Eastern Green Link 3

Marine Environmental Appraisal

Chapter 8 - Fish and Shellfish

Prepared for: Scottish Hydro Electric Transmission plc (SHE-T)

Scottish & Southern Electricity Networks
TRANSMISSION

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Point of Contact: Patricia Elder
Tel: [Redacted]
Email: [Redacted]

Collaborative Environmental Advisers
Registered in England at Mountbatten House, 1 Grosvenor Square, Southampton, SO15 2JU
Registered number: 11114584

Tel: + 44 (0) 7719 523106 or +44 (0) 7920 714 411
Email: info@ceaenvironmental.co.uk
www.ceaenvironmental.co.uk

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Approved	Technical Director	Julie Drew Murphy	29/08/2025	[Redacted]
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Abbreviations/Glossary

BAP	Biodiversity Action Plan
BGS	British Geological Society
CEMP	Construction Environmental Management Plan
CITES	Convention on International Trade in Endangered Species
CIEEM	Chartered Institute for Ecology and Environmental Management
DATRAS	Database of Trawl Surveys
DECC	Department of Energy & Climate Change
EGL	Eastern Green Link
EMF	Electromagnetic Field
FMMP	Fisheries Management and Mitigation Plan
FOCI	Feature of Conservation Interest
GIS	Geographical Information Systems
Habitat	A habitat is the natural environment in which a particular species or community of organisms lives, grows, and reproduces. It provides the physical and biological conditions necessary to sustain life, including food, shelter, water, and space.
HDD	Horizontal Directional Drilling
HRA	Habitats Regulations Appraisal
HVDC	High Voltage Direct Current
ICES	International Council for the Exploration of the Sea
Intertidal	Area of seabed between MHWS and MLWS which is periodically covered by the sea and exposed to the air.
IUCN	International Union for Conservation of Nature
IHLS	International Herring Larvae Survey
JNCC	Joint Nature Conservation Committee
km	Kilometre
KP	Kilometre Point
m	Metre
MarESA	Marine Evidence-based Sensitivity Assessment
MARPOL	Prevention of Pollution at Sea
MCZ	Marine Conservation Zone
MEA	Marine Environmental Assessment
MEAp	Marine Environmental Appraisal
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MMMP	Marine Mammal Mitigation Plan
MPCP	Marine Pollution Contingency Plan
NM	Nautical Mile
NMPi	National Marine Plan Interactive
OSPAR	Oslo and Paris Convention
PLGR	Pre-lay Grapnel Run
PLONOR	Pose Little or No Risk
PMF	Priority Marine Feature

PSA	Particle Size Analysis
RIFG	Regional Inshore Fisheries Group
RLB	Red Line Boundary
RSPB	Royal Society for the Protection of Birds
SAs	Sandeel Assessment and Management Areas
SFF	Scottish Fishermen's Federation
SOLAS	Safety of Life at Sea
SSC	Suspended Sediment Concentration
Subtidal	Area of seabed below MLWS which is permanently below water
t	Tonnes (volume)
TrAC	Transitional and Coastal Waters
UK	United Kingdom
UKOOA	UK Offshore Operators Association
ZoI	Zone of Influence

8. Fish and Shellfish

8.1. Introduction

This chapter of the Marine Environmental Appraisal (MEAp) describes the potential impacts arising from the construction, operation and maintenance and decommissioning of the Proposed Development on fish and shellfish. For the purposes of seeking the necessary consents, the Eastern Green Link (EGL) 3 Project has been split into different 'Schemes' i.e. English Onshore Scheme, English Offshore Scheme, Scottish Onshore Scheme and the Scottish Offshore Scheme (with the latter hereinafter referred to as 'the Proposed Development'). Collectively all components of EGL 3 are referred to as "the Project".

A description of the works expected to be undertaken during construction, operation and maintenance and decommissioning of the Proposed Development is provided in **Chapter 3: Project Description**. The Proposed Development, defined spatially by the Red Line Boundary (RLB), includes approximately 145 kilometres (km) of subsea High Voltage Direct Current (HVDC) cables. The RLB extends from mean high water springs (MHWS) at the landfall at Sandford Bay, Scotland, to the boundary with adjacent English waters and is nominally 700 metres (m) wide. This width is considered adequate to micro-site around sensitive seabed features or habitats, or to allow for the footprint of installation vessels and is the maximum extent of seabed in which construction and operation of the Proposed Development may take place. The RLB is shown in **Figure 8-1 (Drawing reference C01494-EGL3-MEA-FISH-010-C).**

As set out in **Chapter 1: Introduction**, cable installation and some associated activities beyond 12 nautical miles (NM) are exempt from the requirement to obtain a Marine Licence under the Marine and Coastal Access Act 2009 as well as repair of the installed cable in inshore and offshore waters. This chapter presents an assessment of the effects of the Proposed Development from MHWS at the Sandford Bay landfall to the border with English adjacent waters. This is to provide a holistic view of the Proposed Development and any associated impacts. However, consent is not being sought for the exempt cable (either installation or repair) and only cable protection would be included in the Marine Licence beyond 12 NM.

Kilometre Points (KPs) are used throughout this chapter to provide context as to where within the Study Area a feature lies (see **Section 8.1.1** for definition of Study Area). KP 436 is defined at the border with adjacent English waters, while KP 580 is defined at the proposed landfall in Sandford Bay, Peterhead.

Fish and shellfish receptors include purely marine species, diadromous species (species which migrate between freshwater and marine environments), elasmobranchs (sharks, rays and skates), and shellfish (crustaceans and molluscs). Where appropriate, the chapter identifies proportionate measures to avoid, reduce or offset any predicted adverse effects.

This chapter should be read in conjunction with:

- **Chapter 3: Project Description**;
- **Chapter 4: Marine Environmental Appraisal Scope and Methodology**;
- **Chapter 6: Marine Physical Processes** which identifies the spatial extent of potential impacts from temporary sediment suspension and subsequent redeposition;
- **Chapter 7: Intertidal and Subtidal Benthic Ecology** which identifies the extent of potential impacts on intertidal and subtidal benthic ecology receptors; and
- **Chapter 12: Commercial Fisheries** which identifies the spatiotemporal extent of potential impacts on commercial fishery activities, and details commercially important fish species landed in the Study Area.

This chapter is supported by the following appendices:

- **Appendix 3A: Electric and Magnetic Field Assessment**; and
- **Appendix 3C: Heat Calculations**.

8.1.1. Study Area

The Proposed Development would route from MHWS at Sandford Bay, Peterhead, to the border between Scottish and English adjacent waters. The Study Area for fish and shellfish relevant to this Marine Environmental Assessment (MEA) includes the RLB to MHWS, plus an additional 15 km buffer each side (hereafter in this chapter referred to as the 'Study Area'). **Chapter 6: Marine Physical Processes** establishes 15 km as a precautionary zone of influence (ZoI) within which the deposition of suspended sediments would occur. This therefore represents the maximum ZoI for direct and indirect impacts on fish and shellfish. The Study Area is shown in **Figure 8-1 (Drawing reference C01494-EGL3-MEA-FISH-010-C).**

8.2. Data Sources

The fish and shellfish baseline characterisation has been determined based on a review of publicly available information, project-specific survey data and consultation with relevant organisations. This provides a robust, up-to-date characterisation of fish and shellfish within the Study Area in accordance with relevant guidance for this topic.

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 were required for this topic, though data from the marine characterisation survey (benthic survey) has provided data for the assessment. For instance, between June and October 2024, seabed sampling was carried out, which included sediment sampling for Particle Size Analysis (PSA). This PSA data has been used to inform the herring and sandeel assessments. Further details of the scope of the geophysical, geotechnical and benthic surveys are provided in **Chapter 6: Marine Physical Processes** and **Chapter 7: Intertidal and Subtidal Benthic Ecology.**

8.2.2. Publicly Available Data

A desk-based review of publicly available data sources (literature and GIS mapping files) has been used to describe the baseline environment. **Table 8-1** lists the key data sources which have been used to characterise the fish and shellfish baseline.

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

Data Source	Description	Reference
Environment Agency	Transitional and Coastal Waters (TraC) Fish Monitoring Programme.	Environment Agency (2024)
Department of Energy & Climate Change (DECC, 2022)	Offshore Energy Strategic Environmental Assessment 4.	DECC (2022)
Coull et al (1998), Ellis et al (2012)	Fish Sensitivity Maps showing spawning and nursery grounds of selected fish species in UK waters.	Coull *et al* (1998), Ellis *et al* (2012)
International Council for the Exploration of the Sea (ICES)	International Herring Larvae Surveys and International research reports and publications ICES Scientific Reports.	ICES (2023a)
EMODnet	Interactive reference website which shows fish abundance and distribution. http://www.emodnet.eu/biology.	EMODnet (2023)
Marlin.ac.uk	A web site which provides comprehensive assessments of species' intolerance, recoverability, and sensitivity to a variety of pressures.	Marlin.ac.uk
Marine Management Organisation (MMO 2024)	UK Sea Fisheries annual statistics report 2023 and accompanying datasets which includes species catch list for the relevant ICES rectangles.	MMO (2024)
NatureScot	An executive non-departmental public body of the Scottish government responsible for the country's natural heritage. https://www.nature.scot/ Information has been used regarding the current state of Sandeel populations in the North Sea, and current policy on the banning of Sandeel fishing.	NatureScot (2023)
Marine Scotland National Marine Plan Interactive (NMPi)	Provides information on Scottish designated sites and Priority Marine Features.	Marine Scotland (2025)
International Convention for the Conservation of Nature (IUCN)	The IUCN Red List of Threatened Species (https://www.iucnredlist.org/).	IUCN (2025)
Joint Nature Conservation Committee (JNCC)	Species specific data, of native species of conservation interest UK BAP List of UK Priority Species | JNCC Resource Hub.	JNCC (2025)
British Geological Society (BGS)	Marine Sediment Particle Size dataset sourced from the BGS GeoIndex Offshore portal GeoIndex Offshore | BGS.	BGS (2025)
Priority Marine Features (PMF)	List of habitats and species considered as PMF in Scottish Waters.	NatureScot (2020)
UK Offshore Operators Association (UKOOA) sediment quality guidelines for the UK North Sea	Guidelines for assessing sediment quality in the UK North Sea. Primarily focused on the oil and gas industry but relevant to other industries.	UKOOA (2001)

Data Source	Description	Reference
Data from 'Clean Seas Environmental Monitoring Programme' (CSEMP)	A collection of data on contaminants, nutrients, and biological effects in UK waters. This data is used to assess the status and trends of contaminants and biological effects in biota and sediment at monitoring stations around the UK. Data relevant for this project includes stations at Tyne Tees and the Firth of Forth.	Marine Scotland, (2020)
The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR)2	OSPAR2 background concentrations and background assessment concentrations and effect range low and effect range median concentrations for contaminants.	OSPAR (2009)
FishBase	General fish ecology, distribution and biological information.	Fishbase (2025)
Marine Scotland	Marine Scotland Sensitivity Maps which displays sensitive areas relating to the life history of commercially important fish species in British waters.	Aires *et al*. (2014)
Peer-review publications	Cod and whiting spawning ground in the North Sea using modelled predictions.	González-Irusta & Wright (2016), and GonzálezIrusta & Wright (2017)

8.3. Consultation

8.3.1. Non-Statutory Scoping

In January 2024, a MEA Non-Statutory Scoping Report was submitted to the Scottish Government Marine Directorate - Licensing Operations Team (MD-LOT) as part of a pre-application consultation exercise for the Proposed Development. Responses from consultees were received on 15 July 2024. Responses which are relevant to this chapter were received from NatureScot.

The feedback received broadly confirmed that consultees were content with the proposed scope of the fish and shellfish MEAp chapter as set out in the MEA Non-Statutory Scoping Report. **Table 8-2** summarises the comments received relevant to the fish and shellfish assessment, and the regard given to these in preparing the chapter.

Table 8-2: Summary of Scoping Opinion responses for fish and shellfish

Consultee	Comments	Response
NatureScot	We advise the following additional publications (and relevant data layers) to characterise fish spawning grounds: ▪ Langton R., Boulcott P., Wright P.J. (2021). A verified distribution model for the lesser sandeel Ammodytes marinus. Mar. Ecol. Prog. Ser. 667: 145-159. ▪ González-Irusta J.M. and Wright P.J., (2016). Spawning grounds of Atlantic cod (Gadus morhua) in the North Sea. ICES Journal of Marine Science, 73(2), pp.304-3152. ▪ González-Irusta J.M. and Wright P.J., (2017). Spawning grounds of whiting (Merlangius merlangus). Fisheries Research, 195, pp.141-1513. ▪ González-Irusta J.M. and Wright P.J., (2016). Spawning grounds of haddock (Melanogrammus aeglefinus) in the North Sea and West of Scotland. Fisheries Research, 183, pp.180-1914 Table 8-2 list of consultees is missing the East Coast Regional Inshore Fisheries Group (RIFG) the chair [name hidden] can be contacted at [email address hidden]. Further consideration needs to be given to habitat that support fish spawning, (e.g. sandeel and herring), with potential mitigation measures to safeguard these important habitats as well as consideration of impacts to PMF fish and shellfish species.	Except for Langton *et al.,* these papers have been used and described within the MEAp. Unfortunately, the Applicant does not have access to Langton *et al.* Regarding consideration to fish spawning habitat, these have been assessed in Sections **8.8.1, 8.8.2, 8.8.3** and are supported by the literature recommended. Embedded mitigation is summarised in **Table 8-11**. Consultation with the East Coast Regional Inshore Fisheries Group has been undertaken and is reported within the Pre-Application Consultation Report.

Consultee	Comments	Response
Scottish Fishermen's Federation (SFF)	SFF notes from the Table 8-12: Scoping assessment of impacts on fish and shellfish, (p130), that the "temperature increase" would be scoped out assuming that the trenched and buried cables would cause minor increase in the water temperature above the cable route. However, as any temperature change in the fish and shellfish habitat may have adverse effects on their behaviour, and where there is no scientific proof to prove otherwise, SFF would like to see the impacts of temperature increase on fish and shellfish scoped in.	Temperature increase has been assessed from **Section 8.8.5**.
	SFF note from Chapter 8. Fish and Shellfish that the cable route/corridor sit on prime spawning and nursery grounds (e.g. Atlantic herring, sandeel, whiting… etc), SFF would recommend the seabed levelling activities to be undertaken outwith fish spawning and nursery period to prevent any loss of juvenile fish.	Please refer to **Section 8.8.1** for an assessment of temporary habitat loss during construction activities.

8.3.2. Other Consultations

In addition to the non-statutory scoping consultation process, the Applicant has undertaken supplementary consultations with individual fisheries stakeholders to keep them informed of ongoing updates. The Proposed Development have a Fisheries Liaison Officer in place that has been involved in engagement activities.

8.4. Baseline Characterisation

8.4.1. Overview

This section covers the fish and shellfish baseline for the Study Area, with regard to the diversity, abundance, and spatiotemporal distribution of fish and shellfish species. Physical factors such as sedimentation have some determination on the presence/absence of fish and shellfish species; characterisation of the physical baseline environment is reported in **Chapter 6: Marine Physical Processes** but has been considered in this chapter where relevant.

