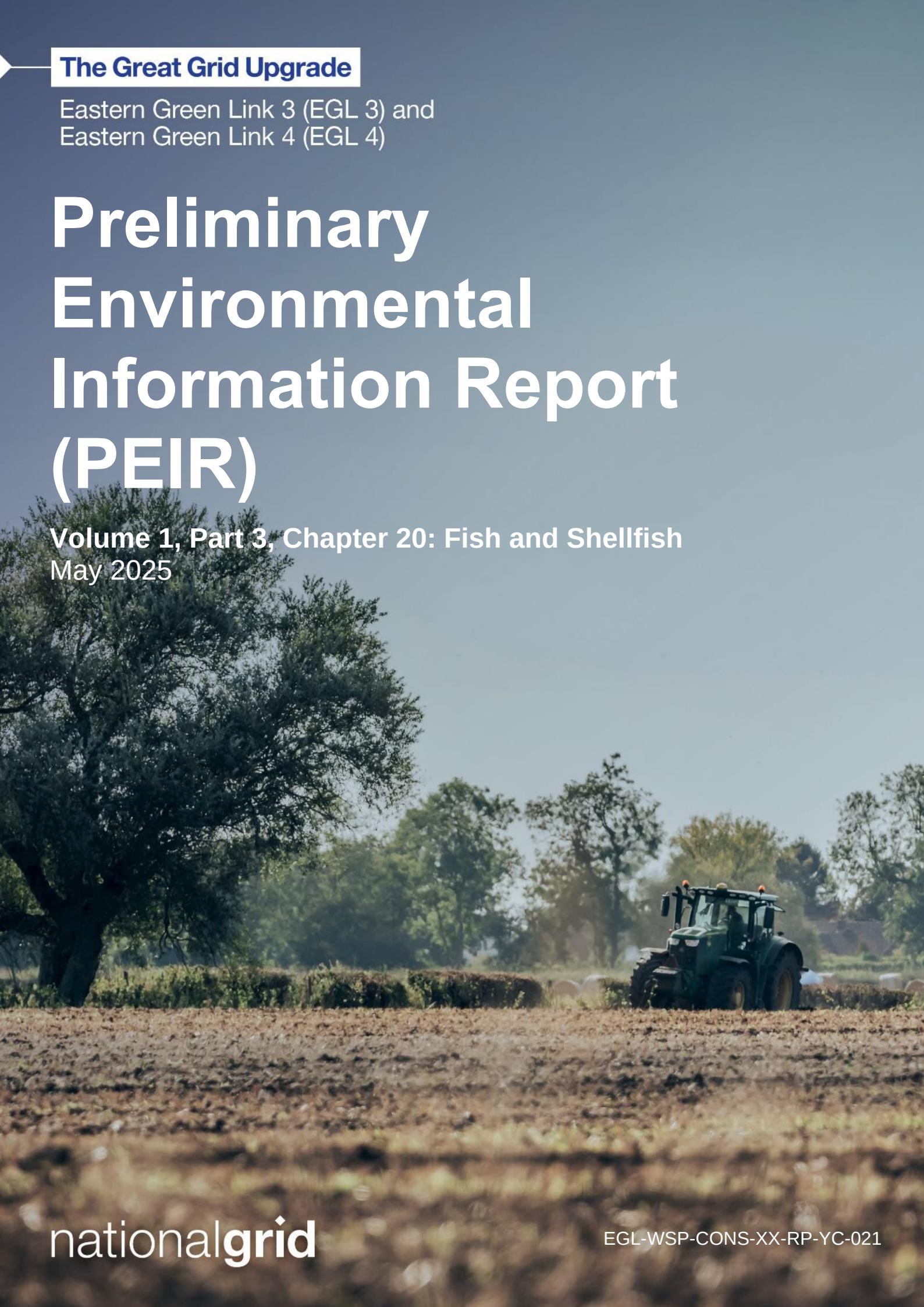
The Great Grid Upgrade

Eastern Green Link 3 (EGL 3) and
Eastern Green Link 4 (EGL 4)

Preliminary Environmental Information Report (PEIR)

Volume 1, Part 3, Chapter 20: Fish and Shellfish

May 2025



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EGL-WSP-CONS-XX-RP-YC-021

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20. Fish and Shellfish

20.1 Introduction

20.1.1 This chapter presents the preliminary findings of the Environmental Impact Assessment (EIA) undertaken to date for the English Offshore Scheme, with respect to Fish and Shellfish, including marine species, diadromous species (species which migrate between freshwater and marine environments), elasmobranchs (sharks, rays and skates), and shellfish (crustaceans and molluscs). The preliminary assessment is based on information obtained to date, March 2025. It should be read in conjunction with the description of the Projects provided in **Volume 1, Part 1, Chapter 4: Project Description.**

20.1.2 This chapter describes the methodology used, the datasets that have informed the preliminary assessment, baseline conditions, environmental measures, and the preliminary Fish and Shellfish effects that could result from the English Offshore Scheme during the construction and operation (and maintenance) phases. Specifically, it relates to the English offshore elements of Eastern Green Link 3 (EGL 3) and Eastern Green Link 4 (EGL 4) (the English Offshore Scheme) seaward of Mean High Water Springs (MHWS) to Scottish waters.

20.1.3 This chapter should be read in conjunction with:

- **Volume 1, Part 2, Chapter 6: Biodiversity** - which identifies the potential impacts on onshore ecology and receptors which might be using the intertidal area;
- **Volume 1, Part 3, Chapter 18: Coastal and Marine Physical Processes** (due to the association with hydrodynamics and sediment transport);
- **Volume 1, Part 3, Chapter 19: Intertidal and Subtidal Benthic Ecology** (due to the close association between fish and shellfish receptors and their habitats);
- **Volume 1, Part 3, Chapter 21: Intertidal and Offshore Ornithology** (due to the close association between fish and shellfish receptors as prey species for marine birds);
- **Volume 1, Part 3, Chapter 22: Marine Mammals and Marine Reptiles** (due to the close association between fish and shellfish receptors as prey species for marine mammals); and
- **Volume 1, Part 3, Chapter 24: Commercial Fisheries** (due to the close association between fish and shellfish species that are commercially caught).

20.1.4 This chapter is supported by the following figures:

- **Volume 3, Part 3, Figure 20-1: Fish and Shellfish Study Area**
- **Volume 3, Part 3, Figure 20-2: Fish nursery and spawning grounds intensity within Study Area (Part 1)**
- **Volume 3, Part 3, Figure 20-3: Fish nursery and spawning grounds intensity within Study Area (Part 2)**

- **Volume 3, Part 3, Figure 20-4: Herring Spawning and Nursery Grounds**
- **Volume 3, Part 3, Figure 20-5: Herring Habitat Classification – England (Part 1)**
- **Volume 3, Part 3, Figure 20-6: Herring Habitat Classification – England (Part 2)**
- **Volume 3, Part 3, Figure 20-7: Sandeel Spawning and Nursery Grounds**
- **Volume 3, Part 3, Figure 20-8: Sandeel Habitat Classification (Part 1)**
- **Volume 3, Part 3, Figure 20-9: Sandeel Habitat Classification (Part 2)**
- **Volume 3, Part 3, Figure 20-10: Relevant Designated Sites for the Protection of Fish and Shellfish**

20.1.5 This chapter is supported by the following appendices:

- **Volume 2, Part 3, Appendix 3.20.A: DATRAS Survey Results**
- **Volume 2, Part 3, Appendix 3.24.B: Fisheries Liaison and Coexistence Plan (FLCP)**
- **Volume 2, Part 1, Appendix 1.4.A: Electromagnetic Field (EMF) Study**
- **Volume 2, Part 1, Appendix 1.4.B: EGL 3 Heat Calculations**
- **Volume 2, Part 1, Appendix 1.4.C: EGL 4 Heat Calculations**
- **EGL 3 and EGL 4 Draft HRA Report (May 2025) (document reference EGL-WSP-CONS-XX-RP-Y-001)**
- **Volume 2, Part 3, Appendix 3.17.A Marine Conservation Zone (MCZ) Assessment Screening**
- **Volume 2, Part 1, Appendix 1.5.C Outline Construction Environmental Management Plan**
- **Volume 2, Part 1, Appendix 1.2.A Regulatory and Planning Context**
- **Volume 2, Part 1, Appendix 1.5.A: Outline Register of Design Measures**

20.1.6 As set out in **Volume 1, Part 1, Chapter 1: Introduction,** cable installation and some associated activities beyond 12 nautical miles (NM) are exempt under the Marine and Coastal Access Act (MCAA) as well as repair of the installed cable. This chapter presents a preliminary assessment of the cable route from MHWS at the Anderby Creek Landfall to the border with Scottish adjacent waters. This is to provide a holistic view of the English Offshore Scheme and any associated impacts. However, consent is not being sought for the exempt cable (either installation or repair) and only cable protection and dredging for sand wave levelling would be included in the Deemed Marine Licence (dML) beyond 12 NM.

Limitations

20.1.7 The information provided in this PEIR is preliminary, the final assessment of potential significant effects will be reported in the Environmental Statement (ES). The PEIR has been produced to fulfil National Grid Electricity Transmission plc's consultation duties, in accordance with Section 42 of the PA2008 and enable consultees to develop an

informed view of the preliminary potential significant effects of the English Offshore Scheme.

20.1.8 This PEI Report has been collated based on a range of publicly available data and information and marine survey data including environmental benthic survey data and eDNA survey data (described further in **Volume 1, Part 3, Chapter 19: Intertidal and Subtidal Benthic Ecology**). It is assumed that the data collated is accurate. The data has been supplemented with additional information acquired as part of the Stakeholder engagement process.

20.1.9 In the absence of data, a precautionary approach has been taken and professional judgement, based on experience of similar linear projects, have been used where required to inform the scope of the assessment.

20.1.10 For many species information regarding spawning and nursery grounds is largely from the data published by Coull et al., (1998, REF 20.[1]), and Ellis et al. (2012, REF 20.2) which remain key data sources for UK waters. It is important to recognise the limitations of these sources in the context of the Projects. For many demersal and pelagic fish species, the underlying data sets provide good coverage of the study area, however for others, such as elasmobranchs, there is limited information about their spawning grounds. It is also noted that more current and regional trends in fish abundance, distribution and behaviours may not be fully represented by the spawning and nursery maps due to the historic and widescale nature of the data sets.

20.1.11 The Marine Management Organisation (MMO) annual catch statistics up to 2023 were the most recent data available at the time of this chapter preparation. There are limitations on this data as smaller vessels do not legally have to share their catch data if the catch is below 30 kg. It also assumes the species are equally spread out within their International Council for the Exploration of the Sea (ICES) reporting rectangle. If newer data is published ahead of the ES, this will be used. It is important to understand that catch statistics focus on the commercial species present, but other species are also found within the study area. Data from ICES biannual bottom trawl surveys, referred to as Datras surveys, and data from the Projects specific marine characterisation surveys have been used to fill this potential data gap.

20.1.12 This chapter was prepared as results from the Projects marine characterisation surveys were being made available. Not all results have been fully incorporated into the baseline description. **Section 20.17** outlines were further assessment still needs to be undertaken.

Preliminary significance conclusions

20.1.13 For ease of reference, a summary of the effects from the preliminary Fish and Shellfish assessment which had any potential significant effects is provided in **Table 20-1**. Further details of the methodology behind the assessment, and a detailed narrative of the assessment itself are provided within the sections below.

Table 20-1 - Preliminary Summary of Significance of Effects

Receptor and summary of predicted effects	Project Phase	Sensitivity/ importance/ value of receptor[1]	Magnitude of change[2]	Significance[3]	Summary rationale
Underwater noise changes – UXO Clearance Shellfish and fish species with demersal life stages	Construction	Medium	Medium	Moderate – Significant without Mitigation	**Section 20.14** concluded that UXO clearance via high order detonation has the potential to cause injury/ mortality. The implementation of mitigation would reduce the magnitude of the impact to low and the significance of the effect to Minor and Not Significant. It should be noted that this assessment has been provided for information only. UXO clearance would be the subject of a separate Marine Licence.

