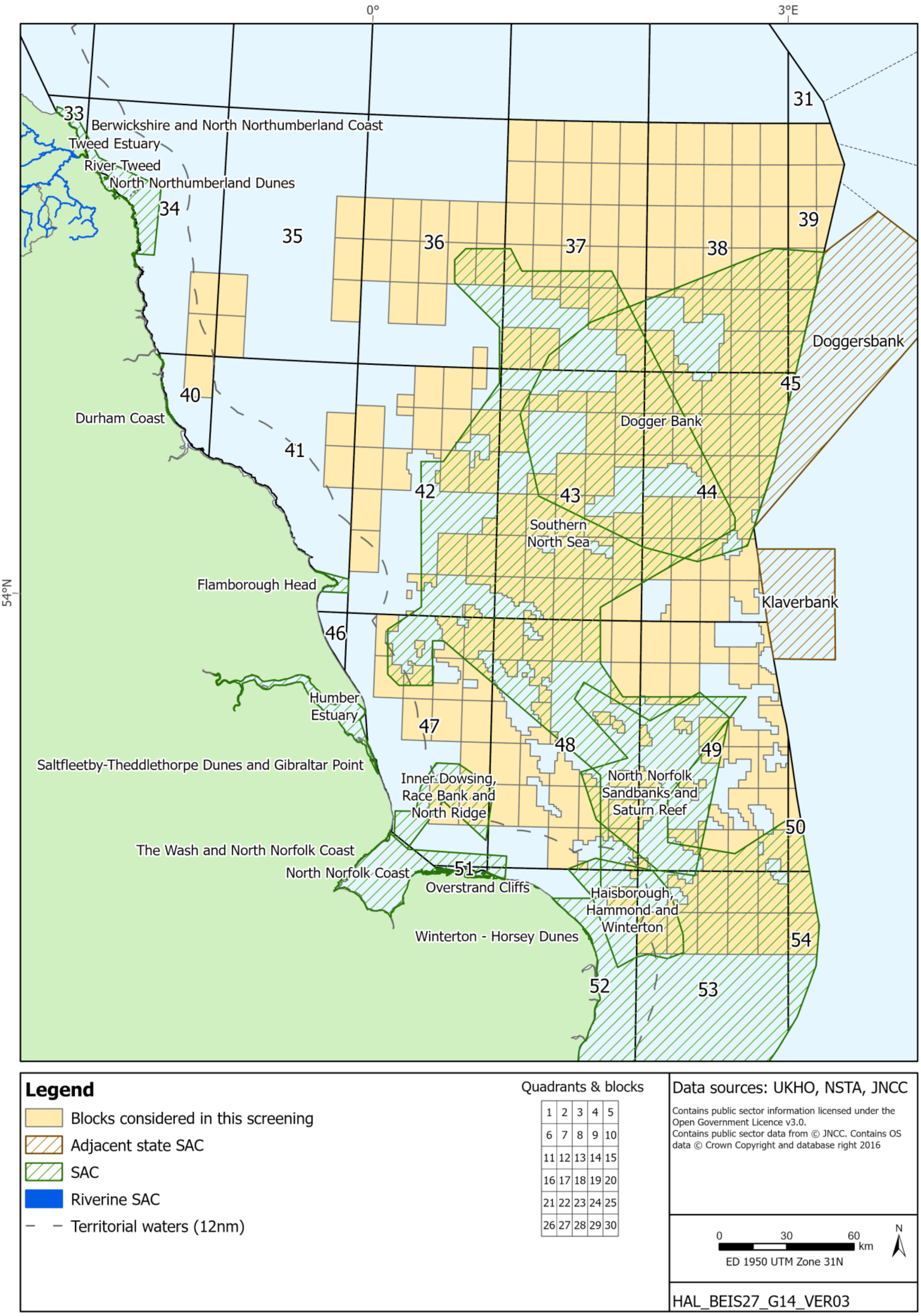
Map A.5: Location of SACs – West of Shetland