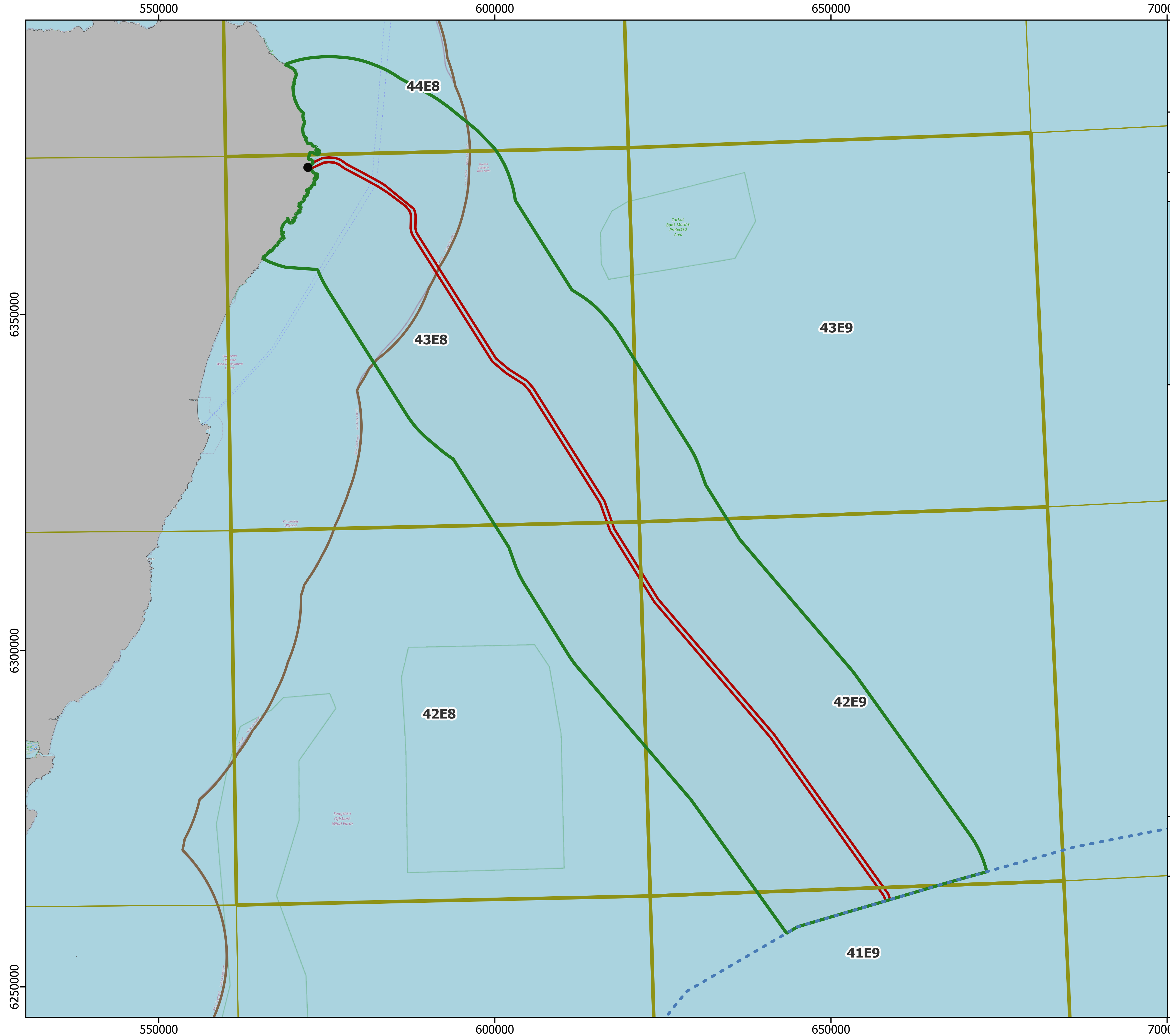
8.4.2. General Species Information

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, 2022). Fish are highly mobile; therefore, it is highly unlikely that cable installation activities and the presence of an operational cable would have any impact on most fish species. The species that may be significantly impacted by the Proposed Development are:

- those that either directly depend on the seabed environment for critical life stages (e.g. spawning and as nursery grounds);
- those that live in contact with the seabed e.g., by resting on the seabed (such as European plaice (*Pleuronectes platessa*), flounder (*Platichthys flesus*), common and lemon sole (*Solea solea; Microstomus kitt*) and shellfish), or those that float in the water just above the seafloor (such as cod (*Gadus morhua)* and whiting (*Merlangius merlangus*)); and/or
- those that are sensitive to electromagnetic fields (EMF) emitted from operational cables.

The baseline has therefore focused on these species, and it should be noted that this section does not provide a definite guide to the shellfish and fish in the area.

The North Sea is home to important fishing grounds used not only by the local 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 1° longitude in size (ICES, 2022). The Proposed Development lies within three ICES rectangles within Scottish waters (42E8, 42E9, 43E8) and one (41E9) is in both English and Scottish waters. As the Study Area (**Figure 8-1 (Drawing reference C01494-EGL3-MEA-FISH-010-C)**) also lies within rectangles 44E8 and 43E9, these rectangles have also been included for assessment.



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Fish and Shellfish Study Area

C01494-EGL3-MEA-FISH-010-C

Legend

- Red Line Boundary
- Study Area (15km Buffer)
- Sandford Bay Landfall
- ICES Rectangle within Study Area
- ICES Rectangle
- Scottish Adjacent Waters
- 12NM Limit

0 10 20 30 KM

0 5 10 15 NM

N

Date	26/06/2025
Coordinate System	WGS 84 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:550,000
Created	JC
Reviewed	AN/ CB
Authorised	JDM

Document Path: X:\GIS\GIS_PROJECTS\C01494_EGL3&4\Project\QGS\EGL3\MEA\07_FISH\C01494-EGL3-MEA-FISH-010.qgz

Analysis of the fishing data from ICES rectangles 42E8, 42E9, 43E8, 43E9, 44E8 has been used as an indication of the commercial fish species present in the Study Area but it is recognised that it does not provide a definitive list of species present. For example, these datasets contain only the retained portions of a catch, and do not contain information on discards (those specimens returned to the sea for reasons including lack of quota (where *de minimis* exemptions exist), low/no market value, poor condition, or being a protected species). For this reason, data were also examined from scientific surveys across the North Sea, which counts every species landed from trawl surveys, using a desk-based assessment of the Database of Trawl Surveys (DATRAS). DATRAS therefore reduces uncertainty in species presence/absence around the Proposed Development. According to commercial statistics the highest volume of catch in 2023 (**Table 8-3**) was haddock in rectangle 42E8, 42E9, 43E8, and 43E9, and herring in rectangle 44E8. Rectangle 44E8 accounted for the most valuable catch overall (11,122.1 t) and across all rectangles, herring was landed in the highest volume (10,502.2 t). For clarity, due to rounding of values, '0.0' figures represent species which were landed in very low volumes, whereas blank cells represent species which were not landed. Ecologically important fish/shellfish which may not be captured by commercial fishers are recorded as part of scientific surveys, as shown through count data in Error! Reference source not found.. For clarity, only species captured in numbers greater than 10 are presented, and species are presented in alphabetical order.

Table 8-3: 2023 landings weight (t) between ICES rectangles of the Study Area (MMO, 2024)

	ICES rectangle					
Species	**42E8**	**42E9**	**43E8**	**43E9**	**44E8**	**Total**
Bass	0.0	0.0	0.0	0.0		0.0
Blue Ling					0.0	0.0
Brill			0.0	0.0	0.1	0.1
Catfish		0.0	0.0	0.0	0.3	0.3
Cod	0.4	0.3	13.6	9.1	40.2	63.6
Conger eel					0.0	0.0
Crabs - Velvet	0.3		11.5	0.0	84.7	96.4
Crabs (edible/brown)	31.0		84.9	2.6	579.4	697.9
Cuckoo Ray		0.0			1.9	1.9
Cuttlefish		0.0		0.0	0.0	0.0
Dabs	0.0		0.0	0.1	0.8	0.9
Deep-Water Redfish			0.0			0.0
Dogfish					0.0	0.0
Green Crab			0.0		0.2	0.2
Gurnard and Latchet			1.2	0.3	0.0	1.5
Gurnards - Grey		0.2	0.6	0.2	6.8	7.9
Gurnards - Red	0.0	0.0	0.3	0.2	0.4	0.9
Haddock	139.3	59.9	2,675.0	2,047.2	1,240.0	6,161.3
Hake	0.0	0.1	0.3	9.2	5.2	14.7
Halibut	0.0	0.1	0.3	0.0	1.7	2.1
Herring			2,634.1	442.3	7,425.8	10,502.2
Horse Mackerel					2.9	2.9
John Dory			0.0	0.0	0.0	0.0
Lemon Sole		0.2	0.2	0.1	3.8	4.3
Lesser Spotted Dog		0.1	0.0	0.1	5.6	5.7
Ling		0.1	0.3	0.2	5.2	5.7
Lobsters	3.3		8.1	0.0	34.8	46.2
Mackerel	2.7		66.8	12.7	840.3	922.5
Megrim			0.1	0.0	0.8	0.9

	ICES rectangle					
Species	42E8	42E9	43E8	43E9	44E8	Total
Mixed Squid and Octopi	0.2	0.3	1.1	1.7	6.7	10.1
Monks or Anglers	1.1	1.9	2.7	3.6	86.8	96.2
Mullet - Other			0.0		0.0	0.0
Nephrops (Norway Lobster)	0.4	32.6	2.1	1.5	191.2	227.8
Octopus		0.0		0.0	0.8	0.8
Plaice	1.7	0.6	23.4	46.0	16.6	88.3
Pollack			0.0		0.1	0.1
Saithe		0.0	5.0	11.7	10.5	27.3
Scallops	102.5		203.6	28.0	319.2	653.3
Sea Catfishes					0.0	0.0
Skates and Rays					0.1	0.1
Sole			0.0			0.0
Spotted Ray				0.3	0.1	0.4
Spurdog	0.1			0.1	2.2	2.5
Squid		0.1	2.0	0.5	6.5	9.1
Surmullet		0.0		0.0	0.2	0.3
Thornback Ray		0.0	0.0	0.0	0.6	0.6
Torsk (Tusk)			0.0	0.0	0.0	0.1
Tub Gurnard					0.0	0.0
Turbot	0.0	0.1	0.1	0.0	0.7	1.0
Unid DS Squal Sharks & Dogfish					0.0	0.0
Unidentified Dogfish					0.1	0.1
Whelks					1.1	1.1
Whiting	2.5	1.2	125.1	120.6	187.2	436.7
Witch		0.4	0.0	0.1	10.4	10.9
Total	285.5	98.4	5,862.3	2,738.6	11,122.1	20,106.9

Table 8-4: Count data of fish/shellfish throughout the Study Area in 2024 (DATRAS, 2025)

Common name	Species	42E8	42E9	43E8	43E9	44E8	Total
Herring	*Clupea harengus*	57	152	30,174	2,614	453	33,450
Haddock	*Melanogrammus aeglefinus*	576	931	9,119	12,194	3,960	26,780
Whiting	*Merlangius merlangus*	202	1,012	3,340	9,537	4,243	18,334
Sprat	*Sprattus sprattus*	1	4,254	7,019	1,433	619	13,326
Grey gurnard	*Eutrigla gurnardus*	120	653	812	4,268	4,998	10,851
European common squid	*Alloteuthis subulata*	4	157	848	5,914	2,098	9,021
Dab	*Limanda limanda*	408	559	944	1,874	1,740	5,525
American plaice	*Hippoglossoides platessoides*	75	120	523	2,633	1,218	4,569
Norway pout	*Trisopterus esmarkii*	110	223	421	728	541	2,023

Common name	Species	42E8	42E9	43E8	43E9	44E8	Total
Plaice	*Pleuronectes platessa*	192	560	199	639	422	2,012
Dogfish	*Scyliorhinus canicula*	6	26	21	292	1,318	1,663
Mackerel	*Scomber scombrus*	375	235	47	156	419	1,232
Pout	*Trisopterus luscus*				143	988	1,131
Poor cod	*Trisopterus minutus*	1	9	67	256	763	1,096
Lemon sole	*Microstomus kitt*	42	156	112	405	149	864
Greater weever	*Trachinus draco*				829		829
Nephrops	*Nephrops norvegicus*	1		1	228	214	444
Atlantic horse mackerel	*Trachurus trachurus*	7	6	4	15	264	296
Cod	*Gadus morhua*	10	30	77	108	44	269
Common dragonet	*Callionymus lyra*	3	21	6	35	155	220
Red gurnard	*Chelidonichthys cuculus*	66	29	9	76	21	201
Lesser argentine	*Argentina sphyraena*		18		9	163	190
Pollock	*Pollachius virens*	1	101	2	32	6	142
Long finned squid	*Loligo forbesi*	25	8	32	35	18	118
European anchovy	*Engraulis encrasicolus*			100	11		111
Pilchard	*Sardina pilchardus*	2		4	70	1	77
European squid	*Loligo vulgaris*			16	51	6	73
Pogge	*Agonus cataphractus*	2	2	28	27	8	67
Queen scallop	*Aequipecten opercularis*	4		54		1	59
Spiny spidercrab	*Maja brachydactyla*		10		10	38	58
Cuckoo ray	*Leucoraja naevus*	9	17	5	15	9	55
Snakeblenny	*Lumpenus lampretaeformis*				48	4	52
Broadtail shortfin squid	*Illex coindetii*	4	7	21	8	11	51
Anglerfish	*Lophius piscatorius*	4	3	6	6	32	51
European hake	*Merluccius merluccius*	21	1	2	12	13	49
Thorny skate	*Amblyraja radiata*		9	5	19	14	47
Spotted dragonet	*Callionymus maculatus*	2	3	2	18	22	47
Edible/brown crab	*Cancer pagurus*	2	2	7	26	5	42
Mueller's pearlside	*Maurolicus muelleri*				38	2	40
Tub gurnard	*Chelidonichthys lucerna*					34	34
Striped red mullet	*Mullus surmuletus*		1	6	11	16	34
European flounder	*Platichthys flesus*		2	11	20		33
King scallop	*Pecten maximus*		2			28	30
Sole	*Solea solea*				10	14	24
Blackbelly rosefish	*Helicolenus dactylopterus*	2	2		5	12	21
Solenette	*Buglossidium luteum*				18		18
Fivebeard rockling	*Ciliata mustela*				2	14	16
Spurdog	*Squalus acanthias*		2	2	11	1	16
Seabass	*Dicentrarchus labrax*				12		12
Mediterranean scaldfish	*Arnoglossus laterna*		3		5	2	10

Common name	Species	42E8	42E9	43E8	43E9	44E8	Total
Bull rout	*Myoxocephalus scorpius*			2	8		10
Total		2,334	9,326	54,048	44,914	25,101	135,723

8.4.3. Species with Demersal Life-Stages

The fish communities most likely to be affected by the Proposed Development are those with demersal life stages e.g., species which either lay their eggs on the seabed (such as herring and sole), have larval or juvenile ages on the seabed, or species that live in contact with the seabed (such as sandeel). Most of the fish species that spawn across the Study Area are demersal and dwell in or within proximity to seabed habitats ranging from sands and muds to gravels and coarse substrates.

According to the UK Sea Fisheries annual statistics report 2024 (which contains data for year 2023), there are high abundances of haddock (*Melanogrammus aeglefinus*), whiting, European plaice, dab (*Limanda limanda*), cod and hake (*Merluccius merluccius*) observed within the ICES rectangles the RLB crosses (MMO, 2023). There are several pelagic species with demersal life stages that have been recorded within the Study Area including herring (*Clupea harengus*) and shad (*Alosa sapidissima*) (MMO, 2023). Of these species herring and sandeel are noted to be particularly sensitive to seabed disturbance due to spawning in very specific substrates. These species are an important component of commercial fisheries and are widely recognised as a critical food source for many seabirds, fish and marine mammals. Both species are listed as Priority Marine Features (PMFs), as summarised in **Table 8-8**.

8.4.3.1. Marine fish

According to the MMO (2024), there are high abundances of haddock, whiting, plaice, monkfish/anglerfish, and cod within the ICES rectangles the RLB crosses (**Table 8-3**; MMO, 2024).

<u>Sandeel (*Ammodytes spp*.)</u>

Sandeel are a shoaling fish species characterised by their slender, eel-like appearance. Of the five sandeel species inhabiting the North Sea (Raitt's sandeel (*Ammodytes marinus*); greater sandeel (*Hyperoplus lanceolatus*); smooth sandeel (*Gymnammodytes semisquamatus*); lesser sandeel (*Ammodytes tobianus*) and Corbin's sandeel (*Hyperoplus immaculatus*)), the lesser sandeel is the most abundant, comprising over 90% of sandeel fishery catches (Brown & May Marine Ltd., 2014; MacDonald *et al*., 2019). Lesser sandeel is largely found within coastal waters from the intertidal zone and Raitt's sandeel is typically found in waters deeper than 20m (Green, 2017; NatureScot, 2023). Sandeel account for around 25% of the entire North Sea fish biomass (MacDonald et al., 2019).

Sandeel are noted in the UK as a 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). Sandeel have historically been intensively fished for oils and animal feed, with stocks in the North Sea landed at levels of over 1 million tonnes in the late 1990s (Defra, 2023). Seven spatially distinct populations of sandeel have been identified within the North Sea divided into sandeel assessment and management areas (SAs) (ICES, 2023). The Proposed Development intersects SA1r and SA4, which show gradual declines in sandeel populations over time, with some recent increases in fishing effort (ICES, 2023; ICES, 2023a). The UK and Scottish Governments have banned fishing of sandeels in Scottish waters of the North Sea from March 2024 with the aim of improving the health of the population and of boosting seabird populations which are dependent on the fish for a significant part of their diet.

Sandeel hibernate during the autumn and winter in specific types of seabed, 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. The adhesive eggs they produce often attach in clumps onto sandy substrate and are partially buried. 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, and during spawning, where sandeel produce eggs which attach to the seabed. Studies have found that sandeel are largely resident and do not disperse over distances greater than 30 km (Royal Society for the Protection of Birds (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.

A sandeel and herring assessment has been undertaken using desk-based studies such as an Atlantic herring and sandeel spawning habitat study and particle size analysis (PSA) from the benthic characterisation survey to allow for the identification of preferred and marginal habitat sediments with the potential to support sandeel following the methodology derived from Greenstreet *et al*. (2010) and Reach et al. (2024) within the Study Area. The Proposed Development crosses potential sandeel spawning grounds (of which the spawning period is usually December and January) identified by Coull *et al*. (1998) off the Fife coast and the Aberdeenshire coast.

Out of the 55 vibrocore sampling stations acquired within the RLB only one station (EGL3_219_EBS) was classified as 'Prime' for sandeel, whilst the sediments at eight stations can be classified as 'Sub-Prime' based on review of PSA data (**Table 8-5**). Sediments at 31 stations were identified as 'Suitable', whilst the remaining stations were classified as 'Unsuitable' due to the increased proportions of silt and find sand.