1. The sensitivity/importance/value of a receptor is defined using the criteria set out in **Section 20.9** and is defined as negligible, low, medium and high.
2. The magnitude of change on a receptor resulting from activities relating to the development is defined using the criteria set out in **Section 20.9** and is defined as negligible, low, medium and high.
3. The significance of the environmental effects is based on the combination of the sensitivity/importance/value of a receptor and the magnitude of change and is expressed as major (significant), moderate (potentially significant) or minor/negligible (not significant), subject to the evaluation methodology outlined in **Section 20.9**.

20.2 Relevant technical guidance

20.2.1 The legislation and planning policy which has informed the assessment of effects with respect to Fish and Shellfish is provided within **Volume 2, Part 1, Appendix 1.2.A: Legislation and Policy Overview**. Further information on policies relevant to the English Offshore Scheme is provided in **Volume 1, Part 1, Chapter 2: Regulatory and Policy Overview.** A preliminary marine plan assessment is provided as **Volume 2, Part 1, Appendix 1.2.B: Marine Plan Assessment.** Relevant technical guidance, specific to Fish and Shellfish, that has informed this PEIR and will inform the assessment within the ES, is summarised below.

Technical guidance

20.2.2 A summary of the technical guidance for Fish and Shellfish is given in **Table 20-2.**

Table 20-2 - Technical Guidance Relevant to the Fish and Shellfish Assessment

Technical guidance document	Context
Natural England Designated sites view, (REF 20.3)	Data and guidance about designated sites and protected species within the UK
Joint Nature Conservation Committee UK Protected Areas (REF 20.4)	Data and guidance about designated sites and protected species in the UK.
Popper et al, (2014) (REF 20. 5)	Sound Exposure Guidelines for fishes and sea turtles

20.3 Consultation and engagement

Overview

20.3.1 The assessment has been informed by consultation responses and ongoing stakeholder engagement. An overview of the approach to consultation is provided in **Section 5.9** of **Volume 1, Part 1, Chapter 5: EIA Approach and Methodology**.

Scoping Opinion

20.3.2 A Scoping Opinion was adopted by the Secretary of State, administered by the Planning Inspectorate, on 05 September 2024. A summary of the relevant responses received in the Scoping Opinion in relation to Fish and Shellfish and confirmation of how these have been addressed within the assessment to date is presented in **Table 20-3.**

20.3.3 **Volume 2, Part 1, Appendix 1.1.A Scoping Opinion Responses** outlines the comments made in the Scoping Opinion in relation to Fish and Shellfish and how these have been addressed within this PEIR.

20.3.4 The information provided in the PEIR is preliminary and not all of the Scoping Opinion comments have been addressed at this stage, however all comments will be addressed within the ES.

Table 20-3 - Summary of EIA Scoping Opinion Responses for Fish and Shellfish Assessment

Consultee	Consideration	How addressed in this PEIR
The Planning Inspectorate	ID 5.3.1 **Table 25-9,** Temporary habitat loss/seabed – Species with pelagic lifecycle - all phases: The Inspectorate agrees that species with a fully pelagic lifecycle would not be affected by disturbance of the seabed and therefore can be scoped out of the assessment	Receptor and impact pathway remains scoped out in preliminary environmental assessment.
The Planning Inspectorate	ID 5.3.2 **Table 25-9,** Permanent habitat loss – Deposit of external cable protection – Pelagic species - all phases: The Inspectorate agrees that species with a fully pelagic lifecycle would not be affected by disturbance of the seabed and therefore can be scoped out of the assessment	Receptor and impact pathway remains scoped out in preliminary environmental assessment.
The Planning Inspectorate	ID 5.3.3 **Table 25-9**, Temporary increase and deposition of suspended sediments – pre-sweeping – Shellfish and marine species with demersal life stage - operation: The Inspectorate is content to scope this matter out, noting that such works are unlikely during operation however, whilst the magnitude of effect is predicted to be lower than at construction, the ES should ensure that where this still results in a potential significant effect, that this is reported. The Applicant's attention is drawn to paragraph 3.5.1 of the MMO's response which requests certain shellfish species to be scoped in. The phase of development to which the comments relate however are unclear and therefore the Inspectorate is unable to make further comments. The MMO should be consulted further on this point and an update provided in the ES as to how such comments were addressed.	This is noted. The applicant has assessed this impact. The preliminary assessment (**Section 20.12**) has concluded that for construction the significance of the effect is minor and not significant. Therefore, as works during operation would be of a lower magnitude than during construction it can be concluded that the significance of effects during operation and decommissioning are also Not Significant.
The Planning Inspectorate	ID 5.3.4 **Table 25-9,** Temporary increase and deposition of suspended sediments during: Seabed preparation, Horizontal Directional Drilling (HDD) duct excavation, cable burial and trenching, anchoring/jack up	This is noted. The applicant has assessed this impact for cockles and herring. The preliminary assessment (**Section 20.13**) has concluded that for

Consultee	Consideration	How addressed in this PEIR
	foundations, deposit of external cable protection - for all species (except cockles) - all phases: The Inspectorate agrees that effects are to be localised and short in temporal scope, however, also notes from MMO's representation, the presence of Herring in the proximity of the Projects and as such, agrees that this matter can be scoped out for the operational phase of the Proposed Development but should be scoped in for construction and decommissioning phases for Herring	construction and decommissioning the significance of the effect is minor and not significant.
The Planning Inspectorate	ID 5.3.5 **Table 25-9**, Temporary increase and deposition of suspended sediments during: Seabed preparation, HDD duct excavation, cable burial and trenching, anchoring/jack up foundations, deposit of external cable protection - On cockles - operation and decommissioning: The Inspectorate is content to scope this matter out for operation and decommissioning, however, whilst the magnitude of effect is predicted to be lower than at construction, the ES should ensure that where this still results in a potential significant effect, that this is reported.	The preliminary assessment has identified that the closest cockle beds lie 17 km distant, outside of the study area. Commercial cockles are no longer considered a sensitive receptor. **Section 20.13** concluded that the significance of the effect during construction was not significant. The magnitude of the impact during operation and decommissioning would be the same or lower than construction and the conclusion remains valid for these phases.
The Planning Inspectorate	ID 5.3.6 **Table 25-9**, Accidental spills from the presence of project vehicles and equipment on all species - all phases: The Inspectorate is content to scope this matter out noting the legal requirements upon vessels to manage any accidental releases or spills of materials or chemicals. The ES should include details of the mitigation and explain how its delivery is assured with reference to relevant documents.	Receptor and impact pathway remains scoped out in preliminary environmental assessment. Several management plans will be provided with the ES to support the Deemed Marine Licence. These will include an Outline Construction Environmental Management Plan (CEMP) and Outline Marine Pollution Contingency Plan. These documents will outline measures to be implemented to comply with legislation (e.g., in relation to the prevention of oil and chemical spills) during all

Consultee	Consideration	How addressed in this PEIR
		phases of the English Offshore Scheme.
The Planning Inspectorate	ID 5.3.7 **Table 25-9,** Introduction or spread of marine invasive non -native species (MINNS) during presence of project vessels and equipment and deposit of external cable protection for shellfish - all phases: The Inspectorate notes a number of commitments in the Scoping Report to manage effects. The Inspectorate agrees that this matter can be scoped out on the basis that the mitigation measures proposed within the outline CoCP such as the Biosecurity Plan should be sufficient to address the likely impacts and avoid a potential significant effect. The ES should include details of the mitigation and explain how its delivery is assured with reference to relevant documents.	Receptor and impact pathway remains scoped out in preliminary environmental assessment. Several management plans will be provided within the ES to support the Deemed Marine Licence. These will include an Outline Construction Environmental Management Plan (CEMP) which will provide details of the biosecurity measures to be taken by the Projects.
The Planning Inspectorate	ID 5.3.8 **Table 25-9,** Underwater noise changes from the presence of project vehicles and equipment for all species -all phases: The Inspectorate does not agree that potential significant effects relating to underwater noise on subtidal species is unlikely, the Scoping Report does not provide information to demonstrate that noise would be localised or evidence of the level of background noise that is currently present. It is also noted that the MMO, Centre for Environment, Fisheries, and Aquaculture Science (Cefas) and Environment Agency in their consultation responses did not agree that this matter could be scoped out. Furthermore, in the absence of confirmed construction details the Inspectorate considers that this matter should be scoped in for further assessment.	A preliminary environmental assessment for the impact pathway has been provided in **Section 20.14**. Additionally, an underwater noise technical note has been produced and is presented as **Volume 2, Part 3, Appendix 3.22.A Underwater Noise Assessment.**
The Planning Inspectorate	ID 5.3.9 **Table 25-9**, Collision risk from presence of project vessels and equipment on basking shark - all phases: The Inspectorate is content that few Basking Sharks have been recorded in the	Receptor and impact pathway remains scoped ‘out’ in the preliminary environmental assessment.

Consultee	Consideration	How addressed in this PEIR
	area in the last decade and therefore the potential for collision is minimal and unlikely to be significant.	
The Planning Inspectorate	ID 5.3.10 **Table 25-9**, Electromagnetic changes-barrier to species movement from presence of cables on all species - construction and decommissioning: The Inspectorate is content to scope this matter out for construction and decommissioning as at these phases, the cables are not in operation.	Receptor and impact pathway remains scoped out in the preliminary environmental assessment for construction and decommissioning. A preliminary environmental assessment has been provided in **Section 20.15** for the operational phase.
The Planning Inspectorate	ID 5.3.11 **Table 25-9,** Temperature increase from the presence of cables on species with demersal life stage - construction and decommissioning: The Inspectorate is content to scope this matter out for construction and decommissioning as at these phases, the cables are not in operation.	Receptor and impact pathway remains scoped out in preliminary environmental assessment for construction and decommissioning. A preliminary environmental assessment has been provided in **Section 20.16** for the operational phase.
The Planning Inspectorate	ID 5.3.12 **Appendix 2**, Cockles and other bivalve species: The Applicant's attention is drawn to MMO's comments at paragraph 2.1 in relation to the inclusion of other bivalve species which should also be scoped into the assessment in addition to cockles. The Applicant should consider including further detail in the ES on species included in the assessment.	This is noted. A preliminary environmental assessment has been provided in **Section 20.13**.
The Planning Inspectorate	ID 5.3.13 **Table 25-3**, Update of species included: The Applicant's attention is drawn to MMO's comment in relation to species to be included in Scoping Report **Table 25-3** (see paragraph 3.5.4)	The species referenced in the scoping opinion have been included in **Table 20-6** of this chapter.
The Planning Inspectorate	ID 5.3.14 Sea Trout and European Eel: The Environment Agency note the omission of Sea Trout and European Eel from the assessment, the Applicant is requested to scope these species into the assessment or	Sea trout and European eel have been included in the baseline (**Sections 20.5.80** and **20.5.82**) and consideration has been given

Consultee	Consideration	How addressed in this PEIR
	through consultation with the Environment Agency agree an approach and provide commentary in the ES	to them in the preliminary assessments.

