7. Intertidal and Subtidal Benthic Ecology

7.1. Study Area Definition

This chapter of the Scoping Report describes the potential impacts arising from the construction, operation and maintenance (O&M), and decommissioning of Eastern Green Link 4 (EGL 4) hereafter referred to as 'the Project' on intertidal and subtidal benthic ecology receptors. Benthic receptors include the organisms living in (infauna) or on (epifauna) the seabed, excluding shellfish which are covered in Chapter 8 – Fish and Shellfish, as well as their supporting habitats.

The Scoping Boundary for the Project extends from MHWS in England to MHWS in Scotland. It is nominally 1 km wide, 500 m either side of the centreline, however, it widens in areas where there is still optionality in the design e.g., to allow for micro-routing around potential seabed features. It is anticipated that the Marine Licence application boundary will ultimately be 500 m following refinement and rationalisation as the MEA and design process evolves.

There are two proposed Landfalls in England (Anderby Creek and Theddlethorpe) and two proposed Landfalls in Scotland (Kinghorn and one in Lower Largo/Lundin Links) being considered at this stage of the environmental assessment process. These options will be subject to further technical feasibility work and stakeholder consultation and will be refined to one preferred option for inclusion in the subsequent Marine Licence application for the Project.

The Study Area includes the Scoping Boundary plus an additional 15 km buffer to either side, representative of the maximum tidal excursion. This is consistent with the Marine Physical Processes chapter (Chapter 6) and incorporates the area within which there is the potential for indirect impacts associated with the deposition of suspended sediments. The Study Area will be reviewed and refined for the Marine Environmental Assessment (MEA) based on maximum tidal excursions and, if appropriate, sediment dispersion modelling. The zone of influence will be influenced by the conclusions of Chapter 6 – Marine Physical Processes, and this chapter should be read in conjunction with these findings.

Kilometre Points (KPs) are used throughout this Chapter to provide context as to where within the Study Area a feature lies. KP 0 is defined at the Anderby Creek Landfall. As there are still alternative Landfalls being considered, KPs have been created along the longest route from the proposed English Landfall at Anderby Creek, around the Holderness Offshore Marine Conservation Zone (MCZ) to the proposed Scottish Landfall at Kinghorn. The KPs for this route are referenced as KP 0 to KP 524.9. Alternative options, which branch off this longest route, are route from the proposed English Landfall at Theddlethorpe to the point where it converges with the longest route (referenced as T_KP 0 to T_KP 18); and through Holderness Offshore MCZ, which is referenced as KP 0 to H_KP 40 and from the longest route where it branches off to the alternative proposed Scottish Landfall in Lower Largo/Lundin Links, which is referenced as L_KP 0 to L_KP 16.

7.2. Data Sources

Data sources for the baseline characterisation will be presented in accordance with relevant guidance for the topic. The datasets that will be used to inform the description of the baseline environment for the MEA are described in the following sub-sections.

7.2.1. Site-specific Survey Data

Site-specific intertidal and subtidal benthic surveys will be carried out to supplement publicly available data sources to characterise the baseline environment and determine the presence of any features that may be of conservation significance. A geophysical survey will be carried out first, over an approximate 500 m wide area, along the length of the proposed submarine cable corridor (including the landfall). In some areas this width will increase to 1 km if there are features of interest. Preliminary interpretation of the geophysical data will be undertaken onboard the survey vessel and environmental sampling stations will be selected based on this interpretation.

The survey methods will be based on consideration of best practice guidance including Davies *et al*. (2001), Wyn *et al.* (2006), Saunders *et al.* (2011), Nobel-James *et al.* (2018), and NRW (2019).

Positioning of environmental grab sampling stations will be based on flexible design and the spacing interval will be informed by geophysical survey outputs as well as a review of publicly available data.

In the nearshore and coastal approaches grab sampling will be spaced between 2 km and 5 km depending on the initial habitat map review as part of survey design planning. This will be confirmed with the initial geophysical survey outputs. Video and photo data gathering should take precedence over grabs if sensitive seabed habitats are identified, which should be utilised to identify the boundary of the feature.

In the offshore area grab sampling will be spaced between 5 km and 10 km depending on the initial habitat map review as part of survey design planning. This will be confirmed with the initial geophysical survey outputs. Video and photo data gathering should take precedence over grabs if sensitive seabed habitats are identified, which should be used to identify the boundary of the feature.

Within Marine Protected Areas (MPAs) Sensitive to Cable Installation grab sampling will be spaced at 2 km intervals with DDV/video transects conducted every 500 m. If a sensitive feature is observed, the video transects should be used to identify the boundary of the feature. Geophysical data will be reviewed prior to acquiring camera transects to establish whether this spacing should be adjusted to provide survey efficiencies without effecting seabed characterisation. Additional camera transects within MPAs may be required.

At each sample location there will be two x Van Veen Grab drops, totalling four samples from two drops (two x Replicate A and B). Sediments from Replicate A only will be analysed from each drop for macrobenthic and physio-chemical analyses, sediments from Replicate B will act as reserve samples. 0.1 m^2 samples will be collected with a Dual Van-Veen grab being used as the primary choice. Only grab samples comprising a minimum of 7 cm grab capacity with evidence of minimal wash-out will be accepted. Three attempts will be made at each station and if no sample is able to be collected this will be recorded. Grab samples will not be taken from areas identified as sensitive habitat such as *Sabellaria* reef.

The habitat mapping and biotope classifications shall be ground-truthed through a combination of photographic surveys (using both high resolution video and stills) and the benthic grab sampling at pre-determined sample locations, informed by the initial habitat maps. Additional video transects will be undertaken to investigate potential sensitive features. The camera will be towed at a maximum of 1 knot above the seabed to ensure consistent footage. The footage will be the only source of ground-truthing in areas where a benthic grab has been unsuccessful.

The footage review will include observations such as substrate characterisation, evidence of benthic activity by organisms, identification of habitats and organisms, characterisation of aquatic vegetation and evidence of fishing activity.

Data will be used to produce intertidal and subtidal habitat maps. Faunal identification and quantification will be carried out on grab samples and still photographs to obtain species density data and percentage cover for colonial species.

Habitats will be identified to the lowest European Nature Information System (EUNIS) habitat classification possible. If a sensitive EC Habitats Directive Annex I listed habitat e.g., biogenic, stony or bedrock reef, etc., is identified the extent of the habitat within the survey area will be determined and consideration will be given to whether additional survey is required to avoid the habitat or further classify it.

Currently both open cut trenching and trenchless techniques are proposed methods of construction in the intertidal area, a Phase 1 habitat walkover survey has been completed on the beach. Characterisation will be based on data from the Phase 1 survey and the subtidal methodology proposed above.

Relevant stakeholders such as MMO, MD-LOT, Natural England, NatureScot, SEPA, Cefas and the JNCC will be consulted prior to the survey commencing. Some of this stakeholder engagement has already been undertaken.

7.2.2. Publicly Available Data

A desk-based review of publicly available data sources (literature and GIS mapping files) will be used to supplement the site-specific ecology surveys and describe the wider baseline environment. Table 7-1 lists the key data sources which would be used in the assessment.

Table 7-1: Key publicly available data sources for intertidal and subtidal benthic ecology

Data Source	Description	Coverage	
		English Study Area	Scottish Study Area
EMODnet (2021)	EUNIS 2019 habitat types.	✓	✓
JNCC	Marine Habitat data product: Habitats Directive Annex I marine habitats. JNCC Conservation Advice for Marine Protected Areas.	✓	✓
Natural England	Natural England Conservation Advice for Marine Protected Areas.	✓	
Inshore Fishing and Conservation Authorities	Website with Information about fishing and the species in the different regional Eastern and Northeastern Inshore Fishing and Conservation Authorities	✓	
British Geological Survey (BGS) Marine Sediment Particle Size dataset	This is a national dataset providing full coverage of the benthic, subtidal and intertidal aspects of the Study Area.	✓	✓

Data Source	Description	Coverage	
		English Study Area	Scottish Study Area
sourced from the BGS GeoIndex Offshore porta			
UKSeaMap 2018	Broad-scale overview of the coverage of different physical seabed habitats in the UK.	✓	✓
OneBenthic Open portal hosted by OpenScience Cefas	Compilation of 33,198 macrofaunal samples from 2014-2016, 83% of which contain associated data on sediment particle size composition. Dataset covers large areas of the UK continental shelf and was funded by the aggregates industry. (OpenScience, Cefas, 2023).	✓	✓
NatureScot	An executive non-departmental public body of the Scottish government responsible for the country's natural heritage. https://www.nature.scot/		✓
Offshore Wind Farm (OWF) and Interconnector Environmental Reports	Environmental Reports for OWF developments Outer Dowsing Offshore Windfarm and Viking Link	✓	✓
DEFRA (2020)	Intertidal substrate foreshore data.	✓	✓

7.2.3. Additional Studies

Beyond the collection of site-specific survey data, no additional studies are proposed to inform this assessment. However, Chapter 6: Marine Physical Processes and Chapter 8: Fish and Shellfish will inform the environmental assessment.

7.3. Consultation

Consultation will be undertaken with stakeholders to supplement the desk-top review and studies. The following bodies will be consulted as a minimum to ensure that the most up-to-date information is collated.

Table 7-2: List of stakeholders to be consulted

England	Scotland
JNCC	JNCC
Natural England (NE)	NatureScot
Centre for Environment, Fisheries and Aquaculture Science (Cefas)	Marine Scotland (MD-LOT)
Inshore Fisheries and Conservation Authority (IFCA) Eastern, North-Eastern and Northumberland.	Scottish Environmental Protection Agency (SEPA)
Environment Agency	Centre for Environment, Fisheries and Aquaculture Science (Cefas)
Marine Management Organisation (MMO)	

7.4. Baseline Characterisation

7.4.1. Introduction

This section has been split into the following sub-sections.

- General information
- English baseline characterisation
- Scottish baseline characterisation

This section provides a characterisation of the current baseline environment and describes the key intertidal and subtidal benthic ecology along the proposed submarine cable corridor. It also includes details of the designated sites and protected species within the English and Scottish Study Areas.

7.4.2. General Information

The proposed submarine cable corridor passes through various broadscale habitats between the proposed English and Scottish landfall sites. Table 7-3 lists these EUNIS habitats along with a description of characterising features. Please note that EUNIS habitat data was not available for some of the nearshore portions of the cable corridor. Where this was the case, habitat descriptions relating to depth and energy regime were noted instead.

Table 7-3: Broadscale habitat descriptions for habitats along the proposed submarine cable corridor.

Broadscale habitat type	EUNIS habitat description
A.5.13 Infralittoral coarse sediment	Moderately exposed habitats with coarse sand, gravelly sand, shingle and gravel in the infralittoral, are subject to disturbance by tidal steams and wave action. Such habitats found on the open coast or in tide-swept marine inlets are characterised by a robust infaunal polychaetes such as *Chaetozone setosa* and *Lanice conchilega*, *Cumacean crustacea* such as *Iphinoe trispinosa* and *Diastylis bradyi,* and venerid bivalves. Habitats with the lancelet *Branchiostoma lanceolatum* may also occur.
A5.14 Circalittoral coarse sediment	Tide-swept circalittoral coarse sands, gravel and shingle generally in depths of over 15-20 m. This habitat may be found in tidal channels of marine inlets, along exposed coasts and offshore. This habitat, as with shallower coarse sediments, may be characterised by robust infaunal polychaetes, mobile crustacea and bivalves. Certain species of sea cucumber (e.g., *Neopentadactyla)* may also be prevalent in these areas along with the lancelet *Branchiostoma lanceolatum*.
A5.15 Deep Circalittoral coarse sediment	Offshore (deep) circalittoral habitats with coarse sands and gravel or shell. This habitat may cover large areas of the offshore continental shelf although there is relatively little quantitative data available. Such habitats are quite diverse compared to shallower versions of this habitat and generally characterised by robust infaunal polychaete and bivalve species. Animal communities in this habitat are closely related to offshore mixed sediments and in some areas, the settlement of *Modiolus modiolus* larvae may occur and consequently these habitats may occasionally have large numbers of juvenile *M. modiolus*. In areas where the mussels reach maturity, their byssus threads bind the sediment together, increasing stability and allowing an increased deposition of silt leading to the development of the biotope A5.622.
A5.25 or A5.26 Circalittoral fine sand or Circalittoral muddy sand	Clean fine sands with less than 5% silt/clay in deeper water, either on the open coast or in tide-swept channels of marine inlets in depths of over 15-20 m. The habitat may also extend offshore and is characterised by a wide range of echinoderms (in some areas including the pea urchin *Echinocyamus pusillus*), polychaetes and bivalves. This habitat is generally more stable than shallower, infralittoral sands and consequently supports a more diverse community. Circalittoral non-cohesive muddy sands with the silt content of the substratum typically ranging from 5% to 20%. This habitat is generally found in water depths of over 15-20 m and supports animal-dominated communities characterised by a wide variety of polychaetes, bivalves such as *Abra alba* and *Nucula nitidosa,* and echinoderms such as *Amphiura spp.* and *Ophiura spp*., and *Astropecten irregularis*. These circalittoral habitats tend to be more stable than their infralittoral counterparts and as such support a richer infaunal community.
A5.27 Deep circalittoral sand	Offshore (deep) circalittoral habitats with fine sands or non-cohesive muddy sands. Very little data is available on these habitats however they are likely to be more stable than their shallower counterparts and characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms.
A5.33 Infralittoral sandy mud	Infralittoral, cohesive sandy mud, typically with over 20% silt/clay, in depths of less than 15-20 m. This habitat is generally found in sheltered bays or marine inlets and along sheltered areas of open coast. Typical species include a rich variety of polychaetes including *Melinna palmata*, tube building amphipods (*Ampelisca* spp.) and deposit feeding bivalves such as *Macoma balthica* and *Mysella bidentata*. Sea pens such as *Virgularia mirabilis* and brittlestars such as *Amphiura* spp. may be present but not in the same abundances as found in deeper circalittoral waters.
A5.35 Circalittoral sandy mud	Circalittoral, cohesive sandy mud, typically with over 20% silt/clay, generally in water depths of over 10 m, with weak or very weak tidal streams. This habitat is generally found in deeper areas of bays and marine inlets or offshore from less wave exposed coasts. Sea pens such as *Virgularia mirabilis* and brittlestars such as *Amphiura* spp. are particularly characteristic of this habitat whilst infaunal species

Broadscale habitat type	EUNIS habitat description
	include the tube building polychaetes *Lagis koreni* and *Owenia fusiformis*, and deposit feeding bivalves such as *Mysella bidentata* and *Abra* spp.
A5.37 Deep circalittoral mud	In mud and cohesive sandy mud in the offshore circalittoral zone, typically below 50-70 m, a variety of faunal communities may develop, depending upon the level of silt/clay and organic matter in the sediment. Communities are typically dominated by polychaetes but often with high numbers of bivalves such as *Thyasira* spp., echinoderms and foraminifera.
A5.44 Circalittoral mixed sediments	Mixed (heterogeneous) sediment habitats in the circalittoral zone (generally below 15-20 m) including well mixed muddy gravelly sands or very poorly sorted mosaics of shell, cobbles and pebbles embedded in or lying upon mud, sand or gravel. Due to the variable nature of the seabed a variety of communities can develop which are often very diverse. A wide range of infaunal polychaetes, bivalves, echinoderms and burrowing anemones, such as *Cerianthus lloydii,* are often present in such habitats and the presence of hard substrata (shells and stones) on the surface enables epifaunal species to become established, particularly hydroids such as *Nemertesia* spp. and *Hydrallmania falcata*. The combination of epifauna and infauna can lead to species rich communities. Coarser mixed sediment communities may show a strong resemblance, in terms of infauna, to biotopes within the A5.1. However, infaunal data for this habitat type is limited to that described under the biotope A5.443, and so are not representative of the infaunal component of this habitat type.
A5.45 Deep circalittoral mixed sediments	Offshore (deep) circalittoral habitats with slightly muddy mixed gravelly sand and stones or shell. This habitat may cover large areas of the offshore continental shelf although there is relatively little data available. Such habitats are often highly diverse with a high number of infaunal polychaete and bivalve species. Animal communities in this habitat are closely related to offshore gravels and coarse sands and in some areas, populations of the horse mussel *Modiolus modiolus* may develop in these habitats (see A5.622).

Source: EUNIS (2019)

7.4.3. English Baseline Characterisation KP 0 to KP 418.7

7.4.3.1. Intertidal Zone, England

The definition of the intertidal zone is the area of seashore that is exposed at low tide and inundated at high tide (Marine Scotland, 2023). The Project will start on the Lincolnshire coast, and at the time of writing a preferred landfall site has not yet been determined, therefore there are two proposed landfalls at Anderby Creek and Theddlethorpe.

At the proposed Anderby Creek landfall the foreshore sediments are largely composed of littoral sand and moderate to high energy infralittoral coarse sediment (EMODnet, 2021).

At the proposed Theddlethorpe landfall the foreshore sediments are also largely composed of sand. The available data indicates that the intertidal area is characterised by a moderate to high energy regime (EMODnet, 2021).

Table 7-3 describes the different habitats present within the Study Area.

7.4.3.2. Subtidal KP 0.45 – KP 418.7 within the English Study Area

The definition of subtidal zone is the area where the seabed falls below the reach of the lowest spring tide.

As the Project moves away from the Lincolnshire coast, the habitat conditions transition from moderate to high energy A5.13 Infralittoral coarse sediment which is present for approximately 0.35 km. The seabed habitat then transitions into A5.14 Circalittoral coarse sediment which remains the dominant substrate for the next 74 km of the proposed submarine cable corridor except for a small patch of A5.25 or A5.26 Circalittoral fine sand or Circalittoral muddy sand between KP 11 and KP 12. Coarse sediment habitats which are a combination of coarse sands, gravel and shingle are widespread across the southern North Sea (OESEA4, 2022). The heterogeneous substrates and high energy conditions associated with A5.14 Circalittoral coarse sediment tend to be characterised by robust polychaete worms such as *Lanice conchilega* and the calcareous tube-building *Spirobranchus triqueter,* mobile crustaceans (particularly amphipods such as *Ampelisca spinipes*) and the sea cucumber *Neopentadactyla mixta*. The lancelet (*Branchiostoma lanceolatum)* may also occur in this habitat.

The habitats A5.25 or A5.26 Circalittoral fine sand or Circalittoral muddy sand are typically characterised by sediments containing between 5% and 20% silt and a high proportion of clean sand. Faunal communities in A5.25 and A5.26 are usually rich support by a diverse variety of polychaetes, bivalves such as white furrow shell *Abra alba,* and echinoderms including as brittlestars (*Amphiura* spp.) and serpent stars (*Ophiura* spp.).

The proposed submarine cable corridor then passes through an area of A5.44 Circalittoral mixed sediment between KP 56 and KP 61.5. Due to the variable nature of this type of seabed, a diverse and wide range of fauna can be found including polychaetes, bivalves, echinoderms and burrowing anemones such as *Cerianthus lloydii*. Where harder substrate such as stones and shells are present, colonial hydroids including *Nemertesia* spp. And *Hydrallmania falcata* may become established.

Next, the proposed submarine cable corridor passes through an area of A5.45 Deep circalittoral mixed sediments between KP 64.2 and KP 66.7, which is surrounded by a border of A5.15 Deep circalittoral coarse sediment. Substrates in A5.45 Deep circalittoral mixed sediment contain a mixture of slightly muddy mixed gravelly sand and stones/shell. Faunal communities are often highly diverse, containing a range of infaunal polychaete and bivalve species. A5.15 Deep circalittoral coarse sediment represents habitats with coarse sands and gravel/shell with diverse faunal communities. Settlement of juvenile horse mussel *Modiolus modiolus* may occur in this habitat and as such, large beds may occasionally be found in this habitat.

Following a small patch of A5.15 Deep circalittoral coarse sediment at KP 67, the proposed submarine cable corridor passes back into A5.14 Circalittoral coarse sediment until KP 73.5 where the substrate transitions back into A5.15. This remains the dominant habitat type until KP 107 except for a small patch of A5.27 Deep circalittoral sand from KP 88 and 89. At KP 107, the proposed submarine cable corridor passes into A5.27 Deep circalittoral sand. Approximately 482 km of the route passes through this habitat type in both the English and Scottish waters. Due to depth and distance offshore, little data is available for this type of habitat. However, it is understood to be a more stable habitat than its shallower counterparts and is characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms. The remainder of the proposed submarine cable corridor in English waters passes through A5.27 Deep circalittoral sand and A5.15 Deep circalittoral coarse sediment intermittently until KP 418.9 at the Scottish border.

Though the proposed submarine cable corridor is not known to pass directly through any areas of Annex I reef, it passes as close as 0.4 km to areas of Bedrock/stony reef. Stony reef, classified as A4.3 Atlantic and Mediterranean low energy circalittoral rock and A4.33 Faunal communities on deep low energy circalittoral rock, occurs on wave-sheltered circalittoral bedrock and boulders subject to mainly weak/very weak tidal streams. Communities identified within this habitat type are often dominated by encrusting red algae, brachiopods (*Neocrania anomala*), the ascidian *Ciona intestinalis* and the sea squirt *Ascidia mentula*.

Below is the list of habitat types along the proposed submarine cable corridor. Firstly, the landfall option of Anderby Creek and then habitats along the Theddlethorpe route are given.

Anderby Creek – KP 0 to KP 418.7 (south to north)

- Littoral sand (intertidal)
- A.5.13 Infralittoral coarse sediment
- A5.14 Circalittoral coarse sediment
- A5.25 or A5.26 Circalittoral fine sand or Circalittoral muddy sand
- A5.44 Circalittoral mixed sediment
- A5.45 Deep circalittoral mixed sediments
- A5.15 Deep Circalittoral coarse sediment
- A5.27 Deep Circalittoral sand

Theddlethorpe T_KP 0 to T_KP 14 (south to north)

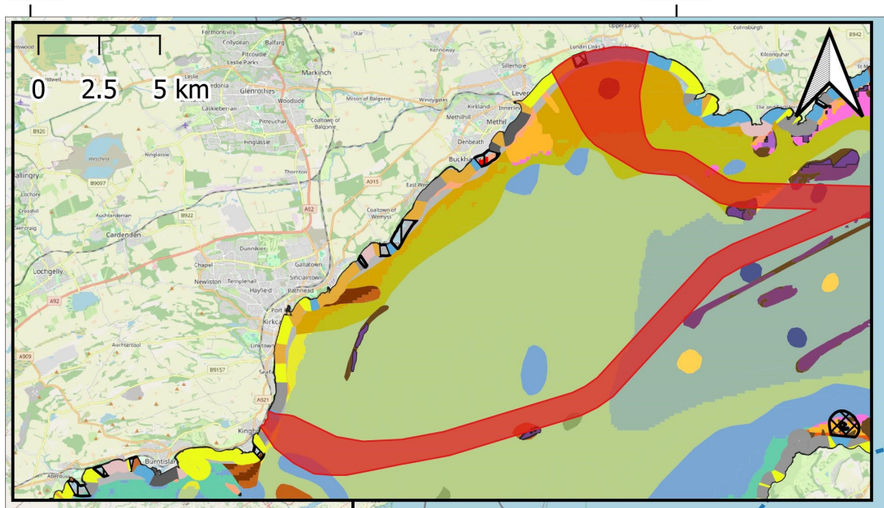
- Littoral sand (intertidal)
- High energy infralittoral seabed
- High energy circalittoral seabed
- A5.14 Circalittoral coarse sediment

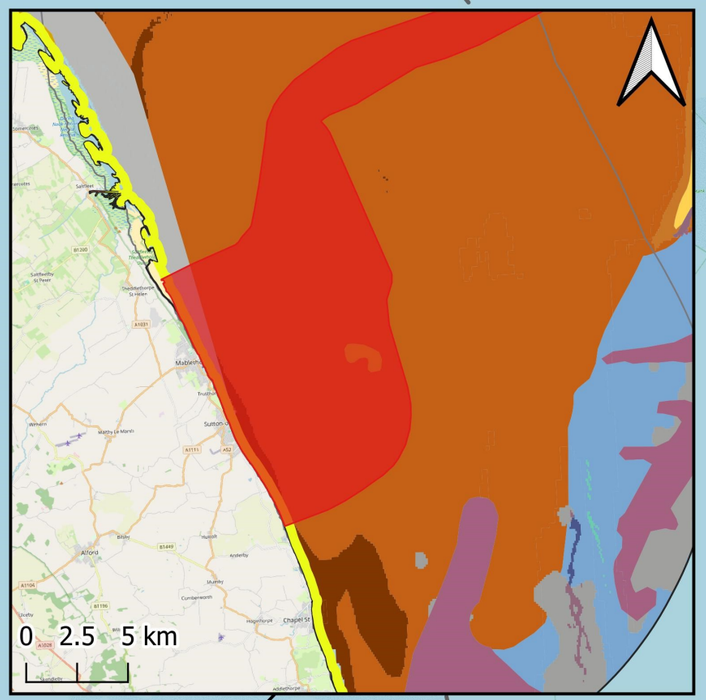
Figure 7-1, Drawing C01494-EGL4-PROT-009, illustrates the predicted intertidal and subtidal benthic habitat types identified within the Study Area.

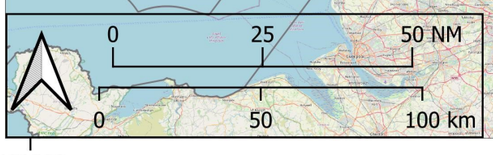
400000 600000 800000

6200000

6000000







Date	08/12/2023
Coordinate System	ETRS89 / UTM Zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	Meters
Scale at A3	1:1,900,000
Created	EP
Reviewed	S Pearce
Authorised	A Farley

collaborative environmental advisers

nationalgrid SP Energy Networks

Intertidal and Subtidal Predicted Benthic Habitat Types

C01494b-EGL4-PROT-009-C

- Exclusive Economic Zone Limit (EEZ)
- 12NM Limit
- Scottish Adjacent Waters
- EGL 4 Scoping Boundary
- Benthic Study Area

Intertidal Zone Foreshore

- Boulders/Loose Rock
- Gravel
- Made Ground
- Mud
- Mud & Gravel
- Not Present
- Rock Platform
- Rock Platform with Banks of Gravel
- Rock Platform with Boulders/Loose Rock
- Sand
- Sand & Gravel
- Sand & Mud
- Unspecified

EUSeaMap (2021) Habitat Types (EUNIZ 2007/ Full-Detail Classification)

- A3: Infralittoral rock and other hard substrata
- A3.1: Atlantic and Mediterranean high energy infralittoral rock
- A3.2: Atlantic and Mediterranean moderate energy infralittoral rock
- A3.3: Atlantic and Mediterranean low energy infralittoral rock
- A4: Circalittoral rock and other hard substrata
- A4.1: Atlantic and Mediterranean high energy circalittoral rock
- A4.12: Sponge communities on deep circalittoral rock
- A4.2: Atlantic and Mediterranean moderate energy circalittoral rock
- A4.27: Faunal communities on deep moderate energy circalittoral rock
- A4.3: Atlantic and Mediterranean low energy circalittoral rock
- A4.33: Faunal communities on deep low energy circalittoral rock
- A5: Sublittoral sediment
- A5.13: Infralittoral coarse sediment
- A5.14: Circalittoral coarse sediment
- A5.15: Deep circalittoral coarse sediment
- A5.23 or A5.24: Infralittoral fine sand or Infralittoral muddy sand
- A5.25 or A5.26: Circalittoral fine sand or Circalittoral muddy sand
- A5.27: Deep circalittoral sand
- A5.33: Infralittoral sandy mud
- A5.35: Circalittoral sandy mud
- A5.36: Circalittoral fine mud
- A5.37: Deep circalittoral mud
- A5.43: Infralittoral mixed sediments
- A5.44: Circalittoral mixed sediments
- A5.45: Deep circalittoral mixed sediments
- A5.6: Sublittoral biogenic reefs
- A5.61: Sublittoral polychaete worm reefs on sediment
- A5.611: [Sabellaria spinulosa] on stable circalittoral mixed sediment
- Na

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Export Date: 08/12/2023

7.4.3.3. Designated Sites within the English Study Area

Table 7-4 presents the sites designated for benthic habitats and or species within the English Study Area, along with their protected features and conservation objectives. Designated sites within the area of the Project are also illustrated in Chapter 5 - Designated Sites in Figure 5-1, Drawing C01494-EGL4-PROT-011.