Map A.6: Location of SACs – northern and central North Sea



Map A.7: Location of SACs – Mid North Sea High and southern North Sea



Map A.8: Location of SACs – Eastern Irish Sea

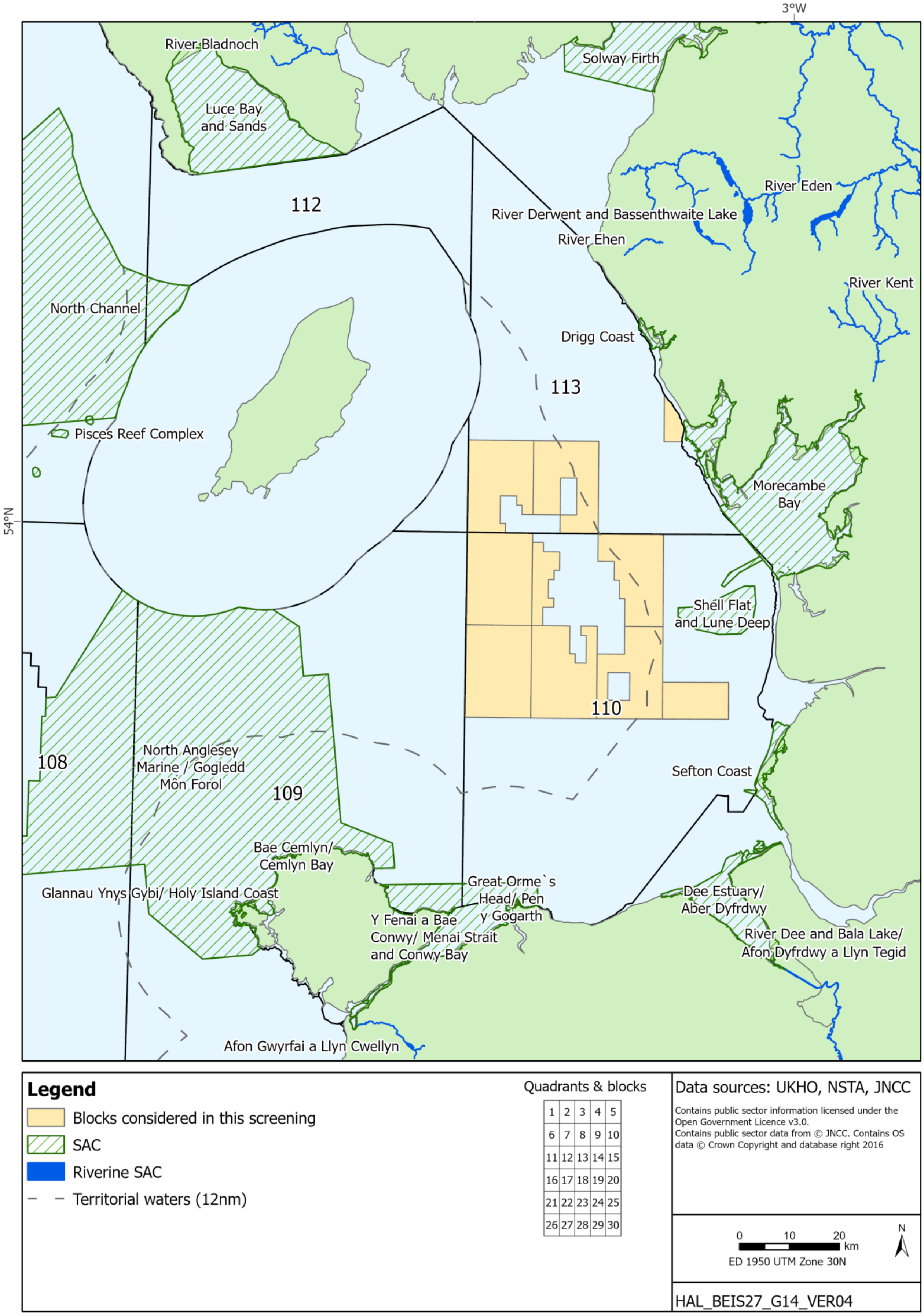


Table A.2: SACs and their Qualifying Features

Site Name	Area (ha)	Annex I Habitat Primary	Annex I Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
WEST OF SHETLAND					
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
Cape Wrath SAC	1009.75	Sea cliffs	N/A	N/A	N/A
Oldshoremore and Sandwood SAC	446.2	Coastal dunes Machairs	Coastal dunes	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
Sullom Voe SAC	2691.43	Inlets and bays	Coastal lagoons Reefs	N/A	N/A

Site Name	Area (ha)	Annex I Habitat Primary	Annex I Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
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
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

Site Name	Area (ha)	Annex I Habitat Primary	Annex I Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
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
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
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
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

Site Name	Area (ha)	Annex I Habitat Primary	Annex I Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
River Tweed SAC	3742.62	Running freshwater	N/A	Atlantic salmon Otter	Sea lamprey Brook lamprey River lamprey
Tweed Estuary SAC	155.93	Estuaries Mudflats and sandflats	N/A	N/A	Sea lamprey River lamprey
Berwickshire and North Northumberland Coast SAC	65334.94	Mudflats and sandflats Inlets and Bays Reefs Sea caves	N/A	Grey seal	N/A
North Northumberland Dunes SAC	1134.2546	Coastal dunes	N/A	Petalwort	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					
Southern North Sea SAC	3695054	N/A	N/A	Harbour porpoise	N/A
Dogger Bank SAC	1233115	Sandbanks	N/A	N/A	N/A