Technical engagement

20.3.5 Technical engagement with consultees in relation to Fish and Shellfish is ongoing. A summary of the technical engagement undertaken to date is outlined in **Table 20-4.**

Table 20-4 - Technical Engagement on the Environmental Aspect Assessment

Consultee	Consideration	How addressed in this PEIR
Marine Management Organisation	MMO ref: DCO/2024/00009 Paragraph 3.4.2 With respect to the impact "Temporary increase and deposition of suspended sediments arising from seabed preparation (e.g., boulder clearance, PLGR), HDD duct excavation, cable burial and trenching, anchoring / jack-up foundations, and the deposit of external cable protection", the MMO recommended that the pathway be scoped 'in' to the assessment for herring for the construction and decommissioning phases. For all other fish species, the MMO were content for this impact to be scoped out.	The applicant has assessed this impact for shellfish, cockles and herring. The preliminary assessment (**Section 20.13**) has concluded that for construction and decommissioning the significance of the effect is Minor and not significant
Marine Management Organisation	MMO ref: DCO/2024/00009 Paragraph 3.5.1. **Table 25-9** [of Scoping Report] indicates that 'Temporary increase and deposition of suspended sediments' is scoped out for shellfish receptors. This should be scoped in for all shellfish species dominant in the area such as Nephrops, Lobster, Edible Crab, Whelk, Scallop as well as cockles. Some shellfish have more sedentary parts to their life cycle that make them more vulnerable to impact from suspended sediments and smothering, i.e. gravid female Nephrops and berried crabs burrow during winter months (November to February).	The applicant has assessed this impact for shellfish, cockles and herring. The preliminary assessment (**Section 20.13**) has concluded that for construction and decommissioning the significance of the effect is Minor and not significant
Marine Management Organisation with Cefas	MMO ref: DCO/2024/00009 Paragraph 3.5.3 The MMO, in consultation with Cefas, considers that **Table 25-3** [of Scoping Report] should be amended to include main shellfish species reflecting commercial fishing landings, i.e. Lobster, Edible Crab, Nephrops, Whelk, Scallop and Cockle	The information requested has been provided in **Table 20-6.**

Consultee	Consideration	How addressed in this PEIR
Marine Management Organisation	MMO ref: DCO/2024/00009 Paragraph 3.5.4 The Fish Nursery and spawning maps (C014940-EGL3&4-FISH-003-B) should be amended to include shellfish species. Spawning grounds will relate to rectangles of fisheries capture, see references (Eaton, 2003; Cefas stock assessments Edible crab and Lobster, 2023; ICES WGNEPS, 2023).	The information requested has been provided in **Table 20-6.**
Marine Management Organisation	MMO ref: DCO/2024/00009 Paragraph 3.5.5 Within Section 25.2.9, electromagnetic (EMF) field studies or desk-based research should include shellfish species that move distances such as Edible crab to verify no boundary effects caused by the EMF field.	The applicant has assessed this impact for Shellfish and fish species with demersal life stage. The preliminary assessment (**Section 20.15**) has concluded that for operations and maintenance the significance of the effect is Minor and not significant
Marine Management Organisation and Cefas	MMO ref: DCO/2024/00009 Paragraph 3.5.6 The MMO, in consultation with Cefas, suggests that the timing of works should be considered as a mitigation measure to minimise any impacts upon berried/spawning/overwintering shellfish or larval phases where possible, especially Nephrops, Lobster, Crab and cockle. These species are deemed to be of high vulnerability, medium sensitivity, with medium to high recoverability and of significant regional importance within the North Sea. Mitigation should be considered through consultation with the fishing industry and relevant stakeholders.	The comment has informed the preliminary assessment of impacts presented in this chapter.
Marine Management Organisation	MMO ref: DCO/2024/00009 Paragraph 3.5.7 Shellfish fisheries monitoring does not appear to be proposed, but information of pre-/post-construction/operation would be valuable to inform any further reporting and support the validation of the expected minimal significant impact.	The preliminary assessment has concluded that the significance of effects on shellfish are **Not Significant**. Technical work groups would be established with stakeholders to discuss if environmental measures are required. The Applicant is open to discussing all measures.
Marine Management Organisation	MMO ref: DCO/2024/00009 Paragraph 3.5.8 **Table 25-2** notes 'Edible crab and Lobster have been considered in Section 25.4.1.6'. The MMO, in consultation with Cefas, were	Noted, this was a typo. It should have said 25.4.30.

Consultee	Consideration	How addressed in this PEIR
	unable to locate this section within the Report and it should be clarified whether this was a typo, or sign posting of the relevant section should be provided.	
Marine Management Organisation	MMO ref: DCO/2024/00009 Paragraph 3.5.9 **Table 29-2** should be updated to include the seasonality of Nephrops (Farne Deeps high seasons October to March and low season is April to September).	This information has been provided in **Table 20-6**.
Marine Management Organisation	MMO ref: DCO/2024/00009 Paragraph 3.5.10 Shellfish dominate the landings within the region and the Fisheries Liaison and Mitigation Action Plan needs to ensure that the Shellfish industry is appropriately contacted, informed, and included. Additionally, the related information within the Fish and Shellfish chapters should reflect this important fishery as well as more detail for the major shellfish species dominant in the area.	The applicants Fisheries Liaison Officer would ensure appropriate contact is made with shellfish fisheries. An outline Fisheries Liaison and Coexistence Plan is presented as **Volume 2, Part 3, Appendix 3.24.B.**
Marine Management Organisation	MMO ref: DCO/2024/00009 Paragraph 3.5.11 Maps of the main Farn Deeps Nephrops fishery can be used as the spawning maps (females remain in muddy burrows within the fishery bounds). These are contained within the working Group on Nephrops Surveys (WGNEPS) 2023 report or can be supplied by the MMO, in consultation with Cefas.	This data set has been used to inform the baseline description.

20.3.6 Ongoing engagement with stakeholders would take place through the duration of the Projects, with regular meetings taking place with the MMO, Cefas and the Northeastern and Northumberland Inshore Fisheries and Conservation Authorities (IFCAs).

20.4 Data gathering methodology

20.4.1 This PEI Report has been collated based on a range of publicly available data and information only. It is assumed that the data collated is accurate. The data has been supplemented with additional information acquired as part of the Stakeholder engagement process. The sources of data used are noted in **Table 20-5**.

Study area

20.4.2 The English Offshore Scheme will route from Anderby Creek across the Southern and Central North Sea to the boundary between the English and Scottish Exclusive Economic Zones (EEZ). The draft Order Limits for the English Offshore Scheme is illustrated in **Volume 3, Part 3, Figure 20-1: Fish and Shellfish Study Area.**

20.4.3 The study area for Fish and Shellfish includes the draft Order Limits up to Mean High Water Springs, plus an additional 15 km buffer either side. This is a precautionary maximum zone of influence that encompasses the potential impact pathways from underwater noise and increased suspended sediment concentrations. The zone of influence has been influenced by the conclusions of **Volume 1, Part 3, Chapter 18: Coastal and Marine Physical Processes**, and this chapter should be read in conjunction with these findings.

Tidal River Works

20.4.4 In addition to the English Offshore Scheme works are proposed within a tidal river. The works consist of the following:

- Tidal river crossing of the River Nene and the River Welland by Horizontal Directional Drilling or trenchless solution beneath the bed of the rivers
- Option for the construction of a Temporary Quay on the River Nene.

20.4.5 In respect to the Tidal River Crossings and in accordance with Article 35 of the 2011 Exempted Activities Order these activities are considered a 'bored tunnel' and exempt from needing a Marine Licence, as works would be carried wholly under the seabed there would be no interaction and no potential for significant adverse effects on the marine environment. Therefore, these works would not be included in the dMLs. Impacts relating to the drill entry and exit above MHWS are assessed in relevant chapters of the English Onshore Scheme in **Volume 1, Part 2**.

20.4.6 The River Nene Temporary Quay is an option being explored within the Projects design for delivery of components for the English Onshore Scheme. At this stage feasibility of the temporary quay is still being explored, and insufficient information is available to complete a preliminary assessment. If taken forward, the ES will include a full assessment of effects of the temporary quay. **Section 20.18** outlines the further work that will be undertaken to inform the assessment.

Desk study

20.4.7 Desk based review of publicly available data sources (literature and GIS mapping files) have been used to describe the baseline environment. A summary of the organisations that have supplied data, or from which data has been sourced, together with the nature of that data is outlined in **Table 20-5.**

Table 20-5 - Data Sources Used to Inform the Fish and Shellfish Assessment

Organisation	Data source	Data provided
Department of Energy & Climate Change (REF 20.6)	Offshore Energy Strategic Environmental Assessment 4 (OESEA4)	Baseline information on the fish and shellfish literature review.
(Coull et al,1998 REF 20.1, Ellis et al, 2012, REF 20.2)	Cefas	Fish Sensitivity Maps showing spawning and nursery grounds of selected fish species in UK waters

Organisation	Data source	Data provided
International Council for the Exploration of the Sea (ICES, 2023, REF 20.7)	https://www.ices.dk/	International Herring Larvae Surveys (IHLS) and international research reports and publications ICES Scientific Reports from 2023
International Council for the Exploration of the Sea (ICES, 2023, REF 20.8)	https://www.ices.dk/	DATRAS online database of trawl surveys. Data used from surveys in 2024.
MarineSpace report prepared for the British Marine Aggregate Producers Association	(MarineSpace, 2013, REF 20. 9)	Environmental Effect Pathways between Marine Aggregate Application Areas and Atlantic Herring Potential Spawning Habitat: Regional Cumulative Impact Assessments. Version 1.0.
MarineSpace report prepared for the UK marine aggregate industry	(Kyle-Henney et al, 2024, REF 20. 10)	MarineSpace report: Identifying and Mapping Atlantic Herring Potential Spawning Habitat: An Updated Method Statement.
MarineSpace report prepared for the UK marine aggregate industry	(Reach et al, 2024, REF 20. 11)	MarineSpace report: Identifying and Mapping Sandeel Potential Supporting Habitat: An Updated Method Statement.
Inshore Fisheries and Conservation Authority	https://association-ifca.org.uk/	Website with Information about fishing and the species in the different regional Inshore Fisheries and Conservation Authorities
FishBase	www.fishbase.org	Species reference website
EMODnet	http://www.emodnet.eu/biology	Interactive reference website which shows fish abundance and distribution.
Marine Management Organisation (MMO 2024, REF 20.12)	www.gov.uk	UK Sea Fisheries annual statistics report 2023 and accompanying datasets which includes species catch list for the relevant ICES rectangles.
International Convention for the Conservation of Nature (IUCN)	https://www.iucnredlist.org/	The IUCN Red List of Threatened Species
Brown & May Marine Ltd report prepared for the Applicant (REF 20.13)	Brown & May Marine Ltd (2023)	EGL 3 and EGL 4 Transmission Reinforcement Cable Projects: Fishing Activity Report

Organisation	Data source	Data provided
(JNCC, REF 20.14)	www.jnccgov.uk	Species specific data, of native species of conservation interest UK BAP List of UK Priority Species
(British Geological Society, REF 20.15)	www.data.gov.uk	Marine Sediment Particle Size dataset sourced from the BGS GeoIndex
(Eaton et al, 2003, REF 20.16)	www.sciencedirect.com	Article published in the journal Fisheries Research summarising results of edible crab *Cancer pagurus* larvae surveys undertaken along the English east coast to inform species distribution.
(Tallack, 2007, REF 20.17)	Cambridge University press	Article published in the Journal of the Marine Biological Association of the United Kingdom assessing the seasonality of the reproductive cycle for edible crab in the Shetland Islands, Scotland.
(FishSource, 2023, REF 20.18)	https://www.fishsource.org/	Summary of the distribution of the Norway lobster *Nephrops norvegicus* in the Farn Deeps fishery within the North Sea.
The Working Group on Nephrops Surveys (WGNEPS, REF 20.19)	www.ices.dk	International co-ordination group on Nephrops surveys both underwater and trawl surveys.

Survey work

20.4.8 Marine characterisation surveys consisting of geophysical, geotechnical and environmental survey techniques were undertaken on a nominal 500 m wide corridor on EGL 3 Project and EGL 4 Project between September 2023 and July 2024. The scope of the geophysical and geotechnical surveys is described in **Volume 1, Part 3, Chapter 18: Coastal and Marine Physical Processes**. The scope of the environmental surveys are described in **Volume 1, Part 3, Chapter 19: Intertidal and Subtidal Benthic Ecology.** It should be noted that draft survey reports were being received as the preliminary environmental assessment was being drafted and not all results were available to inform this chapter. Full details will be provided in the ES. Preliminary particle size analysis has been used to determine the suitability of sediments for herring and sandeel. A full assessment identifying sediments suitable for Atlantic herring spawning and nursery and habitat suitable for sandeel within the Draft Order Limits will be presented in the ES.

20.4.9 It is anticipated that for the ES further information will be available to inform the baseline description. Where preliminary information could be incorporated into this chapter it has been with any gaps identified.

20.5 Overall baseline

20.5.1 The following section outlines the existing baseline conditions for Fish and Shellfish within the study area.

20.5.2 The section focuses on spawning and nursery grounds within the study area, general fish and shellfish recorded within the study area looking at commercial fisheries and relevant survey data, commercial fish species (from an ecology perspective), protected species and relevant designated sites.

Current baseline

20.5.3 The baseline characterisation sections include information on spawning and nursery grounds, protected species and designated sites specific to the study area and species identified to be present within the study area.