Table 7-4: Designated sites in England designated for benthic habitats and species within the Study Area

Site Name and Code	Distance to Scoping Boundary (km)	Relevant Annex I Protected Features	Conservation Objectives
Holderness Offshore MCZ (JNCC, 2021)	Within Scoping Boundary. 8.6 km of the route passes through the MCZ on the longest route. Alternative route crosses (for approximately 20 km)	• Overarching objective	The Conservation Objective for the Holderness Offshore Marine Conservation Zone is that the protected features: • so far as already in favourable condition, remain in such condition; and • so far as not already in favourable condition, be brought into such condition, and remain in such condition.
		• Subtidal coarse sediment • Subtidal mixed sediments • Subtidal sand	With respect to Subtidal coarse sediment, Subtidal sand and Subtidal mixed sediments within the Zone, this means that: i. its extent is stable or increasing; and ii. its structures and functions, its quality, and the composition of its characteristic biological communities (which includes a reference to the diversity and abundance of species forming part of or inhabiting that habitat) are such as to ensure that it remains in a condition which is healthy and not deteriorating. Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery. Any alteration to that feature brought about entirely by natural processes is to be disregarded.
		• North Sea glacial tunnel valleys (e.g., Silver Pit)	With respect to the North Sea glacial tunnel valleys within the Zone, this means that: i. its extent, component elements and integrity are maintained. ii. its structure and functioning are unimpaired; and iii. its surface remains sufficiently unobscured for the purposes of determining whether the conditions in paragraphs (i) and (ii) are satisfied. Any obscurement of that feature brought about entirely by natural processes is to be disregarded. Any alteration to that feature brought about entirely by natural processes is to be disregarded.
		• Ocean quahog (*Arctica islandica*) – **Species of Conservation Importance**	With respect to the Ocean quahog (*Arctica islandica*) within the Zone, this means that the quality and quantity of its habitat and the composition of its population in terms of number, age and sex ratio are such as to ensure that the population is maintained in numbers which enable it to thrive. Any temporary reduction of numbers is to be disregarded if the population is sufficiently thriving and resilient to enable its recovery. Any alteration to that feature brought about entirely by natural processes is to be disregarded.
Farnes East MCZ (JNCC, 2021)	6.29 km	• Moderate energy circalittoral rock: • Subtidal coarse sediment: • Subtidal sand: • Subtidal mud: • Subtidal mixed sediments: • Sea-pen and burrowing megafauna communities – **Feature of Conservation Importance**	The Conservation Objectives for the protected features of the MCZ are: Subject to natural change, the moderate energy circalittoral rock, subtidal coarse sediment, subtidal sand, subtidal mud, subtidal mixed sediments and sea-pen and burrowing megafauna communities features are to remain in or be brought into favourable condition, such that their: • Extent is stable or increasing; and

Site Name and Code	Distance to Scoping Boundary (km)	Relevant Annex I Protected Features	Conservation Objectives
			• Structures and functions, quality, and the composition of their characteristic biological communities are such as to ensure that they are in a condition which is healthy and not deteriorating
		• Ocean quahog (*A. islandica*) – **Species of Conservation Importance**	Subject to natural change, the ocean quahog feature is to remain in or be brought into favourable condition, such that: • The quality and extent of its habitat is stable or increasing; and • The population structure allows numbers to be maintained or increased.
North East of Farnes Deep HPMA (JNCC, 2023)	0.08 km	• Overarching Objective	The Conservation Objective for the North East of Farnes Deep HPMA is that the protected features: • so far as already in favourable condition, remain in such condition; and • so far as not already in favourable condition, be brought into such condition, and remain in such condition.
		• Subtidal coarse sediment • Subtidal sand • Subtidal mixed sediments • Subtidal mud	With respect to Subtidal coarse sediment, Subtidal sand, Subtidal mixed sediments and Subtidal mud within the Zone, this means that— • Extent is stable or increasing; and • Structures and functions, quality, and the composition of characteristic biological communities (which includes a reference to the diversity and abundance of species forming part of or inhabiting each habitat) are such as to ensure that they remain in a condition which is healthy and not deteriorating. Any temporary deterioration in condition is to be disregarded if the habitats are sufficiently healthy and resilient to enable recovery. Any alteration to the features brought about entirely by natural processes is to be disregarded.
		• Ocean quahog (*A. islandica*) – **Species of Conservation Importance**	With respect to the Ocean quahog (*Arctica islandica*) within the site, this means that the quality and quantity of its habitat and the composition of its population in terms of number, age and sex ratio are such as to ensure that the population is maintained in numbers which enable it to thrive. Any temporary reduction of numbers is to be disregarded if the population is sufficiently thriving and resilient to enable its recovery. Any alteration to that feature brought about entirely by natural processes is to be disregarded.
Humber Estuary SAC (UK0030170) (JNCC, 2023a)	4.26 km	• 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)* • 1150 Coastal lagoons Priority Feature • 2160 Dunes with *Hippophae rhamnoides* • 2110 Embryonic shifting dunes • 1130 Estuaries • 1140 Mudflats and sandflats not covered by seawater at low tide. • 2130 Fixed dunes with herbaceous vegetation (`grey dunes`) **- Priority Feature** • 1310 Salicornia and other annuals colonising mud and sand	With regard to the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change, ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; • The extent and distribution of qualifying natural habitats and habitats of qualifying species • The structure and function (including typical species) of qualifying natural habitats. • The structure and function of the habitats of qualifying species

Site Name and Code	Distance to Scoping Boundary (km)	Relevant Annex I Protected Features	Conservation Objectives
		• 1110 Sandbanks which are slightly covered by sea water all the time • 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (`white dunes')	• The supporting processes on which qualifying natural habitats and habitats of qualifying species rely • The populations of qualifying species, and, • The distribution of qualifying species within the site
Saltfleetby – Theddlethorpe Dunes and Gibraltar Point SAC (UK0030270) (JNCC, 2023b)	Within Scoping Boundary for Theddlethrope landfall only	• 2110. Embryonic shifting dunes • 2120. Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); Shifting dunes with marram • 2130. Fixed dunes with herbaceous vegetation ("grey dunes"); Dune grassland **- Priority Feature** • 2160. Dunes with *Hippophae rhamnoides;* Dunes with sea-buckthorn • 2190. Humid dune slacks	With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change, ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; • The extent and distribution of the qualifying natural habitats • The structure and function (including typical species) of the qualifying natural habitats, and, • The supporting processes on which the qualifying natural habitats rely
Inner Dowsing, Race Bank and North Ridge SAC [UK0030370] (JNCC, 2023c)	6.75 km	• 1170 Reefs • 1110 Sandbanks which are slightly covered by sea water all the time	To ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate and that it makes the best possible contribution to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring: • the extent and distribution of qualifying natural habitats and habitats of the qualifying species • the structure and function (including typical species) of qualifying natural habitats • the structure and function of the habitats of the qualifying species • the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely • the populations of each of the qualifying species • the distribution of qualifying species within the site

7.4.3.4. Protected Species and Priority Features within the English Study Area

Sea-pen and burrowing megafauna communities

The Sea-pen and burrowing megafauna communities are a protected feature in the Farnes East MCZ within the English Study Area.

Sea-pen and burrowing megafauna communities are associated with plains of fine mud, and are found at water depths ranging from 15–200 m or more. Sediments are often heavily bioturbated by burrowing megafauna and as such, burrows and mounds may form a prominent feature of the sediment surface with conspicuous populations of sea-pens, typically the slender sea pen (*Virgularia mirabilis)* and phosphorescent sea pen (*Pennatula phosphorea*). Burrowing crustaceans present in this community may include Nephrops (*Norvegicus* spp.), shrimp (*Calocaris macandreae)* or ghost shrimp (*Palaemon paludosus*) (OSPAR, 2010).

Ocean quahog (*Arctica islandica*)

The Ocean quahog is a protected feature in the following designated sites within the English Study Area:

- Holderness Offshore MCZ
- Farnes East MCZ
- North East of Farnes Deep HPMA

The ocean quahog is found widely distributed around British and Irish coasts, as well as offshore. The growth rate of the quahog is rapid in juveniles but slow and indeterminate in adults. Individual growth rates are highly variable between different regions in the North Atlantic, and is variable depending on season, temperature, salinity, hydrography and food supply. They are the longest living unitary species with the oldest recorded specimen found being 507 years old (Tyler-Walters, 2017).

The ocean quahog is a burrowing species which has been found in a range of sediments, from coarse clean sand to muddy sand, in a range of depths typically from 4 m to 482 m deep. It is thought to have a high sensitivity to physical loss of habitat, it is therefore important to conserve the extent and distribution of supporting habitats to provide the best chance of any potential settlement for new recruits and to retain existing individuals (JNCC, 2018).

2130 – Fixed dunes with herbaceous vegetation ("grey dunes") Priority Feature

Fixed dunes with herbaceous vegetation ("grey dunes") Priority Feature is a protected feature for the following designated sites within the English Study Area:

- Humber Estuary SAC
- Saltfleetby – Theddlethorpe Dunes and Gibraltar Point SAC

This habitat is characterised by fixed dune vegetation occurring mainly on large dune systems. It typically occurs inland of the zone dominated by European marram grass (*Ammophila arenaria*) on coastal dunes and represents the vegetation that replaces marram as the dune stabilises and the organic content of the sand increases. In the UK the vegetation corresponds to the following National vegetation classification (NVC) types:

- SD7 European marram grass (*Ammophila arenaria*) – Festuca rubra semi-fixed dune community
- SD8 Red Fescue (*Festuca rubra*) – Lady's bedstraw (*Galium verum*) fixed dune grassland
- SD9b European marram grass– Tall oat grass (*Arrhenatherum elatius*) dune grassland, bloody cranes-bill (*Geranium sanguineum*) sub-community
- SD11 Sand Sedge (*Carex arenaria*) – Siny Iceland lichen (*Cornicularia aculeata*) dune community
- SD12 Sand Sedge – Sheep's fescue (*Festuca ovina*) – Common bent (*Agrostis capillaris)* dune grassland.

The herbaceous vegetation of fixed dunes in the UK exhibits considerable variation. The most widespread type is Atlantic dune grassland, consisting of a short sward characterised by red fescue and lady's bedstraw and is typically rich in species of calcareous substrates. The vegetation shows considerable variation both from north to south and from east to west. In the south, several orchid species are found, including pyramidal orchid (*Anacamptis pyramidalis*), and a rich variety of other species. A taller type of dune grassland vegetation, in which bloody crane's-bill is prominent, is particularly characteristic of north-east England. In areas with a drier and more continental climate, such as Norfolk, and where the substrate is at the acidic end of the spectrum, the fixed dune vegetation is rich in lichens (JNCC, 2023d).

Figure 7-2 (Drawing C01494-EGL4-PROT-010) illustrates the ecologically sensitive sites and features with the English Study Area.

400000 500000 600000 700000 800000 900000

6300000 6200000 6100000 6000000 5900000

0 2.5 5 km

0 2.5 5 km

collaborative environmental advisers

nationalgrid

SP Energy Networks

Relevant Sensitive Sites And Features Within The Benthic Ecology Study Area

C01494b-EGL4-PROT-010-A

- Exclusive Economic Zone Limit (EEZ)
- 12NM Limit
- Scottish Adjacent Waters
- EGL 4 Scoping Boundary
- Benthic Study Area
- Annex I Sandbank
- Ocean Quahog
- Seagrass Cover

Annex I Reef

- Bedrock
- Bedrock and/or Stony
- Biogenic

0 25 50 NM

0 50 100 km

Date	21/12/2023
Coordinate System	ETRS89 / UTM Zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	Meters
Scale at A3	1:1,900,000
Created	EP
Reviewed	S Pearce
Authorised	A Farley

Document Path: X:\GIS\GIS_PROJECTS\C01494_EGL3&4\Project\QGS\EGL4\06_PROT\C01494b_EGL4_PROT_010.qgz

Export Date: 21/12/2023

7.4.4. Scotland Baseline Characterisation KP 418.7 to KP 524.9

7.4.4.1. Intertidal Scotland

At the proposed Kinghorn landfall, Fife, the foreshore sediments are composed of infralittoral sand and gravel overlying a rocky platform. The available data indicates that the intertidal area is characterised by low to moderate energy infralittoral seabed (EMODnet, 2021).

One proposed landfall is located in Lower Largo, at Lundin Links golf course, Fife. The foreshore sediments at the Lower Largo/Lundin Links landfall is composed of infralittoral sand. Available data indicates that the intertidal area here is characterised by low energy infralittoral seabed. All KP points along the proposed Lower Largo/Lundin Links submarine cable corridor can be identified by the prefix 'L_' and run from L_KP 0 at the coast, to L_KP 16 where the proposed submarine cable corridor joins the longer submarine cable corridor from Anderby Creek to Kinghorn.

7.4.4.2. Subtidal KP 418.7– KP 524.9 within the Scottish Study Area

A substantial portion of the proposed submarine cable corridor in Scottish waters overlays A5.27 Deep Circalittoral sand. This biotope starts at KP 418.9 and continues relatively undisturbed until to KP 464 except for a patch of A5.15 Deep circalittoral coarse sediment between KP 432.9 and KP 440. A5.27 Deep Circalittoral sand is characterised by fine sands and non-cohesive muddy sands while A5.15 is characterised by coarse sands with gravel or shell. Both habitats are known to support diverse faunal communities though A5.15 Deep littoral coarse sediments is more likely to support *M. modiolus* beds due to the presence of coarse substrate which is suitable for settlement of larvae.

At KP464, the benthic habitat transitions to A5.37 Deep circalittoral mud which remains the dominant habitat until except for a patch of A5.45 Deep circalittoral mixed sediments between KP 473.1 and KP 476. A5.37 Deep circalittoral mud is characterised by the presence of mud and cohesive sandy mud. Faunal communities are typically dominated by polychaetes, small bivalves such as *Thasira* spp., echinoderms and foraminifera. Sediments in A5.45 Deep circalittoral mixed sediments are typically composed of lightly muddy mixed gravelly sand and stones or shell and support diverse faunal communities which in some locations may include *M. modiolus* beds.

At KP 510, the seabed habitat transitions to A5.35 Circalittoral sandy mud which remains present until the nearshore approach at KP 524.5. Substrate in this habitat is characterised by cohesive sandy mud, typically with over 20% silt, generally in water depths of over 10 m with weak tidal streams. Sea pens such as *V. mirabilis* and brittlestars such as *Amphiura* spp. are commonly associated with this habitat along with a range of tube-building polychaetes and small bivalves.

The final stretch of seabed approaching the Scottish coastline is classified as A5.33 Infralittoral sandy mud, it is understood that this overlies stony bedrock. The proposed submarine cable corridor then reaches the intertidal zone where it intersects with moderate energy infralittoral seabed and low energy infralittoral seabed. Substrates in A5.33 Infralittoral sandy mud are typified by cohesive sandy mud, typically with over 20% silt in depths of less than 15-20 m. A variety of polychaetes including *M. palmata*, tube-building amphipods and small bivalves are associated with this habitat as are the sea pen *V. mirabilis* and brittlestars *Amphiura* spp. Though these are likely to be less abundant than in deeper habitats seen along the proposed submarine cable corridor, such as A5.35 Circalittoral muddy sand.

Below is the list of sediment habitat types the proposed submarine cable corridor goes through within the Scottish Study Area.

From KP 418.7 to KP 524.9 (Kinghorn) (south to north)

- A5.27 Deep circalittoral sand
- A5.15 Deep circalittoral coarse sediment
- A5.37 Deep circalittoral mud
- A5.45 Deep circalittoral mixed sediments
- A5.35 Circalittoral sandy mud
- A5.33 Infralittoral sandy mud
- Moderate energy infralittoral seabed
- Low energy infralittoral seabed

From L_KP 16 to L_KP 0 (Lower Largo/Lundin Links) (south to north)

- A5.37 Deep circalittoral mud
- A5.45 Deep circalittoral mixed sediments
- A5.27 Deep circalittoral sand
- A5.25 or A5.26 Circalittoral fine sand or Circalittoral muddy sand

- A 5.23 or A5.24 Infralittoral fine sand or Infralittoral muddy sand
- Low energy infralittoral sand

7.4.4.3. Designated Sites within the Scottish Study Area

Table 7-5 presents the designated sites designated for benthic habitats and or species within the Scottish Study Area, along with their protected features and conservation objectives. Designated sites within the area of the Project are also illustrated in Chapter 5 – Designated Sites in Figure 5-2 (drawing: C01494-EGL4-PROT-012).

Table 7-5: Designated sites in Scotland designated for benthic habitats and species within the Study Area

Site Name and Code	Distance to Scoping Boundary (km)	Relevant Annex I Protected Features	Conservation Objectives
Firth of Forth Banks Complex MPA (JNCC, 2017)	1.69 km	• Offshore subtidal sands and gravels – **Priority Marine Feature**	With respect to the offshore subtidal sands and gravels within the Nature Conservation MPA (NCMPA), this means that: • extent is stable or increasing; and • structures and functions, quality, and the composition of characteristic biological communities (which includes a reference to the diversity and abundance of species forming part of or living within the habitat) are such as to ensure that they remain in a condition which is healthy and not deteriorating; • Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery from such deterioration. Any alteration to that feature brought about entirely by natural processes is to be disregarded.
		• Shelf banks and mounds large-scale feature	With respect to the shelf banks and mounds large-scale feature within the NCMPA, this means that: • the extent, distribution and structure is maintained; • the function is maintained to ensure that it continues to support its characteristic biological communities (which includes a reference to the diversity of any species associated with the large-scale feature) and their use of the site for, but not restricted to, feeding, courtship, spawning, or use as nursery grounds; and • the processes supporting that feature are maintained. Any alteration to that feature brought about entirely by natural processes is to be disregarded.
		• Wee Bankie key geodiversity area	With respect to the Wee Bankie key geodiversity area within the NCMPA, this means that: • its extent, component elements and integrity are maintained; • its structure and functioning are unimpaired; and • its surface remains sufficiently unobscured for the purposes of determining whether the above criteria are satisfied. Any obscuring of that feature entirely by natural processes is to be disregarded. Any alteration to that feature brought about entirely by natural processes is to be disregarded.
		• Ocean quahog aggregations – **Priority Marine Feature**	With respect to the ocean quahog aggregations within the NCMPA, this means that:

Site Name and Code	Distance to Scoping Boundary (km)	Relevant Annex I Protected Features	Conservation Objectives
			• the quality and quantity of its habitat and the composition of its population in terms of number, age and sex ratio are such as to ensure that the population is maintained in numbers which enable it to thrive. Any temporary reduction of numbers is to be disregarded if the population of ocean quahog aggregations is sufficiently thriving and resilient to enable its recovery. Any alteration to that feature brought about entirely by natural processes is to be disregarded.
Isle of May SAC [UK0030172] (JNCC, 2015)	2.22 km	• 1170 Reefs	To avoid deterioration of the qualifying habitat (Reefs) thus ensuring that the integrity of the site is maintained, and the site makes an appropriate contribution to achieving favourable conservation status for the qualifying interests. To ensure for the qualifying habitat that the following are maintained in the long term: • Extent of the habitat on site • Distribution of the habitat within site • Structure and function of the habitat • Processes supporting the habitat. • Distribution of typical species of the habitat • Viability of typical species as components of the habitat • No significant disturbance of typical species of the habitat

7.4.4.4. Protected Features and Species within the Scottish Study Area

Offshore Subtidal Sands and Gravels

Offshore subtidal sands and gravels are considered a Priority Marine Feature (PMF) in Scottish waters when associated with certain fauna such as '*Glycera lapidum*, *Thyasira* spp. and *Amythasides macroglossus* in offshore gravelly sand'. The Firth of Forth Banks Complex MPA within the Scottish Study Area contains this feature.

Ocean quahog (*Arctica islandica*)

Ocean quahog aggregations are found in various types of sand and gravels and as previously mentioned are long-lived species. As such, ocean quahog is highly protected and is registered on the OSPAR Commission List of Threatened and/or Declining Species & Habitats (OSPAR, 2023). The Ocean quahog is a PMF in the Firth of Forth Banks Complex MPA within the Scottish Study Area

7.5. Proposed Assessment Methodology

The intertidal and subtidal benthic ecology MEA will follow the assessment approach set out in Chapter 4 of this Scoping Report, using the project-wide assessment matrix. The assessment of potential effects will be established using the standard Source-Pathway-Receptor approach.

Data derived from site-specific surveys will provide a more detailed site characterisation and fill key data gaps such as habitat biotope maps; presence, extent and condition of sensitive habitats; and presence of protected species. The results from assessment undertaken to inform the marine physical processes chapter will be used to establish the potential impacts on intertidal and subtidal benthic receptors.

The following UK guidance is available and will be used to inform the assessment:

- Nature conservation considerations and environmental best practice for subsea cables for English Inshore and UK Offshore waters – Appendix 1 Benthic Characterisation (JNCC and Natural England, 2022).
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards (Parker *et al.,* 2022).

- Sensitivity of features based upon the Marine Evidence-based Sensitivity Assessment (MarESA) framework where possible (MarLIN, 2021).
- The MarESA approach used by the Marine Life Information Network (Tyler-Walters *et al.,* 2018) which provides sensitivity reviews of species and habitats.

Where potentially significant impacts are identified, consultation will be undertaken with statutory nature conservation bodies (SNCBs) to agree proportionate and effective mitigation, and residual effects will be presented.

7.6. Scope of Assessment

A range of potential impacts on intertidal and subtidal benthic ecology have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. Table 7-6 describes the potential impacts identified and provides justification as to whether they will be scoped in or out of the MEA. A precautionary approach has been taken and where there is no strong evidence base, or the significance is uncertain at this stage the impact has been scoped 'in' to the MEA. Where there is a clear evidence base that the effect from the impact will not be significant, either alone or in combination with other plans and projects, the impact has been scoped out of the MEA.

Table 7-6: Scoping assessment of impacts on intertidal and subtidal benthic ecology

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
Temporary habitat loss/seabed disturbance *(Abrasion/disturbance of the substrate on the surface of the seabed Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion)*	Trenchless solution and duct installation and open cut trenching at landfall Cable burial and trenching.	Intertidal habitats	**IN** – At this stage of scoping no decision has been made on the installation technique to be used. As noted in the project description this may be either a trenchless technique or an open cut technique used. If an open cut technique is used it will cause temporary habitat loss and disturbance the intertidal area and adjacent terrestrial habitats. Due to the potential disturbance this could cause it has been scoped in at this stage.	**OUT** – If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. If the cable were to fail within the trenchless solution, there is no means of repairing it and a new duct would need to be drilled. This would be the subject of a separate Marine Licence. Therefore, impacts during O&M have been scoped out for the intertidal area.	**OUT** – It is likely that the cables duct would be left in place with no further impacts on the environment.
Temporary habitat loss/seabed disturbance *(Abrasion/disturbance of the substrate on the surface of the seabed Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion)*	Boulder clearance, PLGR, pre-sweeping of sand waves. HDD duct excavation. Cable burial and trenching. Anchoring-/-jack-up foundations. Deposit of external cable protection.	Subtidal – Broadscale habitats	**OUT** – The significance of the effect will vary according to the techniques used during cable burial (e.g., jet or plough trenching) and the sensitivity of the habitat. The Study Area contains commonly occurring infralittoral and circalittoral habitats (e.g., A5.15, A5.27 and A5.45) that are widely distributed within the North Sea region. MarLIN sensitivity assessments for these habitats indicate that due to the burrowing life habitat of the dominant species the habitat has a low sensitivity to abrasion and penetration. Whilst species within the immediate footprint of the construction activities will be affected, the medium to high resilience of the habitat indicates that recovery will occur in the short-term. Effects will not be significant for broadscale habitats and have therefore been scoped out of the assessment.	**OUT** - If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that localised repair works or remedial external cable protection may be required. If these circumstances arise the significance of the effect will be of lower magnitude that during construction. Effects will not be significant for broadscale habitats and have therefore been scoped out of the assessment.	**OUT** - The significance of the effect during decommissioning is similar or of lower magnitude than construction and have therefore been scoped out of the assessment for broadscale habitats.
		Subtidal – Annex I habitats	**IN** – The results of the benthic and environmental surveys will determine if any Annex I habitats are present within the area of the Project. Annex I habitats such as biogenic/geogenic reef, have the potential to be significantly affected by the installation of the cable as they typically have a higher sensitivity to abrasion and penetration and a lower resilience. The assessment will therefore focus on these habitats if they are found to be present.	**IN** - If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that localised repair works may be required. In these circumstances the significance of the effect will be of lower magnitude that during construction. However, the effect could still potentially be significant if within an Annex I habitat.	**IN** - The significance of the effect during decommissioning is similar or of lower magnitude than construction. However, effects could potentially be significant if within an Annex I habitat.

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
Permanent habitat loss *(Physical change (to another seabed type or sediment type) Water flow (tidal current) changes including sediment transport considerations)*	Deposit of external cable protection.	Subtidal – Annex I habitats	**IN** – The extent of Annex I habitat within the North Sea is limited in relation to the wider broadscale habitats. Annex I habitats will have a high sensitivity to the impact pathway due to the potential for reclassification of the habitat type. Given the limited extent of such habitats the change in seabed type can have significant effects with regards the function of a designated site, or the extent of habitat within UK waters. The results of the benthic and environmental surveys will determine if any Annex I habitats are present within the area of the Project and the assessment will focus on these habitats if they are found to be present.	**IN** - If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that localised remedial external cable protection may be required. In these circumstances the significance of the effect will be of lower magnitude that during construction. However, the effect could still potentially be significant if within an Annex I habitat.	**OUT** – During decommissioning no new seabed deposits will be made. There will therefore be no further permanent changes to the seabed.
		Subtidal – Broadscale habitats	**OUT** – The presence of the deposit of external cable protection has the potential to change the seabed type. They also have the potential to very locally alter sediment transport, creating scour pits or causing accretion. This may alter the benthic habitats either directly through a change in the substrate (e.g., sand to rock) or indirectly because of changes to local hydrodynamic conditions (e.g., increased risk of scour). The significance of the effect will vary according to the sensitivity of the habitat and the spatial extent of the deposits. The Study Area contains commonly occurring infralittoral and circalittoral habitats (e.g., A5.15, A5.27 and A5.45) that are widely distributed within the North Sea region. Although MarLIN sensitivity assessments identify that the habitats have high sensitivity to this pressure, the deposits will be extremely localised in relation to the wide extent of the habitat. Using the benthic and environmental survey data and engineering studies, the environmental assessment will identify the habitats that will be affected by deposits. However, where the habitats are not protected and are not within a designated site, no significant effects are predicted, and the pressure will be scoped out of the assessment.	**OUT** – If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that remedial external cable protection may be required. Although MarLIN sensitivity assessments identify that the habitats have high sensitivity to this pressure, the deposits will be extremely localised in relation to the wide extent of the habitat. Where the habitats are not protected and are not within a designated site, no significant effects are predicted, and the pressure will be scoped out of the assessment.	**OUT** – During decommissioning no new seabed deposits will be made. There will therefore be no further permanent changes to the seabed.
Temporary increase and deposition of suspended sediments *(Changes in suspended solids (water clarity)*	Boulder clearance, PLGR. HDD duct excavation. Cable burial and trenching. Anchoring / jack-up foundations.	Broadscale habitats Annex I *Sabellaria spinuolsa* reefs	**OUT** – Sediment suspended by interactions with the seabed will temporarily increase turbidity before being rapidly dispersed through natural hydrodynamic processes. Other projects near the Project reported sediments contaminated with heavy metals, PCBs and PAHs (GEOxyz, 2022), but analysis against OSPAR guidelines concluded that they were considered to be of no concern (OSPAR, 2014). Indirect	**OUT -** If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that localised repair works or remedial external cable protection may be required. In these circumstances the significance of the effect will be of lower magnitude that during	**OUT** - The significance of the effect during decommissioning is similar or of lower magnitude than construction and has therefore been scoped out of the assessment for the same reasons.