Beast Cliff - Whitby (Robin Hood's Bay) SAC	265.38	Sea cliffs	N/A	N/A	N/A
Flamborough Head SAC	6311.96	Reefs Sea cliffs Sea caves	N/A	N/A	N/A
River Derwent SAC	411.23	Running freshwater	N/A	River lamprey	Sea lamprey Bullhead Otter
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	107761.28	Sandbanks Mudflats and sandflats Inlets and bays Reefs Saltmarsh and salt meadows	Coastal lagoons	Harbour seal	Otter
North Norfolk Coast SAC	3207.37	Coastal lagoons Vegetation of stony banks Saltmarsh and salt meadows Coastal dunes	N/A	N/A	Otter Petalwort
Overstrand Cliffs SAC	57.43	Sea cliffs	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
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	366.93	Coastal lagoons	N/A	N/A	N/A
Minsmere to Walberswick Heaths and Marshes SAC	1238.253	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	901.19	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
IRISH SEA					
North Channel SAC	160367	N/A	N/A	Harbour porpoise	N/A
Luce Bay and Sands SAC	48759.28	Inlets and bays Coastal dunes	Sandbanks Mudflats and sandflats Reefs	N/A	Great crested newt
Solway Firth SAC	43636.72	Sandbanks Estuaries Mudflats and sandflats Saltmarsh and salt meadows	Reefs Vegetation of stony banks Coastal dunes	Sea lamprey River lamprey	N/A
River Eden SAC	2430.39	Standing freshwater Running freshwater Forests	N/A	White-clawed (or Atlantic stream) crayfish Sea lamprey Brook lamprey River lamprey Atlantic salmon Bullhead Otter	N/A
River Bladnoch SAC	272.6	N/A	N/A	Atlantic salmon	N/A
Shell Flat and Lune Deep	10565	Sandbanks Reefs	N/A	N/A	N/A
North Anglesey Marine / Gogledd Môn Forol	324949	N/A	N/A	Harbour porpoise	N/A
Bae Cemlyn/ Cemlyn Bay SAC	43.43	Coastal lagoons	Vegetation of stony banks	N/A	N/A
Glannau Ynys Gybi/ Holy Island Coast SAC	464.27	Sea cliffs Heaths	Heaths	N/A	N/A
Glannau Môn: Cors heli / Anglesey Coast: Saltmarsh SAC	1058	Saltmarsh and salt meadows	Estuaries Mudflats and sandflats	N/A	N/A