20.5.4 Over 330 species of fish have been 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, REF 20.20) The species most likely to be affected by the Projects are those with demersal life stages, and hearing specialists such as species within the clupeid family (Atlantic herring, shad, sprat) sensitive to underwater noise changes.

Spawning and Nursery Grounds within the study area

20.5.5 **Table 20-6** summarises the species which use the study area as spawning and nursery grounds and the months within which this occurs. Spawning grounds are described as the location where eggs are laid, and nursery grounds are the location where juveniles of a species are common. Information is taken from the Cefas fisheries sensitivities maps (Coull et al., 1998, REF 20.1); (Ellis et al., 2012, REF 20.2). It also shows the intensity of 0 Group aggregations, which are fish within the first year of their lives (Aires et al., 2014, REF 20.21). Nursey periods have been assumed to be the same as spawning but continue for two further months.

20.5.6 Where information is available in the form of mapped data this has been presented in **Volume 3, Part 3, Figure 20-8: Sandeel Habitat Classification (Part 1)** and **Volume 3, Part 3, Figure 20-9: Sandeel Habitat Classification (Part 2)**.

Table 20-6 - Spawning and Nursery Grounds that Overlap with the Study Area

Key

Spawning Only | Nursery Only | Both

Species	Latin names	Spawning Zone	Intensity	Nursery Zone	Intensity	** Presence of Group 0 Aggregations	J	F	M	A	M	J	J	A	S	O	N	D
Anglerfish	*Lophius piscatorius*	n/a	n/a	Demersal	Low	Low												
Atlantic Cod	*Gadus morhua*	Pelagic	Low	Demersal	High	Low		*	*									
Atlantic Herring (Banks/Dogger Stock)	*Clupea harengus*	Demersal	High	Pelagic	High	Low/Medium												
Atlantic Mackerel	*Scomber scombrus*	Pelagic	Low	Pelagic	Low	Low					*	*	*					
Blue Whiting	*Micromesistius poutassou*	n/a	n/a	Pelagic	Low	n/a				*	*							
Edible Crab	*Cancer pagurus*	Demersal	Unknown	Demersal	Unknown	Unknown												
Common Sole	*Solea solea*	Pelagic/Demersal	Low	Demersal	Low	Low				*								
European Hake	*Merluccius merluccius*	n/a	n/a	Demersal	Low	Low		*	*									
European Plaice	*Pleuronectes platessa*	Pelagic/Demersal	High	Demersal	Low	Low	*	*										
European Sprat	*Sprattus sprattus*	Pelagic	Low	Pelagic	Low	Low/Medium					*	*						
Haddock	*Melanogrammus aeglefinus*	n/a	n/a	Demersal	Low	Medium/High		*	*	*								

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
Lemon Sole	*Microstomus kitt*	Demersal	Low	Demersal	Low	n/a												
Ling	*Molva molva*	n/a	n/a	Demersal	Low	n/a												
Lobster	*Homarus gammarus*	Demersal	Unknown	Demersal	Unknown	Unknown												
Nephrops	*Nephrops norvegicus*	Demersal	Low	Demersal	Low	n/a	+	+	+	*	*	*				+	+	+
Norway Pout ***	*Trisopterus esmarkii*	Demersal	Low	n/a	n/a	Low		*	*									
Sandeels	*Ammodytidae spp.*	Demersal	Low	Demersal	Low	n/a												
Spurdog	*Squalus acanthias*	n/a	n/a	Viviparous	Low	n/a												
Thornback ray	*Raja clavata*	Demersal	Low	Demersal	Low	n/a				*	*	*	*	*				
Whiting	*Merlangius merlangus*	Pelagic	Low	Pelagic	High	Low												
Whelk	*Buccinum undatum*	Demersal	Unknown	Demersal	Unknown	Unknown												

Sources: (Coull et al 1998, REF 20.1), (Ellis et al 2012, REF 20.2), (Aires 2014, REF 20.21). * 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.

n/a No data available + Peak spawning for Nephrops at Farnes Deep

eDNA Results

20.5.7 During the EGL 4 environmental survey eDNA samples were acquired. **Table 20-7** presents the top ten most populous species identified in the eDNA water samples. Sediment samples were also acquired. Only preliminary results were available to inform this chapter. Full details will be provided in the ES.

Table 20-7 - Top Ten Most Populous Species in eDNA Water Samples

Family / species	Common name
Scomber scombrus	Atlantic mackerel
Pleuronectidae	Righteye flounders
Gadidae	Cods and haddocks
Merlangius merlangus	Whiting
Ammodytes sp.	Sandeel sp.
Sprattus sprattus	European Sprat
Limanda limanda	Common dab
Clupea harengus	Herring
Chelidonichthys sp.	Gurnards
Echiichthys vipera	Lesser weaver

Analysis of fisheries statistical data

20.5.8 The North Sea is home to important fishing grounds used not only by the local English and Scottish fleet but also by international vessels from Belgium, the Netherlands, Denmark, France, Ireland, Spain and Germany. To enable accurate monitoring the sea is divided into rectangles by ICES. Each ICES rectangle is approximately 30 nautical miles (NM) squared and is 30 min latitude and 1º longitude in size (ICES, 2022, REF 20.22). Analysis of the fishing data from these ICES rectangles 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.

20.5.9 The MMO produces an annual report and accompanying supporting data, (REF 20.12). The reports are normally issued in September of the following year. The newest data available at this time is for 2023. The ES will use the most up to date data available at the time.

20.5.10 In terms of annual landed weight in 2023 within the study area, shellfish was the largest target species group representing over 93% of the overall catch. Demersal species only accounted for approximately 4.9% and pelagic species approximately 1.6%. However, in terms of catch value, shellfish account for approximately 97% with demersal and pelagic at 1.96% and 0.25% respectively.

20.5.11 **Table 20-8** shows the top five species caught by catch value in GBP within the study area. The draft Order Limits interacts with nine ICES rectangles as illustrated in **Volume 3, Part 3, Figure 20-1: Fish and Shellfish Study Area.** Of the nine rectangles analysed, only one rectangle had a non-shellfish species as the top species

(herring in 40E9). For all the remaining rectangles, the top valued species were either crabs (C.P.Mixed Sexes) in 35F0, 38F0, 40E8 and 41E9, lobsters in 36F0, 37F0 and 38E9 or Nephrops in 39E9.

Table 20-8 Top Five Landed Species by Value (GBP) in 2023 in ICES Rectangles within the Study Area

		ICES Rectangles				
		35F0	**36F0**	**37F0**	**38E9**	**38F0**
Landed Species	1	Crabs - mixed	Lobster	Lobster	Lobster	Crabs - mixed
	2	Cockles	Crabs - mixed	Scallops	Nephrops	Lobster
	3	Lobster	Scallops	Crabs - mixed	Crabs - mixed	Scallops
	4	Whelks	Whelks	Squid	Scallops	Nephrops
	5	Brown Shrimps	Brown Shrimps	Whiting	Squid	Spider crabs
		39E9	**40E8**	**40E9**	**41E9**	
	1	Nephrops	Crabs - mixed	Herring	Crabs - mixed	
	2	Lobster	Nephrops	Nephrops	Nephrops	
	3	Monks & Anglers	Lobster	Crabs - mixed	Haddock	
	4	Haddock	Velvet Crabs	Lobster	Monks & Anglers	
	5	Crabs - mixed	Whiting	Haddock	Gurnards Grey	

Source: MMO (2024, REF 20.12)

20.5.12 **Table 20-9** shows the top five species caught by catch weight in tonnes within the study area. For all of the nine rectangles analysed, 37 of the 45 positions in the top five species by catch weight are shellfish; crabs, cockles, lobster, nephrops and scallops.

Table 20-9 Top Five Landed Species by Weight (Tonnes) in 2023 in ICES Rectangles within the Study Area

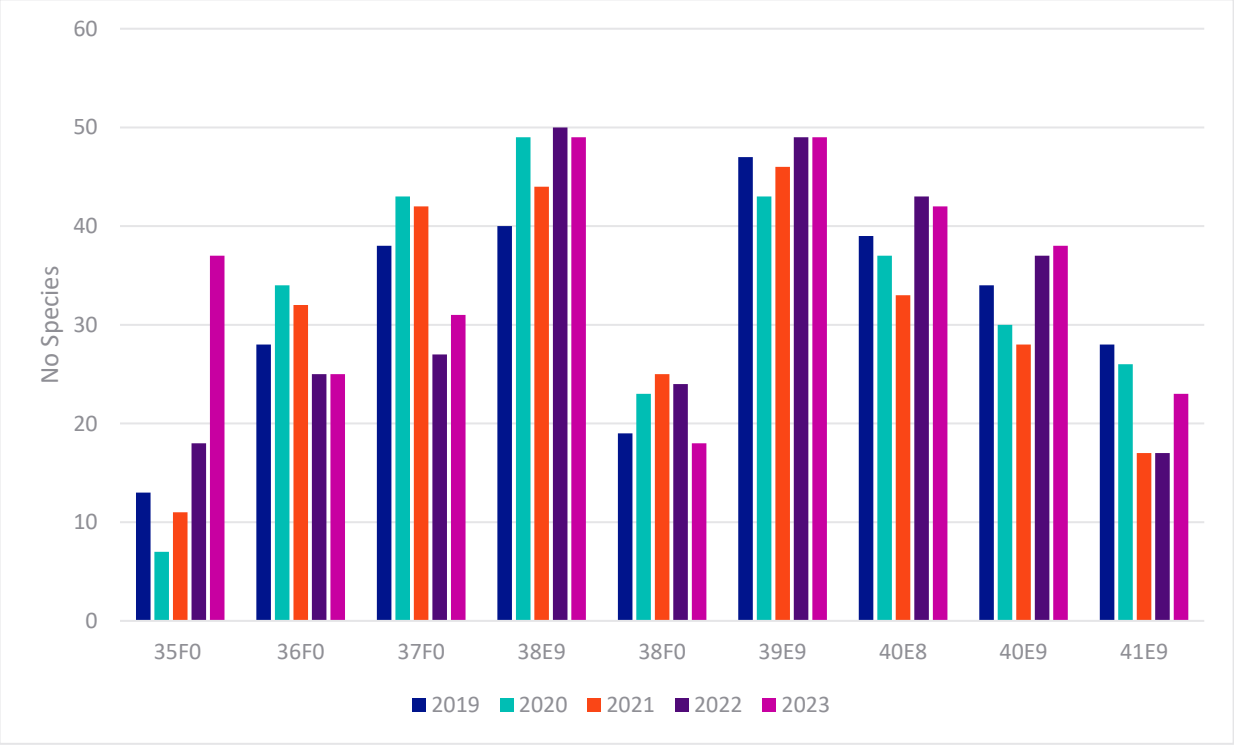
		ICES Rectangles				
		35F0	**36F0**	**37F0**	**38E9**	**38F0**
Landed Species	1	Cockles	Crabs - mixed	Scallops	Crabs - mixed	Crabs - mixed
	2	Crabs - mixed	Lobster	Crabs - mixed	Scallops	Scallops
	3	Whelks	Scallops	Lobster	Nephrops	Lobster
	4	Lobster	Whelks	Whiting	Lobster	Nephrops
	5	Brown Shrimps	Velvet Crabs	Squid	Haddock	Gurnards Grey

	ICES Rectangles				
	35F0	36F0	37F0	38E9	38F0
	39E9	40E8	40E9	41E9	
1	Nephrops	Lobster	Nephrops	Crabs - mixed	
2	Haddock	Nephrops	Lobster	Nephrops	
3	Whiting	Crabs - mixed	Crabs - mixed	Lobster	
4	Monks & Anglers	Velvet Crabs	Herring	Monks & Anglers	
5	Crabs - mixed	Scallops	Squid	Squid	

Source: MMO (2024, REF 20.12)

20.5.13 **Plate 20-1** shows the number of different commercially caught species within the study area within the respective rectangles. The graph shows that within most of the rectangles the number of different species over a period between 2019 and 2023 only varies by around 10 species with the exception of 35F0 and 37F0 which have varied by 19 and 16 different species respectively. This could be caused by several reasons including weather, species abundance and availability.