Table 8-5: Sandeel habitat classification using Greenstreet et al., (2010) for sediments within the RLB

Station ID	Coarse Sand (%)	Silt and Fine Sand (%)	Prime	Sub-Prime	Suitable
EGL3_183_EBS	50.3	49.31		✓	
EGL3_184_S&HSG	54.39	44.84		✓	
EGL3_185_S&HSG	58.77	40.02		✓	
EGL3_187_S&HSG	47.02	44.69			✓
EGL3_189_S&HSG	47.16	25.64			✓
EGL3_190_EBS	66.65	9.4			✓
EGL3_192_S&HSG	30.76	2.68			✓
EGL3_193_S&HSG	74.27	4			✓
EGL3_194_EBS	70.73	5.99			✓
EGL3_195_S&HSG	83.27	1.6			✓
EGL3_196A_EBS	88.6	2.57			✓
EGL3_197_S&HSG	73.64	6.64			✓
EGL3_198_EBS	45.59	52.71			✓
EGL3_199_S&HSG	58.14	36.4		✓	
EGL3_200_S&HSG	62.44	25.62			✓
EGL3_201_S&HSG	65.99	26.85			✓
EGL3_202_EBS	52.05	43.3		✓	
EGL3_203_S&HSG	55.05	40.93		✓	
EGL3_204_S&HSG_SS	61.44	38.21		✓	
EGL3_205_S&HSG	46.49	53.05			✓
EGL3_208_S&HSG	49.83	50.09			✓
EGL3_210_S&HSG	99.64	0.33			✓
EGL3_215_EBS	67.25	9.9			✓
EGL3_217_S&HSG	66.78	6.58			✓
EGL3_218_S&HSG	61.62	9.21			✓
EGL3_219_EBS	79.15	20.83	✓		
EGL3_220_S&HSG	69.32	6.81			✓
EGL3_PT_07_EBS	69.24	2.04			✓
EGL3_PT_06_EBS	51.91	21.17			✓
EGL3_PT_05_EBS	89.98	0			✓
EGL3_PT_03_EBS	59.85	39.98		✓	
SB_INT_01	99.46	0.48			✓
SB_INT_02	99.34	0.63			✓
SB_INT_03	69.4	0.1			✓
SB_INT_05	99.08	0			✓
SB_INT_06	99.81	0.02			✓
SB_INT_07	92.73	0.01			✓
SB_INT_08	99.27	0			✓

Station ID	Coarse Sand (%)	Silt and Fine Sand (%)	Prime	Sub-Prime	Suitable
SB_INT_09	96.02	0			✓
SB_INT_10	61.09	0			✓

The RLB is situated within the spawning grounds off the Aberdeenshire coast identified by Coull *et al*., (1998) for approximately 69 km (KP 511 – KP 580). Although a large section of these defined spawning grounds is classified as 'Unsuitable' habitat for sandeel according to the PSA, there are isolated patches interspersed which are classed as 'Prime', 'Sub-Prime' and 'Suitable'. The distribution of 'Prime' and 'Sub-Prime' habitats within these spawning grounds are as follows:

- KP 533 – KP 534
- KP 541 – KP 544
- KP 546 – KP 547
- KP 571 – KP 572
- KP 578 – KP 579

All the stations within the KPs listed above align with the EMODnet Folk 16 seabed sediment data categorised into Preferred habitat for sandeel. Folk 16 is the more comprehensive of the Folk classifications, which separates sediment types into 16 categories, as opposed to Folk 7 and Folk 5 which define seven and five categories, respectively, and therefore reduces uncertainty in the assessment given the seabed classifications are specific. However, there are also many sampling stations that overlap with the Preferred and Marginal sandeel habitat, as defined by the EMODnet sediment data, which are classified as Unsuitable when using PSA. This analysis demonstrates that areas predicted as suitable for spawning are often unsuitable when validated by sediment sampling.

There are three stations (EGL3_183_EBS, EGL3_184_S&HSG and EGL3_185_S&HSG) between KP 490 – KP 499 which lie in proximity to the spawning ground classified as 'Sub-Prime'. All three stations lie within an area defined by EMODnet seabed sediment data as 'Preferred' habitat for sandeel.

Herring (*Clupea harengus*)

Atlantic herring are listed in the UK as a BAP priority marine species of principal importance (BRIG, 2007). Herring are a widespread streamlined pelagic species occurring throughout the northeast Atlantic continental shelf seas to depths of up to 200 m (Barnes, 2008). Following the decline of herring due to poor management and human exploitation, management regimes have been implemented to stabilise the species' populations and sustain habitats. ICES implemented a long-term recovery plan in 1996 for herring across the North Sea, and closed areas from Atlantic herring fishing exist along the Northumberland and North Yorkshire coast of England to protect vulnerable spawning grounds (Anon, 1998).

In the Atlantic Ocean herring are commonly recognised as an important food source for many seabirds, fish, and marine mammals (Atterbury et al., 2021) and have been identified as a key prey species for highly selective birds including Atlantic puffin and tern species during their breeding season (Weinstien, 2021).

Atlantic herring form dense shoals which lay their eggs on a variety of substrates ranging from boulders and rocks to gravel. As benthic spawners, the species has a specific habitat preference for Gravel and sandy Gravel (using the Folk sediment classification) and have a marginal habitat preference for gravelly Sand, which limits the spatial extent of their spawning grounds. As a result, they are particularly sensitive to any environmental changes and habitat alterations from anthropogenic activities affecting the seabed. A programme of annual surveys has taken place since 1967 by the International Herring Larvae Survey (IHLS) monitoring the abundance of herring larvae (ICES, 2023a). Atlantic herring numbers fluctuate annually, with the species 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, and the Buchan population (Ellis *et al*., 2012) and are characterised by different growth rates, recruitment patterns and migration routes.

A Sandeel and Herring Assessment has been undertaken using desk-based studies and PSA from the benthic characterisation survey to allow for the identification of preferred and marginal habitat following the methodology derived from Kyle-Henney *et al*. (2024) within the Study Area. The RLB crosses the Buchan spawning ground identified by Coull *et al*. (1998), in which the stock usually spawns during August and September.

According to Coull *et al*. (1998), herring spawning ground exists on over half of the Study Area **(Figure 8-2 (Drawing reference C01494-EGL3-MEA-FISH-006-D)).** Ellis *et al*. (2012) further differentiates high intensity spawning ground existing in the areas closer to shore, whilst low intensity nursery grounds exist further offshore **(Figure 8-2 (Drawing reference C01494-EGL3-MEA-FISH-006-D)).** These low and high intensity spawning grounds are prevalent throughout the North Sea (Ellis *et al*. 2012). IHLS have not detected high numbers of herring larvae (per haul) in recent years; in January 2025, 1-2 larvae were identified per haul in only one area (rectangle 43E8) and in 2024, no counts were made **(Figure 8-3 (Drawing reference C01494-EGL3-MEA-FISH-007-D)).** Out of the

321 vibrocore stations taken within the RLB the sediments at three can be classified as 'Prime' habitat and eight can be classified as 'Sub-Prime' (**Table 8-6**).

Table 8-6: Herring spawning ground results using Reach et al., (2013); Kyle-Henney et al., (2024) from vibrocore sampling

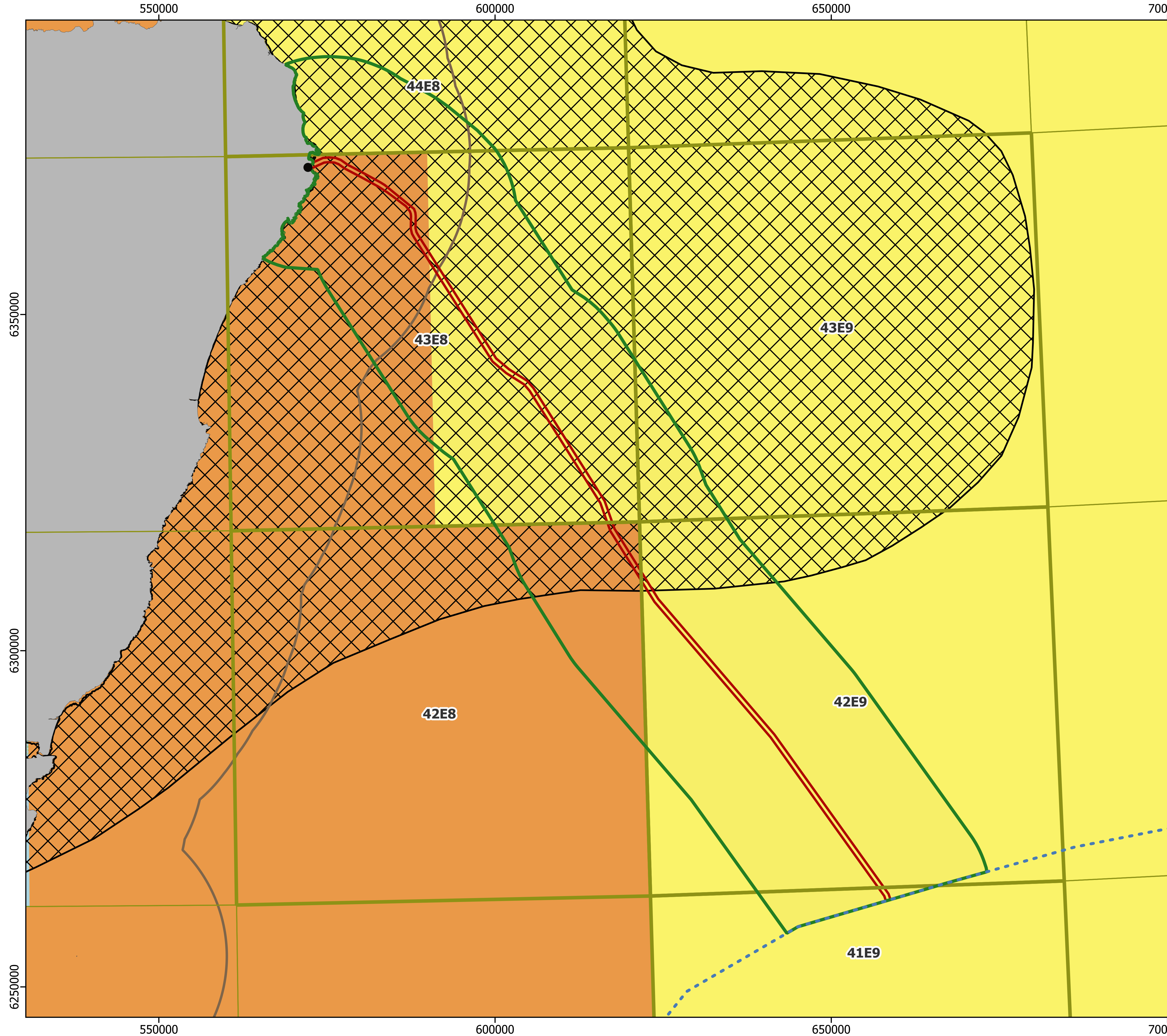
Station ID	Fines (%)	Gravel (%)	Prime	Sub-Prime
VC_003	1	74	✓	
VC_010a	2	31		✓
VC_011	1	39		✓
VC_011	1	40		✓
VC_011	1	48		✓
VC_011	1	53	✓	
VC_019	3	34		✓
VC_020	3	32		✓
VC_059	2	36		✓
VC_060	1	46		✓
VC_519	4	59	✓	

Fourteen stations were deemed as 'Suitable' herring habitat, whilst the remaining stations were classed as 'Unsuitable'.

The Proposed Development is situated in within the Aberdeenshire spawning grounds identified by Coull *et al*., (1998) for approximately 86 km (KP 494 – KP 580). The distribution of Prime and Sub-Prime habitats within the spawning ground are as follows:

- KP 517 – KP 518
- KP 557 – KP 559
- KP 566 – KP 568
- KP 574 – KP 575
- KP 577 – KP 578

The areas in between these KPs are classified as either Suitable or Unsuitable habitat for herring. All stations designated as Prime or Sub-Prime, except for vibrocore stations VC_019 and CVC_020, overlap with areas defined by EMODnet seabed sediment data as Marginal habitat for herring.



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Herring Spawning And Nursery Grounds

C01494-EGL3-MEA-FISH-006-D

Legend

- Red Line Boundary
- Study Area (15km Buffer)
- Sandford Bay Landfall
- ICES Rectangle Within Study Area
- ICES Rectangle
- Herring Spawning Ground (Coull et al, 1998)
- High Intensity Nursery Ground (Ellis et al, 2012)
- Low Intensity Nursery Ground (Ellis et al, 2012)
- Scottish Adjacent Waters
- 12NM Limit

0 10 20 30 KM
0 5 10 15 NM
N

Date	26/06/2025
Coordinate System	WGS 84 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:550,000
Created	JC
Reviewed	AN/ CB
Authorised	JDM

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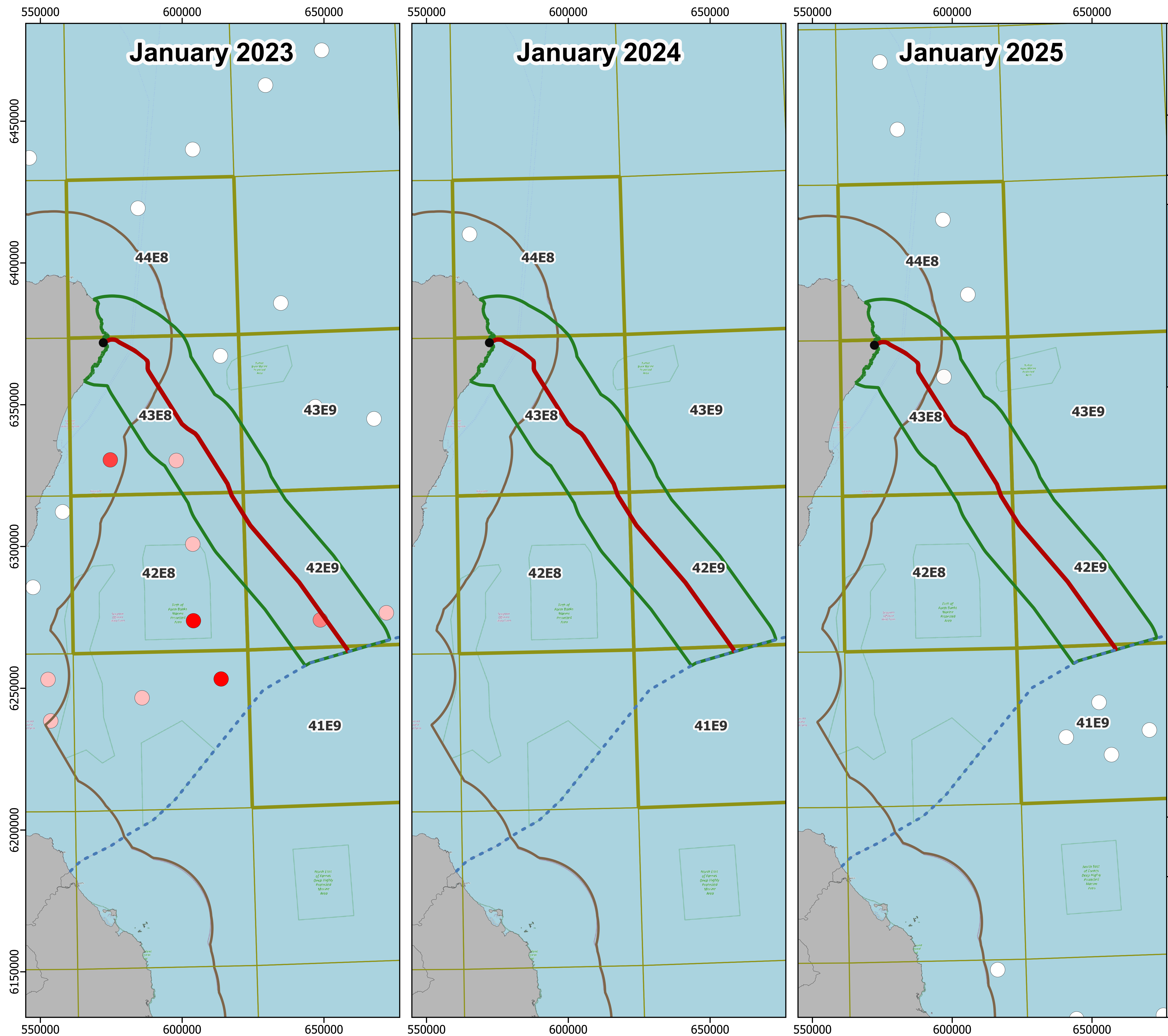

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North Sea herring larval and egg abundance from IHLS surveys (ICES)

C01494-EGL3-MEA-FISH-007-D

Legend

- Red Line Boundary
- Study Area (15km Buffer)
- Sandford Bay Landfall
- ICES Rectangle in Study Area
- ICES Rectangle

Average Number Of Larvae Identified (per haul)

- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6
- Scottish Adjacent Waters
- 12NM Limit

0 30 60 90 KM
0 15 30 45 NM
N

Date	26/06/2025
Coordinate System	WGS 84 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:1,300,000
Created	JC
Reviewed	AN
Authorised	JDM

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8.4.3.2. Shellfish

Shellfish generally live in or on the seabed. They are crustaceans and molluscs which have a shell or shell-like exterior. Shellfish species most at risk are those that live in the upper layers of sediment or those that live on the seabed with limited mobility (e.g. whelk (*Buccinum undatum*)), making them susceptible to changes in seabed disturbance, smothering of sediment and changes in water quality.