Site Name	Area (ha)	Annex I Habitat Primary	Annex I Habitat Qualifying	Annex II Species Primary	Annex II Species Qualifying
Y Twyni o Abermenai i Aberffraw/ Abermenai to Aberffraw Dunes SAC	1871.03	Coastal dunes	Standing freshwater	Petalwort Shore dock	N/A
Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay	26482.67	Sandbanks Mudflats and sandflats Reefs	Inlets and bays Sea caves	N/A	N/A
Afon Gwyrfai a Llyn Cwellyn SAC	111.6	Standing freshwater Running freshwater	N/A	Atlantic salmon Floating water-plantain	Otter
Great Orme`s Head/ Pen y Gogarth SAC	302.63	Heaths Grasslands	Sea cliffs	N/A	N/A
Dee Estuary/ Aber Dyfrdwy	15805.27	Mudflats and sandflats Saltmarsh and salt meadows	Estuaries Sea cliffs Vegetation of drift lines Coastal dunes	N/A	River lamprey Sea lamprey Petalwort
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	1308.93	Running freshwater	N/A	Atlantic salmon Floating water-plantain	Sea lamprey Brook lamprey River lamprey Bullhead Otter
Sefton Coast	4591.59	Coastal dunes	Coastal dunes	Petalwort	Great crested newt
Morecambe Bay	61538.23	Estuaries Mudflats and sandflats Inlets and bays Vegetation of stony banks Saltmarsh and salt meadows Coastal dunes	Sandbanks Coastal lagoons Reefs Coastal dunes	Great crested newt	N/A
Drigg Coast	1397.44	Estuaries Coastal dunes	Mudflats and sandflats Saltmarsh and salt meadows Coastal dunes	N/A	N/A
River Kent	88.9	N/A	Running freshwater	White-clawed (or Atlantic stream) crayfish	Freshwater pearl mussel Bullhead
River Ehen SAC	23.33	N/A	N/A	Freshwater pearl mussel	Atlantic salmon
River Derwent and Bassenthwaite Lake SAC	1793.8	Standing freshwater	Running freshwater	Marsh fritillary butterfly Sea lamprey Brook lamprey River lamprey Atlantic salmon Otter Floating water-plantain	N/A
Croker Carbonate Slabs SCI	6,591	Submarine structures made by leaking gases	N/A	N/A	N/A

A4 Sites in waters of adjacent states

Relevant sites in adjacent states are listed in Table A.3 below. Offshore sites in the Netherlands (shown on Map A.7) 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
MID-NORTH SEA HIGH AND SOUTHERN NORTH SEA			
Doggersbank SAC (Netherlands)	473,500	Sandbanks	Grey seal Harbour seal Harbour porpoise
Klaverbank SAC (Netherlands)	153,900	Reefs	Grey seal Harbour seal Harbour porpoise