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
Smothering and siltation rate changes Hydrocarbon & PAH contamination)	Deposit of external cable protection.		effects from the mobilisation of contaminants entering the food chain are not predicted to be significant. The broadscale habitats identified in the Study Area are dominated by burrowing infauna which would not be affected by a change in water clarity. The benchmark used by Natural England for the pressure is a change in one rank e.g., from clear to intermediate, on the Water Framework Directive scale for one year. While trenching is undertaken a sediment plume will be generated continuously, but it will move with the location of the cable spread. Sands and gravels do not form part of the sediment load and will settle out of suspension quickly. MarLIN categorise light smothering as the deposition of up to 5cm of sediment in a discrete event. Light smothering will occur from several of the project activities. The most significant contributor (relatively) will be from the sediment plume generated by cable trenching. Modelling undertaken for other cable projects (e.g., Viking Link reported in Intertek 2017 GridLink 2020, BERR 2008) indicates that approximately 90% of the suspended sediment is re-deposited within close proximity (<100 m) and would be classed as heavy smothering. The remaining 10% is transported over a wide area, which depending on the strength of the prevailing currents could be as far as 10-15 km, but will be deposited in thicknesses of less than 2 mm. This is within the range of natural variability associated with sediment transport in the region. The modelling also concludes that regardless of the position along a cable route, the sediment plume generated is aligned with the dominant tidal axis. Material is deposited primarily along the dominant tidal axis but with some lateral extension. Over most of the plume the increase in suspended sediment concentrations is generally lower than 30 mg/l with natural conditions returning within a single tidal cycle following the cessation of activities, although if very fine chalk particles are present this could be extended to 4-5 days. Overall, the change in water clarity is not significant and generally in line with changes experienced during storm conditions when background concentrations can reach 1000 mg/l.	construction and has therefore been scoped out of the assessment for the same reasons.	

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
			Benthic communities most sensitive to light smothering will be Annex I reef habitat (e.g., *Sabellaria spinulosa* reef, horse and blue mussel beds). *Sabellaria spinulosa* are not sensitive to the impact pathway (Tillin *et al.,* 2022), requiring some degree of sediment transport for tube-building and feeding. Mussel beds are discussed separately below. No significant effects are predicted from light smothering on most benthic habitat types and the impact pathway has been scoped out of the assessment.		
Temporary increase and deposition of suspended sediments *(Changes in suspended solids (water clarity) Smothering and siltation rate changes* *Hydrocarbon & PAH contamination)*	Boulder clearance, PLGR. HDD duct excavation. Cable burial and trenching. Anchoring / jack-up foundations. Deposit of external cable protection.	Annex *I Modiolus modiolus* and *Mytilus edulis* beds	**IN -** *Modiolus modiolus* (horse mussel) are unable to actively emerge from sediments if buried. If the deposition of fine sediment is not removed by currents/ tidal flow, then mortality can occur. Experiments have shown that light smothering for longer than 8 days can lead to significant mortality (Tillin 2016). *Mytilus edulis* (blue mussel) are more resistant to high levels of suspended material and are able to move up through deposited sediments. However, mortality will depend on the duration of smothering. This impact pathway pressure cannot be scoped out of the assessment for this habitat type until the benthic and environmental surveys have confirmed the absence of blue/horse mussel beds within or in proximity to the Project.	**IN -** If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that localised repair works may be required. This impact pathway cannot be scoped out of the assessment for this habitat type until the ecological surveys have confirmed the absence of blue/horse mussel beds in or within proximity of the Project.	**IN -** The significance of the effect during decommissioning is similar or of lower magnitude than construction. This pressure cannot be scoped out of the assessment for this habitat type until the ecological surveys have confirmed the absence of blue/horse mussel beds in or within proximity of the Project.
Temporary increase and deposition of suspended sediments *(Changes in suspended solids (water clarity) Smothering and siltation rate changes Hydrocarbon & PAH contamination)*	Pre-sweeping	Subtidal habitats	**IN** – Pre-sweeping of sand waves involves the re-positioning of large quantities of sediment from the cable route to either immediately alongside the cable route, or to a separate disposal location. Depending on the technique used and the size of sand waves requiring pre-sweeping, the redeposition of sediment can cause smothering >10 cm deep over relatively wide areas of seabed (in the order of tens of thousands square metres). Effects could also potentially be significant if the disposal site contains sensitive habitats. The impact pathway cannot be scoped out until further information is available on the habitats present and the areas that will require pre-sweeping.	**OUT** – Pre-sweeping is used during construction to ensure that the cables are buried below the base of mobile sediments. Generally during operation, remedial works are focused on protecting sections of cable that have become exposed due to sediment mobility, or to repair cables that have been damaged by a third party (e.g., fishing damage). Pre-sweeping would not be required during a cable repair for third-party damage as the cable would already be exposed on the seabed. Therefore, the only scenario pre-sweeping might be required is where the cable has been damaged during construction and develops a fault in an area where pre-sweeping was used during construction. In this scenario the significance of the effect will be of lower	**IN** – Controlled flow excavation could be used during decommissioning to expose the buried cable. The significance of the effect during decommissioning is similar or of lower magnitude than construction. However, effects could potentially be significant if within a sensitive habitat.

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
				magnitude than during construction and has therefore been scoped out of the assessment.	
Underwater noise changes	Geophysical survey. Presence of project vessels and equipment.	Subtidal species	**OUT** – Most research into the effects of underwater sound has focused on mortality, acute physiological effects or species interactions in species such as fish and marine mammals. There is relatively little evidence on the effects on sediment-dwelling invertebrates although it is thought that chronic exposure could lead to changes in the way in which a species contributes to ecosystem processes such as carbon storage or nutrient cycling (Solan et al 2016). The Project will be a one-off event set against a background of existing anthropogenic noise. Any effects will be localised and short-term and are not predicted to be significant.	**OUT** - If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that localised repair works or remedial external cable protection may be required. In these circumstances the significance of the effect will be of lower magnitude that during construction and has therefore been scoped out of the assessment for the same reasons.	**OUT** - The significance of the effect during decommissioning is similar or of lower magnitude than construction and has therefore been scoped out of the assessment for the same reasons.
Introduction or spread of Marine invasive non-native species (MINNS)	Presence of project vessels and equipment. Deposit of external cable protection.	Subtidal species	**OUT** – Although the introduction of project vessels, equipment, and external cable protection have the potential to bring in and spread MINNS all relevant guidelines will be followed (GB Non-native Species Secretariat, 2015) including vessel cleaning facilities and the use of anti-fouling paint. Project vessels and contractors will comply with the International Convention for the Control and Management of Ships' Ballast water and Sediments. All seabed deposits will be inert with no biologically active material. Project vessels will complete a biosecurity risk assessment prior to arriving on site which will include factors such as origins of the vessels and ensuring that relevant equipment is cleaned before use. Compliance with Regulations will be sufficient to minimise the risk to the environment.		
Electromagnetic changes / Barrier to species movement	Presence of cables	Subtidal species	N/A	**OUT** – Benthic communities are typified by sessile or low mobility species, which are unlikely to navigate using magnetic fields or have electroreceptors. At present there is very little research data available on this subject, however a recent study of polychaete *Hediste diversicolor* and EMF concluded that the species probably was unable to gather any directional information from the factor and therefore did not perceive it as a stressor (Jakubowska *et al.,* 2019). Although some species of mollusc and crustacean are believed to be magnetically sensitive these are discussed within the shellfish and fish topic chapter. This pressure has therefore been scoped out of the assessment for benthic ecology.	N/A
Temperature increase	Presence of cables	Subtidal habitats and species	N/A	**OUT** – During the operation of an HVDC cable heat losses occur because of the resistance in the cable/conductor. This can cause localised heating of the surrounding environment (i.e.,	N/A

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
				sediment for buried cables, or water in the interstitial spaces of external cable protection). There are no specific regulatory limits applied to temperature changes in the seabed, although a 2°C change between seabed surface and 0.2 m depth is used as a guideline in Germany. Conservative calculations undertaken for Viking Link (which crosses German waters) concluded that heating in excess of 2°C at 20 cm sediment depth will only occur if cables are bundled and buried to less than 0.75 m (National Grid and Energinet, 2017). Any temperature changes will be localised to the immediate environment surrounding the cable and undetectable against natural temperature fluctuations in the surrounding sediments and water column. No significant effects are predicted. This pressure has therefore been scoped out of the assessment.	
Accidental spills *(Hydrocarbon & PAH contamination)*	Presence of project vessels and equipment	Intertidal and Subtidal habitats	**OUT** - Project vessels and contractors will comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 which relate to pollution from oil from equipment, fuel tanks etc and release of sewage (black and grey water). It is a legal requirement that all vessels have a Shipboard Oil Pollution Emergency Plan (SOPEP). Compliance with Regulations will be sufficient to minimise the risk to the environment.		

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8. Fish and Shellfish

8.1. Study Area Definition

This chapter of the Scoping Report describes the potential impacts arising from the construction, operation and maintenance (O&M), and decommissioning of the Eastern Green Link 4 (EGL 4) hereafter referred to as 'the Project' on fish and shellfish. Fish and shellfish receptors include marine species, diadromous species (species which migrate between freshwater and marine environments), elasmobranchs (sharks, rays and skates), and shellfish (crustaceans and molluscs).

The Scoping Boundary for the Project extends from MHWS in England to the MHWS in Scotland. It is nominally 1 km wide, 500 m either side of the centreline, however, it widens in areas where there is still optionality in the design e.g., to allow for micro-routeing around potential seabed features. It is anticipated that the Marine Licence application boundary will ultimately be 500 m following refinement and rationalisation as the MEA and design process evolves.

There are two proposed Landfalls in England (Anderby Creek and Theddlethorpe) and two proposed Landfalls in Scotland (one in Kinghorn and one in Lower Largo/Lundin Links) being considered at this stage of the environmental assessment process. These options will be subject to further technical feasibility work and stakeholder consultation and will be refined to one preferred option for inclusion in the subsequent Marine Licence Application for the Project.

The Study Area includes the Scoping Boundary plus an additional 15 km to either side. This is consistent with Chapter 6: Marine Physical Processes and incorporates the potential impact pathways from underwater noise and increased suspended sediment concentrations. It will be reviewed and refined for the MEA based on maximum tidal excursions and if appropriate sediment dispersion modelling. The zone of influence will be influenced by the conclusions of Chapter 6, and this chapter should be read in conjunction with these findings.

Kilometre Points (KPs) are used throughout this Chapter to provide context as to where within the Study Area a feature lies. KP 0 is defined at the Anderby Creek Landfall. As there are still alternative Landfalls being considered, KPs have been created along the longest route from the proposed English Landfall at Anderby Creek, around the Holderness Offshore Marine Conservation Zone (MCZ) to the proposed Scottish Landfall at Kinghorn. The KPs for this route are referenced as KP 0 to KP 524.9. Alternative options, which branch off this longest route, are route from the proposed English Landfall at Theddlethorpe to the point where it converges with the longest route (referenced as T_KP 0 to T_KP 14); and through Holderness Offshore MCZ, which is referenced as H_KP 0 to H_KP 39; and from the proposed Scottish landfall at Lower Largo to the point where it converges with the longest route (referenced as L_KP0 to L_KP15).

8.2. Data Sources

Data sourced for the baseline characterisation will be presented in accordance with relevant guidance for the topic. The datasets that will be used to inform the description of the baseline environment for the MEA are described in the following sub-sections.

8.2.1. Site-specific Survey Data

Extensive contemporary and historic information is available regarding fish and shellfish ecology of the North Sea. Following a detailed review to inform the scope of the data and assessment, as presented, no site-specific surveys are planned for this topic, however data from the benthic survey may provide useful data for the assessment.

8.2.2. Publicly Available Data

Desk based review of publicly available data sources (literature and GIS mapping files) will be used to describe the baseline environment. Table 8-1 lists the key data sources which will be used in the assessment.

Table 8-1: Key publicly available data sources for fish and shellfish

Data Source	Description	Coverage	
		English Study Area	Scottish Study Area
Environment Agency	Transitional and Coastal Waters (TraC) Fish Monitoring Programme	✓	✓
Department of Energy & Climate Change (DECC, 2022)	Offshore Energy Strategic Environmental Assessment 4	✓	✓

Data Source	Description	Coverage	
		English Study Area	Scottish Study Area
Coull *et al* (1998), Ellis *et al* (2012)	Fish Sensitivity Maps showing spawning and nursery grounds of selected fish species in UK waters	✓	✓
International Council for the Exploration of the Sea (ICES)	International Herring Larvae Surveys and International research reports and publications ICES Scientific Reports	✓	✓
Marine Space (2013)	Environmental Effect Pathways between Marine Aggregate Application Areas and Atlantic Herring Potential Spawning Habitat: Regional Cumulative Impact Assessments. Version 1.0. A report for the British Marine Aggregates Producers Association	✓	
Inshore Fishing and Conservation Authority	Website with Information about fishing and the species in the different regional Inshore Fishing and Conservation Authorities	✓	
FishBase	Species reference website www.fishbase.org	✓	✓
EMODnet	Interactive reference website which shows fish abundance and distribution. http://www.emodnet.eu/biology	✓	✓
Marine Management Organisation (MMO 2022)	UK Sea Fisheries annual statistics report 2021 and accompanying datasets which includes species catch list for the relevant ICES rectangles. https://assets.publishing.service.gov.uk/media/6512f96df6746b0012a4ba77/UK_Sea_Fisheries_Statistics_2022_.pdf	✓	✓
NatureScot	An executive non-departmental public body of the Scottish government responsible for the country's natural heritage. https://www.nature.scot/		✓
Marine Scotland	Scottish Government's Marine Directorate is responsible for managing Scotland's seas and freshwater fisheries https://marine.gov.scot/		✓
International Convention for the Conservation of Nature (IUCN)	The IUCN Red List of Threatened Species (https://www.iucnredlist.org/)	✓	✓
Brown & May Marine Ltd (2023)	Eastern Green Link Three and Four Transmission Reinforcement Cable Projects: Fishing Activity Report	✓	✓
Environment Agency	Ecology and Fish Data Explorer. Freshwater fish survey data, used to check presence or absence of migratory fish in catchments and estuaries EA Ecology & Fish Data Explorer	✓	
Scottish Environment Protection Agency (SEPA)	Scotland's principal environmental regulator		✓
Joint Nature Conservation Committee (JNCC)	Species specific data, of native species of conservation interest UK BAP List of UK Priority Species | JNCC Resource Hub	✓	✓
British Geological Society (BGS)	Marine Sediment Particle Size dataset sourced from the BGS GeoIndex Offshore portal GeoIndex Offshore | BGS	✓	✓

8.2.3. Additional Studies

8.2.3.1. Commercial Fishing Activity Study

A fishing activity study was undertaken by Brown & May Marine Ltd in March 2023 to understand the spatial and temporal distribution of fishing activity within the Study Area. This is described in further detail in Chapter 12 - Commercial Fisheries. Landing data from this study which outlines target species and location of key fisheries areas will be used to inform the baseline for fish and shellfish.

8.2.3.2. Herring and Sandeel Assessment

Atlantic herring (*Clupea harengus)* and Sandeel (*Ammodytes spp.*) have specific habitat preferences that limit the spatial extent of spawning. As primary prey species for higher trophic levels, it is important to understand whether there is primary habitat within the Study Area which could be utilised by the species for activities such as spawning, feeding or resting. The assessment will be based on a review of particle size analysis to be carried out on sediment samples obtained through grab sampling and vibrocores in the Study Area. This will be supplemented with a desk-based literature review, e.g., International Herring Larvae Surveys (IHLS) data. The assessment methodology will follow the MEA methodology in conjunction with the methodology developed by MarineSpace et al. (2013) and Latto *et al* (2013) to assess effects on sandeel and Atlantic herring, as well as data sources discussed with Cefas during a recent meeting in November 2023.

8.2.3.3. Fisheries Liaison and Mitigation Action Plan (FLMAP)

A Fisheries Liaison and Mitigation Action Plan will be written which will outline how the Applicants will interact with all the legitimate sea users prior to and during any works on the Project. This will be written by Brown & May Marine Ltd who are the Fisheries Liaison Officer (FLO) for the Project.

8.3. Consultation

Consultation will be undertaken with fisheries stakeholders to supplement the desk-top review and studies. The following bodies are being consulted, as a minimum, to ensure that the most up-to-date information is collated:

Table 8-2: List of consultees

England	Scotland
MMO	MD-LOT
Centre for Environment, Fisheries and Aquaculture Science (Cefas)	Scottish Environment Protection Agency (SEPA)
Environment Agency	Scottish Fishermen's Federation (SFF)
Inshore Fisheries and Conservation Authority (IFCA) - Eastern, North-Eastern and Northumberland.	Scottish Pelagic Fishermen's Association
National Federation of Fishermen's Organisation (NFFO)	Scottish White Fish Producers Association
Fisheries Associations and Individual Fishers (as identified in Chapter 12)	Fisheries Associations and Individual Fishers (as identified in Chapter 12)
	Centre for Environment, Fisheries and Aquaculture Science (Cefas)

8.4. Baseline Characterisation

This section has been split into the following sub-sections:

- General species information
- English baseline characterisation
- Scottish baseline characterisation

The baseline characterisation sections include information on spawning and nursery grounds, designated sites, and protected species specific to the country Study Areas.

8.4.1. General Species Information

8.4.1.1. Overview

There have been over 330 species of fish recorded in UK waters, with the North Sea supporting a wide variety of both pelagic (species that live within the water column) and demersal (species that live or feed on the seabed) species (DECC, 2020). The species most likely to be affected by the Project are those with demersal life stages, and those sensitive to underwater noise changes e.g., hearing specialists such as clupeoids (e.g., Atlantic herring, shad, sprat).

8.4.1.2. Sensitive Demersal and Pelagic Species

The North Sea is home to important fishing grounds used not only by the local English and Scottish fleet but also by international vessels from Belgium, the Netherlands, Denmark, France, Ireland, Spain and Germany. To enable accurate monitoring the sea is divided into rectangles by the International Council for the Exploration of the Sea (ICES). Each ICES rectangle is approximately 30 NM squared and is 30 min latitude and 1o longitude in size (ICES, 2022). The Project lies within 11 of these rectangles, therefore only the distribution data has been analysed for these particular rectangles within this scoping report, rather than the North Sea as a whole.

Sandeel (*Ammodytes spp.*)

Sandeel have been recorded within the Study Area and are significant due to their importance as prey species for a number of bird, fish and marine mammal species. Sandeel hibernate in specific types of seabed during the autumn and winter, particularly coarse sand or fine gravel where they bury themselves in up to 50 cm of sediment (MarLIN, 2023). They briefly emerge from hibernation between December and January to spawn. During the spring and summer, they feed in the water column during the day and then bury themselves in the seabed at night. Their lifecycle makes them sensitive to seabed disturbance, especially during hibernation season. Studies have found that sandeel are largely resident and do not disperse over distances greater than 30 km (RSPB, 2017), and that they do not migrate between grounds suggesting that they are not successful re-colonisers (Jensen et al. 2011). Sandeel are not however considered to be sensitive to increased suspended sediment concentrations and deposition.

The sandeel's environment is under threat for a number of reasons. Temperature variations can impact their metabolic rate and therefore affect reproduction and increase their mortality rate. Physical disturbances to their habitat or removal of sediment brought about by development on or nearby their habitat, and activities which can disrupt local water currents all can affect them and at the moment there is little data available on how sandeel recover from these threats.

The sandeel species Raitt's sandeel (*Ammodytes marinus*) are listed as a principal species of importance in England under Section 41 of the National Environment and Rural Communities Act (2006), meaning that they are of principal importance for the purpose of conserving or enhancing biodiversity (Defra, 2022). Sandeel are also noted in UK Biodiversity Action Plan (BAP) priority marine species of principal importance, requiring conservation due to their ecological importance as a prey species and their marked decline within the UK (a decline of 50% or more over the past 25 years or deterioration or loss of habitat) (BRIG, 2007).

Within Scottish waters, there are five known species of sandeel with the most common species being Raitts sandeel (*Ammodytes marinus*) which can be found in depths over 20 m and the lesser sandeel (*Ammodytes tobianus*) who prefers shallower intertidal waters. Sandeel are a priority marine feature in Scotland and are considered to be threatened and/or declining (NatureScot, 2023).

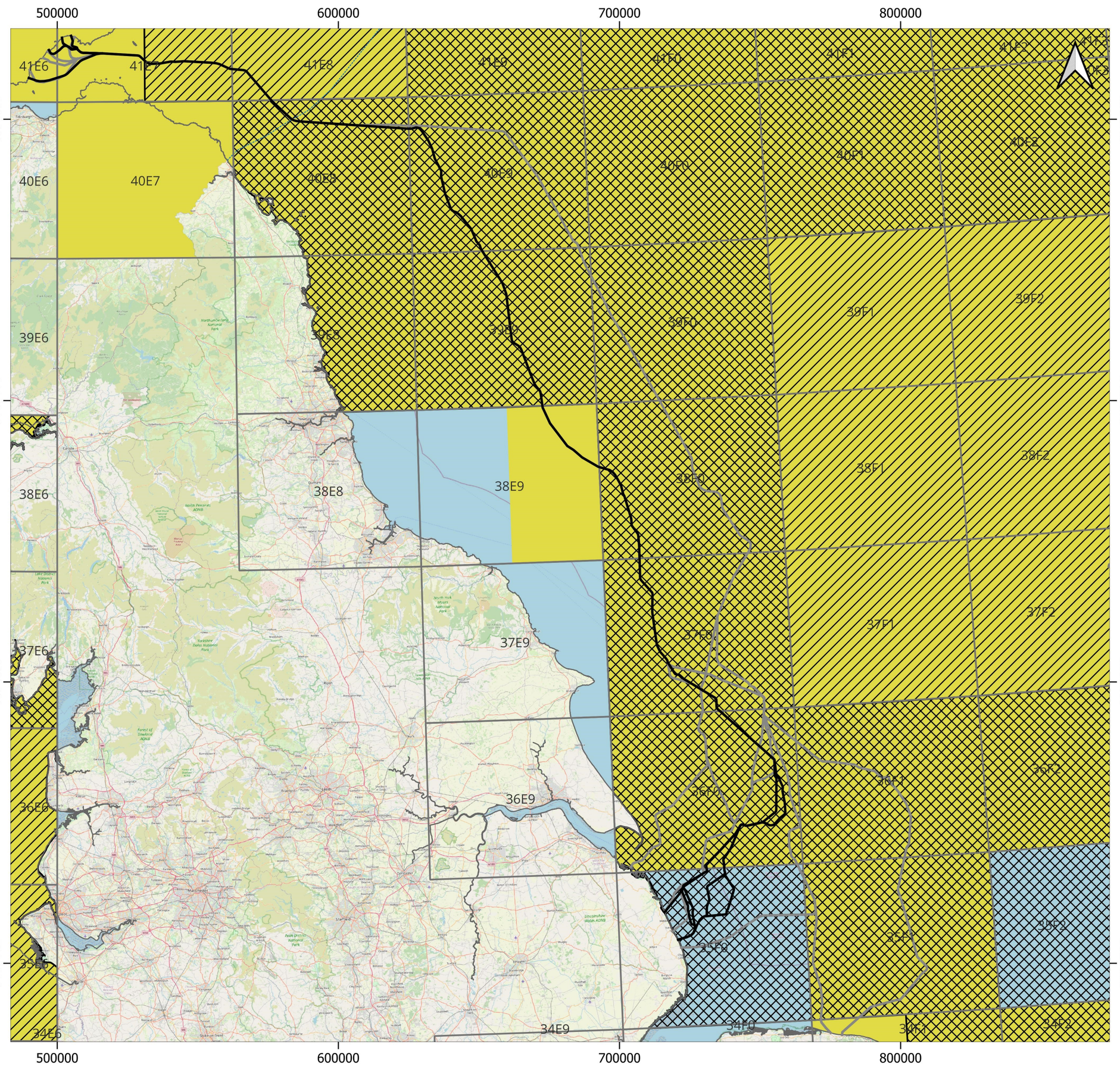
The proposed submarine cable corridor crosses several known sandeel spawning grounds which are illustrated in Figure 8-1, Drawing C01494-ELG4-FISH-001.

Atlantic herring (*Clupea harengus*)

Atlantic herring is a pelagic species which spawns on the seabed. As benthic spawners, the species has a specific habitat preference of gravel and partly sandy gravel (MarineSpace, 2013) which limits the spatial extent of their spawning grounds. As a result, they are particularly sensitive to any seabed disturbance. A programme of annual surveys has taken place since 1967 by the International Herring Larvae Survey (IHLS) monitoring the abundance of herring larvae (ICES, 2023). Atlantic herring numbers fluctuate annually, with Atlantic herring often abandoning and then returning to suitable areas. As a result, all suitable areas of spawning habitat are necessary to maintain a resilient population.

There are four main autumn/winter-spawning populations of herring located across the North Sea alongside several discrete spring-spawning stocks. The autumn-spawning grounds include the Orkney-Shetland population, the Buchan population, the Banks (or Dogger) population and the Downs/Southern Bight population (Ellis et al., 2012) and are characterised by different growth rates, recruitment patterns and migration routes. The English Study Area crosses the Banks spawning grounds and the Scottish Study Area crosses the Buchan spawning grounds.

Figures 8-2, Drawing C01494-EGL4-FISH_002, illustrates the spawning and nursery grounds for Atlantic herring.