Although the Study Area does not lie within any designated shellfish waters, 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 2023 were crab (*Cancer pagurus*), scallop (*Pecten maximus*), nephrops (*Nephrops norvegicus*) and velvet swimmer crabs (*Necora puber*); (MMO, 2024). These shellfish are of commercial importance (see **Chapter 12: Commercial Fisheries**). Crab, scallop and nephrops are considered to have 'moderate' sensitivity to substratum loss (Marlin, 2025a, Marlin 2025b, Marlin 2025c, respectively), with scallop and nephrops also having a 'high' intolerance to this physical pressure (Marlin, 2025b, Marlin 2025c, respectively).

8.4.3.3. Elasmobranchs (sharks, rays and skates)

Elasmobranchs are amongst the most vulnerable marine fish. This is due to their slow growth rates, late maturity, low fecundity and reproductive productivity which limits their ability for population recovery should it decline. All sharks and rays are on the Oslo and Paris Conventions (OSPAR) list of threated or declining species (OSPAR Commission, 2024). As indicated in **Table 8-7,** there is historic evidence of spurdog, spotted ray, blue and flapper skate and tope shark spawning in the Study Area (note, however, blue and flapper skate were not observed from commercial catches in 2023 **(Table 8-3)**, nor scientific surveys in 2024 **(Table 8-4)**. Catch statistics also indicate that the following elasmobranch species are present: thornback ray, lesser spotted dogfish, spotted ray, cuckoo ray, spurdog and starry smooth-hound (MMO, 2024).

Skates and rays are amongst the most common bottom dwelling fish. Thornback ray used to be widespread and abundant in the North Sea. However, due to their slow growth rate, late maturity and low fecundity they became susceptible to over-exploitation by fishing. Since the 1950s their abundance and range has decreased and therefore the species has been classified as 'Near Threatened' by the IUCN.

Thornback rays prefer a variety of softer sediment including mud, sand, shingle and gravel, though less frequently observed on coarser sediment types. Although there is insufficient data in the literature to delineate spawning ground for this species, low intensity nursery grounds overlap the Study Arear (Ellis *et al.,* 2012). Spawning grounds broadly coincide with nursery grounds.

Thornback rays are vulnerable to seabed disturbance as they are demersal spawners. They are oviparous, depositing rectangular egg cases on the sea floor. Incubation generally lasts 4-6 months dependent on water temperature (Shark Trust, 2024). Spawning occurs over a considerable period from February to October peaking from April to August, with the spawning grounds thought to broadly overlap with nursery grounds. Young thornback ray feed largely on small crustaceans (amphipods, mysids and crangonid shrimps), with larger individuals eating larger crustaceans (e.g. swimming crabs) and fish (e.g. sandeels, small gadoids and dragonet).

8.4.4. EMF Sensitive Species

The predominant electroreceptive species present within the Study Area are elasmobranchs (sharks, skates and rays) which have specialist electroreceptive organs (Tricas & Sisneros, 2004). This highly acute sense, which is sensitive to 5 to 20 nV/m (Tricas & New, 1998), is used to detect the bioelectric fields of prey and predators as well as being used for navigational purposes. As described previously elasmobranchs known to occur in the Study Area include thornback ray, lesser spotted dog, spotted ray, and starry smooth-hound.

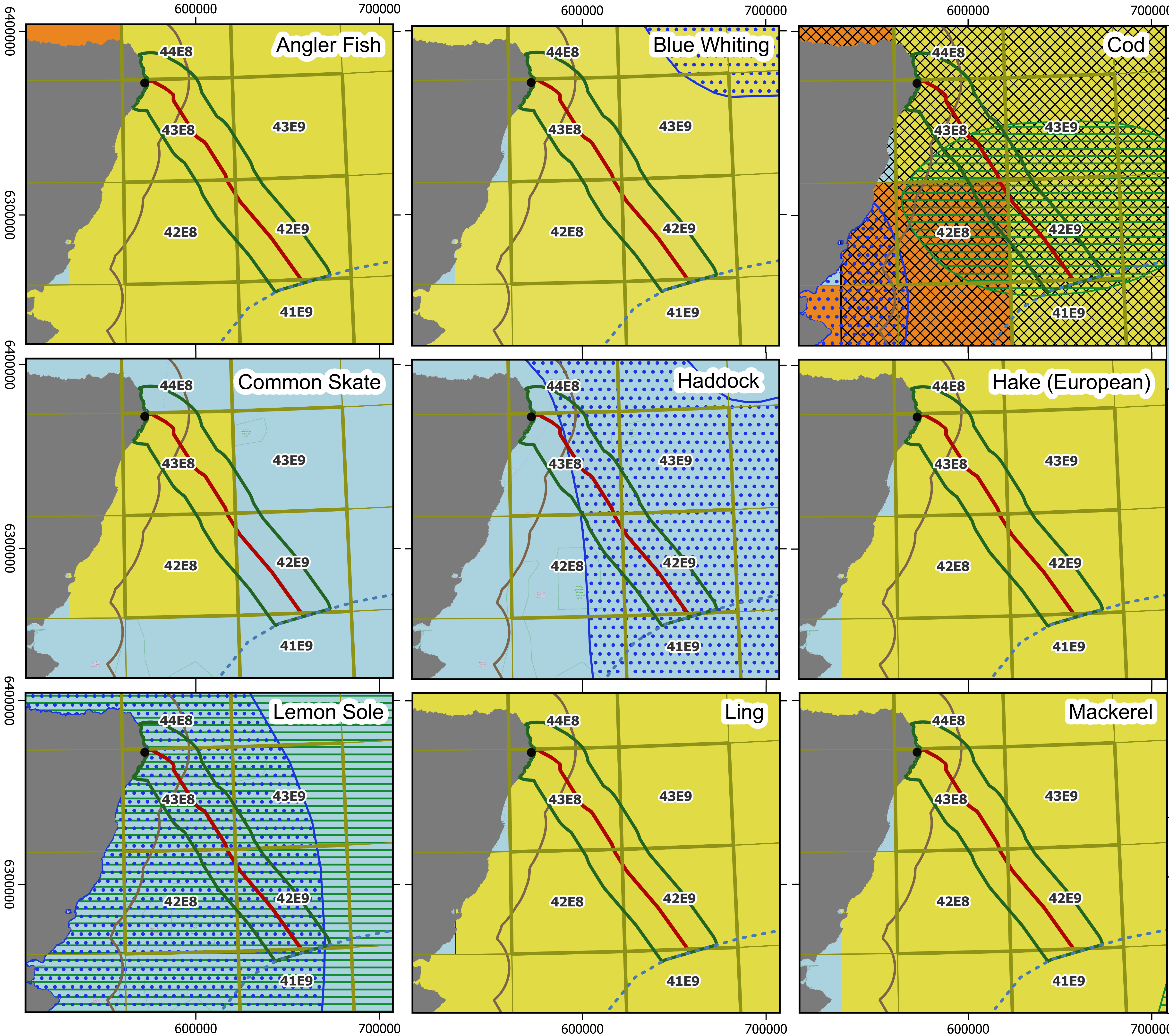
Other species that are electrosensitive including European eel (*Anguilla anguilla*), river lamprey (*Lampetra fluviatilis*), sea lamprey (*Petromyzon marinus*), Atlantic salmon, cod, and plaice (*Pleuronectes platessa*). These species do not have specialised electroreceptors but are able to detect induced voltage gradients associated with water movement through the geomagnetic field (Viking Link, 2017). Atlantic salmon are known to be present in Scottish rivers in proximity to the Study Area including Ugie, Ythan, Don and Water of Philtrum and have salmon fishery boards in place to protect stocks.

There are no designated sites within 40 km which have Atlantic salmon listed as a protected species. However, the species is known to be present in other rivers in Scotland in proximity to the Study Area. European eel undertake an extensive migration to spawn in the Sargasso Sea. The species are listed as a BAP priority marine species of principal importance and are likely to be present within the North Sea.

8.4.5. Spawning and Nursery Grounds

Table 8-7 summarises the species which use the Proposed Development in Scottish waters as spawning and nursery grounds and the months within which this occurs. Information is taken from the Cefas fisheries sensitivity maps (Coull *et al*., 1998; Ellis *et al*., 2012). It also shows the intensity of 0 Group Aggregations; species within the first years of their lives (Aires *et al*., 2014). Norway pout has only been recorded through evidence of 0 Group aggregations; Coull *et al*. (1998) and Ellis *et al*. (2012) do not indicate the presence of spawning or nursey grounds within the proposed submarine cable corridor for the species.

Where information is available in the form of mapped data this has been presented in **Figure 8-4 (Drawing reference C01494-EGL3-MEA-FISH-008-D)** for anglerfish, blue whiting, cod, common skate, haddock, hake, lemon sole, ling, and mackerel, and in **Figure 8-5 (Drawing reference C01494-EGL3-MEA-FISH-009-D)** for nephrops, Norway pout, plaice, Sandeel, spotted ray, sprat, spurdog, tope shark, and whiting. Additionally, González-Irusta & Wright (2016a) has supplemented the haddock information; their research predicts changes in haddock spawners over a series of years; the most recent being in 2015. During that year, abundance predictions were higher in offshore waters than in the coastal waters around Peterhead, and the distribution of the higher abundances were prevalent from the northeast of Scotland, to England's Yorkshire coast. Similarly, González-Irusta & Wright (2017) examined the probability of whiting spawners. In their last modelled year (2015), whiting spawner abundances were predicted to be low along the proposed submarine cable corridor, with the area of largest abundance being offshore, in English waters. Predicted cod spawners (González-Irusta & Wright, 2016b) were low throughout the North Sea across all years modelled (2009-2014); smaller patches of higher abundances existed offshore from Peterhead, though this was the southernmost extent of the higher abundances.



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Fish Nursery And Spawning Grounds With Intensity Within The Study Area (part 1)

C01494-EGL3-MEA-FISH-008-D

Legend

- Red Line Boundary
- Study Area (15km Buffer)
- Sandford Bay Landfall
- ICES Rectangle within Study Area
- ICES Rectangle
- Nursery Grounds (Coull et al. 1998)
- Spawning Grounds (Coull et al. 1998)
- Spawning Grounds With Low Intensity (Ellis et al., 2012)

Nursery Grounds with Intensity (Ellis et al., 2012)

- High
- Low
- Scottish Adjacent Waters
- 12NM Limit

0 30 60 90 KM
0 15 30 45 NM
N

Date	26/06/2025
Coordinate System	ETRS89 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:2,000,000
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Reviewed	AN
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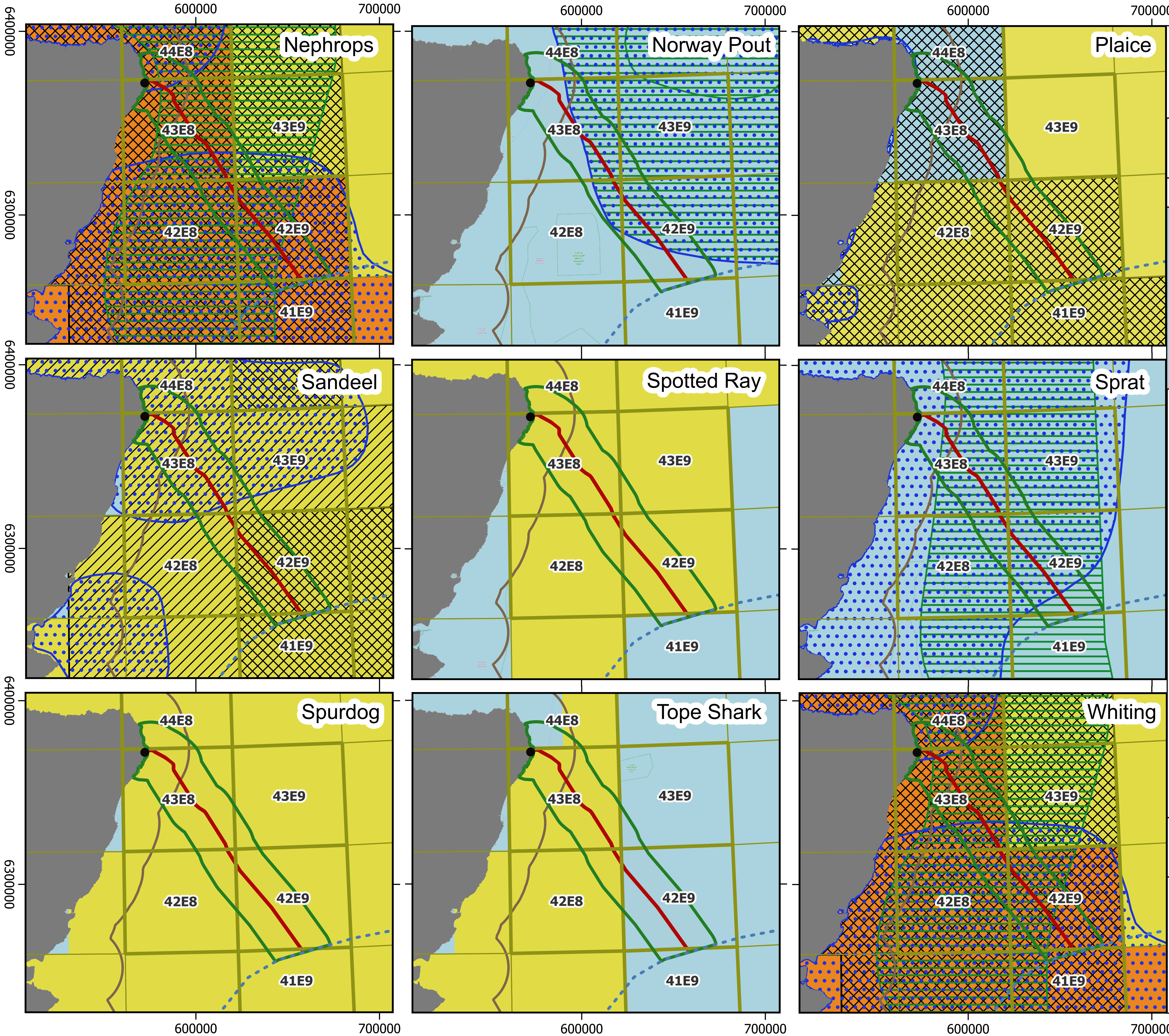

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Fish Nursery And Spawning Grounds With Intensity Within The Study Area (part 2)

C01494-EGL3-MEA-FISH-009-D

Legend

- Red Line Boundary
- Study Area (15km Buffer)
- Sandford Bay Landfall
- ICES Rectangle Within Study Area
- ICES Statistical Rectangle
- Nursery Grounds (Coull et al. 1998)
- Spawning Grounds (Coull et al. 1998)
- Spawning Grounds With Low Intensity (Ellis et al., 2012)

Nursery Grounds With Intensity (Ellis et al., 2012)

- High
- Low
- Scottish Adjacent Waters
- 12NM Limit

0 30 60 90 KM
0 15 30 45 NM
N

Date	26/06/2025
Coordinate System	ETRS89 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:2,000,000
Created	JC
Reviewed	AN/CB
Authorised	JDM

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Table 8-7: Spawning and Nursery grounds that overlap the RLB

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	Spawning	Spawning	Spawning	Spawning	Both	Both	Nursery	Nursery				
Atlantic Cod	*Gadus morhua*	Pelagic	Low	Demersal	Low	Low	Spawning	Spawning *	Spawning *	Spawning								
Atlantic Herring (Buchan Stock)	*Clupea harengus*	Demersal	High	Pelagic	High	Low/Medium								Spawning	Spawning			
Atlantic Mackerel	*Scomber scombrus*	n/a	n/a	Pelagic	Low	Low					Spawning *	Spawning *	Spawning *	Spawning				
Blue Whiting	*Micromesistius poutassou*	n/a	n/a	Pelagic	Low					Spawning *	Both *	Both	Nursery	Nursery				
Blue skate and Flapper skate	*Dipturus flossada* *Dipturus intermedia*	Demersal	Low	Demersal	Low		X	X	X	X	X	X	X	X	X	X	X	X
European Hake	*Merluccius merluccius*	n/a	n/a	Demersal	Low	Low	Spawning	Spawning *	Spawning *	Spawning	Both	Both	Nursery	Nursery				
European Plaice	*Pleuronectes platessa*	Pelagic/Demersal	Low	Demersal	Low	Low/medium	Spawning *	Both *	Both	Nursery	Nursery							Spawning
European Sprat	*Sprattus sprattus*	Pelagic	Low	Pelagic	Low	Low					Spawning *	Spawning *	Both	Both	Nursery	Nursery		
Haddock	*Melanogrammus aeglefinus*	n/a	n/a	Demersal	Low	Medium/High		Spawning *	Spawning *	Both *	Both	Nursery	Nursery					
Lemon Sole	*Microstomus kitt*	Demersal	Low	Demersal	Low					Spawning	Spawning	Spawning	Spawning	Both	Both	Nursery	Nursery	
Ling	*Molva molva*	n/a	n/a	Demersal	Low			Spawning	Spawning	Both	Both	Nursery	Nursery					
Nephrops	*Nephrops norvegicus*	Demersal	Low	Demersal	Low		Both	Both	Both	Both *	Both *	Both *	Both	Both	Both	Both	Both	Both
Norway Pout ***	*Trisopterus esmarkii*	Demersal	Low	Demersal	Low	Low/Medium	Spawning	Spawning *	Both *	Both	Nursery	Nursery						
Saithe	*Pollachius virens*	n/a	n/a	Demersal	Low	Low			Nursery	Nursery	Nursery	Nursery						
Sandeels	Ammodytidae	Demersal	High	Demersal	Low		Both	Both	Nursery	Nursery							Spawning	Spawning
Spotted Ray	*Raja montagui*	Demersal	Low	Demersal	Low					X	Spawning *	Both *	Both *	Nursery	Nursery			
Spurdog	*Squalus acanthias*	n/a	n/a	Viviparous	Low		Both	Both	Both	Both	Both	Both	Both	Both	Both	Both	Both	Both
Tope Shark	*Galeorhinus galeus*	n/a	n/a	Viviparous	Low		Both	Both	Both	Both	Both	Both	Both	Both	Both	Both	Both	Both
Whiting	*Merlangius merlangus*	Pelagic	Low	Pelagic	High	Low/Medium		Spawning	Spawning	Spawning	Both	Both	Nursery	Nursery				

Sources: Coull et al. (1998), Ellis et al. (2012), Aires et al. (2014). * Peak Spawning. ** 0 Group fish defined as fish in the first year of their lives. *** Species only recorded as 0 Group fish within Study Area, X Insufficient data available

Spawning Only   Nursery Only   Both

8.4.6. Designated Sites and Protected Species

The Study Area does not cross any designated shellfish areas.