A5 Ramsar sites

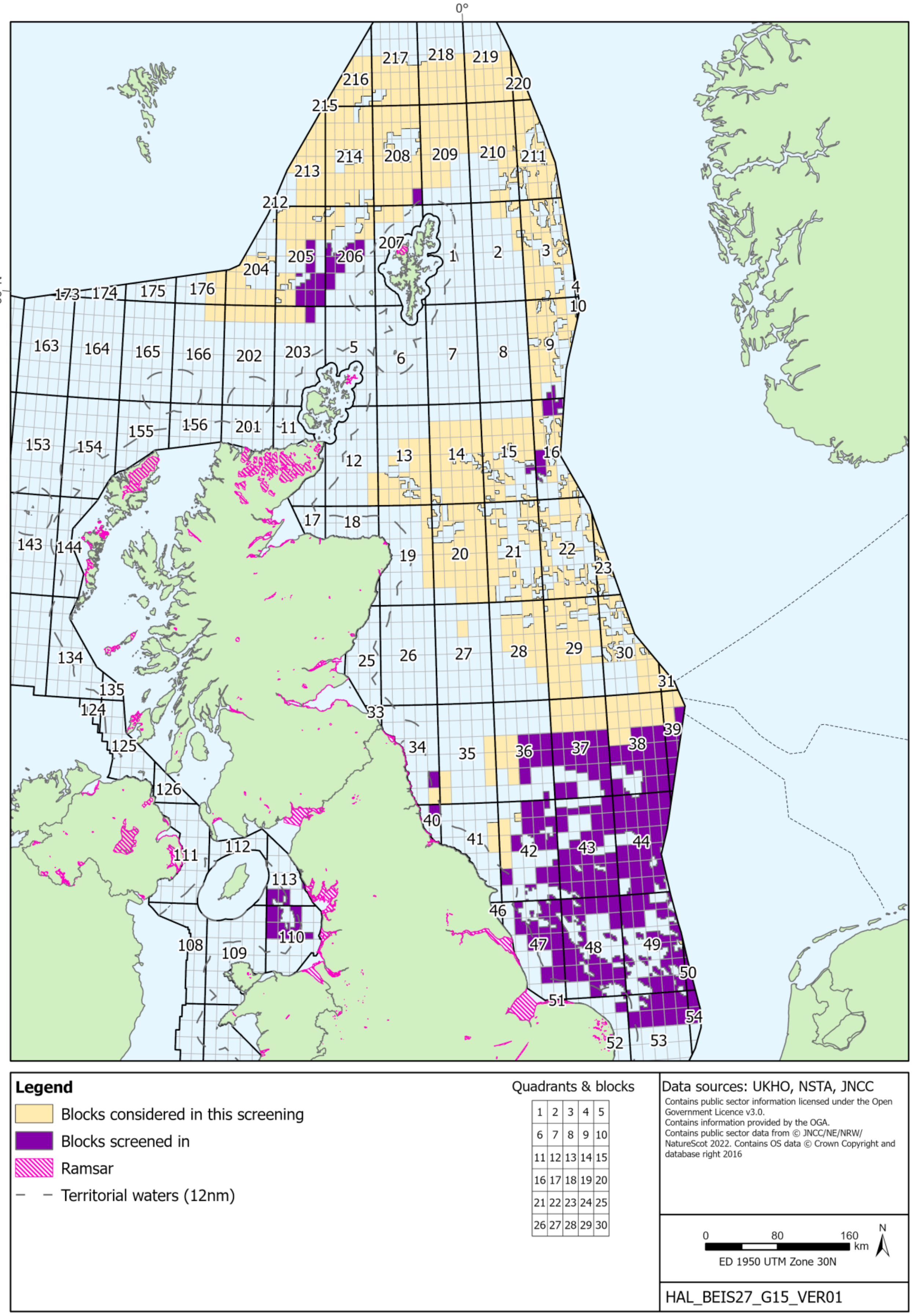
The coastal Ramsar sites listed in Table A.5 and shown on Map A.9 are also SPAs and/or SACs (although site boundaries are not always strictly coincident and a Ramsar site may comprise one or more SAC/SPA sites), see tabulation below.