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Sandeel Spawning and Nursery Grounds

C01494b-EGL4-FISH-001-A

- Exclusive Economic Zone Limit (EEZ)
- Scottish Adjacent Waters
- ICES Statistical Rectangles
- Phase 1 Routes
- Phase 2 Routes

Spawning Grounds with Intensity

- High
- Low

Nursery Grounds with Intensity

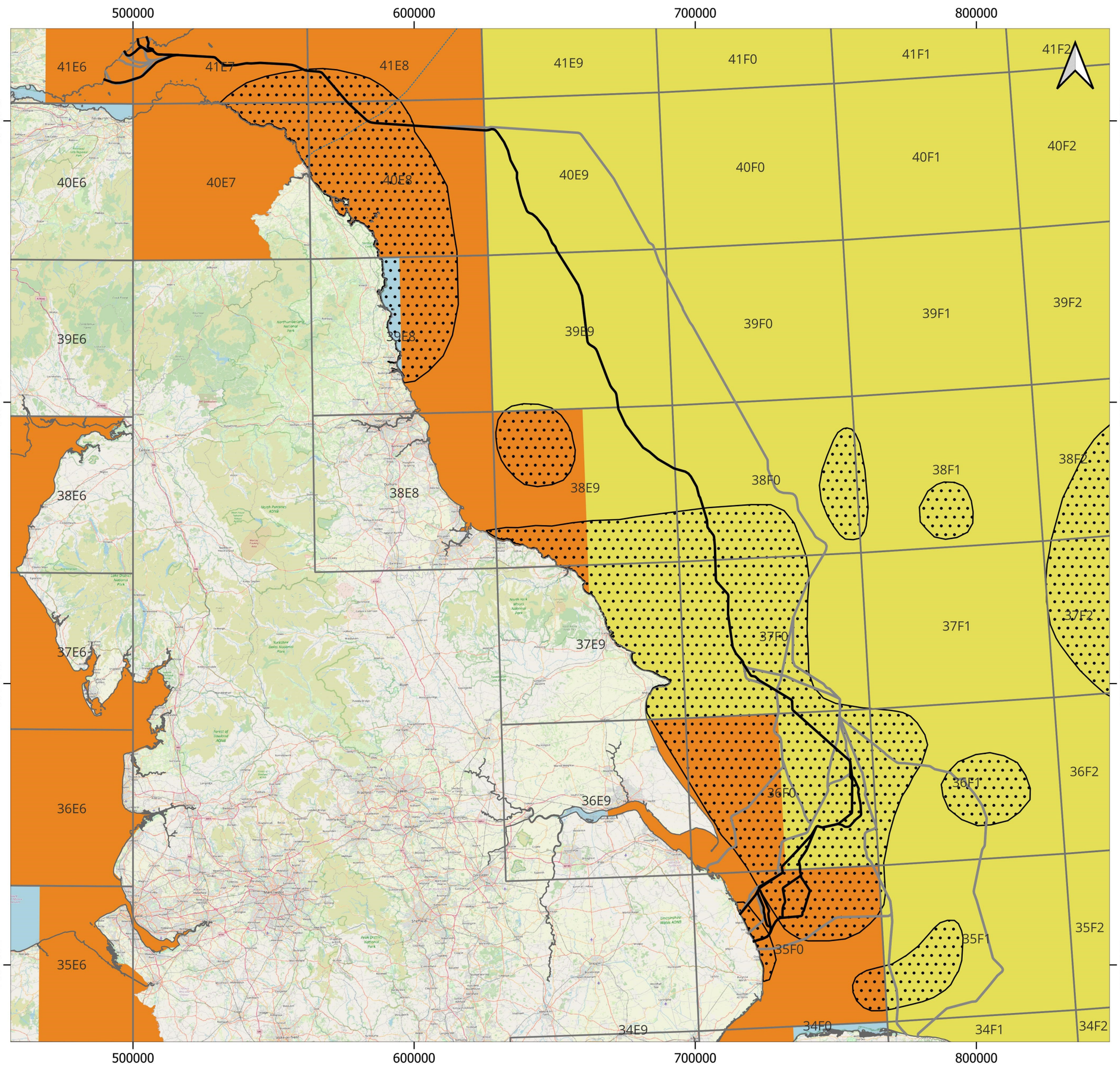
- Low

0 25 50 km

0 10 20 NM

Date	21/12/2023
Coordinate System	ETRS89 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:1,300,000
Created	J Cunningham
Reviewed	S Pearce
Authorised	A Farley

Document Path: X:\GIS\GIS_PROJECTS\C01494_EGL3&4\Project\OGS\EGL4\07_FISH\C01494b_EGL4_FISH_001.qgz, Export Date: 21/12/2023



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Herring Spawning and Nursery Grounds

C01494b-EGL4-FISH-002-A

- Scottish Adjacent Waters
- Phase 1 Routes
- Phase 2 Routes
- ICES Statistical Rectangles

Nursery Grounds with Intensity
- High
- Low

Spawning Grounds with Intensity
- Undetermined

0 25 50 KM

0 10 20 NM

Date	21/12/2023
Coordinate System	ETRS89 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:1,300,000
Created	J Cunningham
Reviewed	S Pearce
Authorised	A Farley

8.4.1.3. Diadromous and Catadromous Fish

Diadromous fish migrate between salt water and fresh water, normally at the time of spawning. Catadromous fish migrate between freshwater and salt water to spawn. The English Study Area lies within the Humber Estuary SAC, close the mouth of the Rivers Ouse' Hull and Trent and as such several species of diadromous and catadromous fish are found within the Study Area. Some of these fish are on the protected species list presented in Table 8-3, including twaite and allis shad (*Alosa fallax, Alosa alosa*), sea lamprey (*Petromyzon marinus*) and river lamprey (*Lampetra fluviatilis*). The sea and river lamprey are both qualifying features of the Humber Estuary SAC which is 4.26 km from the Scoping Boundary and the Tweed Estuary SAC which is 28 km from the Scoping Boundary. Allis and twaite shad are known to have spawning migrations between April and May and, although rare in the region, have been recorded in MMO annual catch statistics.

Smelt (*Osmerus eperlanus*)

Once widespread in the UK, the species is now in decline and subject to protection at certain key locations. The Northeast of Farnes Deep Highly Protected Marine Area (HPMA) provides a critical habitat for this species where it can complete some of its life cycle (gov.uk, 2023). The Scoping Boundary lies approximately 0.1 km from the HPMA.

Smelt have been seen to congregate in shoals in lower estuaries as they migrate into freshwater where they spawn in spring. The species lay their eggs onto the seabed where they adhere to gravel and stones. Smelt are known to congregate near river mouths during winter and then ascend the river between February and April for spawning before returning to the sea (MarLIN, 2023a).

8.4.1.4. Anadromous Species

Anadromous adult fish migrate from the sea to breed in freshwater. The Atlantic salmon (*Salmo salar*) is such a species which is found within the English and Scottish Study Area. Spawning takes place in shallow excavations called redds, found in shallow gravelly areas in clean rivers and streams where the water flows swiftly. The young that emerge spread out into other parts of the river. After a period of 1-6 years the young salmon migrate downstream to the sea as 'smolts'. Salmon have a homing instinct that draws them back to spawn in the river of their birth after 1-3 years in the sea (JNCC, 2023). It is Annex II species and is noted as a qualifying feature of the River Tweed SAC which within 27 km of the Scoping Boundary.

8.4.1.5. Elasmobranchs (Sharks, Rays and Skates)

Elasmobranchs are amongst the most vulnerable marine fish, due to their slow growth rates, late maturity and low fecundity which limits their ability for population recovery should it decline. All sharks and rays are on the OSPAR list of threated or declining species. There are a number of elasmobranchs which are regularly caught by commercial fisheries in the Study Area. These include thornback ray (*Raja clavata*), spotted ray (*Raja montagui),* smooth hound (*Mustelus mustelus*), and common skate (*Dipturus batis*), as well as white skate (*Rostroraja alba*) which are on the IUCN Red list.

Thornback ray are known to use the English Study Area as spawning and nursery grounds with peak spawning between April and August (see Table 8-6). Common skate, spotted ray and tope are known to use the Scottish Study Area as spawning and nursery grounds with peak spawning between April and June (see Table 8-10).

The basking shark (*Cetorhinus maximus*) is the largest fish to visit UK waters measuring up to 12 m in length. Despite its size it feeds exclusively on plankton (MarLIN, 2023a). There are regular sightings in the summer months from southern Cornwall to the Scottish Isles, however sightings of basking shark within the Study Area are rare with only four sightings in the last 10 years.

8.4.1.6. Shellfish (Crustaceans and Molluscs)

Shellfish is a collective term for crustaceans (e.g., shrimp, lobsters, crabs) and molluscs (e.g., cockles, mussels, oysters, whelk) – animals which have a shell or shell-like exterior. Shellfish waters are protected areas under The Water Environment (Water Framework Directive) (WFD) (England and Wales) Regulations 2017 (as amended) (gov.uk, 2017). The English Study Area does not go through any of these protected shellfish areas. Scottish waters also have a WFD, but they use the European Union Directive 2000/60/EC (Eur-Lex, 2023) to provide protection for shellfish. The Scottish Study Area does not go through any of these protected shellfish areas.

A variety of shellfish species are targeted in the waters within the Study Area by commercial fisheries. The top five shellfish species by catch value in 2022 were lobster (*Homarus gammarus*), crab (*Cancer pagurus*), nephrops (*Nephrops norvegicus*), scallop (*Pecten maximus*), and razor clams (*Ensis ensis*) (MMO, 2023). Other species targeted include squid (*Alloteuthis subulata*), brown shrimp (*Crangon crangon*), and cockles (*Cerastoderma edule*).

Ocean Quahog (*Arctica islandica*)

The ocean quahog is found around all British and Irish coasts, as well as offshore. The growth rate of quahog is rapid in juveniles but very slow and indeterminate in adults. Individual growth rates are highly variable between different regions in the North Atlantic, within sites, between seasons and daily, depending on temperature, salinity, hydrography and food supply. They are the longest-unitary species with the oldest recorded specimen found being 507 years old (MarLIN, 2023b).

The ocean quahog is a burrowing species which has been found in a range of sediments, from coarse clean sand to muddy sand in a range of depths typically from 4 m to 482 m deep. Ocean quahogs are thought to have a high sensitivity to physical loss of habitat, it

is therefore important to conserve the extent and distribution of supporting habitats to provide the best chance of any potential settlement for new recruits and to retain existing individuals (JNCC, 2018). As such, the Ocean Quahog is a protected species in a number of sites which are within vicinity of or within the Study Area including Holderness Offshore MCZ and the Firth of Forth Banks complex.

8.4.1.7. Protected Species England and Scotland

Table 8-3 lists the protection afforded to species which have been identified within the Study Areas. Some fish species are protected by several national and international conventions including:

- Convention on International Trade in Endangered Species of Wild Fauna and Flora – CITES. Whose aim is to protect endangered plant and animal species from illegal trade and over-exploitation.
- Convention for the Protection of the Marine Environment of the North-East Atlantic – OSPAR Convention. The OSPAR Convention aims to protect the marine environment of the North-East Atlantic.
- International Union for Conservation of Nature and Natural Resources- IUCN. The IUCN Red Data list catalogues and highlights those animals and plants at high risk of global extinction.
- The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended).
- Natural Environment and Rural Communities (NERC) Act.
- Wildlife and Countryside Act 1981 (as amended in 1985).

Table 8-3: Protected species observed in the English and Scottish Study Areas

Species	International			UK			England	Scotland	
	OSPAR	CITES	IUCN	Wildlife and Countryside Act[1]	Conservation of Offshore Habitats and Species Regulations	Features of Conservation Interest (FOCI)	Species of Principal Importance	Scottish Biodiversity list	Priority Marine Features
Pelagic species									
Herring (*Clupea harengus*)			Least concern				Y	Y	Y
Horse mackerel (*Trachurus trachurus*)			Least concern				Y		Y
Mackerel (Scomber scombrus)			Least Concern				Y		Y
Demersal species									
Atlantic cod (*Gadus morhua*)	Y		Vulnerable				Y	Y	Y
Atlantic halibut (*Hippoglossus hippoglossus*)			Endangered				Y		Y
Bass (*Dicentrarchus labrax)*			Least concern						
Haddock (*Melanogrammus aeglefinus)*			Vulnerable						
Ling (*Molva molva*)			Least concern				Y	Y	Y
Plaice (*Pleuronectes platessa*)			Least concern				Y	Y	
Saithe (*Pollachius virens*)									Y
Sole (*Solea solea*)			Data deficient				Y		
Whiting (*Merlangius merlangus*)			Least concern				Y	Y	Y
Elasmobranch species									
Basking shark (*Cetorhinus maximus*)	Y	Appendix II	Endangered	Schedule 5			Y	Y	Y
Blonde Ray (*Raja brachyura)*			Near Threatened					Y	
Common Skate (*Raja batis*)	Y		Critically endangered				Y	Y	Y
Flapper Skate (Dipturus intermedius)	Y		Critically endangered				Y	Y	Y
Cuckoo Ray (*Leucoraja naevus*)			Least Concern						

Species	International			UK			England	Scotland	
	OSPAR	CITES	IUCN	Wildlife and Countryside Act[1]	Conservation of Offshore Habitats and Species Regulations	Features of Conservation Interest (FOCI)	Species of Principal Importance	Scottish Biodiversity list	Priority Marine Features
Smoothhound (*Mustelus asterias*)			Near Threatened						
Spotted ray (*Raja montagui*)	Y		Least Concern						
Starry Ray (*Amblyraja radiata*)			Least Concern						
Thornback Ray (*Raja clavata*)	Y		Near Threatened					Y	
White Skate (*Rostroraja alba*)	Y		Endangered				Y		
Diadromous species									
Allis shad (*Alosa alosa*)	Y		Least Concern	Schedule 5	Annex II & V		Y	Y	
River lamprey (*Lampetra fluviatilis*)			Least Concern		Annex II		Y	Y	Y
Sea lamprey (*Petromyzon marinus*)	Y		Least Concern		Annex II		Y		Y
Smelt (*Osmerus eperlanus*)			Least Concern			Y	Y	Y	Y
Twaite shad (*Alosa fallax*)			Least Concern	Schedule 5	Annex II & V		Y	Y	
Anadromous species									
Atlantic Salmon *(Salmo salar)*	Y		Vulnerable		Annex II		Y	Y	Y
Shellfish Species									
Cuttlefish (*Sepia officinalis)*			Least Concern						
Ocean quahog (*Arctica islandica*)	Y					Y			Y

Sources JNCC (2007), OSPAR (2023) IUCN (2023)

8.4.2. English Baseline Characterisation KP 0 to KP 418.7

The Scoping Boundary for the Project crosses 11 ICES rectangles, seven of which are within the English Study Area namely 35F0, 36F0, 37F0, 38E9, 38F0, 39E9, 40E9, and one which covers both the English and Scottish Study Areas 40E8. For the purpose of this Scoping Report 40E8 has been included within the data for the English baseline. Analysis of the fishing data from the ICES rectangles has been used as an indication of the commercial fish species caught in these regions.

8.4.2.1. Landing Information

Table 8-4 shows the top four pelagic species caught in 2022 by catch weight and catch value within the English Study Area, it should be noted that for pelagic species the order is the same for catch by weight and by value.

Table 8-5 shows the top five species of shellfish species caught in 2022 by catch weight and catch value within the English Study Area and Table 8-6 shows the same for demersal species.

Table 8-4: Top four pelagic species caught in 2022 within the English Study Area by weight in tonnes and value (£s)

Most caught pelagic species by weight (t) and catch value (£s)
Herring
Mackerel
Horse mackerel
Shad

Source: MMO (2023)

Table 8-5: Top five shellfish species caught in 2022 within the English Study Area by weight in tonnes and value (£s)

Most caught demersal species by weight (t)	Most caught demersal species by value (£s)
Edible crabs	Lobster
Lobsters	Edible crabs
Scallops	Nephrops
Nephrops	Scallops
Whelks	Whelks

Source: MMO (2023)

Table 8-6: Top five demersal species caught in 2022 within the English Study Area by weight in tonnes and value (£s)

Most caught demersal species by weight (t)	Most caught demersal species by value (£s)
Whiting	Whiting
Haddock	Monks & Anglers
Monks & Anglers	Halibut
Dabs	Cod
Cod	Haddock

Source: MMO (2023)

8.4.2.2. Spawning and Nursery Grounds within the English Study Area

Table 8-6 summarises the species which use the English Study Area as spawning and nursery grounds and the months within which this occurs. Spawning grounds are described as the location where eggs are laid, and nursery grounds are the location where juveniles of a species are common. Information is taken from the Cefas fisheries sensitivities maps (Coull *et al.,* 1998; Ellis *et al*., 2012). It also shows the intensity of 0 Group Aggregations. 0 Group aggregation species are fish within the first year of their lives (Aires *et al.,* 2014). There is one species noted within the English Study Area which only has evidence of 0 Group aggregations which is the Norway pout (*Trisopterus esmarkil*); there is no evidence of spawning or nursey areas within the Study Area.

Where information is available in the form of mapped data this has been presented in Figure 8-3 (Drawing C01494-EGL4-FISH-006) and Figure 8-4 (Drawing C01494-EGL4-FISH-007).

Table 8-7: Spawning and Nursery grounds that overlap with the Study Area KP 0 to KP 418.7 in England

Species	Latin names	Spawning Zone	Intensity	Nursery Zone	Intensity	** Presence of Group 0 Aggregations	J	F	M	A	M	J	J	A	S	O	N	D
Anglerfish	*Lophius piscatorius*	n/a	n/a	Demersal	Low	Low												
Atlantic Cod	*Gadus morhua*	Pelagic	Low	Demersal	High	Low		*	*									
Atlantic Herring	*Clupea harengus*	Pelagic	High	Pelagic	High	Low/Medium												
Atlantic Mackerel	*Scomber scombrus*	Pelagic	Low	Pelagic	Low	Low						*	*					
Blue Whiting	*Micromesistius poutassou*	n/a	n/a	Pelagic	Low					*	*							
Common Sole	*Solea solea*	Pelagic/Demersal	Low	Demersal	Low	Low				*								
European Hake	*Merluccius merluccius*	n/a	n/a	Demersal	Low	Low		*	*									
European Plaice	*Pleuronectes platessa*	Pelagic/Demersal	High	Demersal	Low	Low	*	*										
European Sprat	*Sprattus sprattus*	Pelagic	Low	Pelagic	Low	Low/Medium												
Haddock	*Melanogrammus aeglefinus*	n/a	n/a	Demersal	Low	Medium/High		*	*	*								
Horse Mackerel	*Trachurus trachurus*	n/a	n/a	Pelagic	Low	Low												
Lemon Sole	*Microstomus kitt*	Demersal	Low	Demersal	Low													
Ling	*Molva molva*	n/a	n/a	Demersal	Low													
Nephrops	*Nephrops norvegicus*	Demersal	Low	Demersal	Low													
Norway Pout	*Trisopterus esmarkii*	n/a	n/a	n/a	n/a	Low	-	-	-	-	-	-	-	-	-	-	-	-
Sandeels	*Ammodytidae spp.*	Demersal	Low	Demersal	Low													
Spurdog	*Squalus acanthias*			Viviparous	Low													
Thornback ray	*Raja clavata*	Demersal	Low	Demersal	Low					*	*	*	*	*				
Whiting	*Merlangius merlangus*	Pelagic	Low	Pelagic	High	Low												

*Sources: Coull et al (1998), Ellis et al (2012), Aires (2014). * Peak Spawning. ** 0 Group fish defined as fish in the first year of their lives*

	Spawning Only		Nursery Only		Both

600000 800000

6200000 6000000

Angler Fish | Blue Whiting | Cod

Haddock | Lemon Sole | Ling

Mackerel | Nephrops | Plaice

600000 800000

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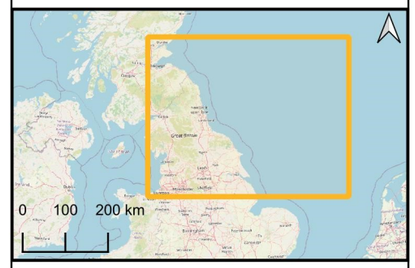
Fish nursery and spawning grounds with intensity of activity within the English Study Area - Map 1

C01494b-EGL4-FISH-006-B



- Scottish Adjacent Waters
- EGL 4 Scoping Boundary
- ICES Statistical Rectangles

Spawning Grounds with Intensity (Ellis et al, 2012)
- Low
- High

Nursery Grounds with Intensity (Ellis et al, 2012)
- Low
- High

Spawning and Nursery Grounds (Coull et al, 1998)
- Spawning Grounds
- Nursery Grounds

0 25 50 km

0 25 50 NM

Date	30/11/2023
Coordinate System	ETRS89 / UTM zone 30N
Projection	Universal Transverse Mercator
Unit	meters
Scale at A3	1:4500000
Created	J Cunningham
Reviewed	D Summers/ S Pearce
Authorised	A Farley

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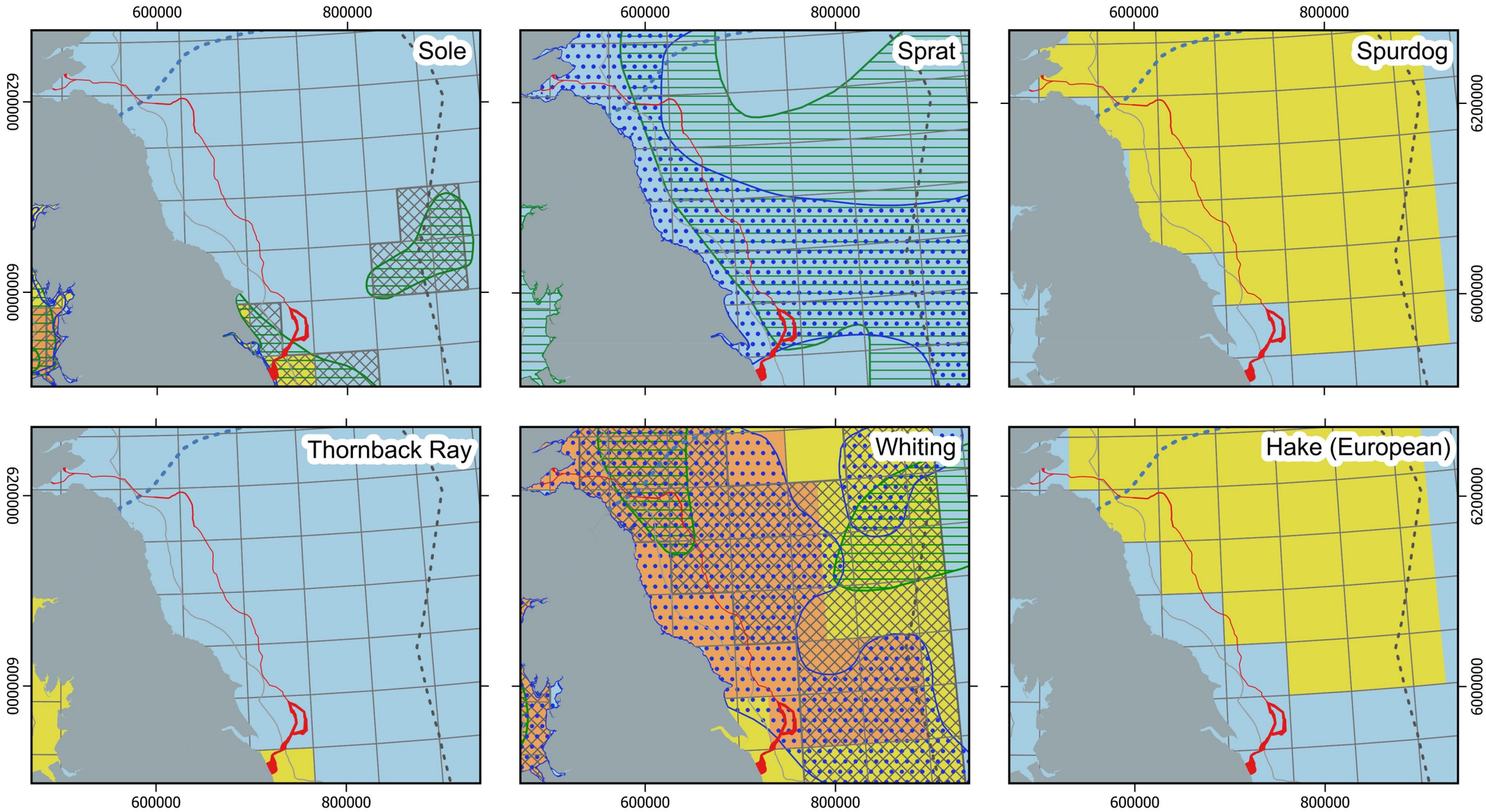

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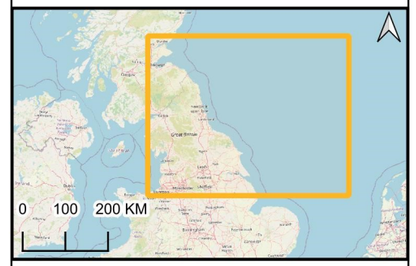
Fish nursery and spawning grounds with intensity of activity within the English Study Area - Map 2

C01494b-EGL4-FISH-007-C



- Exclusive Economic Zone Limit
- 12NM Limit
- Scottish Adjacent Waters
- EGL 4 Scoping Boundary
- ICES Statistical Rectangles

Spawning Grounds with Intensity (Ellis et al 2012)

- Low
- High

Nursery Grounds with Intensity (Ellis et al 2012)

- Low
- High

Spawning & Nursery Grounds (Coull et al 1998)

- Spawning Grounds
- Nursery Grounds

0 20 40 KM

0 20 40 NM

Date	01/12/2023
Coordinate System	ETRS89 / UTM zone 30N
Projection	Universal Transverse Mercator
Unit	meters
Scale at A3	1:4500000
Created	J Cunningham
Reviewed	D Summers/ S Pearce
Authorised	A Farley

Document Path: X:\GIS\GIS_PROJECTS\C01494_EGL3&4\Project\QGS\EGL4\07_FISH\C01494b_FISH_007.qgz. Export Date: 01/12/2023

8.4.2.3. Designated Sites England

Holderness Offshore MCZ

The Scoping Boundary passes through Holderness Offshore MCZ. The MCZ covers an area of 1,176 km^2 and is located approximately 11 km offshore from the Holderness coast in the Southern North Sea region. It crosses the 12 NM territorial seas limit and overlaps with the Southern North Sea SAC (JNCC, 2019). The seabed of the Holderness Offshore MCZ is predominantly composed of sediment habitats ranging from subtidal sand to subtidal coarse sediment and contains part of a glacial tunnel valley. The varied nature of the seabed means it supports a wide range of species, both on and in the sediment, including multiple species of worms, mussel beds, sponges, starfish and crustaceans (such as crabs and shrimp). The site is also a spawning and nursery ground for a number of fish species, including lemon sole, plaice and European sprat. Ocean quahog has also been recorded within the site. The conservation objective for the site is to maintain and/or restore the favourable conservation status of the species.

Humber Estuary SAC

The Scoping Boundary lies approximately 4.26 km from The Humber Estuary European Marine Site (EMS) which comprises of the Humber Estuary Special Area of Conservation (SAC), Humber Estuary Special Protection Area (SPA), Humber Estuary Ramsar Site and Humber Estuary Site of Special Scientific Interest (SSSI). The site extends for 366.57 km^2 and includes the second largest coastal plain estuary in the UK (JNCC, 2023a). The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent. Significant, Annex II migratory fish species are present and include river lamprey and sea lamprey, which breed in the River Derwent, a tributary of the River Ouse and are protected species of the SAC. The conservation objective for the site is to maintain and/or restore the favourable conservation status of the species.

As mentioned above the Humber Estuary SAC includes sea and river lamprey, Table 8-7 shows the seasonality of these species within the SAC.

Table 8-8: Seasonality of protected species in Humber Estuary SAC

Feature	Life stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
River Lamprey	Downstream Migration (Juveniles)	■	■	■	■	■	■	■	■				
River Lamprey	Spawning (Freshwater)			■	■								
River Lamprey	Upstream migration (Adults)	■	■	■				■	■	■	■	■	■
River Lamprey	Estuarine feeding	■	■	■	■	■	■	■	■	■	■	■	■
Sea Lamprey	Downstream Migration (Juveniles)	■	■	■	■						■	■	■
Sea Lamprey	Spawning (Freshwater)					■	■	■					
Sea Lamprey	Upstream migration (Adults)		■	■	■	■	■						

Source: Natural England (2018)

North East of Farnes Deep Highly Protected Marine Area (HPMA)

The Scoping Boundary lies approximately 0.1 km from the HPMA North East of Farnes Deep. The HPMA is located approximately 55 km offshore from the north Northumberland coast, in the northern North Sea. The habitats within the HPMA are relatively stable and support a diverse range of marine flora and fauna such as anemones, worms, molluscs, echinoderms and fish species. Also found here is the ocean quahog which is Feature of Conservation Importance (FOCI) and smelt (JNCC, 2023b). The conservation objective for the site is to maintain and/or restore the favourable conservation status of the species.