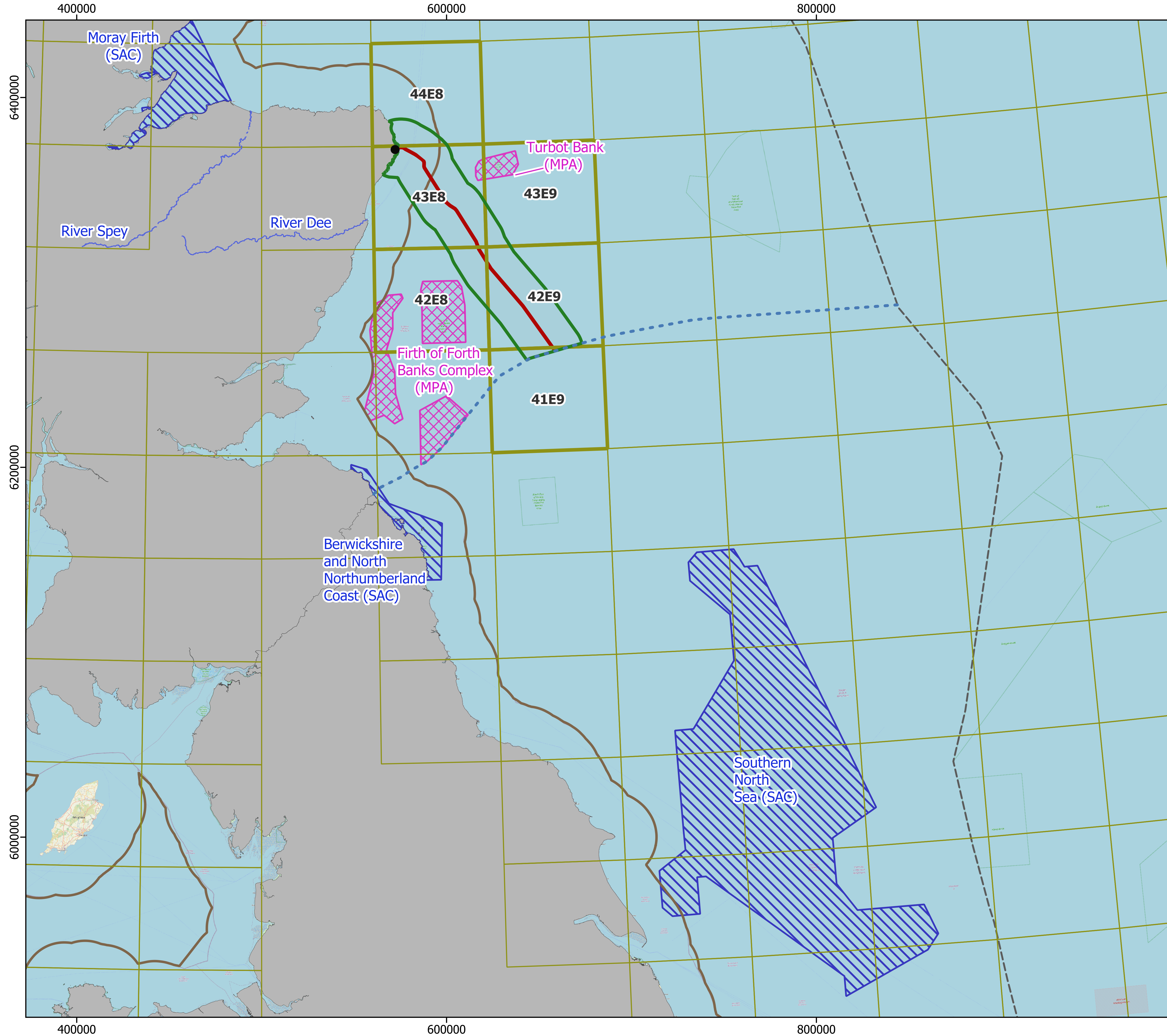
The RLB itself is approximately 18.2 km from the Firth of Forth Banks Complex MPA, which comprises of a group of three shelf banks and mounds, namely Scalp Bank, Berwick Bank, Montrose Bank & Wee Bankie shelf banks and mounds (JNCC, 2014). The Firth of Forth Banks Complex MPA is in offshore waters of the Northern North Sea on the east coast of Scotland, and is strongly influenced by water currents. These currents 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 PMF, 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. Note, however, that quahog were not detected in landings observed via DATRAS **(Table 8-4)**and have been assessed within **Chapter 7: Intertidal and Subtidal Benthic Ecology**.

Turbot Bank MPA is approximately 19.33 km from the RLB (**Figure 8-6 (Drawing reference C01494-EGL3-MEA-FISH-011-D)**), of which sandeel is a protected feature.

Protected species within the Study Area are summarised in **Table 8-8**. Those species under international protection by OSPAR (due to being in declining or threatened populations) are mostly elasmobranchs, though cod, allis shad, sea lamprey, and Atlantic salmon are also listed. The Convention on International Trade in Endangered Species (CITES) protects only basking shark and as an Appendix II species (meaning the species is not necessarily threatened now, but populations require monitoring). The IUCN further classified basking shark as 'endangered' along with white skate and Atlantic halibut (**Table 8-8**). The IUCN also classes common skate and flapper skate as 'critically endangered', Atlantic cod and Atlantic salmon at considered 'vulnerable', and blonde ray, smoothhound, and thornback ray are 'near threatened'. All other species are either 'data deficient' or of 'least concern'.

Within UK legislation (**Table 8-8**) basking shark, allis shad and twaite shad are listed under Schedule 5 of the Wildlife and Countryside Act 1981, which prohibits the intentional killing, injuring, or taking of these species. The Conservation (Natural Habitats &c.) Regulations 1994 lists river lamprey as Annex II species (meaning these species have conservation needs which require the designation of special areas of conservation (SAC)). Sea lamprey are protected under Annex IIa and Va of the European Commission (EC) Habitats Directive. Allis shad and twaite shad are Annex II and V species (the latter Annex meaning the species management measures may be required to help ameliorate their exploitation). Species which are PMFs include only smelt and ocean quahog, due to their populations being considered threatened, rare, or declining.

In Scotland, the Scottish Biodiversity List, and PMF list, include those indicated in **Table 8-8**. The Scottish Biodiversity List includes those species considered most important for biodiversity conservation, whilst the PMF species are of conservation importance in Scottish waters, and their inclusion under this designation help focus future conservation action and marine planning, direct research and education, and promote a consistent approach to marine nature conservation advice.



collaborative environmental advisers

Relevant Designated Sites For The Protection Of Fish And Shellfish With Rivers Of Known Importance To Migratory Salmon

C01494-EGL3-MEA-FISH-011-D

Legend

- Red Line Boundary
- Study Area (15km Buffer)
- Sandford Bay Landfall
- Main Salmon Rivers
- ICES Rectangle within Study Area
- ICES Rectangle
- Marine Protected Area (MPA)
- Special Area of Conservation (SAC)
- Scottish Adjacent Waters
- 12NM Limit
- EEZ

0 50 100 150 KM

0 20 40 60 NM

N

Date	26/06/2025
Coordinate System	WGS 84 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:2,000,000
Created	JC
Reviewed	AN/ CB
Authorised	JDM

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Table 8-8: Protected species observed in the Study Area

Species	International			UK			Scotland	
	OSPAR (Annex II)	CITES	IUCN	Wildlife and Countryside Act	Offshore Marine Regulations 2017	Features of Conservation Interest (FOCI)	Scottish Biodiversity List	Priority Marine Feature (PMF)
Pelagic species								
Herring (*Clupea harengus*)			Least concern				Y	Y
Horse Mackerel (*Trachurus trachurus*)			Least concern					Y
Mackerel (*Scomber scombrus*)			Least Concern					Y
Demersal species								
Atlantic Cod (*Gadus morhua*)	Y		Vulnerable				Y	Y
Atlantic Halibut (*Hippoglossus hippoglossus*)			Endangered					Y
Bass (*Dicentrarchus labrax)*			Least concern					
Haddock (*Melanogrammus aeglefinus)*			Vulnerable					
Ling (*Molva molva*)			Least concern				Y	Y
Plaice (*Pleuronectes platessa*)			Least concern				Y	
Saithe (*Pollachius virens*)								Y
Sole (*Solea solea*)			Data deficient					
Whiting (*Merlangius merlangus*)			Least concern				Y	Y
Elasmobranch species								
Basking Shark (*Cetorhinus maximus*)	Y	Appendix II	Endangered	Schedule 5			Y	Y
Blonde Ray (*Raja brachyura)*			Near Threatened				Y	
Common Skate (*Raja batis*)	Y		Critically endangered				Y	Y
Flapper Skate (*Dipturus intermedius*)	Y		Critically endangered				Y	Y

Species	International			UK			Scotland	
	OSPAR (Annex II)	CITES	IUCN	Wildlife and Countryside Act	Offshore Marine Regulations 2017	Features of Conservation Interest (FOCI)	Scottish Biodiversity List	Priority Marine Feature (PMF)
Cuckoo Ray (*Leucoraja naevus*)			Least Concern					
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					
Diadromous species								
Allis Shad (*Alosa alosa*)	Y		Least Concern	Schedule 5	Annex II & V		Y	
River Lamprey (*Lampetra fluviatilis*)			Least Concern		Annex II		Y	Y
Sea Lamprey (*Petromyzon marinus*)	Y		Least Concern		Annex II			Y
Smelt (*Osmerus eperlanus*)			Least Concern			Y	Y	Y
Twaite Shad (*Alosa fallax*)			Least Concern	Schedule 5	Annex II & V		Y	
Anadromous species								
Atlantic Salmon (*Salmo salar*)	Y		Vulnerable		Annex II		Y	Y
Shellfish Species								
Cuttlefish (*Sepia officinalis*)			Least Concern					
Ocean Quahog (*Arctica islandica*)	Y					Y		Y

8.5. Potential Pressure Identification and Zone of Influence

8.5.1. Spatial Scope

The Study Area for fish and shellfish includes the RLB plus an additional 15 km buffer on either side, which encompasses the potential impact pathways from increased suspended sediment concentrations. Maximum tidal excursions and sediment dispersion modelling has confirmed these zones of influence, as described and assessed within **Section 8.11** and described fully in **Chapter 6: Marine Physical Processes.**

8.5.2. Temporal Scope

The temporal scope of the assessment of fish and shellfish is consistent with the period over which the Proposed Development would be carried out. It assumes construction of the Proposed Development would commence at the earliest in 2028 with the latest possible completion by 2033. Within this window, construction (including pre-lay activity) is expected to take 55 months. Operation would commence in 2033 with periodical maintenance required during the operational phase. It is assumed that maintenance and repair activities could take place at any time during the life span of the Proposed Development.

The Proposed Development is expected to have a life span of more than 40 years. If decommissioning requires cessation of operation and removal of infrastructure at this point in time, then activities and effects associated with the decommissioning phase are expected to be of a similar level to those during the construction phase works albeit with a lesser duration of two years. Acknowledging the complexities of completing a detailed assessment for decommissioning works up to 40 years in the future, based on the information available, the Applicant has concluded that impacts from decommissioning would be no greater than those during the construction phase. Furthermore, should decommissioning take place it is expected that an assessment in accordance with the legislation and guidance at the time of decommissioning would be undertaken and a separate Marine Licence would be sought for decommissioning activities.

8.5.3. Identification of Pressure-Receptor Pathways

Table 8-9 provides a summary of the receptors scoped into the assessment and the potential impacts assessed. The scoping 'in' of these impacts are based on the potential impacts identified within the fish and shellfish MEA Non-Statutory Scoping Report, which also considered a precautionary approach whereby some impacts were scoped 'in' to assessment if a strong evidence base to scope the impact 'out' was lacking. Wider consultation then concluded the impacts to be scoped in/out, such as 'temperature increase' which was encouraged to be assessed within the scoping comments.

Table 8-9: Fish and shellfish receptors scoped in for assessment.

Potential impact	Activity	Project stage	Receptor	Zone of Influence	Reason for Consideration
Temporary habitat loss/seabed disturbance	Boulder clearance, pre-lay grapnel run (PLGR), pre-sweeping of sand waves. Horizontal Directional Drilling (HDD) duct excavation. Cable burial and trenching. Anchoring / jack-up legs	Construction	Shellfish and marine species with demersal life stage	Within RLB	Any disturbance of the seabed has the potential to affect 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. nephrops), those that live on the seabed with limited mobility (e.g. crab, lobster, hibernating sandeel) or those which lay their eggs on the seabed (demersal spawners) e.g., herring. The Proposed Development 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 focuses on the effect on shellfish species due to their limited mobility and high commercial values and sandeel and herring as significant prey species.
		Operation	Shellfish and marine species with demersal life stage	Within RLB	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 than during installation. However, if the

Potential impact	Activity	Project stage	Receptor	Zone of Influence	Reason for Consideration
					activity takes place during key spawning periods, impacts could potentially be significant.
		Decommissioning	Shellfish and marine species with demersal life stage	Within RLB	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.
Permanent habitat loss	Deposit of external cable protection.	Construction	Shellfish and marine species with demersal life stage	Within RLB	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 has been 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.
		Operation	Shellfish and marine species with demersal life stage		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.
Temporary increase and deposition of suspended sediments	Pre-sweeping	Construction	Shellfish and marine species with demersal life stage	15km	Pre-sweeping of sand waves involves the re-positioning of large quantities of sediment from the cable route to alongside the cable route. 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).
		Decommissioning	Shellfish and marine species with demersal life stage	15km	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.
Electromagnetic changes/Barrier to species movement	EMFs produced by the operational cable	Operation	All species	Within RLB	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 of field strength and burial depths have not been undertaken this impact pathway is assessed.
Temperature increase	Water temperature increases	Operation	Shellfish and marine species	Within RLB	Heat emitted from the cable during operation has the potential to effect species which use the seabed for part/all of their lifecycle. Species most at risk are

Potential impact	Activity	Project stage	Receptor	Zone of Influence	Reason for Consideration
	near to the operational cable		with demersal life stage		those that live in the upper layers of sediment (e.g. nephrops), those that live on the seabed with limited mobility (crab, lobster, hibernating sandeel) or those which lay their eggs on the seabed (demersal spawners) e.g., herring.

8.5.4. Guidance

The fish and shellfish assessment has been undertaken in accordance with relevant guidance and has been compiled in accordance with professional standards. The guidance and standards which relate to this assessment are:

- The Chartered Institute for Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in Britain and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018) ;
- Scotland's National Marine Plan (Scottish Government, 2015);
- Scottish Planning Policy (Scottish Government, 2020);
- The Joint Nature Conservation Committee UK Protected Areas guidance (JNCC, 2025); and
- The Marine Evidence-based Sensitivity Assessment (MarESA).

8.6. Key Parameters for Assessment

8.6.1. Realistic Worst-Case Design Scenario

The assessment has followed the Rochdale Envelope approach as outlined **Chapter 3: Project Description.** The assessment of effects has been based on the description of the Proposed Development and parameters outlined in **Chapter 3: Project Description**. Where there is uncertainty regarding a particular design parameter, the realistic worst-case design parameters are provided in **Table 8-10**Error! Reference source not found. below with regards to intertidal and subtidal benthic ecology receptors along with the reasons why these parameters are considered worst-case. The assessment for fish and shellfish has been undertaken on this basis. Effects of greater adverse significance are not likely to arise should any other development scenario (e.g., different infrastructure layout within the RLB), to that assessed here, be taken forward in the final design plan, provided the development scenario is within the Rochdale Envelope parameters set out.