Plate 20-1 - Number of Different Species Caught within the Study Area between 2019 and 2023



Source: MMO (2024, REF 20.12)

20.5.14 The previous paragraphs were focussed on the commercial aspect of fish and shellfish species however it is important to understand that these are not the only species found within the study area. The MMO catch data from 2023 identified a total of 71 different species of fish or shellfish with the ICES rectangles that the draft Order Limits cross.

20.5.15 Biannually ICES undertake bottom trawl surveys within the ICES rectangles of the North Sea, referred to as Datras surveys. These surveys are normally undertaken in Q1 and Q3 each year. These surveys do not just focus on commercially important species but identify all species present unlike the MMO catch statistics.

20.5.16 The Datras surveys undertaken in Q1 and Q3 of 2024 identified 83 different species of fish or shellfish with 19 of these being species that are not commercially caught.

20.5.17 Table 1.1 within **Volume 2, Part 3, Appendix 3.20.A DATRAS Survey Results** shows the species caught within the rectangles within the study area during the two surveys in 2024. The numbers are individuals caught per hour during the survey. The most abundant species caught during these surveys were whiting, followed by haddock, herring and common dab; noting that all four species were caught throughout the entire study area and in both Q1 and Q3 surveys. Other species that were caught across the entire study area were Atlantic mackerel, common squid, Norway pout, grey gurnard, American plaice, European sprat, European plaice, poor cod, lemon sole, Atlantic cod and common dragnet. Thirty-two species were recorded in numbers equal or lower to ten in total across the nine ICEA rectangles, with nine species only recorded once. It should be noted that within these surveys no sandeel were recorded.

General species information

Shellfish species

20.5.18 Shellfish is a collective term for crustaceans (e.g., shrimp, lobsters, crabs) and molluscs (e.g., cockles, mussels, oysters, whelk) - animals which have a shell or shell-like exterior. A variety of shellfish species are targeted in the waters of the North Sea by commercial fisheries or are present as part of the ecosystem. The below descriptions focus on five of the more important commercial species and the Ocean quahog which is on the OSPAR list of threatened and/or declining species and habitats and is a protected feature of several designated sites in the study area.

Whelk

20.5.19 Whelk (*Buccinum undatum*) is frequently found off all British coasts and inhabits a range of seabed types including hard and soft subtidal substrates and occasionally intertidal fringes (Lawler and Vause, 2009, REF 20.[23]). There are no known specific whelk migrations for spawning, though they can show aggregating behaviour. The distribution of young whelk tends to be limited to areas close to the adult stock (Lockwood, 2005, REF 20.[24])

20.5.20 Breeding occurs in late autumn where demersal egg-cases are laid in masses from November until April. Egg development is intracapsular, meaning clumps of demersal egg-cases are laid, from which young hatch as a fully formed whelk during February and March (Smith and Thatje, 2013, REF 20.[25]). Whelk is a highly valued species and is caught mostly in the southernmost ICES rectangles 35F0, 36F0 and 37F0 within the study area.

Cockles

20.5.21 Cockles (*Cerastoderma edule*) inhabit the surface of the sediment, burrowing to a maximum depth of no more than 5 cm (Dabouineau and Ponsero, 2011, REF 20.26) They are active filter feeders, using a syphon tube to feed on material suspended in the water column. Cockles spawn in spring, with the cockle fishing season between June and September. Cockle habitat comprises intertidal beaches of sand, muddy sand and fine gravel within The Wash which is at the furthermost reaches of the study area, but not within the draft Order Limits.

Edible crab

20.5.22 Edible crab (*Cancer pagurus*) is found in a range of intertidal (usually when juvenile) and subtidal habitats, on bedrock, under boulders, mixed coarse grounds and offshore in muddy sand (Neal and Wilson, 2008, REF 20.[27])

20.5.23 Edible crab migrate long distances to offshore overwintering grounds where eggs then hatch (Bennett, 1995. REF 20.28) After pairing and mating (July to September) and subsequent spawning (October to December), egg bearing females move to offshore over-wintering grounds and are largely inactive over the brooding period until their eggs hatch in the spring and summer. The adult females then return from their migration inshore during spring and summer for pairing and mating to commence again.

20.5.24 Edible crab is the most caught shellfish within the study area and is caught all year round with the 2023 catch totalling over 3,500 tonnes, however the majority of this amount was within ICES rectangles 35F0, 36F0 and 37F0 which are within the southernmost part of the draft Order Limits closest inshore.

European lobster

20.5.25 European lobster (*Homarus gammarus*) is an opportunistic scavenger with their diet consisting of small crustaceans, molluscs and polychaetes. European lobster is cosmopolitan to rocky areas of UK and Europe coasts, from below mean low water to depths of 150 m (Buchholz et al., 2012, REF 20.[29]). Both sexes are thought to be sedentary and have not been found to undertake extensive migrations.

20.5.26 Egg bearing females tend to appear from September to December in areas where lobster is normally present with eggs carried externally on females until April/May. As they do not carry out extensive migrations, hatching normally takes place in the same grounds (in spring and early summer) (Pawson, 1995, REF 20.[30]). Primary nursery grounds for lobster are thought to be on rocky grounds in coastal waters, and juveniles can inhabit crevices and are capable of burrowing into soft sediment (Bennett and Nichols, 2007, REF 20.[31])

20.5.27 Lobster is another highly targeted and valuable species which is caught year-round. Similar to edible crab the greater catch is within ICES rectangles 35F0, 36F0 and 37F0.

Norway Lobster (Nephrops)

20.5.28 Norway Lobster (*Nephrops norvegicus*) commonly known as Nephrops are present in muddy habitats, with high concentrations of silt and clay. The species are known to occur in the Farn Deeps area, which is an essential winter fishery running from September to March (FishSource, 2023, REF 20.32)

20.5.29 Nephrops feed primarily on crustaceans but also molluscs and to a lesser extent polychaetes and echinoderms (Parslow-Williams et al, 2002, REF 20.33). Sexually mature Nephrops of both sexes moult towards the end of spring and into the summer. Mating takes place while the female is still 'soft' (Farmer, 1975, REF 20.34) directly after the female has moulted and before the hardening of the new exoskeleton. Once fertilized the eggs are then carried on the females abdomen for 8-9 months, during which time the females tend to remain in their burrows.

20.5.30 Nephrops are commercially caught within ICES rectangles 38E9, 38F0, 39E9, 40E8, 40E9 and 41E9 which are the central and northernmost sections of the draft Order Limits. There are none caught in the southernmost section.

Ocean Quahog

20.5.31 Ocean quahog (*Arctica islandica*) are listed on the OSPAR list of threatened and/or declining species and habitats (REF 20.[35]). It is a protected species in several designated sites within the study area including the Holderness Offshore Marine Conservation Zone (MCZ), North East of Farnes Deep MCZ and Highly Protected Marine Areas (HPMA) and Firth of Forth Banks Complex Nature Conservation Marine Protected Areas (NCMPA). As a protected benthic species, ocean quahog are considered in detail in **Volume 1, Part 3, Chapter 19: Intertidal and Subtidal Benthic Ecology**.

Marine species with demersal life stages

Atlantic herring

20.5.32 Atlantic herring (*Clupea harengus*) is a pelagic species which lays eggs on the seabed. As a benthic spawner, the species has a specific habitat preference of gravel and partly sandy gravel (Kyle-Henney et al., 2024, REF 20.10) which limits the spatial extent of their spawning grounds. As a result, they are particularly sensitive to any seabed disturbance. A programme of annual International Herring Larvae Surveys (IHLS) has taken place since 1967 to monitor the abundance of herring larvae (ICES, 2025, REF 20.36). Atlantic herring numbers fluctuate annually, with Atlantic herring often abandoning and then returning to suitable areas. As a result, availability of all suitable areas of spawning habitat are necessary to maintain a resilient population.

20.5.33 There are four main autumn/winter-spawning populations of herring located across the North Sea alongside several discrete spring-spawning stocks. The autumn-spawning grounds include the Orkney-Shetland population, the Buchan population, the Banks (or Dogger) population and the Downs / Southern Bight population (Ellis et al., 2012, REF 20.2) and are characterised by different growth rates, recruitment patterns and migration routes. The draft Order Limits cross the Banks (off Northeastern England) Atlantic herring spawning grounds identified by Coull et al., (1998, REF 20.1) Typically, the Banks herring stocks spawn over summer and autumn, from August to October

(REF 20.2) .This spawning ground is an important area for a large population of Atlantic herring stock in the North Sea. **Volume 3, Part 3, Figure 20-4: Herring Spawning and Nursery Grounds** illustrates the spawning and nursery grounds for Atlantic herring.

20.5.34 A herring spawning and habitat assessment was undertaken for the English Offshore Scheme. The assessments included a literature review, analysis of other publicly available ecological data and analysis of the preliminary sediment particle size data following the (Kyle-Henney et al., 2024, REF 20.10) updated guidance. Within the assessment International Herring Larvae Surveys (IHLS) data was analysed between 2007 and 2017 to inform the timing of herring spawning. The conclusions of this preliminary herring habitat assessment are presented in the following sections. Further work to incorporate all the environmental baseline survey data is pending and the assessments will be updated for the ES.

EGL 3

20.5.35 Approximately 13.5% of the EGL 3 Project is classified as 'Prime' herring habitat and 8% as 'Sub-Prime.' This covers a total of around 94 km. The majority of 'Prime' and 'Sub-Prime' locations along the EGL 3 Project are situated within the spawning grounds off the Yorkshire coast, as defined by Coull et al. (1998) (REF 20.1). The EGL 3 Project overlaps with the Yorkshire spawning ground for approximately 190 km, of which approximately 59 km (of the total 94 km of the EGL 3 Project) has been classified as ‘Prime’ and/or ‘Sub-Prime’ herring habitat in the suitable water depth for herring spawning. **Volume 3, Part 3, Figure 20-5: Herring Habitat Classification – England (Part 1)** illustrates the preliminary herring habitat classification for EGL 3.

EGL 4

20.5.36 For the EGL 4 Project, approximately 10.7% is classified as 'Prime' herring habitat, with an additional 4.7% categorised as 'Sub-Prime' habitat, covering a total of approximately 65 km. The majority of 'Prime' and 'Sub-Prime' locations along the EGL 4 Project are situated within the spawning grounds off the Yorkshire coast, as defined by Coull et al. (1998) (Ref 20.1) The EGL 4 Project overlaps with the Yorkshire spawning ground for 181 km, with approximately 57 km identified as ‘Prime’ and ‘Sub-Prime’ habitat. **Volume 3, Part 3, Figure 20-6: Herring Habitat Classification – England (Part 2)** illustrates the preliminary herring habitat classification for EGL 4.

Sandeel

20.5.37 Sandeel (*Ammodytes spp*.) have been recorded within the study area and are significant due to their importance as prey species for a number of bird, fish and marine mammal species. Sandeel hibernate in specific types of seabed during the autumn and winter, particularly coarse sand or fine gravel where they bury themselves in up to 50 cm of sediment (MarLIN, 2023, REF 20.[37]) They briefly emerge from hibernation between December and January to spawn. During the spring and summer, they feed in the water column during the day and then bury themselves in the seabed at night. Their lifecycle makes them sensitive to seabed disturbance, especially during hibernation. Studies have found that sandeel are largely resident and do not disperse over distances greater than 30 km (RSPB, 2017, REF 20.[38]), and that they do not migrate between grounds, suggesting that they are not successful re-colonisers

(Jensen et al. 2011, REF 20.39). Sandeel are not however considered to be sensitive to increased suspended sediment concentrations and deposition.

20.5.38 There are three predominant species of sandeel which inhabit the North Sea, Greater sandeel (*Hyperoplus lanceolatus),* Lesser sandeel (*Ammodytes tobianus*) and Raitt's sandeel (*Ammodytes marinus*). A further two species have also been identified as potentially present within the North Sea, although they are less abundant, Corbin's sandeel (*Hyperoplus immaculatus*) and smooth sandeel (*Gymnammodytes semisquamatus*).