River Tweed SAC (also in Scotland)

The Scoping Boundary lies approximately 27 km from the River Tweed SAC. The River Tweed supports a very large, high-quality salmon population in a river which drains a large catchment on the east coast of the UK, with sub-catchments in both Scotland and England which enters the sea in Berwick. The site extends for 374.2 km^2. Considerable work has been undertaken by the Scottish Environment Protection Agency (SEPA) and the River Tweed Foundation in tackling pollution and easing the passage of salmon past artificial barriers in the river. This has reversed many of the river's historical problems with water quality and access for salmon. The site not only supports a population of Atlantic salmon but other Annex II species including sea lamprey, brook lamprey and river Lamprey (JNCC, 2023c). The conservation objective for the site is to maintain and/or restore the favourable conservation status of the species (Natural England, 2018a).

8.4.3. Scottish Baseline Characterisation KP 418.7 to KP 524.9

The Scoping Boundary within the Scottish Study Area crosses three ICES rectangles namely 41E6, 41E7 and 41E8. Analysis of the fishing data from the ICES rectangles has been used as an indication of the commercial fish species caught in these regions.

8.4.3.1. Landing Information

Only two pelagic species were caught in 2022 within the Scottish Study Area, mackerel and Atlantic herring.

Table 8-9 shows the top five species of demersal species caught in 2022 by catch weight and catch value within the Scottish Study Area. Table 8-10 shows the same for shellfish.

Table 8-9: Top five demersal species caught in 2022 within the Scottish Study Area by weight in tonnes and value

Most caught demersal species by weight (t)	Most caught demersal species by value (£'s)
Haddock	Monks & Anglers
Monks & Anglers	Haddock
Thornback ray	Halibut
Dabs	Turbot
Cod	Cod

Source: MMO (2023)

Table 8-10: Top five shellfish species caught in 2022 within the Scottish Study Area by weight in tonnes and value

Most caught demersal species by weight (t)	Most caught demersal species by value (£'s)
Nephrops	Nephrops
Edible crab	Lobster
Lobster	Razor clam
Razor clam	Edible crab
Velvet swimming crab	Velvet swimming crab

Source: MMO (2023)

8.4.3.2. Spawning and Nursery Grounds Scotland

Table 8-11 summarises the species which use the Scottish Study Area as spawning and nursery grounds and the months within which this occurs. Also listed are the 0 Group Aggregation fish species which are noted to be within the Study Area. As with the English Study Area Norway pout is noted within the Scottish Study Area through evidence of 0 Group aggregations; there is no evidence of spawning or nursey areas.

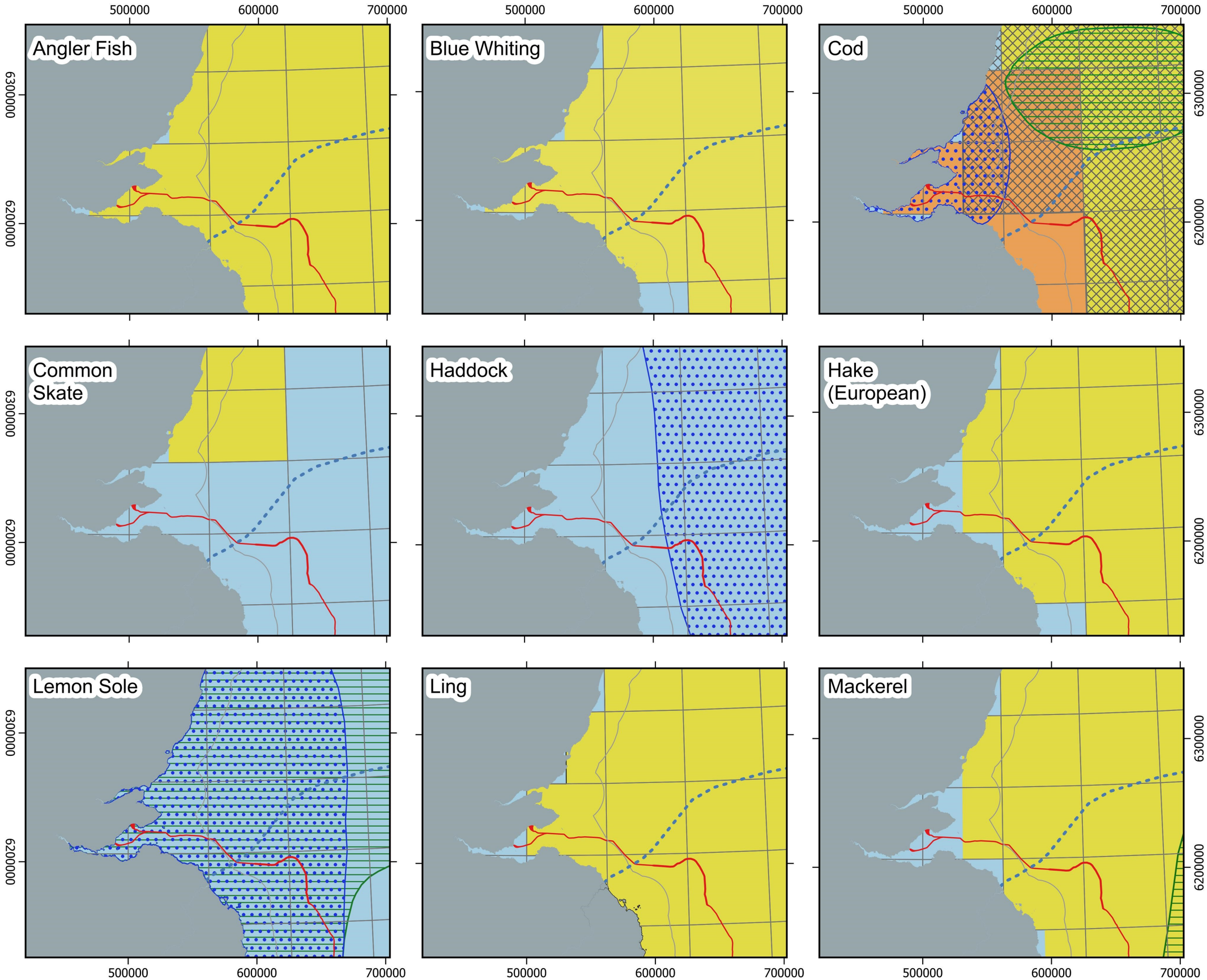
Where information is available in the form of mapped data this has been presented in Figure 8-5 (Drawing C01494-EGL4-FISH-008) and Figure 8-6 (Drawing C01494-EGL4-FISH-009).

Table 8-11: Spawning and Nursery grounds that overlap with the Study Area KP 418.7 to KP 524.9 in Scotland

Species	Latin names	Spawning Zone	Intensity	Nursery Zone	Intensity	** Presence of Group 0 Aggregations	J	F	M	A	M	J	J	A	S	O	N	D
Anglerfish	*Lophius piscatorius*	n/a	n/a	Demersal	Low	Low												
Atlantic Cod	*Gadus morhua*	n/a	n/a	Demersal	High	Low/Medium												
Atlantic Herring	*Clupea harengus*	Pelagic	High	Pelagic	High	Medium												
Atlantic Mackerel	*Scomber scombrus*	n/a	n/a	Pelagic	Low	Low												
Blue Whiting	*Micromesistius poutassou*	n/a	n/a	Pelagic	Low	Low				*	*							
European Hake	*Merluccius merluccius*	n/a	n/a	Demersal	Low	Low/Medium		*	*									
European Plaice	*Pleuronectes platessa*	Pelagic/Demersal	Low	Demersal	Low	Low/medium												
European Sprat	*Sprattus sprattus*	Pelagic	Low	Pelagic	Low	Low/Medium												
Haddock	*Melanogrammus aeglefinus*	n/a	n/a	Demersal	Low	Low/medium		*	*	*								
Horse Mackerel	*Trachurus trachurus*	n/a	n/a	Pelagic	Low	Low												
Lemon Sole	*Microstomus kitt*	Demersal	Low	Demersal	Low													
Ling	*Molva molva*	n/a	n/a	Demersal	Low													
Nephrops	*Nephrops norvegicus*	Demersal	Low	Demersal	Low													
Norway Pout	*Trisopterus esmarkii*	n/a	n/a	n/a	n/a	Low												
Saithe	*Pollachius virens*	n/a	n/a	Demersal	Low		*	*										
Sandeels	*Ammodytidae spp.*	Demersal	High	Demersal	Low													
Spotted ray	*Raja montagui*	Demersal	Low	Demersal	Low						*	*	*					
Spurdog	*Squalus acanthias*	n/a	n/a	Viviparous	Low													
Tope Shark	*Galeorhinus galeus*	n/a	n/a	Viviparous	Low													
Whiting	*Merlangius merlangus*	Pelagic	Low	Pelagic	High	Low/Medium												

*Sources: Coull et al (1998), Ellis et al (2012), Aires (2014). * Peak Spawning. ** 0 Group fish defined as fish in the first year of their lives*

	Spawning Only		Nursery Only		Both



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Fish nursery and spawning grounds with intensity of activity within the Scottish Study Area - Map 1

C01494b-EGL4-FISH-008-C

- 12NM Limit
- Scottish Adjacent Waters
- EGL 4 Scoping Boundary
- ICES Statistical Rectangles

Spawning Grounds with Intensity (Ellis et al 2012)
- Low
- High

Nursery Grounds with Intensity (Ellis et al 2012)
- Low
- High

Spawning and Nursery Grounds (Coull et al 1998)
- Spawning Grounds
- Nursery Grounds

0 25 50 km

0 10 20 NM

Date	01/12/2023
Coordinate System	ETRS89 / UTM zone 30N
Projection	Universal Transverse Mercator
Unit	meters
Scale at A3	1:2700000
Created	EP
Reviewed	S Pearce
Authorised	A Farley

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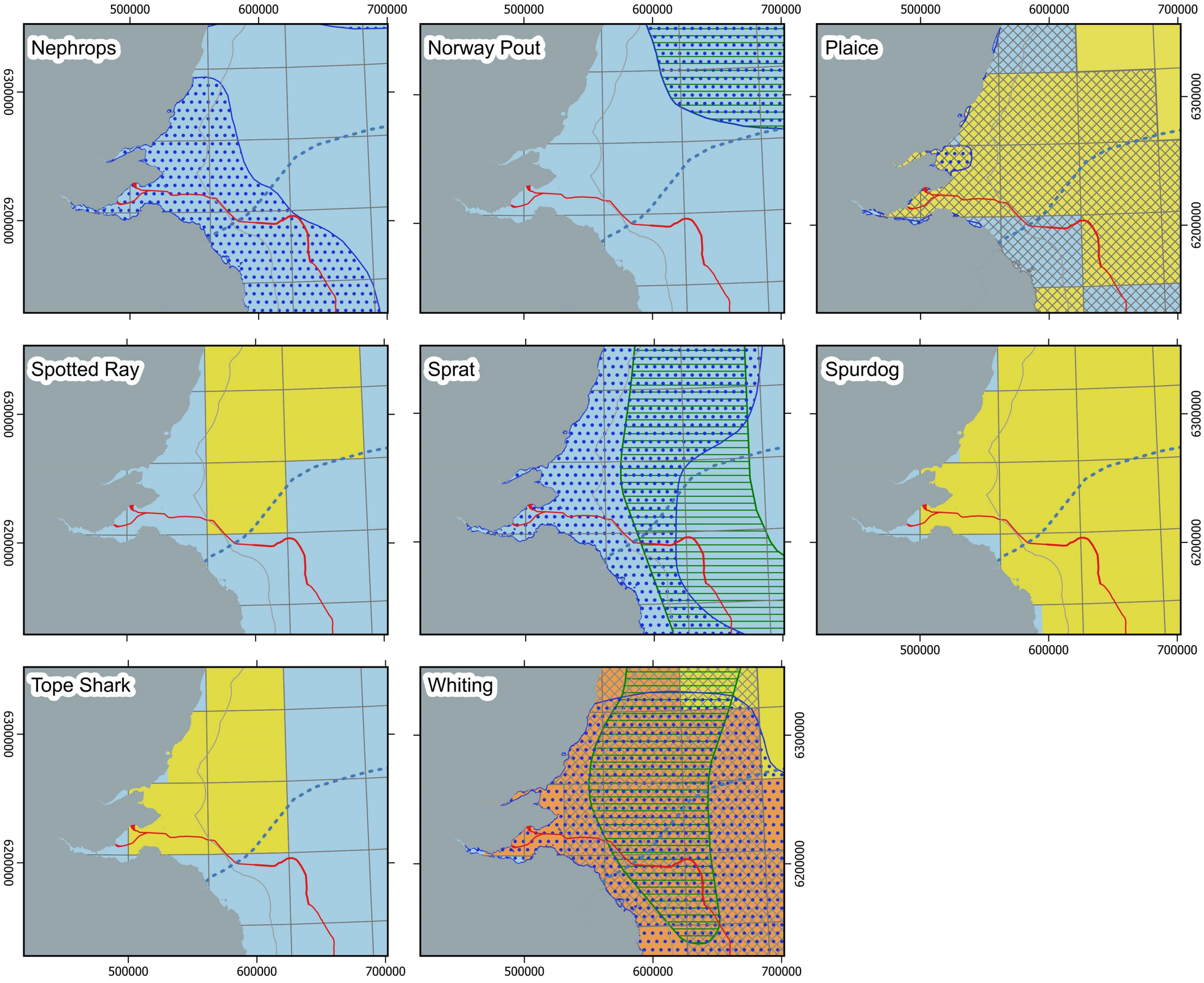

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Fish nursery and spawning grounds with intensity of activity within the Scottish Study Area - Map 2

C01494b-EGL4-FISH-009-B

12NM Limit

Scottish Adjacent Waters

EGL 4 Scoping Boundary

ICES Statistical Rectangles

Spawning Grounds with Intensity (Ellis et al, 2012)

Low

High

Nursery Grounds with Intensity (Ellis et al, 2012)

Low

High

Spawning and Nursery Grounds (Coull et al, 1998)

Spawning Grounds

Nursery Grounds

0 25 50 km

0 10 20 NM

Date	01/12/2023
Coordinate System	ETRS89 / UTM zone 30N
Projection	Universal Transverse Mercator
Unit	meters
Scale at A3	1:2700000
Created	EP
Reviewed	S Pearce
Authorised	A Farley

Data Sources-UKHO- Contains public sector information licensed under the Open Government Licence v3.0. CEFAS-Spawning and Nursery Grounds Layers for Selected Fish in UK Waters in 2010 & Coull et al & Ellis et al (1998/2010/2012)-Contains public sector information licensed under the Open Government Licence v3.0. ICES-All public data are under the Creative Commons (CC BY 4.0) licence. Data correct at time of export.

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8.4.3.3. Designated Sites Scotland

Firth of Forth Banks Complex MPA

The Scoping Boundary lies approximately 2.3 km from the Firth of Forth Banks Complex MPA, which comprises of a group of three shelf banks and mounds, namely Scalp Bank, Berwick Bank, Montrose Bank & Wee Bankie shelf banks and mounds (JNCC, 2014). It is located in offshore waters of the Northern North Sea on the east coast of Scotland and is strongly influenced by water currents. These result in a 'mosaic' of habitats including various types of sand and gravels which overlie the shelf banks and mounds, supporting a diverse range of benthic species, including the ocean quahog, which is a Feature of Conservation Importance, and a protected species of the Firth of Forth Banks Complex MPA. The conservation objective for the site is to maintain and/or restore the favourable conservation status of the species.

8.5. Proposed Assessment Methodology

The fish and shellfish MEA will follow the assessment approach set out in Chapter 4 of this Scoping Report, using the project-wide assessment matrix. The assessment of potential effects will be established using the standard Source-Pathway-Receptor approach.

Data derived from the site-specific survey will provide a more detailed site characterisation and fill key data gaps such as sediment particle size distributions (which informs the presence of species such as sandeel and herring), habitat biotopes and extent of shellfish beds (if present). A sandeel and Atlantic herring habitat assessment will be undertaken to inform the assessment of effects. In addition, the results from any assessment undertaken to inform the marine physical processes chapter will be used to establish the potential impacts on fish and shellfish.

Where impacts are not predicted to be significant, simple assessments, using an evidence-based approach that is proportionate to the anticipated level of significance will be undertaken. The potential for mortality, permanent and temporary injury and behavioural disturbance of noise sensitive fish and shellfish receptors based on impact thresholds reported in Popper *et al.* (2014) will be assessed.

Where significant effects are identified, mitigation measures will be proposed, and residual effects presented.

8.6. Scope of Assessment

A range of potential impacts on fish and shellfish have been identified which may occur during the construction, operation and maintenance (O&M), and decommissioning phases of the Project. Table 8-12 describes the potential impacts identified and provides justification as to whether they will be scoped in or out of the MEA. A precautionary approach has been taken and where there is no strong evidence base, or the significance is uncertain at this stage the impact has been scoped 'in' to the MEA. Where there is a clear evidence base that the effect from the impact will not be significant, either alone or in combination with other plans and projects, the impact has been scoped out of the MEA.

Table 8-12: Scoping assessment of impacts on fish and shellfish

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
Temporary habitat loss/seabed disturbance *(Abrasion/disturbance of the substrate on the surface of the seabed* *Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion)*	Boulder clearance, PLGR, pre-sweeping of sand waves. HDD duct excavation. Cable burial and trenching. Anchoring / jack-up foundations.	Shellfish and marine species with demersal life stage	**IN –** Any disturbance of the seabed has the potential to effect species which use the seabed for part/all of their lifecycle. Species most at risk are those that live in the upper layers of sediment (e.g., cockles), those that live on the seabed with limited mobility (e.g., ocean quahog, whelk, crab, lobster, hibernating sandeel) or those which lay their eggs on the seabed (demersal spawners) e.g., herring. The Project crosses many spawning and nursery grounds and whilst these cover large areas of the North Sea suitable habitats within these areas may be limited. Disturbance during the spawning season could have a direct impact on the spawning biomass for a specific year group. The assessment will focus on the effect on shellfish species due to their limited mobility and high commercial values and sandeel and herring as significant prey species.	**IN –** If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that localised repair works, or remedial external cable protection may be required. In these circumstances the significance of the effect will be of lower magnitude that during installation. However, if the activity takes place during key spawning periods, impacts could potentially be significant.	**IN –** The significance of the effect during decommissioning is similar or of lower magnitude than installation. However, effects could potentially be significant if within a sensitive spawning ground.
		Species with fully pelagic lifecycle	**OUT –** Species which have a fully pelagic lifecycle will not be significantly affected by disturbance of the seabed and will therefore be scoped out of the assessment.		
Permanent habitat loss *(Physical change (to another seabed type or sediment type)* *Water flow (tidal current) changes including sediment transport considerations)*	Deposit of external cable protection.	Shellfish and marine species with demersal life stage	**IN –** The presence of the deposit of external cable protection has the potential to change the seabed type, changing the habitat for shellfish and marine species with demersal life stages. They also have the potential to alter sediment transport at a local level, creating scour pits or causing accretion. If the deposits are close to sensitive shellfish beds or within demersal spawning grounds, there is the potential that changes to the habitat could have a significant effect on shellfish or species with demersal life stages. The significance of the effect will vary according to local factors such as the position of the external cable protection in relation to the prevailing current, the mobility of the seabed, and the sensitivity of the habitat. Information from ecological and marine surveys will be used to avoid areas of significant importance where possible. However, as the locations where external cable protection will be used has not currently been identified, the impact pathway cannot be scoped out of the assessment.	**IN –** If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that localised repair works, or remedial external cable protection may be required. In these circumstances the significance of the effect will be of lower magnitude that during installation. However, if the activity takes place during key spawning periods, impacts could potentially be significant.	**OUT –** No new seabed deposits will be made and no further permanent changes to the seabed.
		Pelagic Species	**OUT –** Species which have a fully pelagic lifecycle will not be significantly affected by localised seabed deposits and will therefore be scoped out of the assessment		

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
Temporary increase and deposition of suspended sediments *(Changes in suspended solids (water clarity)* *Smothering and siltation rate changes* *Hydrocarbon & PAH contamination)*	Pre-sweeping	Shellfish and marine species with demersal life stage	**IN** - Pre-sweeping of sand waves involves the re-positioning of large quantities of sediment from the cable route to either immediate alongside the cable route, or to a separate disposal location. Depending on the technique used and the size of sand waves requiring pre-sweeping, the redeposition of sediment can cause smothering >10 cm deep over relatively wide areas of seabed (in the order of tens of thousands square metres). Effects could potentially be significant if the disposal site contains sensitive spawning grounds, ocean quahog aggregations or shellfish beds. Therefore, the impact pathway cannot be scoped out for this specific activity until further information is available on the areas that will require pre-sweeping.	**OUT –** Pre-sweeping is used to during construction to ensure that the cables are buried below the base of mobile sediments. Generally during operation, remedial works are focused on protecting sections of cable that have become exposed due to sediment mobility, or to repair cables that have been damaged by a third party (e.g., fishing damage). Pre-sweeping would not be required during a cable repair for third-party damage as the cable would already be exposed on the seabed. Therefore, the only scenario pre-sweeping might be required is where the cable has been damaged during construction and develops a fault in an area where pre-sweeping was used during construction. In this scenario the significance of the effect will be of lower magnitude than during construction and has been scoped out of the assessment.	**IN –** Pre-sweeping or controlled flow excavation could be used during decommissioning to expose the buried cable. The significance of the effect during decommissioning is similar or of lower magnitude than construction. However, effects could potentially be significant if within a sensitive habitat.
Temporary increase and deposition of suspended sediments *(Changes in suspended solids (water clarity)* *Smothering and siltation rate changes* *Hydrocarbon & PAH contamination)*	Seabed preparation (e.g., boulder clearance, PLGR). HDD duct excavation Cable burial and trenching. Anchoring/jack-up foundations. Deposit of external cable protection.	All species (except cockles)	**OUT -** The most significant contributor (relatively) will be from the sediment plume generated by cable trenching. During trenching the area affected depends on the trenching technique deployed e.g., ploughing will create a slightly larger footprint than jet trenching. However, in both cases the spatial extent of heavy smothering is extremely localised, restricted to less than a couple of metres either side of the trench (GridLink, 2020, BERR, 2008) and significant effects are unlikely. Modelling undertaken for other cable projects (e.g., Viking Link reported in Intertek 2017, GridLink 2020, BERR 2008) indicates that approximately 90% of the suspended sediment is re-deposited within close proximity (<100 m) and would be classed as heavy smothering. The remaining 10% is transported over a wide area, which depending on the strength of the prevailing currents could be as far as 10 – 15 km but will be deposited in thicknesses of less than 2 mm. With respect to changes in water clarity, the benchmark used by Natural England for the pressure is a change in one rank e.g., from clear to intermediate, on the Water Framework Directive scale for one year. While trenching is undertaken a sediment plume will be generated continuously, but it will move with the location of the cable spread. Sands and gravels do	**OUT** - If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that localised repair work or remedial external cable protection may be required. In these circumstances the significance of the effect will be of lower magnitude than during construction and the impact has therefore been scoped out of the assessment for the same reasons.	**OUT -** The significance of the effect during decommissioning is similar or of lower magnitude than construction and has therefore been scoped out of the assessment for the same reasons.

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
			not form part of the sediment load and will settle out of suspension quickly. Modelling undertaken for other cable projects (e.g., Viking Link reported in Intertek 2017, GridLink 2020, BERR 2008), concludes that regardless of the position along a cable route, the sediment plume generated is aligned with the dominant tidal axis. Material is deposited primarily along the dominant tidal axis but with some lateral extension. Over most of the plume the increase in suspended sediment concentrations is generally lower than 30 mg/l with natural conditions returning within a single tidal cycle following the cessation of activities, although if very fine chalk particles are present this could be extended to 4-5 days. Overall, the change in water clarity is not significant and generally in line with changes experienced during storm conditions when background concentrations can reach 1000mg/l (GridLink, 2020). Sediment contamination in the North Sea is focused on areas of high anthropogenic activity e.g., around disposal sites, estuaries and where drilling activity has taken place. Sediments in areas where pre-sweeping is proposed will be tested to ensure compliance with Cefas Action Levels for disposal.		
Temporary increase and deposition of suspended sediments *(Changes in suspended solids (water clarity)* *Smothering and siltation rate changes* *Hydrocarbon & PAH contamination)*	Seabed preparation (e.g., boulder clearance, PLGR). HDD duct excavation. Cable burial and trenching. Anchoring/jack-up foundations. Deposit of external cable protection.	Cockles	**IN –** Cockles are susceptible to smothering and changes in water quality. There is a cockle area in ICEs rectangle 35F0 within The Wash which is in the Study Area. There could be some concerns amongst fisheries stakeholders that if contaminated sediments are suspended by cable trenching this could have a significant impact on sensitive cockle beds. Other recent projects where reported sediments have been contaminated with heavy metals, PCBs and PAHs were analysed against Cefas Guidelines which concluded that there were considered to be of no concern (NeuConnect, 2019). Indirect effects from the mobilisation of contaminants entering the food chain are not predicted to be significant. However, the impact pathway will not be scoped out for this specific activity until further information is available on seabed contamination levels within the Project.	**OUT -** If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that localised repair works may be required. In these circumstances the significance of the effect will be of lower magnitude than during installation and has therefore been scoped out of the assessment.	**OUT -** The significance of the effect during decommissioning is similar or of lower magnitude than installation and has therefore been scoped out of the assessment.
Accidental spills	Presence of project vessels and equipment	All species	**OUT -** Project vessels and contractors will comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 which relate to pollution from oil from equipment, fuel tanks etc and release of sewage (black and grey water). It is a legal requirement that all vessels have a SOPEP. Compliance with Regulations will be sufficient to minimise the risk to the environment.		