Table A.5: Coastal Ramsar sites and corresponding SPAs and SACs

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	Durham Coast North Northumberland Dunes Berwickshire and North Northumberland Coast

Ramsar Name	SPA Name	SAC Name
Southern North Sea		
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	-
Irish Sea		
Upper Solway Flats and Marshes	Upper Solway Flats and Marshes Solway Firth pSPA	Solway Firth
Duddon Estuary	Morecambe Bay and Duddon Estuary	Morecambe Bay
Mersey Estuary	Liverpool Bay / Bae Lerpwl Mersey Estuary	-
Morecambe Bay	Morecambe Bay and Duddon Estuary	Morecambe Bay
Ribble and Alt Estuaries	Ribble and Alt Estuaries Liverpool Bay / Bae Lerpwl	Sefton Coast
The Dee Estuary	The Dee Estuary Mersey Narrows and North Wirral Foreshore Liverpool Bay / Bae Lerpwl	River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid Dee Estuary/ Aber Dyfrdwy
Mersey Narrows and North Wirral Foreshore	The Dee Estuary Mersey Narrows and North Wirral Foreshore Liverpool Bay / Bae Lerpwl	Dee Estuary/ Aber Dyfrdwy

Map A.9: Location of coastal Ramsar sites



Appendix B – Sites screened in

B1 Introduction

The following tables list the 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 Figure 5.1 to Figure 5.4)
- Underwater noise (Section 4.5, also see Figure 5.5 to Figure 5.7)

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

B2 Physical disturbance and drilling

West of Shetland								
SPAs								
Seas off Foula[1]	203/4	205/19	205/23b	205/23c	205/24b	205/25	205/28	205/29
	205/30	206/11c	206/11d	206/12b	206/16	206/17	206/21	
Central and Northern North Sea								
SPAs								
Northumberland Marine[2]	34/25							
Northumbria Coast	40/5							
Teesmouth and Cleveland Coast	40/5							
SACs								
Braemar Pockmarks	9/27c	9/28b	16/2	16/3d	16/4			
Scanner Pockmark	15/20d	15/25c	16/16	16/21e				
Southern North Sea								
SPAs								
Outer Thames Estuary	53/6	53/7	53/8					
Humber Estuary	47/7b							
Greater Wash[3]	47/13	47/14	47/15	47/20	47/24	47/25	47/2c	47/7b
	47/8a	48/21	48/28b	48/29c	52/5b	53/6		
Flamborough & Filey Coast	42/21							
SACs								
Flamborough Head	42/21							
Humber Estuary	47/7b							
Haisborough, Hammond and Winterton	48/28b	48/29b	48/29c	48/30b	48/30c	49/26b	52/5b	52/5c
	53/2c	53/3	53/6	53/7	53/8			
Inner Dowsing, Race Bank and North Ridge	47/14	47/15	47/20	47/24	47/25	48/16	48/21	
North Norfolk Sandbanks and Saturn Reef	48/10	48/14d	48/15b	48/18c	48/19e	48/20c	48/23c	48/24
	48/25c	48/25d	48/28b	48/29b	48/3	48/30b	48/30c	48/4
	49/6b	49/7	49/11b	49/12c	49/13a	49/14a	49/16d	49/17c
	49/18b	49/18c	49/19c	49/21b	49/21d	49/22d	49/23b	49/23c
	49/24	49/24c	49/26b	49/27c	49/28c	52/5c	53/2c	53/3
Dogger Bank	37/19	37/20	37/23b	37/24	37/25	37/26	37/27	37/30a
	38/13	38/14	38/15	38/16	38/17	38/18	38/19	38/20
	38/21a	38/22a	38/23b	38/24	38/25	38/26	38/27b	38/28b
	38/29	38/30	39/11	39/12	39/16	39/17	39/21	39/26
	42/10b	43/10	43/12a	43/13	43/14	43/15b	43/16	43/17
	43/18	43/19c	43/19d	43/1b	43/20c	43/23	43/24b	43/25
	43/2b	43/3b	43/4b	43/5	43/6	43/9	44/1	44/10
	44/11c	44/12b	44/13	44/14	44/15	44/16	44/17	44/18a