It should be noted that Unexploded Ordnance (UXO) clearance is not being sought under the Marine Licence to which this MEAp relates. In the event that clearance is identified as necessary, a separate Marine Licence would be sought and assessment would be carried out in support of that Marine Licence application. As such, UXO clearance has not been assessed in this MEAp.

Table 8-10: EGL 3 Project Worst-case Assumptions

Impact Pathway	Construction	Operation	Decommissioning	Most sensitive location or scenario
Temporary habitat loss/ seabed disturbance	4.35 km^2 – width of the PLGR 30 m x length of 145 km	To be confirmed if maintenance is required	Similar footprint as is disturbed during construction and operation combined.	Herring or sandeel habitat
Permanent habitat loss	0.135 km^2 (including 0.035 km^2 from infrastructure crossings)	To be confirmed if maintenance is required	No new deposits but assumes cable protection remains in place.	Herring or sandeel habitat
Temporary increase and deposition of suspended sediments	Project specific data presented in **Chapter 6: Marine Physical Processes,** concludes coarse sediment would settle within the RLB and fine sediment plumes can travel up to 13.6 km and would cause light surface smothering of <1 mm.			Herring habitat
Electromagnetic changes	N/A during construction	EMF generated by the bundled cables would fall to 67.5 μT within 1 m of the	N/A during decommissioning	Shellfish and marine species with demersal life stage

Impact Pathway	Construction	Operation	Decommissioning	Most sensitive location or scenario
		cables, and to 57.5 μT within 2 m of the cables. Calculations are detailed in **Appendix 3A: Electric and Magnetic Field (EMF) Assessment**		
Temperature increase	N/A during construction	Assuming an ambient seabed temperature of 12 °C, seabed temperatures at 0.2 m immediately above the cables are estimated to be 13 - 14 °C, with the cables operating at maximum operating temperatures. Please see **Appendix 3C: Heat Calculations** for further information.	N/A during decommissioning	Shellfish and marine species with demersal life stage

8.7. Embedded Mitigation Measures

As set out **Chapter 4: Marine Environmental Appraisal Scope and Methodology**, embedded mitigation measures form part of the design for which consent is sought and can be characterised as 'design measures' or 'control and management measures'. This embedded mitigation would be implemented as part of the Proposed Development and secured by way of a condition in the Marine Licence as relevant.

Several management plans would be provided to discharge Marine Licence conditions prior to the start of construction. These would include a Construction Environmental Management Plan (CEMP), a Marine Pollution Contingency Plan (MPCP), Marine Mammal Mitigation Plan (MMMP) and a Fisheries Management and Mitigation Plan (FMMP). These documents will outline measures to be implemented to comply with legislation, such as Prevention of Pollution at Sea (MARPOL) and Safety of Life at Sea (SOLAS), and the mitigation commitments proposed within this MEAp (Embedded Mitigation OMT08). An Outline CEMP is provided as **Appendix 3B: Outline Construction Environmental Management Plan**. In addition, design measures identified through the MEAp process have been applied to avoid or reduce potential significant effects.

Table 8-11 outlines the embedded mitigation measures that would be implemented for the Proposed Development that have been considered by the fish and shellfish MEA.

Embedded mitigation that was proposed at scoping to justify why a potential impact pathway was not significant has also been included in **Table 8-11**, along with the impact pathway that it was addressing (i.e. temporary and permanent habitat loss).

Table 8-11: Embedded mitigation measures used for fish and shellfish assessment

Impact Pathway	Receptor	Embedded Mitigation Measures
Temporary and Permanent habitat loss	Shellfish and marine species with demersal life stage (herring and sandeel)	OMT03 - The intention is to bury the cables in the seabed, except in areas where burial is not possible e.g. where ground conditions do not allow burial or at infrastructure crossings.
		OMT10 - Designated (and as minimal as possible) anchoring areas and protocols shall be employed during marine operations to minimise physical disturbance of the seabed.
Permanent habitat loss due to the deposit of external cable protection		OMT04 - Cable protection features would only be installed where considered necessary for the safe operation of the Proposed Development. This includes the repair of cables due to accidental damage, where depth of lowering is not achieved and at infrastructure crossings.
		OMT05 - Where possible, cable protection materials would be selected to match the environment (e.g. when cables are installed in areas of cobbles or other natural rock

Impact Pathway	Receptor	Embedded Mitigation Measures
		features, rock of similar diameter and material as the receiving environment should be used).
Temporary increase and deposition of suspended sediment		OMT02 - Drilling fluids required for trenchless operations will be carefully managed to minimise the risk of breakouts into the marine environment. Specific avoidance measures would include: ▪ the use of biodegradable drilling fluids (pose little or no risk (PLONOR) substances) where practicable, ▪ drilling fluids will be tested for contamination to determine possible reuse or disposal; and ▪ if disposal is required drilling fluids would be transported by a licensed courier to a licensed waste disposal site. ▪ Chemicals will be chosen from the list of chemicals approved under the Offshore Chemical Notification Scheme. https://www.cefas.co.uk/data-and-publications/ocns/ and a chemical risk assessment will be provided as part of the CEMP. Further measures including a Shipboard Oil Pollution Emergency Plan will ensure compliance with the Prevention of Pollution at Sea (MARPOL) and SOLAS conventions
Electromagnetic changes		OMT12 - HVDC poles would be bundled to minimise the effects of EMF for electrosensitive receptors.

8.8. Significance Assessment

The generic project-wide approach to the assessment methodology is set out in **Chapter 4: Marine Environmental Appraisal Scope and Methodology**. The criteria for characterising the value and sensitivity and magnitude for fish and shellfish are outlined in **Table 8-12** and **Table 8-13**, respectively. The significance of an effect, either adverse or beneficial, has been determined using a combination of the magnitude of the impact and the sensitivity of the receptor. A matrix approach (see **Table 8-14)** is used throughout all topic areas to ensure a consistent approach within the assessment. This assessment has used available evidence, professional judgement and knowledge of fish and shellfish to determine the level of impact.

The assessment of sensitivity has been made with consideration of the vulnerability of the receptor to an impact and its ability to recover and adapt. Vulnerability can differ between different groups and species of fish and shellfish and varies depending on the impact pathway. For example, certain mobile demersal species are less sensitive to temporary habitat loss than shellfish species with limited mobility.

Several species identified as present within the Study Area are protected by international and national legislation and are therefore considered to be of very high importance.

The assessment of magnitude has been made with consideration of the extent of the area impacted, the duration and frequency of the impact and the scale of the change i.e., whether it has an effect at an individual or population level. When determining the magnitude of impacts the life history and ecology of the receptors is important. Factors such as seasonality of presence or whether specific areas are required for a certain life stage which the species may be unwilling or unable to move away from are considered.

Table 8-12: Criteria for characterising the sensitivity of receptors

Sensitivity	Description of Criteria
High	Value: The receptor is a protected feature of an internationally or nationally designated site (e.g., SAC, MPA) and the licensable activity is taking place during a sensitive season. Sensitivity: The receptor has low tolerance to change i.e., recovery will take longer than 10 years following the cessation of activity or will not occur.
Medium	Value: The receptor is values or is considered rare, but not protected. Sensitivity: The receptor has intermediate tolerance to change i.e., recovery to pre-impact conditions is possible between 5 and 10 years.
Low	Value: The receptor is common/widespread, with no specific conservation value.

Sensitivity	Description of Criteria
	Sensitivity: The receptor has high tolerance to change with recovery to pre-impact conditions between 1 and 5 years.
Negligible	Value: The receptor is common or widespread. Sensitivity: The receptor is tolerant to change with no effect on its character. Recovery expected to be relatively rapid, i.e., less than approximately six months following cessation of activity.

Table 8-13: Criteria for characterising the magnitude of an impact

Magnitude	Definition
High	Impacts last >15 years on a regional or population/habitat level or are a major alteration to key elements/features of the baseline condition such that post-impact baseline character will be fundamentally changed. Natural recruitment will not return the population/habitat to the baseline condition.
Medium	Impacts are of medium term (7-15 years) duration on a local level (wider than project footprint) or alter an element of the baseline conditions such as that post-impact the damage to the baseline is above that experienced under natural conditions but with no permanent effect on integrity.
Low	Impacts are temporary (<1 year) or short term (1-7 years) in duration on a site specific level. Impacts limited to discrete areas within the Project footprint. Negligible contribution to cumulative effects.
Negligible	Very little or no detectable change from baseline conditions, for any length of time. Disturbance is within the range of natural variability or is such a localised impact that the alteration to the key characteristics and features of the particular receptor does not affect ecological function. Negligible contribution to cumulative effects.

Table 8-14: Significance matrix

		Sensitivity			
		High	**Medium**	**Low**	**Negligible**
Adverse magnitude	**High**	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Minor
	Low	Moderate	Minor	Minor	Negligible
	Negligible	Minor	Minor	Negligible	Negligible
Beneficial magnitude	**Negligible**	Minor	Minor	Negligible	Negligible
	Low	Moderate	Minor	Negligible	Negligible
	Medium	Major	Moderate	Minor	Negligible
	High	Major	Major	Moderate	Minor

8.8.1. Temporary Habitat Loss/Seabed Disturbance – All Phases

Two of the pressures established by the FeAST (NatureScot, 2025) have been considered under this overarching category, namely: abrasion/penetration of the substrate on the surface of the seabed and penetration and/or disturbance of the substratum below the surface of the seabed including abrasion.

Aspects of the Proposed Development that physically disturb the seabed e.g., seabed preparation (including unexploded ordnance (UXO) identification and pre-sweeping of sandwaves), cable burial, cable repair, and eventual cable removal, have the potential to disturb subtidal habitats and species and cause temporary habitat loss. Typically, the extent of this disturbance would be a maximum of 30 m wide along the entire Proposed Development, although noting for the most part not all of this area would be disturbed. Beyond this footprint, low intensity physical disturbance may also occur from vessel anchoring or UXO identification. The worst-case installation footprint for temporary habitat loss is presented below:

- Construction: approximately 4.35 km^2
- Operation: to be determined if maintenance is required
- Decommissioning: equal to the total footprint of construction

Most activities that penetrate the seabed would present a temporary impact i.e., would only be undertaken for a short period and the seabed would be able to recover after the activity. Some activities would occur in the same footprint and would be separated by several months e.g., seabed clearance followed by trenching. Abrasion and penetration of the substrate could result in the localised loss of damage to sediment habitats but does not directly remove habitats. However, a change in the habitat, even temporarily, could lead to an impact on species biodiversity and abundance within the area.

Species most at risk are those that live in the upper layers of sediment, those that live on the seabed with limited mobility (e.g., crab, and lobster, and hibernating sandeel) or those which lay their eggs on the seabed (demersal spawners) e.g., herring. The Proposed Development crosses a number of 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.

Most activities that penetrate the seabed would present a temporary impact i.e., would only be undertaken once, and the seabed would be able to recover after the activity. Some activities would occur in the same footprint and would be separated by several months e.g., seabed preparation followed by trenching.

The following section has been sub-divided to consider each receptor, providing an assessment that provides justification for the assigned receptor values/sensitivities and the magnitude of the impact. A summary of the assessment conclusions is provided in **Table 8-15** for ease of reference. Where receptors share a common sensitivity/value, magnitude and significance of effect they have been grouped together.

Table 8-15: Summary of assessment conclusions for temporary habitat loss and seabed disturbance

Receptor	Sensitivity/Value	Magnitude	Significance of Effect
Herring	Medium	Low	Minor
Sandeel	Medium	Low	Minor
Shellfish	Medium	Low	Minor

8.8.1.1. Herring

This receptor has been identified as having a value and **sensitivity** of **medium** because of the fragility and importance of successful egg hatching and recruitment. If spawning is interrupted or herring eggs are damaged this could lead to a decrease in recruitment for the year, leading to decreased fish stocks and lack of prey availability for the species preying upon Atlantic herring. If construction, maintenance or decommissioning works take place during a sensitive season e.g. August to October, this may affect eggs within a highly localised area. However, it should be noted that herring behaviour shows a lack of site fidelity in terms of annual return to spawning locations. They are of national conservation importance, are of commercial importance **(Table 8-3)** and ecologically important as a prey species.

The majority of the Study Area exists over low intensity herring nursery grounds (Ellis *et al*. 2012) and spawning ground (Coull *et al*. 1998); (**Figure 8-2 (Drawing reference C01494-EGL3-MEA-FISH-006-D)**). High intensity nursery ground does exist, though is prevalent in inshore waters **(Figure 8-2 (Drawing reference C01494-EGL3-MEA-FISH-006-D)).** The spatial extent of temporary habitat loss/seabed disturbance to herring grounds has been assessed as low, given the availability of alternative available habitat surrounding the Study Area, and the wider North Sea. Further, the RLB covers 23.44 km^2 of low intensity herring nursery ground. The construction works are not of a continuous nature (e.g. compared to maintenance marine aggregate extraction which causes continuous seabed disturbance). The **magnitude** of the impact has been assessed as **low** because any seabed disturbance would be of temporary duration and highly localised.

The **significance** of the effect has been assessed as **Minor** and **Not Significant** during all phases of the Proposed Development.

8.8.1.2. Sandeel

This receptor has been identified as having a value and **sensitivity** of **medium** because of its strong habitat preferences and ecology. Sandeel bury themselves in sediments and hibernate within the sediment during winter months. Significant seabed disturbance during the period November to February in areas of 'Prime' sandeel habitat (only one 'Prime' habitat station was recorded (see **Section 8.5.3**) has the potential to be detrimental to population numbers. In addition, they are of national conservation importance and are ecologically important as a prey species. Before the 2024 banning of targeting/landing sandeel, they were also commercially valuable.

The spawning grounds that the Proposed Development would cross are considered 'low intensity' spawning grounds by Ellis *et al.*, (2012) (**Figure 8-5 (Drawing reference C01494-EGL3-MEA-FISH-009-D)**), of which the RLB 42.54 km^2, and 99.76 km^2 of low intensity sandeel nursery grounds.

The spatial extent of temporary habitat loss/seabed disturbance to sandeel grounds is considered low, given the availability of alternative available habitat surrounding the Study Area, and the wider North Sea. The works are not of a continuous nature (e.g. compared to marine aggregate extraction which causes continuous seabed disturbance). The **magnitude** of the impact has been assessed as **low** because any seabed disturbance would be of temporary duration and highly localised. Recovery would be expected over the short to medium term (one to five years) with individuals recolonising suitable substrates following completion of cable installation.

The **significance** of the effect has been assessed as **Minor** and **Not Significant** during all phases of the Proposed Development.

8.8.1.3. Shellfish

There is potential for shellfish to be affected by temporary habitat loss/seabed disturbance during construction. Within the Study Area, crab and scallop are the most abundantly landed, commercially targeted species (697.9 t of crab and 653.3 t of scallop landed in 2023 from the area; **Table 8-4**.

Those shellfish identified in **Table 8-4** can disperse over short distances; this is also the case for nephrops, provided they have muddy habitat available for burrowing. At all life stages, shellfish are considered to have a **medium sensitivity** to physical damage due to limited dispersal.

The **magnitude** of the impact has been assessed as **low** due to the temporary nature of activities, the small, localised footprint of disturbance, the fact that the seabed would not be altered and species would be able to use it again after disturbance, and once the cables are installed the seabed would not be routinely disturbed.

The **significance** of the effect has been assessed as **Minor** and **Not Significant** during all phases of the Proposed Development.

8.8.2. Permanent Habitat Loss – Construction and Operation

Permanent habitat loss arises from the permanent change of one marine habitat type to another marine habitat type through the change in substratum including to artificial material (e.g., concrete). Associated activities include the installation of cables within the seabed (and eventual decommissioning if they remain in-situ) and the deposition of external cable protection. Introduction of hard substrate into a habitat via marine cables and external cable protection would replace other natural substrates, leading to permanent loss of these habitats and associated species. External cable protection would be used in the construction of infrastructure crossings and for burial remediation where full cable burial into sediment has not been achieved. Whilst most external cable protection would be installed during construction, it would also be required during the operation phase, either for the maintenance of infrastructure crossings or for remedial burial e.g., associated with a cable repair, or if the cables become exposed. The worst-case installation footprint for permanent habitat loss is presented below:

- Construction: approximately 0.135 km^2
- Operation: to be determined if maintenance is required

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 would 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.

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.

This impact relates to the permanent change of one marine habitat type to another marine habitat type, through the change in substratum, including to artificial material (e.g., concrete). This involves the permanent loss of one marine habitat type but the creation of another. Associated activities include the installation of cables within the seabed (and eventual decommissioning if they remain in-situ) and the deposition of external cable protection. External cable protection would be used in the construction of infrastructure crossings and for burial remediation where full cable burial into sediment has not been achieved. Whilst most external cable protection would be installed during construction, it would also be required during the operation phase, either for the maintenance of infrastructure crossings or for remedial burial e.g., associated with a cable repair, or if the cables become exposed.