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
(Hydrocarbon & PAH contamination)					
Introduction or spread of marine invasive non-native species (MINNS)	Presence of project vessels and equipment. Deposit of external cable protection.	Shellfish	**OUT –** Although the introduction of project vessels, equipment, and external cable protection have the potential to introduce and spread MINNS, all relevant guidelines will be followed (GB Non-native Species Secretariat, 2015) including vessel cleaning facilities and the use of anti-fouling paint. Project vessels and contractors will comply with the International Convention for the Control and Management of Ships' Ballast water and Sediments. All seabed deposits will be inert with no biologically active material. Project vessels will complete a biosecurity risk assessment prior to arriving on site which will include factors such as origins of the vessels and ensuring that relevant equipment is cleaned before use. Compliance with Regulations will be sufficient to minimise the risk to the environment.		
Underwater noise changes	Presence of project vessels and equipment	All species	**OUT –** All of the operations involved in the preparation and construction of subsea cable generate underwater sound. The presence of vessels creates a continuous sound. The Project will be a one-off event set against a background of existing shipping noise. Any effects will be localised and short-term and are not predicted to be significant.	**OUT -** If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that localised repair works may be required. In these circumstances the significance of the effect will be of lower magnitude than during construction and has therefore been scoped out of the assessment for the same reasons.	**OUT -** The significance of the effect during decommissioning is similar or of lower magnitude than construction and has therefore been scoped out of the assessment for the same reasons.
Collision risk	Presence of project vessels and equipment	Basking shark	**OUT –** There have only been a couple of sightings of basking shark within the waters of the Study Area during the last 20 years (NBN Atlas, 2023) This impact pathway has been scoped out due to the scarcity of the species within the Study Area.		
Electromagnetic changes/Barrier to species movement	Presence of cables	All species	N/A	**IN –** Some species of mollusc, crustacean, marine fish and elasmobranchs detect electric and magnetic fields. Bundling of the cables and cable burial reduces the EMF exposure. Given that calculations as to the field strength and burial depths have not been undertaken this impact pathway cannot be scoped out of the assessment at this stage.	N/A
Temperature increase	Presence of cables	Species with demersal life stage	N/A	**OUT –** During the operation of an HVDC cable heat losses occur because of the resistance in the cable/conductor. This can cause localised heating of the surrounding environment (i.e., sediment for buried cables, or water in the interstitial spaces of external cable protection). There are no specific regulatory limits applied to temperature changes in the seabed, although a 2°C changed between seabed surface and 0.2m depth is used as a guideline in Germany.	N/A

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
				Conservative calculations undertaken for Viking Link (which crosses German waters) concluded that heating in excess of 2°C at 20 cm sediment depth will only occur if cables are bundled and buried to less than 0.75 m (National Grid and Energinet, 2017). As yet the cable burial risk assessment has not been carried out. However, evidence from similar projects show that risk of shipping and fishing interactions that a minimum burial depth of 1.5 – 2m is required (NeuConnect, 2019, GridLink, 2020) Any temperature changes will be localised to the immediate environment surrounding the cable and undetectable against natural temperature fluctuations in the surrounding sediments and water column. No significant effects are predicted. This pressure has therefore been scoped out of the assessment.	

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9. Intertidal and Offshore Ornithology

9.1. Study Area Definition

This chapter of the Scoping Report describes the potential impacts arising from the construction, operation and maintenance (O&M), and decommissioning of the Eastern Green Link 4 (EGL 4) hereafter referred to as 'the Project' on Intertidal and Offshore Ornithology. Intertidal and Offshore Ornithology receptors include species of bird that use the intertidal and offshore area for breeding, foraging and loafing.

The Scoping Boundary for the Project extends from MHWS in England to the MHWS in Scotland. It is nominally 1 km wide, 500 m either side of the centreline, but however, it widens in areas where there is still optionality in the design e.g., to allow for micro-routeing around potential seabed features. It is anticipated that the Marine Licence application boundary will ultimately be 500 m following refinement and rationalisation as the MEA and design process evolves.

There are two proposed Landfalls in England (Anderby Creek and Theddlethorpe) and two proposed Landfalls in Scotland (one in Kinghorn and one in Lower Largo/Lundin Links) being considered at this stage of the environmental assessment process. These options will be subject to further technical feasibility work and stakeholder consultation and will be refined to one preferred option for inclusion in the subsequent Marine Licence application for the Project.

Kilometre Points (KPs) are used throughout this Chapter to provide context as to where within the Study Area a feature lies. KP 0 is defined at the Anderby Creek Landfall. As there are still alternative Landfalls being considered, KPs have been created along the longest route from the proposed English Landfall at Anderby Creek, around the Holderness Offshore Marine Conservation Zone (MCZ) to the proposed Scottish Landfall at Kinghorn. The KPs for this route are referenced as KP 0 to KP 524.9. Alternative options, which branch off this longest route, are route from the proposed English Landfall at Theddlethorpe to the point where it converges with the longest route (referenced as T_KP 0 to T_KP 18) ; and through Holderness Offshore MCZ, which is referenced as KP 0 to H_KP 40 and from the longest route where it branches off to the proposed Scottish Landfall in Lower Largo/Lundin Links, which is reference as L_KP 0 to L_KP 16 .

The Study Area for the intertidal and offshore ornithology assessment has been defined recognising the highly mobile nature of birds and the distance over which they can range. The extent of the Study Area incorporates the Scoping Boundary plus an additional 15 km either side of the proposed submarine cable corridor. This is a precautionary maximum zone of influence (based on the maximum tidal excursion) that encompasses the potential impact pathway from increased sediment concentrations, which could affect diving birds' ability to seek prey. The Study Area will be reviewed and refined for the marine environmental assessment (MEA) based on maximum tidal excursions and if appropriate sediment dispersion modelling. The zone of influence will be affected by the findings of Chapter 6 – Marine Physical Processes, which should be read in conjunction with this chapter. The Study Area has considered:

- Seabird foraging ranges (Thaxter et al., 2012; Woodward et al., 2019)
- Recent recommendations from statutory nature conservation bodies (SNCBs) regarding maximum disturbance/displacement ranges for sensitive bird species (MIG-Birds, 2022).

According to advice from SNCBs, a maximum buffer of 10 km should be applied to consider red-throated diver (*Gavia stellata*), which are considered to be particularly vulnerable to disturbance (MIG-Birds, 2022), and a buffer of at least 4 km should be applied for other diving birds. The 15 km buffer used to define the Study Area is therefore sufficiently precautionary to cover the potential effects of displacement as well as potential effects resulting from increases in turbidity.

The Study Area for intertidal and offshore ornithology and its relation to the Project is presented in Figure 9-1 (Drawing: C01494b-BIRD-001) and Figure 9-2 (Drawing: C01494b-BIRD-002).

9.2. Data Sources

Data sourced for the baseline characterisation will be presented in accordance with relevant guidance for the topic. The datasets that will be used to inform the description of the baseline environment for the MEA are described in the following sub-sections.

9.2.1. Site-specific Survey Data

Due to the temporary and transient nature of construction, offshore site-specific bird surveys are not considered necessary for the proposed submarine cable corridor. For the Scottish landfalls winter vantage point surveys along the coast, walkover winter surveys and breeding bird surveys are planned to be conducted in 2024.

9.2.2. Publicly Available Data

A desk-based review of publicly available data sources (literature and GIS mapping files) will be used to describe the baseline environment. Extensive contemporary and historic information is available regarding the ornithological characteristics of the North Sea and will be used in the MEA. Table 9-1 lists the key data sources which will be used in the assessment.

Table 9-1: Key publicly available data sources for intertidal and offshore ornithology

Data Source	Description	Coverage Relative to Study Area	
		English Study Area	Scottish Study Area
Natural England	Natural England Conservation Advice for Marine Protected Areas	✓	
JNCC	JNCC Conservation Advice for Marine Protected Areas	✓	✓
British Trust for Ornithology (BTO) Non-Estuarine Waterbird Surveys (NEWS)	Waterbird Populations: Numbers and Trends by Count Sector (Welcome to BirdFacts | BTO - British Trust for Ornithology)	✓	✓
IUCN	The International Convention for the Conservation of Nature (IUCN) Red List of Threatened Species (https://www.iucnredlist.org/)	✓	✓
Offshore Energy Strategic Environmental Assessment (SEA) 4 (2022)	Appendix 1 Environmental Baseline, A1a.5 Birds (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1061529/Appendix_1a_5_-_Birds.pdf)	✓	✓
BTO Wetland Bird Survey (WebS)	Annual survey reports of wetland waterbirds.	✓	✓
National Bird Atlas (Balmer et al., 2013)	Results of the five years of breeding season and wintering surveys across the UK at a 10 km resolution.	✓	✓
NatureScot	NatureScot's register for key protected areas across Scotland. Report of the Seasonal Periods for Birds in the Scottish Marine Environment.		✓
Environmental Statements and Scoping reports from Offshore Wind Farm (OWF) Developments. (From MD-LOT Public Register)	• Outer Dowsing Offshore Wind Preliminary Environmental Information Report Volume 1, Chapter 12: Intertidal and Offshore Ornithology (2023) • Hornsea 4 Offshore Wind Farm Environmental Statement, Volume A2, Chapter 5: Offshore and Intertidal Ornithology (2021) • Hornsea Offshore Wind Farm Project One Environmental Statement, Volume 5, Chapter 5.5.1 Ornithology Technical Report (2013) • Hornsea 3 Offshore Wind Farm Environmental Statement, Volume 2,	✓	✓

Data Source	Description	Coverage Relative to Study Area	
		English Study Area	Scottish Study Area
	Chapter 5, Offshore Ornithology (2018) • Triton Knoll Offshore Wind Farm Final Environmental Assessment Scoping Report (2009) • Neart na Gaoithe Offshore Windfarm Environmental Impact Assessment Report, Chapter 9, Ornithology (2018) • Berwick Bank Offshore Wind Farm Environmental Impact Assessment Report, Volume 2, Chapter 11, Offshore and Intertidal Ornithology (2022) • Berwick Bank Offshore Windfarm – Cambois Connection Marine Scheme, Volume 1, Chapter 10, Environmental Impact Assessment Scoping Report (2022)		

9.2.3. Additional Studies

No specific additional studies will be undertaken to inform the baseline characterisation of the receptor. However, the MEA will draw upon the findings of studies undertaken for other topics such as sediment dispersion modelling (see Chapter 6) and sandeel and Atlantic herring habitat assessment (see Chapter 8).

9.3. Consultation

Consultation will be undertaken with ornithology stakeholders to supplement the desktop review and studies. The following bodies will be consulted, as a minimum, to ensure that the most up-to-date information is collated:

Table 9-2: List of stakeholders to be consulted

Stakeholder	England	Scotland
Marine Management Organisation (MMO)	✓	
Joint Nature Conservation Committee (JNCC)	✓	✓
Natural England (NE)	✓	
NatureScot		✓
Marine Directorate – Licencing Operations Team (MD-LOT)		✓

9.4. Baseline Characterisation

9.4.1. Introduction

Intertidal and offshore ornithology refers to the diversity, abundance and function of marine bird species present in the Study Area up to MHWS, at all life stages including feeding, breeding, overwintering and migrating. Marine birds are highly mobile but can be constrained during certain times of the year by factors such as their need to return to a colony to feed and care for chicks, or when they are flightless during a post-breeding moult. Species can also be restricted by their foraging strategy and the availability of prey species and their sensitivity to human activities such as vessel traffic (Atterbury *et al*., 2021).

For the purposes of this Scoping Report, marine birds have been grouped according to Atterbury *et al*. (2021) based on their sensitivity and exposure to impacts. Table 9-3 (extracted and adapted from Atterbury *et al.* 2021) describes the various functional groups.

Table 9-3: Marine bird groups (adapted from Table 3: Marine Bird in Atterbury et al., 2021 pg.4)

Function group	Information
Divers, grebes and mergansers	"*This group includes great northern diver, black-throated diver, red-throated diver, Slavonian grebe, and red-breasted merganser. These species tend to aggregate in coastal waters, and in bays, estuaries and firths. They can aggregate in large numbers in specific areas over the winter, whilst during the breeding season they tend to forage within restricted ranges from their breeding areas. Some of these species have a flightless period following breeding (moulting), during which they may be particularly sensitive to some impacts. They are largely thought to be water column feeders, although there is some evidence that some species may also be benthic feeders (Duckworth et al. 2020 in Atterbury et al. 2021).*" "*This group is highly sensitive to noise and visual disturbance, such as from vessel traffic (Fliessbach et al. 2019 in Atterbury et al. 2021). Since some of these species may not resettle quickly after being flushed, the vessel transit route plus a buffer of several kilometres may be effectively lost as habitat to some diver and grebe species, with evidence for this being particularly strong for red-throated diver (Mendel et al. 2019 in Atterbury et al. 2021).*" "*These species are thought to have some sensitivity to underwater noise and may be impacted by changes in suspended solids when foraging in the water column.*"
Seaducks, geese and swans	"*This group includes common eider, goldeneye, scaup, long-tailed duck, common scoter, velvet scoter, whooper swan, Bewick's swan, greylag goose, barnacle goose, pink-footed goose, dark-bellied brent goose, light-bellied brent goose, shelduck, pintail, pochard, shoveler, wigeon, teal, mallard and gadwall. This category includes species which breed in the UK, migrate through UK waters, and/or winter in the UK. They can use a variety of waters both inshore and offshore. They are benthic, surface or grazing feeders. While some diving sea duck species like eiders and scoters specialise in foraging on shellfish and crustaceans, others such as long-tailed duck, goldeneye and scaup are generalist feeders and their diet can include aquatic plants, polychaetes, amphipods, aquatic insects and some small fish. Other duck, swan and goose species within this group are surface feeders, utilising prey on the surface of intertidal habitats such as the small gastropod mollusc hydrobia, as well as grazing on saltmarsh and coastal grazing marsh.* *Most species within this group are sensitive to visual and noise disturbance from vessel traffic (Fliessbach et al. 2019 in Atterbury et al. 2021). In two studies looking at the disturbance effects caused by vessels, common scoters were not observed resettling after being flushed (Schwemmer et al. 2011; Fliessbach et al. 2019 both cited in in Atterbury et al. 2021). However, most species in this group, it is not known if or how quickly they recover and move back to areas once a vessel has passed through. It is unknown whether species within this group are sensitive to underwater noise. For species which are benthic feeders, activities that are likely to disturb seabed habitats and species may affect the availability of suitable prey.*"
Auks	"*There are four auk species commonly found in waters around the UK: Atlantic puffin, black guillemot, common guillemot and razorbill. They aggregate around the UK in inshore and offshore waters throughout the year. During the breeding season, they tend to form large colonies, and impacts occurring in favoured foraging areas within range of these colonies can have implications for their ability to successfully raise chicks. Adults have a flightless moult period immediately after chicks fledge, which can last several months. When chicks fledge, they too are flightless for several weeks. During these periods adults and chicks may be particularly sensitive to some pressures, including noise and visual disturbance. Auks are water-column feeders, feeding largely on pelagic and demersal fish.* *Auks are sensitive to noise and visual disturbance. Vessel transits through important foraging areas or aggregations of these species should be avoided. While there is evidence for underwater anthropogenic noise affecting the foraging behaviour of related species (African penguins; Pichegru et al. 2017 in Atterbury et al. 2021), it remains unclear how sensitive auks are to this impact. As these are species that feed in the water column, they may be affected by changes in water turbidity due to increases in suspended sediments…, which would affect their ability to successfully forage for their prey. In addition, disturbance and loss of seabed habitats can affect availability of suitable prey (e.g., sandeel).*"
Terns, gulls, kittiwakes and gannets	"*This group includes common tern, Sandwich tern, Arctic tern, little tern, roseate tern, great black-backed gull, lesser black-backed gull, herring gull, common gull, black-headed gull, Mediterranean gull, little gull, black-legged kittiwakes, petrel species and northern gannet. These species aggregate around the UK in inshore and offshore waters, with terns being present during the spring and autumn migrations and the breeding season, while others can be present in UK waters throughout the year. During the breeding season, they tend to breed in colonies, and impacts occurring in favoured foraging areas within range of these colonies can have implications for their ability to successfully raise chicks. Except for gannets, all species in this group are surface*

Function group	Information
	feeders, with some species also feeding in exposed tidal areas. They feed on a wide variety of marine prey including fish, squid, crustaceans, jellyfish and offal. *These species are low to moderately sensitive to noise and visual disturbance, and some species within this group may be attracted to some vessels, potentially in hope of fishery discards/offal. It is unknown whether species within this group are sensitive to underwater noise. As most species in this group are surface feeders, they may be affected by changes in suspended solids that would affect their ability to successfully forage for their prey (van Kruchten & van der Hammen 2011; Cook & Burton 2010, both cited in Atterbury et al. 2021)."*
Waders and harriers	*"This group includes wader species which breed, migrate and winter along the UK coast. Wader species have various foraging strategies, but all are surface or near-surface feeders, making use of open coast, mud and sandflats, saltmarshes, saline lagoons, rocky coasts (e.g., purple sandpiper, oystercatcher) and nearby grazing marsh and arable land to both feed and roost. Some, such as oystercatcher, are more (but not exclusively) reliant on localised food resources such as cockle and mussel beds whilst others are more generalist. Some species are largely restricted to certain breeding habitats (e.g., avocet: saline lagoons, saltpans and scrapes; ringed plover: sand and shingle, saltmarsh edges) whilst other species utilise a broader range of coastal and adjacent habitats.* *This group also includes marsh and hen harrier. Both species can use intertidal habitats extensively in winter for foraging and roosting. Marsh harrier will also utilise coastal habitats in the breeding season and may also breed in saline reedbeds.* *This group is sensitive to visual and noise disturbance from vessel traffic. Waders and other species using intertidal habitats are at risk from disturbance caused by people and machinery…across and adjacent to those habitats. In general, there is less risk of disturbance of those habitats from shipping…except where vessels capable of navigating shallow waters are employed. Activities that are likely to disturb their intertidal habitats and prey species may affect the availability of suitable prey for these species."*

The southern North Sea and the adjacent coastline provide habitats (both breeding and foraging areas) for a wide range of both nationally and internationally recognised marine bird populations. The distribution and abundance of these bird populations fluctuates throughout the year depending on factors such as food availability and seasonality for periods such as breeding.

9.4.2. English Baseline Characterisation KP 0 to KP 418.7

9.4.2.1. Overview

The proposed English landfall is within the Greater Wash SPA and crosses a number of other neighbouring designated sites as it approaches the proposed landfalls. The designated sites include a variety of marine habitats of importance for breeding and non-breeding birds, including extensive intertidal mudflats and sandflats, subtidal sandbanks and biogenic reef. Offshore, the proposed submarine cable corridor lies within a shallow area of low salinity which is important for a number of bird species, in particular divers, gulls, seaduck and terns (BEIS, 2022; JNCC, 1995). The area is characterised by extensive sandbank features present at depths of less than 25 m, many of which are protected for their importance in providing habitat and affecting water and sediment dynamics (BEIS, 2022). As discussed above and in Chapter 6 of this Scoping Report, a large proportion of the offshore area in this location is covered by other habitats and species listed under the relevant legislation (SACs).

The recent Offshore Energy Strategic Environmental Assessment (SEA) 4 discusses aspects of the UK baseline environment to facilitate discussion around the potential for future development of renewable energy and oil & gas abstraction. It characterises the UK bird fauna as 'western Palaearctic', meaning that the majority of species are found across western Europe and extend into western Asia and northern Africa.

Digital aerial bird surveys from offshore wind farms in the English Study Area (Outer Dowsing, Hornsea 3 and 4, Triton Knoll) consistently identified the marine birds listed in Table 9-4 as present in the Study Area.

Table 9-4: Marine birds present in the English Study Area

Functional Group	Species
Divers, grebes and mergansers	Red-throated diver, Gannet, Fulmar, Manx Shearwater, Shag
Auks	Puffin, Guillemot, Razorbill, Little auk
Terns, gulls, kittiwakes and gannets	Herring gull, Great black-backed gull, Lesser black-backed gull, Kittiwake, Black-headed gull, Little gull, Common gull, Sandwich tern, Common tern, Artic tern, Artic skua, Great skua
Seaducks, geese and swans	Common scoter

Functional Group	Species
Waders and harriers	Oystercatcher, Sanderling, Curlew

9.4.2.2. Designated Sites England

The intertidal and offshore areas in England along the proposed submarine cable corridor are extensively covered by designated sites for the protection of bird species and their habitats, including SPAs, proposed SPAs (pSPAs), Ramsar sites, SSSIs and NNRs. These sites are illustrated in Figure 9-1 (Drawing: C01494-EGL4-BIRD-001). The following section identifies the designated features for these sites, as these are the species which are most likely to be seen within the Study Area and are considered the most relevant sensitive receptors for the purposes of characterising the receiving environment. However, it should be noted that other bird species may be encountered within the Study Area.

There are several bird species known to be reliant on the intertidal habitats of the east coast that lie in the vicinity of the proposed landfalls and the nearshore parts of the proposed submarine cable corridor. The intertidal environment of the Lincolnshire coast is characterised by shifting, sandy beaches, sand dunes and soft cliffs, and it is actively eroding. The Humber Estuary and The Wash are the northern and southern boundaries of the Lincolnshire coast, respectively. Intertidal areas of both the Wash and Humber are important habitat for wading birds. However, the distribution and abundance of seabirds in the area varies throughout the year depending on factors such as food availability and seasonality for periods such as breeding. These are summarised in Table 9-5 below, along with the bird species which have been identified as protected features. The English landfalls overlap the Greater Wash SPA which has offshore ornithological designations for breeding terns and overwintering red-throated diver (*Gavia stellata*) and common scoter (*Melanitta nigra*).

Table 9-5 presents the designated sites that are designated for ornithology identified using publicly available GIS data (JNCC, 2022). The Project passes through the Greater Wash SPA for approximately 35.7 km. It also passes through the Holderness Offshore Marine Conservation Zone (MCZ), which is designated for subtidal habitats and species that support bird populations within the estuary and Southern North Sea Special Area of Conservation (SAC), which is an area of importance for harbour porpoise.

Table 9-5: Designated sites within proximity of the English Study Area

Note: non-marine birds are in light grey.

Designated site	Distance from Scoping Boundary (km)	Site description	Protected feature SPA	Ramsar	SSSI	NNR
Humber Estuary SPA, Ramsar and SSSI	Overlaps for 0.34 km	The Humber Estuary is located on the east coast of England and comprises extensive wetland and coastal habitats. The inner estuary supports extensive areas of reedbed, with areas of mature and developing saltmarsh backed by grazing marsh in the middle and outer estuary. On the north Lincolnshire coast, the saltmarsh is backed by low sand dunes with marshy slacks and brackish pools. Parts of the estuary are owned and managed by conservation organisations. The estuary supports important numbers of waterbirds (especially geese, ducks and waders) during the migration periods and in winter. In summer, it supports important breeding populations of bittern *Botaurus stellaris*, marsh harrier (*Circus aeruginosus),* avocet (*Recurvirostra avosetta)* and little tern (*Sterna albifrons)* (Natural England, 2014). The SPA covers an area of 37,630.24 ha and qualifies under article 4.2 of the Directive (79/409/EEC) as it is used regularly by over 20,000 waterbirds (waterbirds as defined by the Ramsar Convention) in any season. The SPA is also designated as a Ramsar site and SSSI.	**Breeding** Avocet (*Recurvirostra avosetta*) Bittern (*Botaurus stellaris*) Little tern (*Sterna albifrons*) Marsh Harrier (*Circus aeruginosus*) **Non-breeding** Avocet (*Recurvirostra avosetta*) Bar-tailed godwit (*Limosa lapponica*) Bittern (*Botaurus stellaris*) Black-tailed godwit (*Limosa limosa islandica*) Dunlin, *(Calidris alpina*) Golden plover (*Pluvialis apricaria*) Hen harrier (*Circus cyaneus*) Knot, *(Calidris canutus*) Redshank (*Tringa tetanus*) Ruff (*Calidris pugnax*) Shelduck (*Tadorna tadorna*) Waterbird assemblage	**Wintering and Passage** Bar-tailed godwit (*Limosa lapponica*) Black-tailed godwit (*Limosa limosa*) Dunlin (*Calidris alpina*) Golden plover (*Pluvialis apricaria*) Knot (*Calidris canutus*) Redshank (*Tringa tetanus*) **Wintering** Shelduck (*Tadorna tadorna*) Waterbird assemblage	**Non-Breeding** Avocet (*Recurvirostra avosetta*) Bar-tailed godwit (*Limosa lapponica*) Bittern (*Botaurus stellaris*) Dark-bellied brent goose (*Branta bernicla bernicla*) Curlew (*Numenius arquata*) Dunlin (*Calidris alpina*) Golden plover (*Pluvialis apricaria*) Goldeneye (*Bucephala clangula*) Greenshank (*Tringa nebularia*) Grey plover (*Pluvialis squatarola*) Knot (*Calidris canutus*) Lapwing *(Vanellus vanellus)* Oystercatcher *(Haematopus ostralegus*) Pochard (*Aythya farina*) Redshank (*Tringa tetanus*) Ringed plover (*Charadrius hiaticula*) Ruff (*Philomachus pugnax*) Sanderling (*Calidris alba*) Shelduck (*Tadorna tadorna*) Wigeon (*Anas Penelope*) Teal (*Anas crecca*) Scaup (*Aythya marila*) Turnstone (*Arenaria interpres*) Whimbrel (*Numenius phaeopus*) Breeding bird assemblages	-
Greater Wash SPA	Overlaps for 35.7 km	The Greater Wash SPA lies along the east coast of England, predominantly in the	**Breeding** Little tern (*Sterna albifrons*)	-	-	-

Designated site	Distance from Scoping Boundary (km)	Site description	Protected feature SPA	Ramsar	SSSI	NNR
		coastal waters of the mid–southern North Sea between the counties of Yorkshire to the north and Suffolk to the south. It covers an area of c. 3,536 km² and supports the largest breeding populations of little terns within the UK SPA network by protecting important foraging areas. It also supports the second largest aggregation of non-breeding red-throated diver and little gull (JNCC, 2018). The area of the SPA includes a range of marine habitats, including intertidal mudflats and sandflats, subtidal sandbanks and biogenic reef, including *Sabellaria* reefs and mussel beds. Much of the area is less than 30m water depth, with a deep channel of 90 m depth at the Wash approaches.	Sandwich tern (*Thalasseus sandvicensis*) **Non-breeding** Common scoter (*Melanitta nigra*) Common tern (*Sterna hirundo*) Little gull (*Hydrocoloeus (Larus) minutus*) Red-throated diver (*Gavia stellata*)			
Saltfleetby – Theddlethorpe Dunes SSSI	Overlaps for 0.34 km	The Saltfleetby to Theddlethorpe Dunes SSSI is a nationally important site which compromises of salt and freshwater marshes, flats and dunes. These habitats support a variety of rich flora and fauna. There are outstanding assemblages of invertebrates, vascular plants and breeding birds, and it is the most north-easterly breeding site in the UK for the Natterjack Toad. The extensive intertidal sands and mudflats provide perfect grounds for feeding and roosting waterfowl and waders including shelduck, dunlin and brent geese. Saltmarsh communities in succession dominate the area and attract yellow wagtails which breed on the marsh and a small colony of little tern on the shingle bank (Natural England, 1981). The SSSI site is also designated as a NNR.	**Breeding** Little Tern (*Sterna albifrons*) **Non-Breeding** Dark-bellied Brent Goose (*Branta bernicla bernicla*) Dunlin (*Calidris alpina alpina*) Knot (*Calidris canutus*) Redshank (*Tringa tetanus*) Sanderling (*Calidris alba*) Wigeon (*Anas Penelope*) Non-breeding waterbirds	-	-	**Breeding** Little Tern (*Sterna albifrons*) **Non-Breeding** Dark-bellied Brent Goose (*Branta bernicla bernicla*) Dunlin (*Calidris alpina alpina*) Knot (*Calidris canutus*) Redshank (*Tringa tetanus*) Sanderling (*Calidris alba*) Wigeon (*Anas Penelope*) Non-breeding waterbirds

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6000000
5900000

Humber Estuary RAMSAR
Saltfleetby - Theddlethorpe Dunes SSSI
Saltfleetby - Theddlethorpe Dunes NNR
Greater Wash SPA
0 2.5 5 km

Greater Wash SPA
Humber Estuary RAMSAR
Saltfleetby - Theddlethorpe Dunes SSSI
Saltfleetby - Theddlethorpe Dunes NNR

collaborative environmental advisers

nationalgrid SP Energy Networks

Intertidal and Offshore Ornithology Including Designated Sites in England

C01494b-EGL4-BIRD-001-B

- Exclusive Economic Zone Limit (EEZ)
- Scottish Adjacent Waters
- 12NM Limit
- 15 km Study Area
- EGL 4 Scoping Boundary

Designated Sites

- Special Protection Area (SPA)
- National Nature Reserve (NNR)
- Site of Special Scientific Interest (SSSI)
- RAMSAR Site

0 10 20 NM

0 25 50 KM

Date	05/01/2024
Coordinate System	ETRS89 / UTM Zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	Meters
Scale at A3	1:1,400,000
Created	EP
Reviewed	SP
Authorised	AF

Document Path: X:\GIS\GIS_PROJECTS\C01494_EGL3&4\Project\QGS\EGL4\09_BIRD\C01494b_BIRD_001.qgz

Export Date: 05/01/2024

9.4.2.3. Species Seasonality England

There are three regular patterns of species occurrence in the UK: resident, summer visitors (breeding) and winter visitors (non-breeding) (BEIS, 2022). Table 9-6 provides information on the seasonality of each species listed as a qualifying feature of the designated sites in England identified above. Information on seasonality has been recorded from Natural England's Designated Sites view Site Search (naturalengland.org.uk) and the Humber Estuary Low Tide Programme (2013). Where seasonality between sites differs all months where species presence is noted has been identified. Species seasonality has only been considered for marine birds. Species not considered to be marine birds including lapwing *(Vanellus vanellus*), hen harrier (*Circus cyaneus*), bittern (*Botaurus stellaris*) and marsh harrier (*Circus aeruginosus*) have not been included in the seasonality table.