	44/19b	44/21	44/22	44/23a	44/24c	44/25	44/27	44/28
	44/2b	44/3b	44/4	44/5	44/6	44/7	44/8	44/9
	45/1							
Southern North Sea	36/13	36/14	36/15	36/18	36/19	36/20	36/23	36/30c
	37/11	37/12	37/16	37/17	37/18	37/19	37/20	37/22b
	37/23b	37/24	37/25	37/26	37/27	37/30a	38/21a	38/26
	38/27b	42/10b	42/12b	42/13c	42/13d	42/14	42/15b	42/20a
	42/24	42/25	42/28f	42/28i	42/28j	42/29c	42/3	42/30b
	42/30c	42/4	42/5c	42/8	42/9b	43/10	43/12a	43/13
	43/14	43/15b	43/16	43/17	43/18	43/19c	43/19d	43/1b
	43/20c	43/21	43/22b	43/22c	43/23	43/24b	43/24c	43/25
	43/26b	43/27b	43/27c	43/28	43/29	43/2b	43/30	43/3b
	43/4b	43/5	43/6	43/9	44/1	44/11c	44/12b	44/13
	44/14	44/16	44/17	44/18a	44/19b	44/21	44/22	44/23a
	44/24c	44/27	44/2b	44/3b	44/6	44/7	44/8	47/10c
	47/13	47/14	47/15	47/2c	47/3j	47/3k	47/4d	47/5b
	47/7b	47/8a	47/9a	48/1	48/10	48/11b	48/12a	48/13b
	48/14d	48/15b	48/17d	48/18c	48/19e	48/20c	48/23c	48/24
	48/25c	48/25d	48/28b	48/29b	48/29c	48/2b	48/3	48/30b
	48/30c	48/4	48/5	48/6b	48/6c	48/7d	48/7e	49/10e
	49/11b	49/12c	49/13a	49/14a	49/15b	49/16d	49/17c	49/18b
	49/18c	49/19c	49/21b	49/21d	49/22d	49/23b	49/23c	49/24b
	49/24c	49/25b	49/26b	49/27c	49/28c	49/29	49/30b	49/6b
	49/7	49/9f	50/21	50/26	52/5b	52/5c	53/10	53/2c
	53/3	53/4	53/5c	53/6	53/7	53/8	53/9	54/1
	54/6							
Doggersbank	38/25	38/30	39/11	39/12	39/16	39/17	39/21	39/26
	44/10	44/14	44/15	44/19b	44/24c	44/5	44/9	45/1
Klaverbank	44/19b	44/24c	44/25	44/29a	44/30c	49/10e	49/4f	49/5d
	49/9f							
Eastern Irish Sea								
SPAs								
Liverpool Bay[4]	110/2d	110/3b	110/7b	110/8b	110/9a	113/27c		
Morecambe Bay and Duddon Estuary	110/3b	113/24	113/27c					
Ribble and Alt Estuaries	110/9a							
SACs								
Shell Flat and Lune Deep	110/3b	110/8b	110/9a					
Morecambe Bay	113/24							

Notes: the following additional sites are screened in for being a source colony or adjoining waterbird site with likely connectivity to a site already screened in (see Section 4.6.1):

[1]Foula SPA

[2]Lindisfarne SPA, Coquet Island SPA, Farne Islands SPA

[3]North Norfolk Coast SPA, Gibraltar Point SPA, Great Yarmouth North Denes SPA, Breydon Water SPA, The Wash SPA, Outer Thames Estuary SPA