20.5.39 Raitt's sandeel (*Ammodytes marinus*) are listed as a principal species of importance in England under Section 41 of the National Environment and Rural Communities Act (2006) (REF 20.40), meaning that they are of principal importance for the purpose of conserving or enhancing biodiversity (Defra, 2022, REF 20.[41]). Sandeel are also noted in UK Biodiversity Action Plan (BAP) priority marine species of principal importance, requiring conservation due to their ecological importance as a prey species and their marked decline within the UK (a decline of 50% or more over the past 25 years or deterioration or loss of habitat) (BRIG, 2007, REF 20.[42])

20.5.40 The draft Order Limits cross several known sandeel spawning grounds which are illustrated in **Volume 3, Part 3, Figure 20-7: Sandeel Spawning and Nursery Grounds**.

20.5.41 A sandeel habitat assessment was undertaken for the English Offshore Scheme. The assessments included a literature review, analysis of other publicly available ecological data and analysis of the preliminary sediment particle size data (PSA) following the benthic survey. The assessments included a literature review and PSA and other ecological data following the Reach *et al.,* (2024) (REF 20.11) updated guidance. The conclusions of this preliminary sandeel habitat assessment are presented in the following sections. Further work to incorporate all the environmental baseline survey data is pending and the assessments will be updated for the ES.

EGL 3

20.5.42 The majority of the Prime and Sub-Prime locations along the EGL 3 Project lie either within the Lincolnshire or Northumberland spawning grounds, as defined by Coull et al., (1998, REF, 20.1). The EGL 3 Project overlaps with the Lincolnshire spawning ground for approximately 136 km, of which 10 km has been classified as 'Prime' and/or 'Sub-Prime' sandeel habitat. The EGL 3 Project also overlaps with the Northumberland spawning ground for 83 km. **Volume 3, Part 3, Figure 20-8: Sandeel Habitat Classification (Part 1)** presents the preliminary sandeel habitat classification for EGL 3.

EGL 4

20.5.43 All the Prime and Sub-Prime locations along the EGL 4 Project lie within either the Lincolnshire or Northumberland spawning grounds, as defined by (Coull et al. 1998, REF 20.1). The EGL 4 Project overlaps with the Lincolnshire spawning ground for approximately 135 km, of which 48 km has been classified as 'Prime' and/or 'Sub-Prime' sandeel habitat. The EGL 4 Project also overlaps with the Northumberland spawning ground for 147 km, with approximately 25 km identified as 'Prime' and 'Sub-

Prime' habitat. **Volume 3, Part 3, Figure 20-9: Sandeel Habitat Classification (Part 2)** presents the preliminary sandeel habitat classification for EGL 4.

Whiting

20.5.44 Whiting (*Merlangius merlangus*) is a fast-growing commercially important demersal species, which is widespread across the North Sea and common to inshore waters. It is found mostly at depths of 30 m and 100 m and inhabiting a variety of substrates including mud, gravel, sand and rock (Barnes, 2008, REF 20.[43])

20.5.45 Location of spawning grounds appears not to be determined on sediment type but tends to be at depths between 50 - 100 m. The factors that determine spawning ground selection are considered limited. Whiting are thought to have one of the longest spawning periods among North Sea species, from February to June, with a peak in April as shown in **Table 20-6**.

20.5.46 Whiting have a mixed diet which consists of decapods e.g., *Crangon crangon*, amphipods, copepods, and fish, including small fish species such as sprat, sandeel, herring, cod, and haddock (Derweduwen et al., 2012, REF 20.44). Juvenile whiting feed primarily on small crustaceans such as shrimp. Whiting is the most abundantly caught demersal species within the study area. Whiting was also the most abundantly caught species in the Datras surveys being caught in every location in both the Q1 and Q3 surveys in 2024.

20.5.47 The high intensity nursery grounds for whiting encompasses the whole English Offshore Scheme with the exception of approximately 49 km from the Anderby Creek Landfall. The spawning grounds for whiting is only present on approximately 105 km of the EGL 4 Project from KP 316 to KP 422 - the northernmost section. Spawning and nursery areas in relation to the draft Order Limits are illustrated in **Volume 3, Part 3**, **Figure 20-3: Fish nursery and spawning grounds intensity within Study Area (Part 2)**.

Sole

20.5.48 Sole (*Solea solea*) is associated with a habitat of sandy and muddy sediments at depths up to 70 m where their favoured food source, polychaetes, are most abundant (Reeve, 2007, REF 20.[45]) Sole prey upon small crustaceans, small molluscs and fish. They are particularly sensitive to temperature which defines their distribution. They are caught all year round and are most abundant in ICES rectangles 38F0, 38E9 and 39E9 according to the MMO catch data. Whereas within the Datras survey data there are ICES rectangles where they have not been recorded, but they are most abundant in the Q3 surveys in 35F0 and 40E8.

20.5.49 Mature sole return to shallow inshore waters such as the mouths of estuaries, which have relatively higher water temperatures, during spring to spawn. Shallow waters like sand banks also act as nursery areas for juveniles. The 0-groups (fish in their first year of life) are relatively abundant at all depths (Limpenny et al., 2011, REF 20.[46]). Their spawning grounds which in the study area are of low intensity are within approximately the first 55 km of the draft Order Limits and nursery grounds approximately in the first 3.5 km which is illustrated in **Volume 3, Part 3, Figure 20-3: Fish nursery and spawning grounds intensity within Study Area (Part 2)**.

Plaice

20.5.50 Plaice (*Pleuronectes platessa*) is associated with a seabed habitat of sand and gravel substrates in depths between 10 m and 50 m (Kay and Dipper, 2009, REF 20.[47]). Spawning in the North Sea occurs over a wide area, across most of the offshore and deeper areas of the southern North Sea. Juvenile nursery areas are generally in shallow areas of depths less than 10 m with sandy or muddy area habitat. There are no identified spawning areas for plaice within the study area. The nursery areas for place are all along the coastline out to approximately 18 km from rectangle 35F0 up to 39E8. Nursery areas in relation to the draft Order Limits are illustrated in **Volume 3, Part 3, Figure 20-3: Fish nursery and spawning grounds intensity within Study Area (Part 2)**.

20.5.51 Plaice diet includes a wide range of benthic and epibenthic species including polychaetes, molluscs, crustaceans and occasionally on brittle stars, and sandeel. They are caught all year round and are most abundant in rectangles 38E9, 39E9 and 40E8 according to the MMO catch statistics. In terms of the Datras survey data they were recorded in all locations and both the Q1 and Q3 surveys.

Cod

20.5.52 Atlantic cod (*Gadus morhua*). Both juvenile and adult cod occur throughout most of the North Sea and therefore within the study area. Cod are a demersal species and are generally found in either, shallower (depths less than 50 m), colder and less saline waters of the southern North Sea, or, deeper (depths greater than 100 m), warmer and more saline waters of the northern North Sea (Hedger et al., 2004, REF 20.[48]). Cod are pelagic spawners; therefore, their spawning grounds are not substrate specific. Their peak spawning is February and March as shown in **Table 20-6**. Juvenile cod inhabit a wide variety of habitats but are often found in shallower waters than adults.

20.5.53 The results of quarterly Datras surveys reveal that adult cod are widely distributed during the colder, winter months but their range contracts during spring and summer as they retreat northwards in response to increasing temperatures in the English Channel and Southern Bight. Adult cod have a diet of crustaceans, molluscs, and fish including sandeel, haddock, herring and several flatfish species and there is also evidence of cannibalism (Wilding & Heard, 2004, REF 20.[49]). Cod are thought to be responsible for significant mortality on commercial fish stocks of clupeid, gadoid and flatfish species (Macer & Easey, 1988, REF 20.[50])

20.5.54 Cod are caught all year round in the further north ICES rectangles of the study area such as 39E9 and 40E8, further south they are typically caught in winter or early spring. There are nursery grounds for cod along much of the draft Order limits which vary between high and low intensity, the highest intensity is found in the central section of the English Offshore Scheme. In terms of spawning the draft Order Limits go through approximately 40 km of spawning grounds between KP 100 to KP 137 for EGL 4 and KP 108 and KP 146 for EGL 3. Spawning and nursery areas in relation to the draft Order Limits are illustrated in **Volume 3, Part 3, Figure 20-2: Fish nursery and spawning grounds intensity within Study Area (Part 1)**.

Haddock

20.5.55 Haddock (*Melanogrammus aeglefinus*) is a member of the cod-like fish family commonly found throughout the North Sea. Spawning takes place from March to May, at depths of 100-150 m (Alekseeva & Tormosova, 1979, REF 20.[51]) as shown in **Table 20-6**. In their larval stages, haddock mainly feed on the immature stages of copepods, ostracods and limacina with their diet changing as they grow, moving on to larger pelagic prey such as amphipods, euphausiids, eggs of invertebrates, zoea larvae of decapods and increasing numbers of copepods (Basktrikin et al, 2014, REF 20.[52]).

20.5.56 Once they have reached the settled, demersal, post-larval stage, they gradually switch from pelagic to benthic prey. Adults primarily feed on benthic invertebrates such as sea urchins, brittlestars, bivalves and worms, (Schuckel et al 2010, REF 20.53) however, they will feed opportunistically on smaller fish such as capelin, sandeels and Norway pout. Juvenile haddock are an important prey for larger demersal fish, including other gadoids, while seals prey on the larger fish.

20.5.57 Low intensity nursery grounds for haddock are only present for approximately t 170 km of the EGL 4 Project from KP 221 to KP 394, and for approximately 203 km of the EGL 3 Project from KP 231 to KP 435. There are no spawning grounds within the study area. Nursery areas in relation to the draft Order Limits are illustrated in **Volume 3, Part 3, Figure 20-2: Fish nursery and spawning grounds intensity within Study Area (Part 1)**.

20.5.58 Haddock is a commercially valuable species which is caught mostly in the central and northernmost part of the study area according to the MMO catch data. However, haddock was the second most abundant species recorded in the Datras surveys being identified in all locations and both the Q1 and Q2 surveys.

Pelagic species

Mackerel

20.5.59 Mackerel (*Scomber scombrus*) are distributed throughout the North Sea. Within the study area, mackerel migrate north in June and July to spawn and then disperse to feed within central North Sea. In October, some of the stock migrate to western Shetland and some to the Norwegian Trench, where they overwinter. The following spring, they then return south to the spawning grounds.

20.5.60 Mackerel has a varied diet with adults eating large quantities of pelagic crustaceans. They also prey on schools of smaller fish, particularly sprat, herring and sandeel. Juvenile mackerel eat fish larvae, crustacean larvae and their own larvae. Mackerel are the prey species for sharks, marine mammals, and a variety of seabirds.

20.5.61 Mackerel are typically caught between June and October. Spawning and nursery areas in relation to the English Offshore Scheme are illustrated in **Volume 3, Part 3, Figure 20-2 Fish nursery and spawning grounds intensity within Study Area (Part 1)**; though the draft Order Limits do not go through the spawning grounds, they do go through low intensity nursery grounds. Mackerel were identified as the most populous species present in a preliminary review of the EGL 4 Project eDNA results.

Sprat

20.5.62 European sprat (*Sprattus sprattus*) are found throughout the North Sea, although they tend to remain within the 50 m depth contour. They are common in inshore waters during summer months where they spawn, before migrating to winter feeding grounds. Spawning is thought to occur between May and August, peaking between May and June, in both coastal waters and up to 100 km offshore in deep basins (Coull et al., 1998, REF 20.1). Sprat are pelagic spawners with their eggs and larvae being subject to larval drift, moving to inshore nursery areas. Young sprat are often found close inshore in schools with juvenile herring.

20.5.63 Sprat are important prey species for several species, including piscivorous fish, marine mammals and seabirds. Sprat themselves tend to feed on small planktonic crustaceans, including copepod nauplii and bivalve larvae (Maes & Ollevier, 2002, REF 20.54).

20.5.64 Within the MMO 2023 catch data there was only 1 catch containing sprat which was in August in rectangle 40E9, however they were frequently identified within the Datras bottom trawl surveys in 2024. There are extensive areas of sprat and spawning and nursery grounds. Spawning and nursery areas in relation to the draft Order Limits are illustrated in **Volume 3, Part 3, Figure 20-3: Fish nursery and spawning grounds intensity within Study Area (Part 2).**

Elasmobranchs (Sharks, Rays and Skates)

20.5.65 Elasmobranchs are amongst the most vulnerable marine fish, due to their slow growth rates, late maturity, and low fecundity which limits their ability for population recovery should it decline. All sharks and rays are on the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) list of threated or declining species. There are a number of elasmobranchs which are regularly caught by commercial fisheries in the study area. These include thornback ray (*Raja clavata*), lesser spotted dogfish (*Scyliorhinus canicula*), spotted ray (*Raja montagui*), starry smooth-hound (*Mustelus asterias*), blue skate (*Dipturus flossada*) as well as white skate (*Rostroraja alba*) which is on the IUCN Red list.