As migratory fish are only transient within the RLB, they do not have functional associations with seabed types; therefore, this receptor group has not been considered further. Similarly, whilst demersal species high and low intensity nursery and/or spawning grounds are present throughout the Study Area, most are highly mobile, with capabilities to avoid any disturbance and utilise nearby available habitats, with grounds stretching over large areas of the North Sea; therefore, this receptor group has not been considered further.

This section therefore focuses on more vulnerable species groups such as shellfish and fish with demersal life stages that have specific habitat preferences.

Research has shown that some fish and shellfish species utilise rocky areas for shelter when guarding eggs/nests, and for protection from predators (Barrett *et al.*, 2014). The Proposed Development is primarily gravelly sand, though permanent habitat loss due to external cable protection could be beneficial for some fish. Some species such as small fishes from the gobiidae and bleniidae families, may utilise the hard structures for shelter/protection; or larger fishes may utilise any increased prey availability on/near to the hard structures.

However, those fish associated with gravelly/sandy seabed would experience a loss of habitat. Fish species which are considered sensitive to permanent habitat loss also include sandeel and herring, due to their habitat requirements for spawning. Sandeel utilise sandy sediments and herring utilise gravelly sediments. As sandeel also bury, habitats need to allow for this behaviour.

The following section has been sub-divided to consider each receptor, providing an assessment that provides justification for the assigned receptor values/sensitivities and the magnitude of the impact. A summary of the assessment conclusions is provided in **Table 8-16** for ease of reference. Where receptors share a common sensitivity/value, magnitude and significant of effect they have been grouped together.

Table 8-16: Summary of assessment conclusions for permanent habitat loss

Receptor	Sensitivity/Value	Magnitude	Significance of Effect
Herring	Medium	Low	Minor
Sandeel	Medium	Low	Minor
Shellfish	Medium	Low	Minor

8.8.2.1. Herring

The **sensitivity** of herring to the impact has been assessed as **medium**. Herring have specific habitat specialism and a change in habitat in a preferred spawning ground could be detrimental to stock recruitment. In addition, they are of national conservation importance, are of commercial importance and ecologically important as a prey species.

Whilst it is possible that external cable protection, especially rock berm, has the potential to provide functional habitat for spawning activities, this cannot be guaranteed. However, the **magnitude** of the impact has been assessed as **low** because the spatial extent of permanent habitat loss is currently (0.11 km^2) across all cable protection in Scotland. For herring grounds this is extremely localised, given the availability of alternative available habitat surrounding the Proposed Development, and within the wider North Sea. Localised changes would not have a significant effect on overall herring abundance.

The **significance** of the effect has been assessed as **Minor** and **Not Significant** during construction and operation of the Proposed Development.

8.8.2.2. Sandeel

The **sensitivity** of sandeel to this impact is **medium** because the species is associated with habitat types where they can bury. A change to a hard substrate limits these opportunities. In addition, they are of national conservation importance, are of commercial importance (albeit now, their fishery is subjected to a landing ban) and ecologically important as a prey species.

The **magnitude** of the impact has been assessed as **low** because the spatial extent of permanent habitat loss for all cable protection was 0.11 km^2 and for sandeel grounds this is extremely localised, given the availability of alternative available habitat surrounding the RLB, and within the wider North Sea. The localised change in habitat would not alter overall sandeel abundance.

The **significance** of the effect has been assessed as **Minor** and **Not Significant** during construction and operation of the Proposed Development.

8.8.2.3. Shellfish

This receptor is identified as having a value and **sensitivity** of **medium** because of its commercial and/or conservation importance. In addition, some shellfish species, such as edible crab and scallop, are moderately sensitive to habitat loss, as these species tend to be associated with habitat types in which they can partially bury. A change to a hard substrate would limit these opportunities. Although it is acknowledged that some species such as crab and lobster may benefit from the addition of artificial hard substrates, providing additional refuge and new potential food sources.

The **magnitude** of the impact has been assessed as **low**. This is due to the small scale of the predicted footprints compared to the wider suitable habitat areas of sand, gravelly sand and slightly gravelly sand habitat seabed within, and outside of the Proposed Development.

The **significance** of the effect has been assessed as **Minor** and **Not Significant** during construction and operation of the Proposed Development.

8.8.3. Temporary Increase and Deposition of Suspended Sediments – All Phases

Temporary increases and deposition of suspended sediments are likely to occur from pre-sweeping. The pre-sweeping of sand waves involves the re-positioning of large quantities of sediment from the cable route to immediately alongside the cable route. 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). Note, that pre-sweeping would only be via a controlled flow excavator (CFE), also known as a mass flow excavator (MFE) and that extent of pre-sweeping would be limited; the final determination of depths and locations would be made post consent and would be informed by the cable burial risk assessment and pre-installation surveys, which can be compared to the marine characterisation survey data to determine seabed mobility.

The maximum design scenario for sand wave pre-sweeping is a maximum volume of 1,000 m^3 (for full parameters, see **Chapter 3: Project Description)**.

Project specific data presented in **Chapter 6: Coastal and Marine Physical Processes** demonstrates that coarse sediment plumes, created from seabed preparation and cable trenching activities, would settle from the water column within the RLB. In most cases this coarse sediment would cause light surface smothering of <5 cm, but at KP 548 smothering from medium sand can cause smothering of up to 9.5 cm and at KP 575 coarse sand can cause smothering of up 17.9 cm. In both instances, this occurs within 100 m of the source of activity. Fine sediment particulate plumes can travel up to 13.6 km from trenching activities and would cause light surface smothering of <1 mm.

Sediment disturbed by construction activities would result in very high sediment concentrations within 5-10 m of the activity, which would last the duration of the activity. The maximum distance from construction activities where suspended sediment concentrations exceed 5 mg/l is 4.6 km at KP 548. Any exceedances of more than 5 mg/l would be of short duration beyond the RLB.

For fish and shellfish species increased turbidity reduces visibility and could cause reduced feeding success or clog gills, whilst an increase in sediment deposition may clog feeding apparatus, or cause mortality in eggs / larvae through smothering or damage/mortality if toxic sediments are disturbed and deposited.

8.8.3.1. Shellfish and fish species with demersal life stages

Shellfish present in the Study Area include lobster, crab (edible, green, velvet and spider), crawfish, king and queen scallop, whelk, squids, and octopuses (**Table 8-3, Table 8-4**). Many crustacean species, including the edible crab are known to be tolerant of, and have low sensitivity to temporary increases and deposition of suspended sediments. Some shellfish could be impacted when hunting for prey; increased turbidity has been shown to increase the time crabs search for prey which would increase their vulnerability to predators. Whilst species such as the edible crab and lobster bury into sediment while berried, both rely on sufficient aeration to their eggs which may be difficult to achieve with increases in deposited suspended sediments.

When not buried, edible lobster, lobster, and king scallops are considered mobile and capable of tolerating a sediment smothering depth of 5 cm (Neal & Wilson, 2008). Further, these species show avoidance when conditions become too inclement, moving away from an impacted area. As such, these receptors are considered to have low sensitivity to temporary increase and deposition of suspended sediments.

Bivalve species such as scallops are adapted to a sedimentary environment and changes in suspended sediment concentrations do not necessarily lead to negative effects. Juvenile and adult scallop could probably lift themselves clear of a new layer of sediment <5 cm and are documented to 'jump' as an escape mechanism (Minchin & Buestel, 1983).

Herring and sandeel are demersal spawners with specific habitat preferences and are regarded as having medium sensitivity to smothering effects from suspended sediment concentrations. Herring larvae and eggs have been identified as very tolerant to high levels of suspended sediment concentrations (as high as 300 mg/l) and can tolerate short term exposure to 500 mg/l. Sandeel deposit eggs on the seabed and can become covered with sand under normal tidal conditions. Studies have shown eggs can develop normally and hatch as soon as the currents uncover them, although there can be a delay to the hatching period.

It is considered that the sensitivity of herring and sandeel represent the worst case. Taking the above literature into consideration, and the commercial importance to the region, the national conservation and ecological importance of species such as herring and sandeel, the **sensitivity** of the receptors has been assessed as **medium**.

Whilst it is acknowledged that the sediment deposition in the pre-sweeping areas would cause mortality of shellfish and species with demersal life stages due to the depth of sediment deposition, the footprint would be very localised, within levels that species can tolerate. The **magnitude** of the impact has been assessed as **low,** given the small spatial scale.

The **significance** of the effect has been assessed as **Minor** and **Not Significant**.

During decommissioning, the level of pre-sweeping required, if at all would be lower or the same in magnitude than required during construction and therefore this preliminary conclusion is also relevant for decommissioning, for which a separate assessment would be carried out when a Marine Licence is sought for decommissioning activities.

8.8.4. Electromagnetic Changes/Barrier to Species Movement - Operation

During the operation of an HVDC cable electromagnetic fields (EMFs) are generated. To inform the assessment, several scenarios were modelled to calculate the EMF emissions. The calculations are presented in **Appendix 3A: Electric and Magnetic Field Assessment.** They show that for bundled HVDC poles the magnetic field dissipates to below background geomagnetic levels within 20 m when cables are buried at 1 m below the seabed. The magnetic field directly above the cables at the seabed is 122.8μT (or 75.4 μT without the earth's magnetic field).

8.8.4.1. Shellfish and fish species with demersal life stages

Sensitivity to EMF is species dependent. Any impacts would mostly affect those species on the seabed, such as flatfish and shellfish species rather than pelagic species or demersal species which tend to swim a few meters above the seabed, and which would be out of the range of EMF emissions (Gill, 2012). There is very limited information about the sensitivity of species with demersal life stages to EMF, but there have been a small number of investigations in laboratory experiments and field observations.

Flatfishes like plaice can use magnetic fields as navigational cues (Lacy-Hulbert *et al*., 1998) though their sensitivities to EMFs are not documented. Surveys which investigated the effect of an offshore windfarm in the Baltic Sea, concluded that EMF was unlikely to alter cod behaviour, as cod were observed near the cable during both active and inactive transmissions, over several years (Bergström *et al*., 2013).

Research on edible crab and lobster responses to EMFs have found effects only at strengths well beyond those modelled for the Proposed Development; at 250 μT, edible crab were found to have a behavioural response, and at 2,800 μT, effects were noticed on crab and lobster embryonic development, with significant differences in egg volume and consequently, decreased carapace length, total length, and maximum eye diameter in the larvae of both species (Harsanyi *et al*., 2022).

Documented scallop responses to EMFs appear scarce, though Twist *et al* (2016) examined the movement of the endemic scallop (*Pecten novaezealandiae*) which, given its same genus, could be considered a proxy species for king scallop. This research (Twist *et al.,* (2016) found endemic scallop to move 1.82 m per month on average. As such, scallop can be assumed capable of moving away from a distress source such as EMFs from a cable.

The effects of EMFs on whelks are not conclusive due to the lack of research. However, the first study of EMFs on another small gastropod, the common periwinkle (*Littorina littorea*), found no significant difference in behavioural or physiological responses when in a control environment (baseline 60 μT) compared to an experimental environment (500 μT); (Chapman *et al*.,2023).

Based on the discussions above, the **sensitivity** of shellfish and fish species with a demersal life stage has been assessed as **low**.

The **magnitude** of the impact of EMF changes and barriers to movement has been assessed to be **negligible**, as the EMFs emitted from the bundled cables would only cause a localised insignificant increase in the background magnetic field which is not of ecological importance for these species.

The **significance** of the effect has been assessed as **Negligible** and **Not Significant** during operation of the Proposed Development.

8.8.4.2. Diadromous species

The Proposed Development is approximately 30 km from the river Dee (at the closest point). This river is used by migratory fish, including Atlantic salmon, sea and river lamprey. Studies on salmonids have shown evidence that EMFs from cables can affect the behaviour of migratory fish; tagged European eel swimming speeds were reduced (Westerberg & Lagenfelt (2008), and swimming trajectories during passage over a cable differed to their normal behaviour. Conversely, another study in the USA found no significant difference to migration success in juvenile salmon in response to a HVDC cable (Wyman *et al*., 2018) though some specimens were intrigued by the cable, and some took a longer route to cross the cable. Regardless, the impacts of EMFs on salmon in this were deemed to be neither adverse nor beneficial.

Long-term exposure studies of fish to EMFs have found greater water permeability in salmon eggs than at control sites, though embryonic development and survival were not hindered (Sadowski *et al.,* 2007) and further, this water permeability was observed at an EMF strength of 2,000 μT. It should be noted that Salmon spawn in rivers and Salmon eggs would not be present within the Proposed Development.

Research suggests that despite diadromous species being considered EMF sensitive, they would not be sensitive to the highly localised, low-level change in geomagnetic fields associated with the operational cables. Species mentioned above have been shown to spend most of their time in the top 10 m of the water column, rather than on the seabed where the EMF changes would be more noticeable. The sensitivity of the species is therefore assessed as **negligible.**

The **magnitude** of the impact of EMF changes and barriers to movement has been assessed to be **negligible**, as the EMFs emitted from the bundled cables would only cause a localised insignificant increase in the background magnetic field which would not affect the behaviour of these species.

The **significance** of the effect has been assessed as **Negligible** and **Not Significant** during operation of the Proposed Development.

8.8.4.3. Elasmobranchs

The Proposed Development passes through areas of suitable habitat for a range of elasmobranchs including common skate, tope shark, spurdog, and spotted ray **(Figure 8-4 (Drawing reference C01494-EGL3-MEA-FISH-008-D), Figure 8-5 (Drawing reference C01494-EGL3-MEA-FISH-009-D)**). Whilst research on the impacts of EMFs on these species are limited, in general, elasmobranchs can detect and respond to EMFs due to their electrosensory systems which are used for hunting and navigation (Hutchison *et al*., 2018).

When exposed to EMFs generated by cables, little skate (*Leucoraja erinacea*), an American ray which is similar to UK rays, travelled 20% to 90% further than those in control enclosures. They swam at lower average speeds, made more frequent turns, and spent more time near the seabed. This behaviour was considered exploratory, indicating that the cable did not act as a barrier to their movement (Hutchison *et al.,* 2018), and rather, the species was intrigued by the introduced EMFs. Since, studies have observed similar responses, with little skate travelling longer distances at slower speeds when exposed to EMF levels of 65.3 μT. Avoidance and/or repulsion from EMFs has been demonstrated among elasmobranchs, though the behaviour is species-specific. For example, spurdog have been documented to avoid direct current electric field at emission intensities at 10 μV/cm (Gill and Taylor, 2001) though it is acknowledged that 10 μV/cm is higher than typical offshore cable levels. Spurdog were, however, noted to be attracted to DC emissions at emission levels like their prey.

Both lesser spotted dogfish and thornback ray have exhibited increased searching effort to find prey around operational subsea cables (Gill *et al.,* 2009), though this behaviour did not always occur, and subsequently, from the study of Gill *et al*. (2009), the Scottish Government (2022) has concluded there being neither a positive nor negative effect on elasmobranchs as a result of EMF encounter. Further, research on dogfish responses to EMF emissions (Kimber *et al.,* 2011) found that the species could potentially confuse EMF emissions from subsea cables with those naturally produced from their prey.

In an Australian study, embryonic bamboo shark (*Chiloscyllium punctatum*), which have a similar life-history to dogfish, showed avoidance behaviour when electric fields were similar to their predators (0-20 Hz), by a 'freeze response', whereby they stop their respiratory gill movements (and as such, reduce their own electrosensory output to minimise detection from predators) whilst inside their egg cases (Kempster et al., 2013). As bamboo shark share the same family as dogfish (Scyliorhidae), it is plausible that behaviour may be similar.

The **sensitivity** of elasmobranchs to EMF changes has been assessed as **medium,** due to the above information.

The **magnitude** of the impact of EMF changes and barriers to movement has been assessed to be **negligible**, as the EMFs emitted from the bundled cables would only cause a localised insignificant increase in the background magnetic field which is below the levels which cause behavioural changes in elasmobranchs.

The **significance** of the effect has been assessed as **Minor** and **Not Significant** during operation of the Proposed Development.

8.8.5. Temperature Increase - Operation

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 change between seabed surface and 0.2 m depth is used as a guideline in Germany. The benchmark for sensitivity used by MarESA is a 5 °C increase in temperature for one month, or 2 °C for one year.

Species that could be particularly affected by this impact are species that bury themselves in the top layer of sediment e.g., such as shellfish like nephrops and crab. A review of information on the Marine Life Information Network for shellfish species in the Study Area identified that adult crab are not tolerant of temperatures over 20 °C, whilst spiny lobster (proxy for European lobster) has a high sensitivity to temperature changes with egg loss positively correlated to an increase in temperature and mortality observed at temperatures above 24 °C. Nephrops are known to inhabit cohesive muddy sediments, where they create an extensive yet shallow network of unlined branching burrows (Atkinson, 1974). These burrow systems typically extend to a depth of approximately 20 cm. However, bottom temperatures within their inhabited distribution ranges from 7 – 15 °C, although the maximum and minimum temperatures limiting nephrops are not known.