Table 9-6: Species seasonality for designated sites

Key	Annex I Species			Non-Annex I Species	

Protected species	Site	Sensitivity	Seasonality											
			J	F	M	A	M	J	J	A	S	O	N	D
Avocet (*Recurvirostra avosetta*)	Humber Estuary SPA	Breeding												
Avocet (*Recurvirostra avosetta*)	Humber Estuary SPA	Non-breeding												
Bar-tailed godwit (*Limosa lapponica*)	Humber Estuary SPA, Ramsar and SSSI	Non-breeding												
Bittern (*Botaurus stellaris*)	Humber Estuary SPA and SSSI	Non-breeding												
Black-tailed godwit (*Limosa limosa islandica*)	Humber Estuary SPA and Ramsar	Non-breeding												
Common scoter (*Melanitta nigra*)	Greater Wash SPA	Non-breeding												
Common tern (*Sterna hirundo*)	Greater Wash SPA	Breeding												
Curlew (*Numenius arquata*)	Humber Estuary SSSI	Non-breeding												
Dark-bellied brent Goose (*Branta bernicla bernicla*)	Saltfleetby – Theddlethorpe Dunes SSSI and NNR, Humber Estuary SSSI	Non-breeding												
Dunlin (*Calidris alpina alpina*)	Humber Estuary SPA, Ramsar and SSSI, Saltfleetby – Theddlethorpe Dunes SSSI and NNR	Non-breeding												
Golden plover (*Pluvialis apricaria*)	Humber Estuary SPA, Ramsar and SSSI	Non-breeding												
Goldeneye (*Bucephala clangula*)	Humber Estuary SSSI	Non-breeding												
Greenshank (*Tringa nebularia*)	Humber Estuary SSSI	Non-breeding												
Grey plover (*Pluvialis squatarola*)	Humber Estuary SSSI	Non-breeding												
Knot (*Calidris canutus*)	Humber Estuary SPA, Ramsar and SSSI, Saltfleetby – Theddlethorpe Dunes NNR	Non-breeding												
Little gull, (*Hydrocoloeus (Larus) minutus*)	Greater Wash SPA	Non-breeding												
Little tern (*Sterna albifrons*)	Humber Estuary SPA, Greater Wash SPA, Humber Estuary SPA, Saltfleetby – Theddlethorpe Dunes SSSI and NNR	Breeding												
Oystercatcher (*Haematopus ostralegus*)	Humber Estuary SSSI	Non-breeding												
Pochard (*Aythya farina*)	Humber Estuary SSSI	Non-breeding												

Protected species	Site	Sensitivity	Seasonality											
			J	F	M	A	M	J	J	A	S	O	N	D
Redshank (*Tringa tetanus*)	Humber Estuary SPA, Ramsar and SSSI, Saltfleetby – Theddlethorpe Dunes SSSI and NNR	Non-breeding												
Ringed plover (*Charadrius hiaticula*)	Humber Estuary SSSI	Non-breeding												
Ruff (*Calidris pugnax*)	Humber Estuary SPA and SSSI	Non-breeding												
Red-throated diver (*Gavia stellata*)	Greater Wash SPA	Non-breeding												
Sanderling (*Calidris alba*)	Saltfleetby – Theddlethorpe Dunes SSSI and NNR, Humber Estuary SSSI	Non-breeding												
Sandwich tern (*Thalasseus sandvicensis*)	Greater Wash SPA	Breeding												
Shelduck (*Tadorna tadorna*)	Humber Estuary SPA, Ramsar and SSSI	Non-breeding												
Scaup (*Aythya marila*)	Humber Estuary SSSI	Non-breeding												
Turnstone (*Arenaria interpres*)	Humber Estuary SSSI	Non-breeding												
Teal (*Anas crecca*)	Humber Estuary SSSI	Non-breeding												
Wigeon (*Anas Penelope*)	Saltfleetby – Theddlethorpe Dunes SSSI and NNR, Humber Estuary SSSI	Non-breeding												
Whimbrel (*Numenius phaeopus*)	Humber Estuary SSSI	Non-breeding												

9.4.3. Scottish Baseline Characterisation KP 418.7 to KP 524.9

9.4.3.1. Overview

The proposed Scottish landfall is within the Firth of Forth SPA, Ramsar and SSSI and the Outer Firth of Forth and St Andrews Complex SPA sites. There are a number of other neighbouring designated sites in close proximity to the Scottish Study Area. The Firth of Forth SPA, SSSI and Ramsar includes a complex variety of estuarine and coastal habitats that supports populations of European importance of Annex 1 species. The area is characterised by extensive invertebrate-rich intertidal flats and rocky shores, areas of saltmarsh, lagoons and sand dunes which provides feeding and roosting grounds for birds (NatureScot, 2018). The site attracts nationally and internationally important numbers of wintering waders and wildfowl. The Project also crosses the Outer Firth of Forth and St Andrews Bay Complex SPA which serves as an important breeding ground for a number of species during the summer season and provides shelter for seabirds and waterbirds to feed, moult, rest and roost.

During the breeding season, the sea in the southeast of Scotland is internationally important for at least thirteen breeding bird species including northern gannet (*Morus bassanus*), Manx shearwater (*Puffinus puffinus*), cormorant (*Phalacrocorax carbo*), shag (*Phalacrocorax aristotelis*), herring gull (*Larus argentatus*), lesser black-backed gull (*Larus fuscus*), black-legged kittiwake (*Rissa tridactyla*), common tern (*Sterna hirundo*), Arctic tern (*Sterna paradisaea*), Sandwich tern (*Sterna sandvicensis*), common guillemot (*Uria aalge*), razorbill (*Alca torda*) and Atlantic puffin (*Fratercula arctica*) (JNCC, 1997; NatureScot, 2020).

Digital aerial bird surveys from offshore wind farms in the Scottish Study Area (Berwick Bank and Neart na Gaoithe) consistently identified the marine birds listed in Table 9-7 as present in the Study Area. Survey data from offshore wind farms in close proximity to the study area demonstrated the intertidal areas support a diversity of species typical of coastal areas across the east coast of Scotland. This primarily included seaducks, wading birds, divers, grebes predominately in the non-breeding season (RPS, 2022).

Table 9-7: Marine birds present in the Scottish Study Area

Functional Group	Species
Divers, grebes and mergansers	Red-throated diver, Northern Gannet, Northern Fulmar, Manx Shearwater, Sooty Shearwater, Cormorant, Shag
Auks	Puffin, Guillemot, Razorbill, Little auk

Functional Group	Species
Terns, gulls, kittiwakes and gannets	Herring gull, Black-headed gull, Common gull, Great black-backed gull, Little gull, Kittiwake, Artic tern, Lesser black-backed gull, Artic skua, Great skua
Seaducks, geese and swans	Common Scoter, Pink-Footed goose, Eider
Waders and harriers	Oystercatcher, Curlew, Dunlin, Redshank

9.4.3.2. Designated Sites Scotland

The intertidal and offshore areas in Scotland along the proposed submarine cable corridor are extensively covered by designated sites for the protection of bird species and their habitats, including SPAs, Ramsar sites and SSSIs. These sites are illustrated in Figure 9-2 (Drawing: C01494-EGL4-BIRD-002). The following section identifies the designated features for these sites, as these are the species which are most likely to be seen within the Study Area and are considered the most relevant sensitive receptors for the purposes of characterising the receiving environment. However, it should be noted that other bird species may be encountered within the Study Area.

Table 9-8 presents the designated sites that are designated for ornithology identified using publicly available GIS data (JNCC, 2022). The Project crosses through the Firth of Forth SPA, Ramsar and SSSI for 0.09 km at the Kinghorn Landfall and 0.22 km at the Lower Largo/Lundin Links landfall. The proposed submarine cable corridor also crosses the Outer Firth of Forth and St Andrews Bay Complex SPA for approximately 82 km, which serves as an important breeding ground for a number of species during the summer season and provides shelter for seabirds and waterbirds to feed, moult, rest and roost.

Table 9-8: Designated sites within proximity of the Scottish Study Area

Note: non marine birds are in light grey

Designated Site	Distance from Scoping Boundary (km)	Site description	Protected feature SPA	Ramsar	SSSI
Outer Firth of Forth and St. Andrews Bay Complex SPA	Project overlaps for ~82.2 km.	The Outer Firth of Forth and St Andrews Bay Complex SPA contains many sheltered areas, such as firths, inlets and sandy bays, used by seabirds and waterbirds to feed, moult, rest and roost. The sheltered areas lie close to the nesting sites of a large number of birds breeding in the area during the summer season. During this time, the SPA provides feeding grounds for thousands of northern gannet (*Morus bassanus*), black-legged kittiwake (*Rissa tridactyla*), Atlantic puffin (*Fratercula arctica*) and the largest concentration of common tern (*Sterna hirundo*) in Scotland (JNCC, 2020). The SPA is also an important refuge for birds which have migrated thousands of miles from their breeding grounds in northern Europe and western Siberia to spend the winter in the area. During this time of the year, the site supports more than 35% of the common eider (*Somateria mollissima mollissima)* and over 23% of the velvet scoter (*Melanitta fusca*) British wintering populations, along with the largest Scottish concentrations of red-throated diver (*Gavia stellata*) and little gull (*Larus minutus*).	**Breeding** Arctic tern (*Sterna paradisaea*) Common scoter (*Melanitta nigra)* Common tern (*Sterna hirundo*) Gannet (*Morus bassanus*) Guillemot (*Uria aalge*) Herring gull (*Larus argentatus*) Kittiwake (*Rissa tridactyla*) Puffin (*Fratercula arctica*) Manx shearwater (*Puffinus puffinus*) Shag (*Phalacrocorax aristotelis*) **Non-breeding** Black-headed gull (*Chroicocephalus ridibundus*) Common gull (*Larus canus*) Eider (*Somateria mollissima*) Goldeneye (*Bucephala clangula*) Guillemot (*Uria aalge*) Herring gull (*Larus argentatus*) Kittiwake (*Rissa tridactyla*) Little gull (*Hydrocoloeus minutus*) Long-tailed duck (*Clangula hyemalis*) Razorbill (*Alca torda*) Red-breasted merganser (*Mergus serrator*) Red-throated diver (*Gavia stellata*) Shag (*Phalacrocorax aristotelis*) Slavonian grebe (*Podiceps auritus*) Velvet scoter *(Melanitta fusca*)	-	-

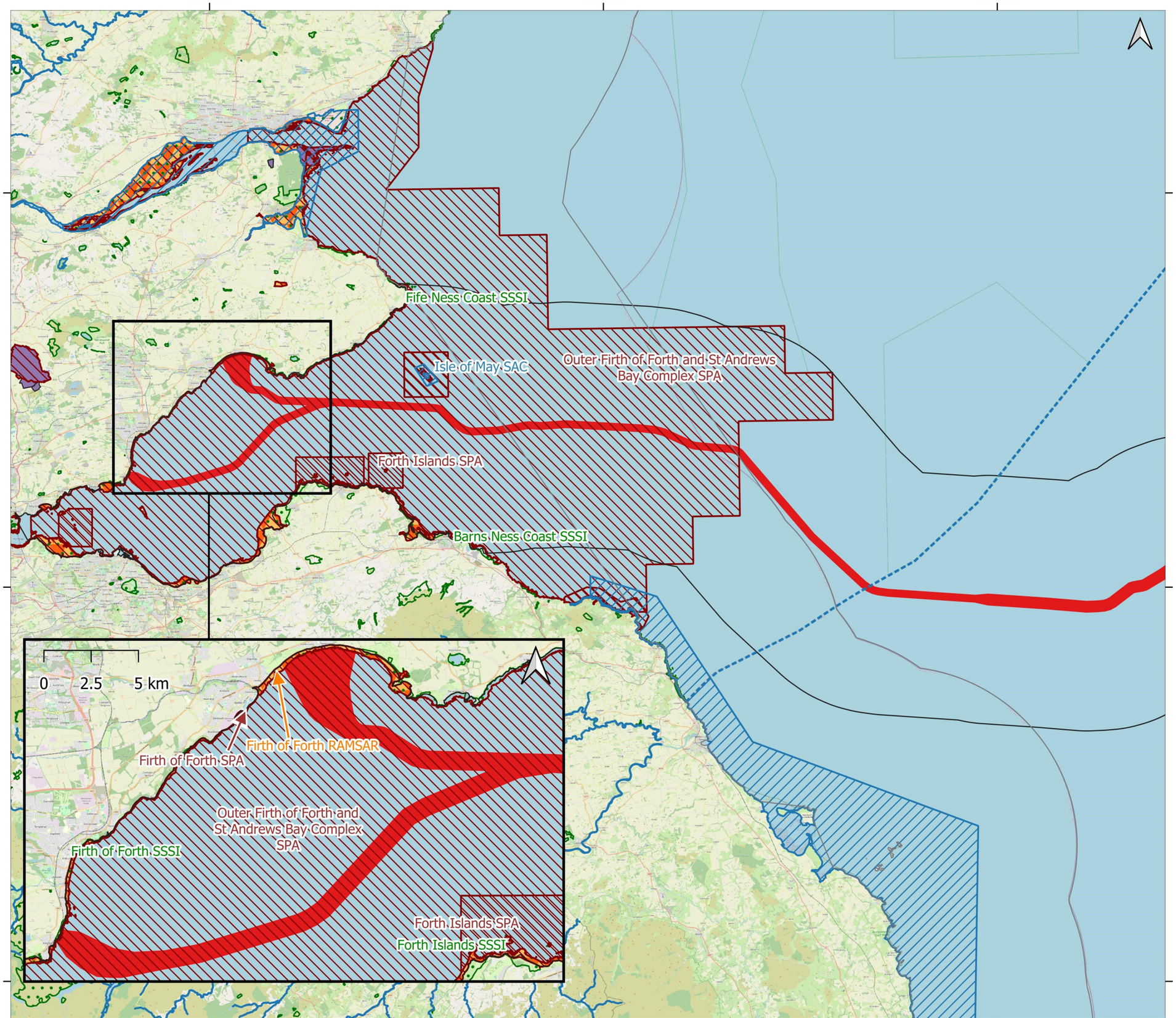
Designated Site	Distance from Scoping Boundary (km)	Site description	Protected feature SPA	Ramsar	SSSI
			Breeding and non-breeding seabird assemblage Non-breeding waterfowl assemblage		
Forth Islands SPA and SSSI	0.67 km	Forth Islands SPA consists of a series of islands supporting the main seabird colonies in the Firth of Forth including the islands of Ichmickery, Fidra, The Lamb, Isle of May, Craigleith, Bass Rock and Long Craig. Long Craig at the time of classification supported the largest colony of roseate tern in Scotland; i is the most northerly of only six regular colonies. Forth Islands SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: Arctic tern (*Sterna paradisaea)* (mean between 1992 and 1996 of 540 pairs, 1.2% of the GB population); roseate tern (*Sterna dougallii*) (mean between 1997 and 2001 of 8 pairs, 13% of the GB population); common tern (*Sterna hirundo*) (mean between 1997 and 2001 of 334 pairs, 3% of the GB population) and sandwich tern (*Sterna sandvicensis*) (an average of 440 pairs, 3% of the GB population) (Nature 2000, 2018). The boundary of the SPA overlaps with the Firth Islands SSSI. The SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: northern gannet, European shag, lesser black-backed gull and Atlantic puffin. Forth Islands SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds (NatureScot, 2018).	**Breeding** Arctic tern (*Sterna paradisaea*) Common tern (*Sterna hirundo*) Cormorant (*Phalacrocorax carbo*) Gannet (Morus bassanus) Guillemot (*Uria aalge*) Herring gull (*Larus argentatus*) Kittiwake (*Rissa tridactyla*) Lesser black-backed gull (*Larus fuscus*) Puffin (*Fratercula arctica*) Razorbill (*Alca torda*) Roseate tern (*Sterna dougallii*) Sandwich tern (*Sterna sandvicensis*) Shag (*Phalacrocorax aristotelis*) Seabird breeding assemblages		**Breeding** Cormorant (*Phalacrocorax carbo*) Puffin (*Fratercula arctica*) Breeding seabird colony
Firth of Forth SPA, Ramsar and SSSI	Overlaps Kinghorn landfall for 0.09 km. Overlaps Lower Largo/Lundin Links landfall for 0.22 km	The Firth of Forth SPA is a complex of estuarine and coastal habitats in southeast Scotland stretching from Alloa to the coasts of Fife and East Lothian. The site includes extensive invertebrate-rich intertidal flats and rocky shores, areas of saltmarsh, lagoons and sand dune. The boundary of the SPA mostly follows that of the Firth of Forth SSSI and slightly overlaps with Forth Islands SPA (Nature Scot, 2018a). The site area is 6317.93 ha. The SPA is also designated as a Ramsar site under two criterion (Ramsar, 2005) and a SSSI. The Firth of Forth SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species (1993/94 to 1997/98 winter peak means): red-throated diver (*Gavia stellata*) 90 individuals, 2% of the GB population), Slavonian grebe (*Podiceps auratus*) (84 individuals, 21% of the GB population),	**Non-breeding** Bar-tailed godwit (*Limosa lapponica*) Common scoter (*Melanitta nigra*) Cormorant (*Phalacrocorax carbo)* Curlew (*Numenius arquata*) Dunlin (*Calidris alpina alpina*) Eider (*Somateria mollissima*) Golden plover (*Pluvialis apricaria*) Goldeneye (*Bucephala clangula*) Great crested grebe (*Podiceps cristatus*) Grey plover (*Pluvialis squatarola*)	**Non-breeding** Bar-tailed godwit (*Limosa lapponica*) Common scoter *(Melanitta nigra*) Cormorant (*Phalacrocorax* carbo) Curlew (*Numenius arquata*) Dunlin (*Calidris alpina alpina*) Eider (*Somateria mollissima*) Golden plover (*Pluvialis apricaria*) Goldeneye (*Bucephala clangula*) Great crested grebe (*Podiceps cristatus*)	**Non-breeding** Bar-tailed godwit (*Limosa lapponica*) Common scoter (*Melanitta nigra*) Cormorant (*Phalacrocorax carbo*) Curlew (*Numenius arquata*) Dunlin (*Calidris alpina alpina*) Eider (*Somateria mollissima*) Golden plover (*Pluvialis apricaria*) Goldeneye (*Bucephala clangula*) Great crested grebe (*Podiceps cristatus*)

Designated Site	Distance from Scoping Boundary (km)	Site description	Protected feature SPA	Ramsar	SSSI
		golden plover (*Pluvialis apricaria)* (2,949 individuals, 1% of the GB population) and bar-tailed godwit (*Limosa lapponica)* (1,974 individuals, 4% of the GB population). The SPA also qualifies under Article 4.1 by regularly supporting a population of European importance of the Annex 1 species: sandwich tern (*Sterna sandvicensis)* during the passage period (a winter peak mean during the five-year period 1993/94 to 1997/98 of 1,617 individuals, 6% of the GB population). The Firth of Forth SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species (1993/94 to 1997/98 winter peak means): pink-footed goose (*Anser brachyrhynchus*) (10,852 individuals, 6% of the Eastern Greenland/Iceland/UK biogeographic population); shelduck (*Tadorna tadorna)* (4,509 individuals, 2% of the North-western Europe biogeographic population); knot (*Calidris canutus)* (9,258 individuals, 3% of the North-eastern Canada/ Greenland/Iceland/North-western Europe biogeographic population); redshank (Tringa *totanus)* (4,341 individuals, 3% of the Eastern Atlantic biogeographic population) and turnstone (*Arenaria interpres*) (860 individuals, 1% of the Western Palearctic biogeographic population) (Nature Scot, 2018a). The site regularly supports an excess of 20,000 individual waterfowl. In the five-year period 1992/93 to 1996/97 a winter peak mean of 95,000 individual waterfowl was recorded, comprising 45,000 wildfowl and 50,000 waders.	Knot (*Calidris canutus*) Lapwing *(Vanellus vanellus*) Long-tailed duck (*Clangula hyemalis*) Mallard (*Anas platyrhynchos*) Oystercatcher (*Haematopus ostralegus*) Pink-footed goose (*Anser brachyrhynchus*) Red-breasted merganser (*Mergus serrator*) Red-throated diver (*Gavia stellata*) Redshank (*Tringa totanus*) Ringed plover (*Charadrius hiaticula*) Scaup (*Aythya marila*) Shelduck (*Tadorna tadorna*) Slavonian grebe (*Podiceps auritus*) Turnstone (*Arenaria interpres*) Velvet scoter (*Melanitta fusca*) Wigeon (*Anas penelope*) Non-breeding waterfowl assemblage **Passage** Sandwich tern (*Sterna sandvicensis*)	Grey plover (*Pluvialis squatarola*) Knot (*Calidris canutus*) Lapwing (*Vanellus vanellus)* Long-tailed duck (*Clangula hyemalis*) Mallard (*Anas platyrhynchos*) Oystercatcher (*Haematopus ostralegus*) Pink-footed goose (*Anser brachyrhynchus*) Red-breasted merganser (*Mergus serrator*) Red-throated diver (*Gavia stellata*) Redshank (*Tringa totanus*) Ringed plover (*Charadrius hiaticula*) Scaup (*Aythya marila*) Shelduck (*Tadorna tadorna*) Slavonian grebe (*Podiceps auritus*) Turnstone (*Arenaria interpres*) Velvet scoter (*Melanitta fusca*) Wigeon (*Anas penelope*) Non-breeding waterfowl assemblage **Passage** Sandwich tern (*Sterna sandvicensis*)	Grey plover (*Pluvialis squatarola*) Knot (*Calidris canutus*) Lapwing (*Vanellus vanellus*) Long-tailed duck (*Clangula hyemalis*) Mallard (*Anas platyrhynchos*) Oystercatcher (*Haematopus ostralegus*) Pink-footed goose (*Anser brachyrhynchus*) Red-breasted merganser (*Mergus serrator*) Red-throated diver (*Gavia stellata*) Redshank (*Tringa totanus*) Ringed plover (*Charadrius hiaticula*) Scaup (*Aythya marila*) Shelduck (*Tadorna tadorna*) Slavonian grebe (*Podiceps auritus*) Turnstone (*Arenaria interpres*) Velvet scoter (*Melanitta fusca*) Wigeon (*Anas penelope*) **Breeding** Eider (*Somateria mollissima*) Ringed plover (*Charadrius hiaticula*) Shelduck (*Tadorna tadorna*) **Passage** Sandwich tern (*Sterna sandvicensis*)
Cameron Reservoir SPA, Ramsar and SSSI	9.08 km away from Lower Largo/Lundin Links landfall	Cameron Reservoir SPA is located in Fife and covers an area of 64.4 ha. The reservoir is mesotrophic with a grassland and willow fringe. The site is of international importance for its wintering pink-footed geese (*Anser brachyrhynchus).* The site qualifies as an SPA under Article 4.2 by regularly supporting internationally important wintering numbers of the	**Non-breeding** Pink-footed geese (*Anser brachyrhynchus*)	**Non-breeding** Pink-footed geese (*Anser brachyrhynchus*)	**Non-breeding** Pink-footed geese (*Anser brachyrhynchus*)

Designated Site	Distance from Scoping Boundary (km)	Site description	Protected feature SPA	Ramsar	SSSI
		Icelandic/Greenlandic population of pink-footed geese. During the five-winter period 1986/87 to 1990/91 an average peak of 6,760 pink-footed geese was recorded, representing over 6% of the Icelandic/Greenlandic population (Nature Scot, Nd.). It qualifies as a Ramsar Site under Ramsar Criterion 6 for the same reason (Ramsar 2005a) and is also designated a SSSI.			
Firth of Tay and Eden Estuary SPA	14.3 km away from Lower Largo/Lundin Links landfall	The Firth of Tay and Eden Estuary SPA covers an area of 6947.62 and comprises a network of estuarine and coastal environment in eastern Scotland from the mouth of the River Earn in the inner Firth of Tay, east to Barry Sands on the Angus coast and St Andrews on the Fife coast. The Firth of Tay and Eden Estuary SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex I species. This includes marsh harrier (*Circus aeruginosus)* (1992 to 1996, an average of 4 females, 3% of the GB population) and little tern (*Sternula albifrons)* (1993 to1997, an average of 25 pairs, 1% of the GB population) in the breeding season. Over the winter the site regularly supports bar-tailed godwit (*Limosa lapponica)* (1990/91 to 1994/95, a winter peak mean of 2,400 individuals, 5% of the GB population) (Nature Scot, 2018b). The SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: redshank, greylag goose and pink-footed goose. The site also sustains an excess of 20,000 individual waterfowl (JNCC, 2018a). Firth of Tay and Eden Estuary Ramsar site qualifies under Ramsar Criterion 2 by supporting: Marsh harrier (*Circus aeruginosus)* (1992 to 1996, an average of 4 females, 3% of the GB population), and little tern (*Sternula albifrons)* (1993 to1997, an average of 25 pairs, 1% of the GB population) (Nature Scot, 2021). The Ramsar supports an internationally important assemblage of wintering waterfowl, and fourteen bird species breed in nationally significant numbers at the site. Abertay Sands are also important as a major haul-out site for both grey seals (*Halichoerus grypus)* and breeding common seals (*Phoca vitulina)*.	**Breeding** Little tern (*Sternula albifrons*) Marsh harrier (*Circus aeruginosus*) **Non-breeding** Bar-tailed godwit (*Limosa lapponica*) Common scoter (*Melanitta nigra*) Cormorant (*Phalacrocorax carbo*) Dunlin (*Calidris alpina alpina*) Eider (*Somateria mollissima*) Goldeneye (*Bucephala clangula*) Goosander (*Mergus merganser*) Grey plover (*Pluvialis squatarola*) Greylag goose (*Anser anser*) Icelandic Black-tailed godwit (*Limosa limosa islandica*) Long-tailed duck (*Clangula hyemalis*) Oystercatcher (*Haematopus ostralegus*) Pink-footed goose (*Anser brachyrhynchus*) Red-breasted merganser (*Mergus serrator*) Redshank (*Tringa totanus*) Sanderling (*Calidris alba*) Shelduck (*Tadorna tadorna*) Velvet scoter (*Melanitta fusca*) Non-breeding waterfowl assemblage	**Breeding** Little tern (*Sternula albifrons*) Marsh harrier (*Circus aeruginosus*) **Non-breeding** Bar-tailed godwit (*Limosa lapponica*) Common scoter (*Melanitta nigra*) Cormorant (*Phalacrocorax carbo)* Dunlin (*Calidris alpina alpina*) Eider (*Somateria mollissima*) Goldeneye (*Bucephala clangula*) Goosander (*Mergus merganser*) Grey plover (*Pluvialis squatarola*) Greylag goose (*Anser anser*) Icelandic Black-tailed godwit (*Limosa limosa islandica*) Long-tailed duck (*Clangula hyemalis*) Oystercatcher (*Haematopus ostralegus*) Pink-footed goose (*Anser brachyrhynchus*) Red-breasted merganser (*Mergus serrator*) Redshank (*Tringa totanus*) Sanderling (*Calidris alba*) Shelduck (*Tadorna tadorna*) Velvet scoter (*Melanitta fusca*) Non-breeding waterfowl assemblage	