20.5.66 The Datras survey recorded several elasmobranchs including: Small-spotted catshark (*Scyliorhinus canicular),* Starry smooth-hound (*Mustelus asterias*), Cuckoo ray (*Leucoraja naevus*), and Thornbak ray (*Raja clavata*).

20.5.67 Elasmobranchs are the predominant electroreceptive species present within the study area. The species have specialist electroreceptive organs (Tricas & Sisneros, 2004, REF 20.55) which are sensitive to 5 to 20 nV/m (Tricas & New, 1998, REF 20.56) and are used to detect the bioelectric fields of prey and predators as well as being used for navigational purposes.

20.5.68 Skates and rays are amongst the most common bottom-dwelling fish. Thornback rays are known to use the study area as spawning and nursery grounds. The species peak spawning is between April and August (see **Table 20-6**). Spawning and nursery areas for Thornback ray in relation to the draft Order Limits are illustrated in **Volume 3, Part 3, Figure 20-3: Fish nursery and spawning grounds intensity within Study Area (Part 2).**

Basking shark

20.5.69 The basking shark (*Cetorhinus maximus*) is the largest fish to visit UK waters measuring up to 12 m in length. Despite its size it feeds exclusively on plankton (MarLIN, 2023, REF 20.57). There are regular sightings in the summer months from southern Cornwall to the Scottish Isles, however sightings of basking shark within the study area are rare with only two sightings in the last 10 years.

Diadromous and Catadromous Fish

20.5.70 Diadromous fish migrate between saltwater and freshwater, normally at the time of spawning. Catadromous fish spend most of their life cycle in fresh water and migrate to saltwater to spawn. Species known to be present in the study area, either because they have been recorded in the MMO catch statistics, Datras bottom trawl surveys or eDNA results or are listed as protected species in relevant designated European sites are:

- Twaite shad (*Alosa fallax)*
- Allis shad (*Alosa alosa)*
- Sea lamprey (*Petromyzon marinus)*
- River lamprey (*Lampetra fluviatilis)*
- Atlantic salmon (*Salmo salar)*
- European eel (*Anguilla anguilla*)
- Smelt (*Osmerus eperlanus*)
- Sea trout (*Salmo trutta*)

20.5.71 Some fish species are more sensitive to disturbance or injuries caused by noise than others. Diadromous species including Atlantic salmon, sea lamprey and river lamprey are sensitive to noise and are electrosensitive. 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, REF 20.58).

Sea Lamprey

20.5.72 The sea lamprey (*Petromyzon marinus)* is a primitive, jawless fish resembling an eel. It is the largest of the lampreys found in the UK. It occurs in estuaries and easily accessible rivers, over much of the Atlantic coastal area of western and northern Europe and eastern North America. It has declined in some parts of its European range.

20.5.73 It is an anadromous species. Sea lamprey are the largest of the three lamprey species, reaching a size of approximately one meter in length. After spending 18-24 months feeding at sea, adult sea lamprey migrate into rivers during the spring and early summer. Sea lamprey need clean river gravel for spawning and after the eggs hatch the juvenile larval stage, known as ammocoetes, burrow in marginal silt or sand. Sea lamprey prefer warm waters in which to spawn.

20.5.74 Sea lamprey are present in the Humber Estuary SAC, River Tweed SAC and Tweed Estuary SAC.

20.5.75 There were no recorded sea lamprey within the Datras survey, the MMO statistical catch data or the eDNA data sets.

River lamprey

20.5.76 The river lamprey (*Lampetra fluviatilis*) is found in coastal waters, estuaries and accessible rivers. The species is normally anadromous, and pollution or artificial obstacles such as weirs or dams impede migration.

20.5.77 River lamprey need clean gravel for spawning, and marginal silt or sand for the burrowing ammocoete larval stage. River lamprey are qualifying features in the Humber Estuary SAC and Tweed Estuary SAC. The river lamprey use the designated site as a transitional point between freshwater and sea water. There was no recorded river lamprey within the Datras survey, the MMO statistical catch data or the eDNA data sets.

Atlantic Salmon

20.5.78 The Atlantic salmon (*Salmo salar*) is a diadromous species found within the study area. Spawning takes place in shallow excavations called redds, found in shallow gravelly areas in clean rivers and streams where the water flows swiftly. The young that emerge spread out into other parts of the river. After a period of 1-6 years the young salmon migrate downstream to the sea as 'smolts'. Salmon have a homing instinct that draws them back to spawn in the river of their birth after 1-3 years in the sea (JNCC, 2023, REF 20.59). The salmon start their migration from sea to freshwater between November and February (Wildlife trust, 2025, REF 20.60).

20.5.79 Salmon are an Annex II species and are noted as a qualifying feature of the River Tweed SAC which is located 30.5 km from the draft Order Limits in relation to EGL 4 at its closest point. Atlantic salmon were not recorded in the Datras surveys or the MMO 2023 catch statistics, but were picked up as present at one station in the eDNA survey. They are most likely to be recorded in the northernmost section of the draft Order Limits.

Sea trout

20.5.80 Sea trout (*Salmo trutta trutta*) and brown trout are the same species. A combination of genetics and environmental factors, principally lack of food, will mean that some trout will go to sea to feed before returning to spawn. Young trout of 1 to 3 years old and 5 to 7 inches long will go through some physiological changes which includes the ability to cope with salt water and changing to a silver colour. These small silver trout are called smolts. Smolts will shoal together to migrate to sea, usually around late March/April and usually at night (Wildtrout.org. 2025, REF 20.61)

20.5.81 Going to sea gives the trout access to a much richer source of food, so sea trout will often be substantially bigger than the resident brown trout of the same river. Sea trout were not recorded in the Datras surveys, the MMO 2023 catch statistics or the eDNA survey data.

European eel

20.5.82 European eel (*Anguilla anguilla*) are highly sensitive to noise and likely to be present within the draft Order Limits. The River Tweed SAC has an important population of European eel (Tweed Foundation, 2014, REF 20.62) and it is possible that individuals would be present in the draft Order Limits during their migration through the North Sea

to and from the Sargasso Sea; they are not a qualifying feature of this designated site. European eel were not recorded in the Datras surveys, the MMO 2023 catch statistics or the eDNA survey data. They are most likely to be recorded in the northernmost section of the draft Order Limits.

Smelt

20.5.83 Smelt (*Osmerus eperlanus*) once widespread in the UK, is now in decline and subject to protection at certain key locations. The Northeast of Farnes Deep HPMA and MCZ provides a critical habitat for this species where it can complete some of its life cycle (gov.uk, 2023, REF 20.63). The draft Order Limits diverge around this HPMA and MCZ, with EGL 3 routeing to the east of the site and EGL 4 to the west. The North of Farnes Deep HPMA and MCZ are both located approximately 4.9 km from the draft Order Limits relative to EGL 3 at its closest point, and approximately 0.28 km from the draft Order Limits in relation to EGL 4.

20.5.84 Typically smelt have been observed congregating in shoals in lower estuaries during winter, before ascending rivers between February and April where they spawn in spring before returning to the sea (MarLIN, 2023, REF 20. 37). The species lay their eggs onto the seabed where they adhere to coarse substrates and vegetation to prevent dispersal during incubation.

20.5.85 Smelt were not recorded in the Datras surveys, the MMO 2023 catch statistics or the eDNA survey data.

Prey Species and Food Webs

20.5.86 Several species which occur within the study area have an important role in the North Sea's food web being prey to predators such as birds, marine mammals and piscivorous fish, and, depending on the species, predators of other fish and shellfish. Food webs should also be considered on a global rather than regional basis; though regional changes can have far reaching effects (Albouy et al, 2019, REF 20.64).

20.5.87 Sandeel are a UK Biodiversity Action Plan (BAP) (REF 20.14) priority species, and are preyed upon by several predators which vary depending on whether sandeel are buried or swimming. Whilst active, sandeel are part of the diet of many sea birds including kittiwake, razorbill, puffin and tern species. Usually when buried, sandeel are prey species to herring, sea trout, cod, whiting, and grey gurnard. Additionally, they are prey species for several marine mammals including seal and harbour porpoise.

20.5.88 Like sandeel, herring are a UK BAP (REF 20.14) species and are a prey item for several species of sea bird and fish species such as whiting, cod, mackerel and horse mackerel. Herring eggs are also known to attract predators such as haddock, spurdog, mackerel, lemon sole and other herring.

20.5.89 Sprat is also important prey for other fish species including cod, grey gurnard, herring, sandeel, spurdog, horse mackerel, mackerel, sea trout and whiting, and seabirds.

Protected Species

20.5.90 **Table 20-10** lists the protection afforded to species which have been identified within the study area. Some fish species are protected by several national and international conventions including:

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

Table 20-10 - Protected Species Observed within the Study Area

Species	International			UK			England
	OSPAR	CITES	IUCN	Wildlife and Countryside Act	COMHSR	Features of Conservation Interest (FOCI)	Species of Principal Importance
Pelagic species							
Herring *(Clupea harengus)*			Least concern				Y
Horse mackerel *(Trachurus trachurus)*			Least concern				Y
Mackerel *(Scomber scombrus)*			Least Concern				Y
Demersal Species							
Atlantic cod *(Gadus morhua)*	Y		Vulnerable				Y
Atlantic halibut *(Hippoglossus hippoglossus)*			Endangered				Y
Bass *(Dicentrarchus labrax)*			Least concern				
Haddock *(Melanogrammus aeglefinus)*			Vulnerable				
Ling *(Molva molva)*			Least concern				Y
Plaice *(Pleuronectes platessa)*			Least concern				Y
Saithe *(Pollachius virens)*							

Species	International			UK			England
	OSPAR	CITES	IUCN	Wildlife and Countryside Act	COMHSR	Features of Conservation Interest (FOCI)	Species of Principal Importance
Sole *(Solea solea)*			Data deficient				Y
Whiting *(Merlangius merlangus)*			Least concern				Y
Elasmobranch species							
Basking shark *(Cetorhinus maximus)*	Y	Appendix II	Endangered	Schedule 5			Y
Blonde Ray *(Raja brachyura)*			Near Threatened				
Common Skate *(Raja batis)*	Y		Critically endangered				Y
Cuckoo Ray *(Leucoraja naevus)*			Least Concern				
Lesser spotted dogfish *(Scyliorhinus canicula)*			Least Concern				
Starry smooth-hound *(Mustelus asterias)*			Near Threatened				
Spotted ray *(Raja montagui)*	Y		Least Concern				
Starry Ray *(Amblyraja radiata)*			Least Concern				
Thornback Ray *(Raja clavata)*	Y		Near Threatened				

Species	International			UK			England
	OSPAR	CITES	IUCN	Wildlife and Countryside Act	COMHSR	Features of Conservation Interest (FOCI)	Species of Principal Importance
White Skate *(Rostroraja alba)*	Y		Endangered				Y
Diadromous species							
Allis shad *(Alosa alosa)*	Y		Least Concern	Schedule 5	Annex II & V		Y
River Lamprey *(Lampetra fluviatilis)*			Least Concern		Annex II		Y
Sea Lamprey *(Petromyzon marinus)*	Y				Annex II		Y
Smelt *(Osmerus eperlanus)*			Least Concern			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
European eel *(Anguilla Anguilla)*	Y		Critically endangered				
Shellfish Species							
Cuttlefish *(Sepia officinalis)*			Least Concern				
Ocean quahog *(Arctica islandica)*	Y					Y	

Sources JNCC (2007, REF 20.65,) OSPAR (2023, REF 20.35) IUCN (2023, REF 20.66)

Designated Sites

20.5.91 **Volume 3, Part 3, Figure 20-10: Relevant Designated Sites for the Protection of Fish and Shellfish** illustrates the relevant designated sites for the protection of fish or shellfish species within the study area. Further descriptions of these site are in the below section.