[4]Mersey Narrows and North Wirral Foreshore SPA, The Dee Estuary SPA

B3 Underwater noise

West of Shetland								
SPAs								
Seas off Foula[1]	203/4	205/14	205/19	205/23b	205/23c	205/24b	205/25	205/28
	205/29	205/30	206/11c	206/11d	206/12b	206/13b	206/14	206/16
	206/17	206/21						
Northern and Central North Sea								
SPAs								
Hermaness, Saxa Vord and Valla Field	208/30							
Northumberland Marine[2]	34/25							
Southern North Sea								
SPAs								
Northumberland Marine	34/25							
Flamborough & Filey Coast	42/21							
Greater Wash[3]	47/13	47/14	47/15	47/20	47/24	47/25	47/2c	47/7b
	47/8a	48/16	48/21	48/22a	48/28b	48/29c	48/30c	52/5b
	52/5c	53/6						
Humber Estuary	47/7b	47/13						
Outer Thames Estuary	53/6	53/7	53/8					
SACs								
Southern North Sea	36/13	36/14	36/15	36/18	36/19	36/20	36/23	36/30c
	37/11	37/12	37/13	37/14	37/15	37/16	37/17	37/18
	37/19	37/20	37/22b	37/23b	37/24	37/25	37/26	37/27
	37/30a	38/16	38/21a	38/26	38/27b	42/10b	42/12b	42/13c
	42/13d	42/14	42/15b	42/20a	42/24	42/25	42/28f	42/28i
	42/28j	42/29c	42/3	42/30b	42/30c	42/4	42/5c	42/8
	42/9b	43/10	43/12a	43/13	43/14	43/15b	43/16	43/17
	43/18	43/19c	43/19d	43/1b	43/20c	43/21	43/22b	43/22c
	43/23	43/24b	43/24c	43/25	43/26b	43/27b	43/27c	43/28
	43/29	43/2b	43/30	43/3b	43/4b	43/5	43/6	43/9
	44/1	44/11c	44/12b	44/13	44/14	44/15	44/16	44/17
	44/18a	44/19b	44/21	44/22	44/23a	44/24c	44/26d	44/27
	44/28	44/2b	44/3b	44/6	44/7	44/8	44/9	47/10c
	47/13	47/14	47/15	47/2c	47/3j	47/3k	47/4d	47/5b
	47/7b	47/8a	47/9a	48/1	48/10	48/11b	48/12a	48/13b
	48/14d	48/15b	48/16	48/17d	48/18c	48/19e	48/20c	48/23c
	48/24	48/25c	48/25d	48/28b	48/29b	48/29c	48/2b	48/3
	48/30b	48/30c	48/4	48/5	48/6b	48/6c	48/7d	48/7e
	49/1	49/10e	49/11b	49/12c	49/13a	49/14a	49/15b	49/16d
	49/17c	49/18b	49/18c	49/19c	49/20c	49/21b	49/21d	49/22d
	49/23b	49/23c	49/24b	49/24c	49/25b	49/26b	49/27c	49/28c

	49/29	49/30b	49/3b	49/4f	49/6b	49/7	49/9f	50/16
	50/21	50/26	52/5b	52/5c	53/10	53/2c	53/3	53/4
	53/5c	53/6	53/7	53/8	53/9	54/1	54/6	
The Wash and North Norfolk Coast	47/24	47/25	48/21	48/22a				
Humber Estuary	47/7b	47/13						
Klaverbank	44/18a	44/19b	44/23a	44/24c	44/25	44/28	44/29a	44/30c
Doggersbank	49/10e	49/4f	49/5d	49/9f				
	38/20	38/25	38/30	39/11	39/12	39/16	39/17	39/21
	39/26	39/7	44/10	44/13	44/14	44/15	44/18a	44/19b
	44/23a	44/24c	44/4	44/5	44/9	45/1		
Eastern Irish Sea								
SPAs								
Ribble and Alt Estuaries	110/9a							
Liverpool Bay	110/1	110/2d	110/3b	110/6	110/7b	110/8b	110/9a	113/26c
	113/27c							

Notes: the following additional sites are screened in for being a source colony or adjoining waterbird site with likely connectivity to a site already screened in (see Section 4.6.1):

[1]Foula SPA

[2]Lindisfarne SPA, Coquet Island SPA, Farne Islands SPA

[3]The Wash SPA, Outer Thames Estuary SPA

This publication is available from: https://www.gov.uk/guidance/offshore-energy-strategic-environmental-assessment-sea-an-overview-of-the-sea-process