Sandeel and herring lay their eggs on top of the seabed. Juvenile and adult sandeel burrow into the sediment, however this is also in the surface sediments, as they must not go beyond the oxic layer to survive (Holland *et al* 2005).

Overall, the receptor shellfish and species with a demersal life stage has been assessed as having a **sensitivity** of **medium** to thermal emissions. This is partly precautionary due to the limited information on physiology and how species respond to the changes in temperature, but also due to the commercial and ecological importance of the identified sensitive species in the Study Area.

Assuming an ambient seabed temperature of 12 °C, seabed temperatures at 0.2 m immediately above the cables are estimated to be 13 - 14 °C, with the cables operating at maximum operating temperatures. The actual system is unlikely to reach these temperatures as the system would have to operate at full load continuously for an extended period (months/years) to meet these temperatures. The system would not be at full load for this long and therefore the temperature would fluctuate and be unlikely to reach these maximums. Although thermal effects would be long-term and occurring continuously for the operational lifetime of the Proposed Development, the temperature increase is low level and likely to be only a few degrees higher than ambient at the shallow sediment depths (<20 cm) at which shellfish and sandeel bury themselves. Where the cables are buried at a shallower depth, or surface laid with external cable protection, there is the potential for fauna to be exposed to higher temperature gradients. However, there is negligible capacity to heat the overlying water, meaning there will be no effects on demersal species.

Due to natural seasonal changes in water temperature, a sediment temperature change of a few degrees higher than ambient is regarded as an insignificant temperature increase. Coupled with the fact that temperature changes would be isolated to immediately above the cables, the **magnitude** of the impact on shellfish and fish species with demersal life stages has been assessed as **low**.

The **significance** of the effect has been assessed as **Minor** and **Not Significant** during operation of the Proposed Development.

8.9. Project Specific Mitigation Measures

The appraisal of the effects of the Proposed Development on fish and shellfish receptors identified effects not exceeding 'minor' significance for the construction, operation and maintenance and decommissioning phases. These effects can be adequately controlled from the design and control measures embedded into the Proposed Development. No additional mitigation is proposed.

8.10. Residual Effects

The appraisal of the effects of the Proposed Development on fish and shellfish receptors identified effects not exceeding 'minor' significance for the construction, operation and maintenance and decommissioning phases. No residual effects are predicted.

8.11. Cumulative Effects

If the construction or decommissioning of other plans and projects have a temporal overlap with the construction of the Proposed Development, there is potential for cumulative adverse effects on fish and shellfish greater than that caused solely by the Proposed Development. As outlined by **Chapter 4: Marine Environmental Appraisal Scope and Methodology**, a four-stage approach has been undertaken to assess the cumulative adverse effects from other plans and projects in-combination with the construction of the Proposed Development.

8.11.1. Stage 1: Identification of ZoI

Chapter 8: Marine Physical Processes concluded that the furthest distance that suspended sediment would be deposited from the Proposed Development is 13.6 km, dependent on peak flow speed. All sedimentation outside the RLB would be from fine particulates that would settle in 1 mm (at 6.5 km from the plume source) or less thicknesses, which is indistinguishable from background levels. Additionally, Sinclair *et al*. (2023) reported that 90 % of sediments suspended during cable laying activities are predicted to resettle within 1 km of the RLB and Gooding *et al*. (2012) suggests that fine particles may travel 1-2 km from the source. Therefore, the ZoI for the cumulative effects assessment for fish and shellfish is 2 km. Any sedimentation outside of this 2 km ZoI as a result of the Proposed Development would not cause significant cumulative adverse effects on fish and shellfish receptors. All plans and projects within the ZoI are assessed in-combination with the Proposed Development to determine if there will be any significant cumulative adverse effects to fish and shellfish (**Section 8.11.4**).

8.11.2. Stage 2: Shortlist of Plans and Projects Relevant to Fish and Shellfish

Chapter 4: Marine Environmental Appraisal Scope and Methodology outlines a longlist of plans and projects within 30 km of the Proposed Development. From this longlist, three plans/projects within 2 km of the Proposed Development have been shortlisted to inform the cumulative effects assessment for fish and shellfish **(**

Table 8-17**).** Infrastructure within this ZoI that is already operational has been scoped out, since the effects of the maintenance of operational projects has influenced the baseline assessment.

Table 8-17: Shortlist of projects

Application Reference	Plan or project	Type of project	Distance from Proposed Development	Status
00010344	Morven Offshore Wind Farm (OWF)	OWF	1.98 km	Pre Application - Scoping Report
06771 & 06870	NorthConnect	Cable	0 km / crosses	Licence expired
SCOP-0020	MarramWind OWF	Export cable	0 km/crosses	Pre Application – Scoping Report
00011091	Cenos Floating OWF – transmission infrastructure	Export cable	0 km/crosses	Application – EIA Submitted
SCOP-0066	Aspen Floating OWF – transmission infrastructure	Export cable	0 km/crosses	Pre-application – Scoping Report
00009943	Eastern Green Link 2 (EGL 2)	Cable	0 km / crosses	Licence granted

8.11.3. Stage 3: Information Gathering and Identification of Pressure-Receptor Pathways

Construction of the Proposed Development is scheduled to commence in 2028 with the latest possible completion by 2033. Within this window, construction (including pre-lay activity) is expected to take 55 months. Morven OWF is situated approximately 1.98 km from the Proposed Development and is due to commence construction in 2027, with commercial operation scheduled to begin in 2030 (Power Technology, 2024). Thus, there would be a direct temporal overlap in construction between the two projects. The construction of EGL 2 is currently underway, with cable operation scheduled for 2029 (Eastern Green Link 2, 2025). Additionally, EGL 2 and the Proposed Development share the same landfall at Sandford Bay, Peterhead. Therefore, it is expected that there would be a temporal overlap in construction with the Proposed Development for one year. The Marine Licence for EGL 2 has been granted and can be viewed using the marine.gov.scot website (Application Reference number: 00009943/00011033).

Northconnect is planned to cross the Proposed Development at approximately KP 576. However, construction of Northconnect has been placed on hold by the Norwegian Government, and the current Marine Licence for this project has expired (expiration date 2024) (Northconnect, 2025). It is understood that the Cenos OWF has taken on the planned cable route from NorthConnect and a new licence application has been submitted. NorthConnect is therefore not considered further, however Cenos OWF is detailed further below and taken forward for assessment.

MarramWind OWF is currently in pre-application, having submitted the Scoping Report in January 2023 (application reference number: SCOP-0020) (Scottish Government, 2023). Construction is scheduled to begin in the late 2020s, following planning decisions in 2026, and MarramWind OWF is scheduled to be operational in the 2030s. Therefore, there may be a direct temporal overlap in construction between the two projects. The scoping boundary of MarramWind OWF overlaps with the RLB of the Proposed Development at Peterhead nearshore. However, due to the application stage of MarramWind OWF, there is no EIA available for this project and its project-alone impact to fish and shellfish receptors is unknown. Therefore, MarramWind OWF cannot be assessed in-combination with the Proposed Development and will not be taken forward to stage 4 of the cumulative effects assessment.

As Morven OWF is situated outside of the RLB of the Proposed Development, simultaneous construction or sequential construction in quick succession of the two projects has the potential for cumulative adverse effects from temporary increase and deposition of suspended sediments from associated construction activities. EGL 2 overlaps the RLB of the Proposed Development at the proposed landfall, Sandford Bay and Peterhead nearshore. Thus, simultaneous construction or sequential construction in quick succession of the two projects has the potential for adverse cumulative effects from: temporary habitat loss from cable construction activities in the nearshore; temporary increase and deposition of suspended sediments from HDD at the landfall and cable construction activities in the nearshore; temperature increase and EMF changes from adjacent HVDC cables within Peterhead nearshore.

Cenos Floating OWF's transmission crosses the Proposed Development. It is currently in its permitting phase (EIA reports have been submitted) and it is anticipated to begin construction from 2030, with operation in 2031. As such, there may be a direct temporal overlap in construction between the two projects.

Aspen Floating OWF's transmission crosses the Proposed Development and is currently in its pre-application phase. It is anticipated that construction may begin in 2028, with operation in 2029/2030. As such, there may be a direct temporal overlap in construction between the two projects.

8.11.4. Stage 4: Assessment

8.11.4.1. Temporary habitat loss/seabed disturbance

Cenos Floating OWF is to be operational for 35 years, with 500 m safety zones around infrastructure during periods of major maintenance. The transmission infrastructure will consist of either one offshore substation and converter platform (OSCP) fully integrated to provide HVDC power transmission and HVAC power distribution, or two OSCPs to provide HVDC power transmission and HVAC power distribution. The latter scenario would include two OSCP jackets positioned adjacently at the same location, with a 50 m minimum spacing between jackets. There is no anticipated interaction between the OWF infrastructure and the Proposed Development as the latter is anticipated to interact and cross the export cable only. Cable burial depth is anticipated to be 0.4 m minimum (target of 1 m), with a maximum depth of 1.5 m. During operation, this impact was assessed as having a negligible significance, which is not significant.

EGL 2 overlaps with the Proposed Development at the proposed landfall, Sandford Bay and Peterhead nearshore (KP 582 – KP 579), within broadscale habitats Atlantic infralittoral rock, Atlantic infralittoral coarse sediment and Atlantic circalittoral rock. Both projects are committed to using HDD at the landfall, thus cumulative effects of temporary habitat loss/seabed disturbance to Atlantic infralittoral rock habitats will not occur.

As outlined in Chapter 2: Project Description of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022a), the maximum width of temporary seabed disturbance from cable trenching is 25 m for EGL 2. Thus, it is assumed the worst-case cumulative effect of temporary seabed disturbance will be approximately double that from the Proposed Development. Although both project cables will occur within the same broadscale habitat, these cables will run adjacent to one another and not overlap. Furthermore, each project cable will be buried within its own trench. Therefore, the same patch of broadscale habitat will not be disturbed by both projects. **Section 8.8.1** of this MEAp concludes that there are no significant adverse effects of temporary habitat loss/seabed disturbance on fish and shellfish as a result of the Proposed Development. Chapter 9: Fish and Shellfish Ecology of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022) concluded 'not significant' effects for all marine fish and shellfish receptors, given the temporary, short-term and spatially limited extent of works.

Consequently, the cumulative effect of temporary habitat loss/seabed disturbance is predicted to be of low magnitude. Combined within the medium sensitivity of herring, sandeel, and shellfish receptors, the cumulative effect has been assessed as **Minor** and **Not Significant**.

8.11.4.2. Permanent habitat loss – EGL 2

Cenos Floating OWF's parameters are detailed in Section **8.11.4.1** and are assessed as not significant**.**

As outlined in Chapter 2: Project Description of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022), the footprints of rock protection across the proposed submarine cable corridor include planned/remedial rock berms. Thus, it is assumed the worst-case cumulative effect of temporary seabed disturbance will be approximately double that from the Proposed Development. Although both project cables will occur within the same area, these cables will run adjacent to one another and not overlap. Furthermore, each project cable will be buried within its own trench. **Section 8.8.1** of this MEAp concludes that there are no significant adverse effects of permanent habitat loss on fish and shellfish as a result of the Proposed Development. Chapter 9: Fish and Shellfish Ecology of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022) concluded 'not significant' effects for all marine fish and shellfish receptors, given the small extent and scale of the impact, along with wide availability of suitable habitats for marine fish receptors in the central North Sea.

Consequently, the cumulative effect of permanent habitat loss is predicted to be of low magnitude. Combined within the medium sensitivity of herring, sandeel, and shellfish receptors, the cumulative effect is predicted to be **Minor**, which is **Not Significant**.

8.11.4.3. Temporary increase and deposition of suspended sediment

Cenos Floating OWF's parameters are detailed in Section **8.11.4.1** and are assessed as not significant**.**

For EGL 2, as outlined in Chapter 2: Project Description of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022), the distance travelled by suspended coarse sand typical of the majority of the sediments affected, is expected to be approximately 247 m (before deposition from Installation Phase activities). Fine sands, silts and clay may be transported beyond the proposed submarine corridor with any fine sand settling on the seabed up to 1.5 km from the point where it is mobilised. It is calculated that there would be no significant elevated concentration levels beyond the dispersal range calculated for fine sand which corresponds to a maximum 1.5 km from the point of mobilisation within the proposed submarine cable corridor. Consequently, any impact from suspended sediment concentration (SSC) is expected to be small and highly localised. Based on these calculations, any measurable change in suspended sediment concentrations would be mostly within the bottom 5 m of the water column and finer fractions that are transported further would also be rapidly diluted, so that the SSC would be low and the deposition thickness on the seabed, where the sediment would settle, would be trivial. Although project cables would occur within the same area, these cables would run adjacent to one another and not overlap. Furthermore, each project cable would be buried within its own trench.

Section 8.8.1 of this MEAp concludes that there are no significant adverse effects of temporary increase and deposition of suspended sediment on fish and shellfish as a result of the Proposed Development. Chapter 9: Fish and Shellfish Ecology of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022) concluded 'not significant' effects for all marine fish and shellfish receptors, given the short-term nature of any increase in SSC occurring during cable installation.

Morven OWF is currently at its scoping stage, as such no environmental impact assessment information available at this time. It is assumed Morven would not have a significant impact on fish and shellfish, and that the predicted 1 mm of smothering from the Proposed Development would not significantly change any impact in combination with Morven.

Consequently, the cumulative effect of temporary increase and deposition of suspended sediment is predicted to be of low magnitude. Combined within the medium sensitivity of shellfish and fish with demersal life stages, the cumulative effect from Cenos Floating OWF, EGL 2 and Morven OWF has been assessed as Minor and **Not Significant**. As Morven OWF is at an earlier development stage than the Proposed Development it would need to complete a cumulative impact assessment and include the Proposed Development within its EIA.

8.11.4.4. Electromagnetic changes

Cenos Floating OWF's parameters are detailed in Section **8.11.4.1** and are assessed as not significant**.**

For EGL 2, as outlined in Chapter 2: Project Description of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022), EMF modelling has predicted that for the separated cables, the magnetic field resulted in a combined field strength of 404 μT at the seabed, reducing to marginally above the background level 20 m from the cables. The bundled cables had significantly lower magnetic fields due to cancellation of the magnetic fields between poles. EMF from bundled cables reduced to the background geomagnetic field strength by around 5 m to 10 m from the cable, as such having only a very localised effect. Although both project cables would occur within the same area, these cables would run adjacent to one another and not overlap. Furthermore, each project cable would be buried within its own trench and at a distance greater than 10 m from the cable, background levels of EMF are expected.

Section 8.8.1 of this MEAp concludes that there are no significant adverse effects of electromagnetic changes on shellfish and fish with demersal life stages, elasmobranchs, and diadromous as a result of the Proposed Development. Chapter 9: Fish and Shellfish Ecology of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022) concluded 'not significant' effects for these receptors, due to any responses to EMFs occurring over a very limited area and with effects being temporary and ones which would not interfere with key functional activities of the receptors.

Consequently, the cumulative effect of electromagnetic changes is predicted to be of low magnitude. Combined within the medium sensitivity of shellfish and fish species with demersal life stages, the cumulative effect has been assessed as **Minor** and **Not Significant**.

8.11.4.5. Temperature increase

Cenos Floating OWF's parameters are detailed in Section **8.11.4.1** and are assessed as not significant**.**

For EGL 2, it is intended that the cables would l be buried within the sediment at a minimum depth of 1 m and a maximum depth of 2.25 m. As outlined in Chapter 2: Project Description of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022), heat modelling has predicted that for bundled cables buried at a depth of 1.5 m, the increase in sediment temperature is limited to approximately 3 °C within 50 cm of the seabed surface. This was calculated based upon a maximum seabed ambient surface sediment temperature of 15 °C. Where a cable burial depth of only 0.6 m is achieved, the temperature increase below the seabed surface will be approximately 5°C, though this would not result in a corresponding 5°C increase on the seabed surface, due to the cooling effect of the sea water. For unbundled cables the heat profile of each individual cable at the surface may be lower but the affected area will be around two cables, rather than one.

Although project cables would l occur within the same area, these cables would run adjacent to one another and not overlap. Furthermore, each project cable would be buried within its own trench.

Section 8.8.1 of this MEAp concludes that there are no significant adverse effects of temperature increase on herring and sandeel spawning grounds, and shellfish as a result of the Proposed Development. Chapter 9: Fish and Shellfish Ecology of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022) concluded 'not significant' effects for these receptors, due to temperature increase being minimal in the top layers of the seabed from the buried cable.

Consequently, the cumulative effect of temperature increase is predicted to be of low magnitude. Combined within the medium sensitivity of shellfish and fish species with demersal life stages, the cumulative effect has been assessed as **Minor** and **Not Significant**.

8.11.4.6. Stage 4 assessment conclusion

Cumulative effects have been assessed for temporary habitat loss/seabed disturbance, permanent habitat loss, temporary increase and deposition of suspended sediment, electromagnetic changes, and temperature increase, for projects Morven OWF, NorthConnect, MarramWind OWF, Cenos Floating OWF, Aspen Floating OWF, and Eastern Green Link 2. In all cases, no cumulative effects were predicted.

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