Designated Site	Distance from Scoping Boundary (km)	Site description	Protected feature SPA	Ramsar	SSSI
Isle of May SSSI	2.91 km	The Isle of May SSSI is located at the entrance of the Firth of Forth on the east coast of Scotland. It is approximately 1.8 km long but less than 500 m wide. The island was formed from basalt volcanic rock. In the west coast there are vertical cliffs up to 60 m in height which gradually slope down towards sea level in the east. The island is divided into a number of islets separated by intertidal channels and are characteristic by a number of coastal landforms including arches, caves and stacks (SNH, 2011). The islands support internationally important number of breeding seabirds and grey seals. The seabird colony is one of the largest on the east coast of Scotland, with around 140,000 breeding birds from eleven species. This includes the internationality important colony of puffin (*Fratercula arctica)*, which now has over 40,000 pairs. The colony is the fifth largest in the UK (Nature Scot, Nda).	**Breeding** Eider (*Somateria mollissima*) Guillemot (*Uria aalge*) Kittiwake (*Rissa tridactyla*) Puffin (*Fratercula arctica*) Shag (*Phalacrocorax aristotelis*) Breeding seabird colony **Non-breeding** Purple sandpiper (*Calidris maritima*) Turnstone (*Arenaria interpres*)		
Bass Rock SSSI	7.61 km	Bass Rock SSSI is an island located in the Firth of Forth formed from the remains of a volcanic plug and is 107 m above sea level (Nature Scot, 2010). The SSSI supports the largest single-rock northern gannet colony in the world. Although the island supports a number of seabird species, the main interest of the site is the large gannet colony. There are approximately 48,000 breeding pairs, which supports 22% of the UK population of gannet. The numbers of gannets have been growing consistently throughout the 20th century. The species typically nests on the top of the island above the cliffs, with the availability of nesting sites being a determining factor in the size of the colony (SNH, 2010).			**Breeding** Gannet (*Morus bassanus*) Breeding seabird colony
Inchmickery SSSI	9. 35 km away from Kinghorn landfall.	Inchmickery SSSI is a small collection of islands located in of the Firth of Forth. Rising 14 m above sea level, the island was created by a volcanic intrusion. The site compromises of the small island of Inchmickery and the Cow and Calves, a small group of rocks 300 m to the north (SNH, 2011a). Originally the site was designated having the largest populations of nationally important breeding colonies of sandwich tern and roseate tern. However, none of these species now breed on the island and were last noted nesting at the site in 1998 (Nature Scot, 2023). The island now has large numbers of herring and lesser black backed gulls which are part of the internationally important populations spread throughout the various islands of the			**Breeding** Fulmar (*Fulmarus glacialis*) Herring gull (*Larus argentatus*) Lesser black-backed gull (*Larus fuscus*) Shag (*Phalacrocorax aristotelis*)

Designated Site	Distance from Scoping Boundary (km)	Site description	Protected feature SPA	Ramsar	SSSI
		Forth. Smaller numbers of shag and fulmar also nest on the island and are also part of internationally important populations.			
Kilconquhar Loch SSSI	4.91 km away from Lower Largo/Lundin Links landfall.	Kilconquhar Loch SSSI is located south of the village of Kilconquhar. The site consists of large eutrophic loch known as a 'kettle hole', bordered by an extensive transition mire and wet woodlands. A wide range of aquatic flora and a diverse breeding bird community is historically supported by the circular loch. This includes several uncommon waterfowl species and one national rarity, the black-necked grebe. Nationally important number of tufted duck and pochard winter on the loch (SNH, 2010a).			**Non-Breeding** Pochard (*Aythya ferina)* Tufted duck (*Aythya fuligula*) Breeding bird assemblage
Eden Estuary SSSI	14.3 km away from Lower Largo/Lundin Links landfall.	Eden Estuary SSSI is located between St Andrews and the Firth of Tay. The area contains extensive intertidal mudflats which is home to a rich invertebrate fauna and a wide diversity of coastal and estuarine vegetation types. The extensive mudflats are very varied, with beds of mussels, brown algae and eelgrass. Two nationally scarce species of eelgrass (*Zostera angustifolia*) and (*Z. noltei*) are present (Nature Scot, 2023a). The site supports nationally and internationally important populations of thirteen species of waterfowl and waders occurring in the winter or on passage including oystercatchers, bar-tailed and black-tailed godwits, grey plover and redshank. These species use the estuary for feeding and roosting. Internationally significant numbers of shelduck occur in winter. Nationally important numbers of wintering sea duck occur in St Andrews Bay and the Eden Mouth, including common and velvet scoter, scaup and eider. The site is also used by nationally important numbers of greylag geese as a nocturnal roost (SNH, 2011b). For a number of species, the site has been classified as being in an unfavourable condition due to the decrease in numbers being noted.			**Non-breeding** Bar-tailed godwit (*Limosa lapponica*) Common scoter (*Melanitta nigra*) Eider (*Somateria mollissima*) Grey plover (*Pluvialis squatarola*) Greylag goose (*Anser anser*) Icelandic Black-tailed godwit (*Limosa limosa islandica*) Oystercatcher (*Haematopus ostralegus*) Red-breasted merganser (*Mergus serrator*) Redshank (*Tringa totanus*) Ringed plover (*Charadrius hiaticula*) Scaup (*Aythya marila*) Shelduck (*Tadorna tadorna*) Velvet scoter (*Melanitta fusca*)



collaborative environmental advisers

nationalgrid

SP Energy Networks

Intertidal and Offshore Ornithology Including Designated Sites in Scotland

C01494b-EGL4-BIRD-002-D

- Exclusive Economic Zone Limit (EEZ)
- Scottish Adjacent Waters
- 12NM Limit
- EGL 4 Scoping Boundary
- 15 km Study Area

Designated Sites

- Special Protection Area (SPA)
- Special Area of Conservation (SAC)
- Site of Special Scientific Interest (SSSI)
- RAMSAR Site
- National Nature Reserve (NNR)

0 10 20 NM

0 10 20 KM

Date	05/12/2023
Coordinate System	ETRS89 / UTM Zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	Meters
Scale at A3	1:480,000
Created	EP
Reviewed	SP
Authorised	AF

Document Path: X:\GIS\GIS_PROJECTS\C01494_EGL3&4\Project\QGS\EGL4\09_BIRD\C01494b_BIRD_002.qgz

Export Date: 05/12/2023

9.4.3.3. Species Seasonality Scotland

There are three regular patterns of species occurrence in the UK: resident, summer visitors (breeding) and winter visitors (non-breeding) (BEIS, 2022). Table 9-9 provides information on the seasonality of each species listed as a qualifying feature of the designated sites in Scotland identified above. Information on seasonality has been recorded from Nature Scot's SiteLink Search (https://sitelink.nature.scot/home), NatureScot short guidance note (2020) and a literature review on the qualifying interest species of SPAs in the Firth of Forth (Woodward *et al*., 2015). Where seasonality between sites differs, all months where species presence is noted has been identified. Species seasonality has only been considered for marine birds. Species not considered to be marine birds including lapwing *(Vanellus vanellus*) and Marsh harrier (*Circus aeruginosus*), have not been included in the seasonality table.

Table 9-9: Species seasonality for designated sites

Key	Annex I Species		Other Species	

Protected species	Site	Sensitivity	Seasonality											
			J	F	M	A	M	J	J	A	S	O	N	D
Arctic tern (*Sterna paradisaea*)	Forth Islands SPA, Outer Firth of Forth and St. Andrews Bay Complex SPA	Breeding												
Bar-tailed godwit (*Limosa lapponica*)	Eden Estuary SSSI, Firth of Forth SPA, SSSI and Ramsar, Firth of Tay and Eden Estuary Ramsar and SPA	Non-breeding												
Black-headed gull (*Chroicocephalus ridibundus*)	Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Common gull (*Larus canus*)	Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Common scoter *(Melanitta nigra*)	Eden Estuary SSSI, Firth of Forth SPA, SSSI and Ramsar, Firth of Tay and Eden Estuary Ramsar and SPA	Non-breeding												
Common scoter (Melanitta nigra)	Outer Firth of Forth and St. Andrews Bay Complex SPA	Breeding												
Common tern (*Sterna hirundo*)	Forth Islands SPA, Outer Firth of Forth and St. Andrews Bay Complex SPA	Breeding												
Cormorant (*Phalacrocorax carbo*)	Firth of Forth SPA, SSSI and Ramsar, Firth of Tay and Eden Estuary Ramsar and SPA	Non-breeding												
Cormorant (Phalacrocorax carbo)	Forth Islands SSSI and SPA	Breeding												
Curlew (*Numenius arquata*)	Firth of Forth SPA, SSSI and Ramsar	Non-breeding												
Dunlin (*Calidris alpina alpina)*	Firth of Forth SPA, SSSI and Ramsar, Firth of Tay and Eden Estuary Ramsar and SPA	Non-breeding												
Eider (*Somateria mollissima*)	Eden Estuary SSSI, Firth of Forth SPA and Ramsar, Firth of Tay and Eden Estuary Ramsar and SPA, Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Eider (*Somateria mollissima*)	Isle of May SSSI, Firth of Forth SSSI	Breeding												
Fulmar (*Fulmarus glacialis*)	Inchmickery SSSI	Breeding												
Gannet (*Morus bassanus*)	Bass Rock SSSI, Forth Island SPA, Outer Firth of Forth and St. Andrews Bay Complex SPA	Breeding												

Protected species	Site	Sensitivity	Seasonality											
			J	F	M	A	M	J	J	A	S	O	N	D
Golden plover (*Pluvialis apricaria*)	Firth of Forth SPA, SSSI and Ramsar	Non-breeding												
Goldeneye (*Bucephala clangula*)	Firth of Forth SPA, SSSI and Ramsar, Firth of Tay and Eden Estuary Ramsar and SPA, Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Goosander (*Mergus merganser*)	Firth of Tay and Eden Estuary Ramsar and SPA	Non-breeding												
Great crested grebe (*Podiceps cristatus*)	Firth of Forth SPA, SSSI and Ramsar	Non-breeding												
Grey plover (*Pluvialis squatarola*)	Eden Estuary SSSI, Firth of Forth SPA, SSSI and Ramsar, Firth of Tay and Eden Estuary Ramsar and SPA	Non-breeding												
Greylag goose (*Anser anser*)	Eden Estuary SSSI, Firth of Tay and Eden Estuary Ramsar and SPA	Non-breeding												
Guillemot (*Uria aalge*)	Isle of May SSSI, Forth Islands SPA, Outer Firth of Forth and St. Andrews Bay Complex SPA	Breeding												
Guillemot (*Uria aalge*)	Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Herring gull (*Larus argentatus*)	Inchmickery SSSI, Forth Islands SPA, Outer Firth of Forth and St. Andrews Bay Complex SPA	Breeding												
Herring gull (*Larus argentatus*)	Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Icelandic Black-tailed godwit (*Limosa limosa islandica*)	Eden Estuary SSSI, Firth of Tay and Eden Estuary Ramsar and SPA	Non-breeding												
Kittiwake (*Rissa tridactyla*)	Isle of May SSSI, Forth Islands SPA, Outer Firth of Forth and St. Andrews Bay Complex SPA	Breeding												
Knot (*Calidris canutus*)	Firth of Forth SPA, SSSI and Ramsar	Non-breeding												
Lesser black-backed gull (*Larus fuscus*)	Inchmickery SSSI, Forth Islands SPA	Breeding												
Little gull (*Hydrocoloeus minutus*)	Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Little tern (*Sternula albifrons*)	Firth of Tay and Eden Estuary Ramsar and SPA	Breeding												
Long-tailed duck (*Clangula hyemalis*)	Firth of Forth SPA, SSSI and Ramsar, Firth of Tay and Eden Estuary Ramsar and SPA, Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Mallard (*Anas platyrhynchos*)	Firth of Forth SPA, SSSI and Ramsar	Non-breeding												
Manx shearwater (*Puffinus puffinus*)	Outer Firth of Forth and St. Andrews Bay Complex SPA	Breeding												
Oystercatcher (*Haematopus ostralegus*)	Eden Estuary SSSI, Firth of Forth SPA, SSSI and Ramsar, Firth of Tay and Eden Estuary Ramsar and SPA	Non-breeding												

Protected species	Site	Sensitivity	Seasonality											
			J	F	M	A	M	J	J	A	S	O	N	D
Pink-footed geese (*Anser brachyrhynchus*)	Cameron Reservoir SPA, SSSI and Ramsar, Firth of Forth SPA, SSSI and Ramsar, Firth of Tay and Eden Estuary Ramsar and SPA	Non-breeding												
Pochard (*Aythya ferina*)	Kilconquhar Loch SSSI	Non-breeding												
Puffin (*Fratercula arctica*)	Forth Islands SSSI and SPA, Isle of May SSSI, Outer Firth of Forth and St. Andrews Bay Complex SPA	Breeding												
Purple sandpiper (*Calidris maritima*)	Isle of May SSSI	Non-breeding												
Razorbill (*Alca torda*)	Forth Islands SPA	Breeding												
Razorbill (*Alca torda*)	Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Red-breasted merganser (*Mergus serrator*)	Eden Estuary SSSI, Firth of Forth SPA, SSSI and Ramsar, Firth of Tay and Eden Estuary Ramsar and SPA, Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Red-throated diver (*Gavia stellata*)	Firth of Forth SPA, SSSI and Ramsar, Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Redshank (*Tringa totanus*)	Eden Estuary SSSI, Firth of Forth SPA, SSSI and Ramsar, Firth of Tay and Eden Estuary Ramsar and SPA	Non-breeding												
Ringed plover (*Charadrius hiaticula*)	Eden Estuary SSSI	Non-breeding												
Ringed plover (*Charadrius hiaticula*)	Firth of Forth SPA, SSSI and Ramsar	Breeding												
Roseate tern (*Sterna dougallii*)	Forth Islands SPA	Breeding												
Sanderling (*Calidris alba*)	Firth of Tay and Eden Estuary Ramsar and SPA	Non-breeding												
Sandwich tern (*Sterna sandvicensis*)	Firth of Forth SPA, SSSI and Ramsar, Forth Islands SPA	Passage												
Scaup (*Aythya marila*)	Eden Estuary SSSI, Firth of Forth SPA, SSSI and Ramsar	Non-breeding												
Shag (*Phalacrocorax aristotelis*)	Inchmickery SSSI, Isle of May SSSI, Forth Islands SPA, Outer Firth of Forth and St. Andrews Bay Complex SPA	Breeding												
Shag (*Phalacrocorax aristotelis*)	Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Shelduck (*Tadorna tadorna*)	Eden Estuary SSSI, Firth of Tay and Eden Estuary Ramsar and SPA	Non-breeding												
Shelduck (*Tadorna tadorna*)	Firth of Forth SPA, SSSI and Ramsar	Breeding												
Slavonian grebe (*Podiceps auritus*)	Firth of Forth SPA, SSSI and Ramsar, Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Tufted duck (*Aythya fuligula*)	Kilconquhar Loch SSSI	Non-breeding												

Protected species	Site	Sensitivity	Seasonality											
			J	F	M	A	M	J	J	A	S	O	N	D
Turnstone (*Arenaria interpres*)	Firth of Forth SPA, SSSI and Ramsar, Isle of May SSSI	Non-breeding												
Velvet scoter (*Melanitta fusca*)	Eden Estuary SSSI, Firth of Forth SPA, SSSI and Ramsar, Firth of Tay and Eden Estuary Ramsar and SPA, Outer Firth of Forth and St. Andrews Bay Complex SPA	Non-breeding												
Wigeon (*Anas penelope*)	Firth of Forth SPA, SSSI and Ramsar	Non-breeding												

9.4.4. Sensitive Receptors

Species identified as sensitive receptors are likely to form the main focus of the MEA. These include Annex I species for which sites are designated, as well as those which are considered to be particularly sensitive to disturbance due to factors such as their abundance, particular biological characteristics, and susceptibility to disturbance. A number of marine birds may be impacted by underwater noise pressures that result from visual disturbances caused by vessel traffic or changes in water clarity affecting the ability of the birds to forage successfully.

Whilst seaducks (such as shelduck) and waders are considered to be sensitive to noise and visual disturbance, divers, grebes and mergansers are considered highly sensitive to noise and visual disturbance, such as that caused by vessel traffic (Atterbury *et al*., 2021). Inshore activities at the intertidal zone and those at the location of the cable landfall, will disturb waders who spend large portions of time in those areas (Fliessbach *et al*., 2019). Terns, gulls, kittiwakes and gannets are considered to have low to moderate sensitivity to noise and visual disturbance. Species which plunge dive for prey e.g., divers and terns are sensitive to changes in water clarity which impedes the ability to locate prey species. Auks such as guillemot and razorbill have been identified as protected features of the designated sites within the Study Area. Adult and chick auks have a flightless moult period immediately after chicks fledge from the nest, which can last for several months. During this period adults and chicks are particularly sensitive to pressures including visual disturbance and noise (JNCC and Natural England, 2022).

9.5. Proposed Assessment Methodology

The intertidal and offshore ornithology MEA will follow the assessment approach set out in Chapter 4 of this Scoping Report, using the project-wide assessment matrix. The assessment of potential effects will be established using the standard Source-Pathway-Receptor approach.

The results from studies completed to inform other topics e.g., sediment dispersion modelling, sandeel and Atlantic herring habitat assessment will be used to establish the potential significance of impacts on ornithology receptors.

Where impacts are not predicted to be significant, simple assessments, using an evidence-based approach that is proportionate to the anticipated level of significance will be undertaken. Where potentially significant impacts are identified, consultation will be undertaken with statutory nature conservation bodies to agree proportionate and effective mitigation, and residual effects will be presented.

The Intertidal and Offshore Ornithology MEA will be prepared in accordance with relevant MEA guidance and industry best practice documents including National Infrastructure Planning advice notes; professional MEA guidance documents and Natural England Offshore wind cabling: ten years' experience and recommendations (Natural England, 2018). Most of the guidance on the potential impacts of offshore development on birds focuses on renewable energy generation. This guidance will be referred to where relevant and proportionate to the level of construction activity required for the installation of submarine cables.

9.6. Scope of Assessment

A range of potential impacts on intertidal and offshore ornithology have been identified which may occur during the installation, O&M, and decommissioning phases of the Project. Table 9-10 describes the potential impacts identified and justification as to whether they will be scoped in or out of the MEA. A precautionary approach has been taken and where there is no strong evidence base, or the significance is uncertain at this stage the impact has been scoped into the MEA. Where there is a clear evidence base that the effect from the impact will not be significant, either alone or in combination with other plans and projects, the impact has been scoped out of the MEA.

Where relevant, bird species have been grouped according to their sensitivity to disturbance or their method of feeding after Atterbury et al. (2021).

Whilst it is acknowledged that some purely onshore species may use the intertidal area for foraging, passage or loafing, the proposed Project will have very limited interaction with the intertidal area should the preferred method of using a trenchless technology (HDD) to install the cables within the intertidal area be used, however some disturbance to species using the intertidal area may occur should open cut trenching being used. Works associated with the transition from offshore to onshore such as the trenching or HDD punch out and cable pull-in may require personnel and equipment on the intertidal area, but this will be limited in duration. Components such as HDD compound are part of the scope of the Onshore Scheme; the potential impacts of which are assessed in the terrestrial environmental assessment.

Table 9-10: Scoping assessment of impacts on intertidal and offshore ornithology

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
Temporary increase and deposition of suspended sediments *(Changes in suspended solids (water clarity)*	Boulder clearance, PLGR, pre-sweeping of sand waves. HDD duct excavation. Cable burial and trenching. Deposit of external cable protection.	Divers, grebes and mergansers	**OUT –** Diving species such as red-throated divers dive for prey and rely on clear vision for success. A reduction in water clarity as a result of increased suspended solids in the water column following disturbance of seabed sediments (i.e., because of route clearance, seabed preparation, cable burial, deposition of external cable protection and repair/remediation works), could negatively impact foraging success. In addition, the deposition of suspended sediments from the water column has the potential to smother potential prey species which live on the sea floor, thus reducing prey abundance. However, as described in Chapter 6 Marine Physical Environment, there is evidence that any sediment plumes will be rapidly dissipated as result of natural current flow. In addition, the footprint of the Project is sufficiently narrow such that a relatively small area of the seabed will be affected at any one time. Diving birds will therefore have sufficient alternative feeding grounds and prey species available and as a result are unlikely to be significantly adversely affected by a temporary reduction in water clarity or deposition of suspended sediments.		
		Seaducks, geese and swans	**OUT –** Some species of sea ducks, geese and swans present in the designated sites as protected species are classified as 'diving ducks' according to the RSPB (2022), including eider, goldeneye and pochard. There are also species of surface feeders including shelduck, teal and wigeon that may on occasion 'shallow dive' in search of invertebrates, shellfish and aquatic snails. Therefore, there is potential for an adverse impact on their foraging abilities as a result of decreased water clarity. However, as described in Chapter 6 Marine Physical Environment, there is evidence that any sediment plumes are likely to be rapidly dissipated as result of natural current flow. In addition, the footprint of the Project is sufficiently narrow such that a relatively small area of the seabed will be affected at any one time. Diving birds will therefore have sufficient alternative feeding grounds available and as a result are unlikely to be significantly adversely affected by a temporary reduction in water clarity.		
		Terns, gulls, kittiwakes and gannets	**OUT –** Diving birds such as kittiwake, common tern and little tern, which are protected features across a number of designated sites in the Study Area, plunge dive for food and therefore there is potential for an adverse impact on their foraging abilities as a result of decreased water clarity. Kittiwake are particularly vulnerable to food shortages as a result of increased suspended sediments, as they can only take prey when it occurs near to the surface of the sea, unlike auks which have the ability to dive to greater depths for a variety of prey in the water column (Wanless et al., 2018). However, as described in Chapter 6 of this Scoping Report, there is evidence that any sediment plumes are likely to be rapidly dissipated as result of natural current flow. In addition, the footprint of the Project is sufficiently narrow such that a relatively small area of the seabed will be affected at any one time. Diving birds will therefore have sufficient alternative feeding grounds available and as a result are unlikely to be significantly adversely affected by a temporary reduction in water clarity.		
		Harriers and Waders	**OUT –** Wading birds and harriers do not dive for food and are therefore very unlikely to be adversely affected by a decrease in water clarity as a result of increased suspended sediments during any stage of the Project.		
		Auks	**OUT** – Auks feed on pelagic and demersal fish in the water column (Atterbury et al., 2021). Therefore, there is potential for an adverse impact on their foraging abilities as a result of decreased water clarity due to increased suspended solids in the water column following disturbance of seabed sediments (i.e., because of route clearance, seabed preparation, cable burial, deposition of external cable protection and repair/remediation works). However, as described in Chapter 6 Marine Physical Environment, there is evidence that any sediment plumes will be rapidly dissipated as result of natural current flow. In addition, the footprint of the Project is sufficiently narrow such that a relatively small area of the seabed will be affected at any one time. Auks will therefore have sufficient alternative feeding grounds available and as a result are unlikely to be significantly adversely affected by a temporary reduction in water clarity.		
Changes in distribution of prey species	Pre-sweeping of sand waves. Cable burial and trenching.	All species	**OUT –** Pre-sweeping of the seabed and the installation of the cable will cause a localised, temporary loss of habitat leading to a potential reduction in prey availability. However, these activities will take place over a relatively small area of the seabed, and there will be sufficient alternative foraging areas available. In addition, these activities are transient in nature. The seabed	**OUT –** Any pre-sweeping or cable maintenance required during the lifetime of the cable will be temporary and localised in nature. Such activities will not constitute a significant impact on prey availability due to their transience and small footprint.	**OUT -** It is expected that decommissioning activities will result in a lower magnitude effect than that already considered during installation.

Potential Impacts	Project Activities	Sensitive Receptors	Scoping Justification		
			Construction	Operation (including repair and maintenance)	Decommissioning
			habitat will recover and will continue to support prey species within the short-term. These activities are therefore not considered to significantly adversely affect the prey availability for bird species within the Study Area.		
	Deposit of external cable protection.	All species	**IN –** The deposition of cable protection will result in permanent alteration of affected areas of the seabed. This has the potential to reduce areas of habitat for prey species such as sandeel and herring and consequently reduce prey availability for bird species in the Study Area. Further assessment will be undertaken within the MEA to evaluate the sensitivity of relevant prey species to habitat alteration.	**IN -** If the cable is installed correctly the likelihood of it requiring maintenance and repair is significantly reduced. However, there remains the potential that remedial external cable protection may be required in discrete locations which has the potential to reduce sandeel and herring habitat and therefore reduce prey availability.	**OUT –** No additional cable protection will be deposited for decommissioning therefore it can be scoped out.
Visual / physical disturbance or displacement	Presence of project vessels and equipment.	Divers, grebes and mergansers	**IN -** Diving species such as red-throated divers are recognised as being highly sensitive to noise and visual disturbance, such as that caused by vessel traffic (Atterbury *et al.,* 2021). Once flushed, they may not rapidly resettle. It is recommended that vessel transit through SPAs where these species are present should be avoided where possible. The extent of the potential impact of project vessels during all phases of the project life cycle on diving species will be considered further as part of the MEA.		
		Seaducks, geese and swans	**IN –** Species present within this group such as shelduck are considered to be sensitive to noise and visual disturbance (Atterbury et al., 2021), and it is not known how rapidly they resettle following disturbance. The extent of the potential impact of project vessels (especially at the landfall/intertidal area) during all phases of the project life on this group will be considered further as part of the MEA.		
		Terns, gulls, kittiwakes and gannets	**OUT –** These species are considered to be low to moderately sensitive to noise and visual disturbance (Atterbury et al., 2021). It is not considered that the presence of the project vessels is likely to have a significant impact on this group.		
		Harriers and Waders	**IN –** These species are considered to be sensitive to noise and visual disturbance (Atterbury et al., 2021). Although they are largely present within the intertidal areas rather than offshore, there is the potential for them to be disturbed due to vessel traffic and during works in close proximity to the landfall and intertidal area. The extent of any potential impact on these species will be considered further as part of the MEA.		
		Auks	**IN** - Species present within this group such as guillemot and razorbill are sensitive to noise (Atterbury et al., 2021). Post-breeding, they moult and become flightless, forming large aggregations on the water. Disturbance during this time could be significant and this group will be considered further as part of the MEA.		
Accidental spills (*Hydrocarbon & PAH contamination*)	Presence of project vessels and equipment.	All species	**OUT -** Project vessels and contractors will comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 which relate to pollution from oil from equipment, fuel tanks etc and release of sewage (black and grey water). It is a legal requirement that all vessels have a Shipboard Oil Pollution Emergency Plan (SOPEP). Compliance with Regulations will be sufficient to minimise the risk to the environment.		

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