Holderness Offshore MCZ

20.5.92 The draft Order Limits for EGL 3 avoids the Holderness Offshore MCZ. The draft Order Limits for EGL 4 overlaps with this MCZ for approximately 9 km on the southeastern tip and for approximately 1.5 km on the northeastern tip. However, the indicative EGL 4 cable route avoids crossing the site at the northeastern tip.

20.5.93 The Holderness Offshore MCZ covers an area of 1,176 km^2 and is located approximately 11 km offshore from the Holderness coast in the Southern North Sea region. It crosses the 12 NM territorial seas limit and overlaps with the Southern North Sea SAC (JNCC, 2019, REF 20.67) The seabed of the Holderness Offshore MCZ is predominantly composed of sediment habitats ranging from subtidal sand to subtidal coarse sediment and contains part of a glacial tunnel valley. The varied nature of the seabed means it supports a wide range of species, both on and in the sediment, including multiple species of worms, mussel beds, sponges, starfish and crustaceans (such as crabs and shrimp). The site is also a spawning and nursery ground for a number of fish species, including lemon sole, plaice and European sprat. Ocean quahog has also been recorded within the site. The conservation objective for the site is to maintain and/or restore the favourable conservation status of the species.

Humber Estuary SAC

20.5.94 The draft Order Limits lie approximately 7 km from Humber Estuary SAC. The site extends for 366.57 km^2 and includes the second largest coastal plain estuary in the UK (JNCC, 2023, REF 20.68). The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent.

20.5.95 Significant Annex II migratory fish species are present and include river lamprey and sea lamprey, which breed in the River Derwent, a tributary of the River Ouse and are a protected species of the SAC. The conservation objective for the site is to maintain and/or restore the favourable conservation status of the species.

20.5.96 **Table 20-11** illustrates the seasonality of the River and Sea Lamprey with the Humber Estuary SAC.

Table 20-11 - Seasonality of Protected Species in Humber Estuary SAC

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

Source: Natural England (2018, REF 20.69)

North East of Farnes Deep HPMA and MCZ

20.5.97 The draft Order Limits diverge around the North East of Farnes Deep HPMA and MCZ with EGL 3 routeing to the east of the site and EGL 4 to the west. This HPMA and MCZ is located approximately 4.9 km from the draft Order Limits in relation to EGL 3 at its closest point, and approximately 0.28 km from the draft Order Limits in relation to EGL 4.

20.5.98 The HPMA and MCZ are located approximately 55 km offshore from the north Northumberland coast, in the northern North Sea. The habitats within the sites are relatively stable and support a diverse range of marine flora and fauna such as anemones, worms, molluscs, echinoderms and fish species. Also found here is the ocean quahog which is a FOCI and smelt (JNCC, 2023, REF 20.70). The conservation objective for the site is to maintain and/or restore the favourable conservation status of the species.

River Tweed SAC

20.5.99 The River Tweed SAC is located approximately 30 km from the draft Order Limits of EGL 4 at its closest point. The SAC supports a very large, high-quality salmon population in a river which drains a large catchment on the east coast of the UK, with sub-catchments in both Scotland and England which enters the sea in Berwick. The site extends for 374.2 km^2.

20.5.100 The site not only supports a population of Atlantic salmon but other Annex II species including sea lamprey and river lamprey (JNCC, 2023, REF 20.[71]) The conservation objective for the site is to maintain and/or restore the favourable conservation status of the species (Natural England, 2018, REF 20.[72])

Tweed Estuary SAC

20.5.101 The Tweed Estuary SAC is located approximately 27 km from the draft Order Limits for EGL 4 at its closest point. The Tweed Estuary SAC is a complex estuary located on the northeast coast of England which discharges into the North Sea. The variety of intertidal sediment present within the estuary support a wide range of invertebrate communities including worms, molluscs and crustaceans. The diversity of species and habitats increases up the estuary with increasing shelter until the lower salinity estuarine conditions limit the diversity to species tolerant of brackish water only.

20.5.102 Atlantic salmon and Allis shad are present within the estuary. River lamprey and sea lamprey can be found in spring when adult migrate pass the estuary to spawn in sand beds and silt in the upstream sections of the river. Both sea and river lamprey are protected as Annex II species and are a qualifying feature of the Tweed Estuary SAC. The conservation status for the site is to maintain and/or restore the favourable conservation status of the species (Natural England, 2018, REF 20.[73])

Future baseline

20.5.103 As the Projects are likely to exist for up to 40 years it is difficult to provide accurate predictions of the future baseline scenario for fish and shellfish ecology, given the spatiotemporal changes to the marine environment. The baseline environment for fish and shellfish will change, due to natural coastal processes and weather events (such as storms), and effects of climate change.

20.5.104 It is therefore important to consider these changes which may directly or indirectly affect fish and shellfish species and populations in the short, mid, and long-term future. For example, one of the most responsive shellfish receptor groups to environmental change are squids; expansion ranges of squids have been shown to have increased throughout the North Sea in the last 35 years (van der Kooij et al., 2016, REF 20.74) due to increases in water temperatures. Indirectly, it could be expected that large fish populations could add additional impacts on prey species (such as mackerel, herring, whiting and haddock; Barrett et al., 2022, REF 20.[75]) And also provide additional prey resources for squid predators such as spurdog and whiting.

20.5.105 Research has suggested that there have been significant changes in fish communities in the northeast Atlantic over several decades as a result of a number of factors including climate change and fishing activities (DECC, 2022, REF 20.6). These communities consist of species that have complex interconnections with one another and the natural environment.

20.5.106 Fish and shellfish populations are prone to natural variations in population size and distributions, largely as a result of year-to-year variation in recruitment success and these population trends will be influenced by broad-scale climatic and hydrological variations, as well as anthropogenic effects such as climate change and overfishing.

20.5.107 Fish and shellfish play a crucial role in the transfer of energy from lowest to the highest trophic levels within the ecosystem and serve to recycle nutrients from higher levels through the consumption of detritus. Therefore, their populations will be decided by both top-down factors such as predation, and bottom-up factors such as ocean climate and plankton abundance.

20.6 Environmental measures

20.6.1 As set out in **Volume 1, Part 1, Chapter 5: PEIR Approach and Methodology,** the environmental measures are characterised as design measures or control and management measures. A range of environmental measures would be implemented as part of the English Offshore Scheme and will be secured in the DCO as relevant. **Table 20-12** outlines how these design and control measures would influence the fish and shellfish assessment.

20.6.2 Several management plans will be provided as Outline Management Plans with the DCO application to support the Deemed Marine Licences. These will include an Outline Construction Environmental Management Plan (CEMP – **Volume 2, Part 1, Appendix 1.5.C Outline Construction Environmental Management Plan**) and Outline Marine Pollution Contingency Plan. These documents will outline measures to be implemented to comply with legislation (e.g., in relation to the prevention of oil and chemical spills) during all phases of the English Offshore Scheme. Final management plans will be submitted in accordance with the dMLs to discharge the licence conditions. An Outline CEMP can be found in **Volume 2, Part 1, Appendix 1.5.C Outline Construction Environmental Management Plan**. In addition, design measures identified through the EIA process have been applied to avoid or reduce potential significant effects." Design measures included that are relevant to Fish and Shellfish receptors are included in **Table 20-12** below and are also included in **Volume 2, Part 1, Appendix 1.5.A: Outline Register of Design Measures.** Compliance with these measures will be secured by the way of the DCO.

Table 20-12 Summary of the Environmental Measures

Receptor	Potential changes and effects	Embedded measures
Shellfish and marine species with demersal life stage	Temporary and Permanent habitat loss Electromagnetic changes	The intention is to bury the cables in the seabed, except in areas where trenching is not possible e.g. where ground conditions do not allow burial or at infrastructure crossings.
Shellfish and marine species with demersal life stage	Permanent habitat loss due to the deposit of external cable protection	Cable protection features would only be installed where considered necessary for the safe operation of the English Offshore Scheme. This includes the repair of cables due to accidental damage, where depth of lowering is not achieved and at infrastructure crossings.
Shellfish and marine species with demersal life stage	Permanent habitat loss due to the deposit of external cable protection	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 features, rock of similar diameter and material as the receiving environment should be used as an alternative to the current normal approach of using terrestrially sourced granite).

Receptor	Potential changes and effects	Embedded measures
Shellfish and marine species with demersal life stage	Electromagnetic changes	HVDC poles would be bundled to minimise the effects of EMF for electrosensitive receptors.

20.7 Scope of the assessment

Spatial scope and study area

20.7.1 The spatial scope of the assessment of fish and shellfish covers the area of the English Offshore Scheme contained within the draft Order Limits, together with the study area as described in Section 21.4.3.

Temporal scope

20.7.2 The temporal scope of the assessment of fish and shellfish is consistent with the period over which the English Offshore Scheme would be carried out. It assumes construction of the English Offshore Scheme would commence at the earliest 2028 and cover a period of 6 years of total construction time. Operation would commence in 2033 with periodical maintenance required during the operational phase of the English Offshore Scheme. It is assumed that maintenance and repair activities could take place at any time during the life span of the English Offshore Scheme.

20.7.3 The English Offshore Scheme 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.

Identification of receptors

20.7.4 The principal fish and shellfish receptors that have been identified as being potentially impacted by the Projects are summarised in **Table 20-13**.

Table 20-13 Fish and Shellfish Receptors Subject to Potential Effects

Receptor	Reason for consideration
Shellfish and marine species with demersal life stages (including sandeel and herring)	Species which have life stages where they are in contact with the seabed are more sensitive to seabed disturbance and activities associated with cable installation, maintenance, and decommissioning.
Cockles	Cockles are susceptible to smothering and changes in water quality which could be caused by project activities during construction, maintenance, and decommissioning.
High and medium hearing sensitivity species e.g., those with a swim bladder connected to their hearing apparatus (Atlantic cod, herring and other clupeids) and those with a swim bladder but do not use it to support hearing (Atlantic salmon, sea trout, European eel)	High and medium hearing sensitivity species of fish are sensitive to changes in underwater noise levels and therefore must be considered by the EIA.
Electrosensitive species e.g., elasmobranchs, some species of shellfish	Electrosensitive species of fish and shellfish are known to occur in the study area. During operation, the cables would emit an electromagnetic field and therefore impacts on these species must be considered by the EIA.
European sites designated for fish and shellfish features including Humber Estuary SAC, River Tweed SAC and Tweed Estuary SAC (see **Volume 3, Part 3, Figure 20-10: Relevant Designated Sites for the Protection of Fish and Shellfish**)	These sites of international importance are within 40 km of the draft Order Limits. Whilst the study area for fish and shellfish is 15 km from the draft Order Limits the HRA screening provided as **EGL 3 and EGL 4 Draft HRA Report (May 2025) (document reference EGL-WSP-CONS-XX-RP-Y-001)**, considered a wider search area for relevant fish species considering their mobile nature. Screening concluded that likely significant effects on the relevant SACs could be ruled out and that an Appropriate Assessment would not be required as per the Habitats Regulations.
Nationally designated sites with a fish / shellfish qualifying feature including Holderness Offshore MCZ, North East of Farnes Deep HPMA and MCZ (see **Volume 3, Part 3, Figure 20-10: Relevant Designated Sites for the Protection of Fish and Shellfish**)	Nationally designated sites within 40 km of the draft Order Limits. Whilst the study area for fish and shellfish is 15 km from the draft Order Limits the MCZ Assessment screening provided as **Volume 2, Part 3, Appendix 3.17.A Marine Conservation Zone (MCZ) Assessment Screening**, considered a wider search area for relevant fish species considering their mobile nature. The Assessment concluded that a likely significant effect could not be ruled out for Holderness

Receptor	Reason for consideration
	Offshore MCZ and North East of Farnes Deep HPMA and that Stage 1 Assessment would be required. A Stage 1 Assessment will be provided with the ES.

Potential effects considered within this assessment

20.7.5 The effects on Fish and shellfish receptors which have the potential to be significant and have been taken forward for detailed assessment are summarised in **Table 20-14.**

Table 20-14 Fish and Shellfish Receptors Scoped in for Further Assessment

Receptor	Likely significant effects
Shellfish and marine species with demersal life stages	**Temporary habitat loss/seabed disturbance** from activities such as pre-sweeping of sand-waves, cable burial and trenching, cable repair and cable removal.
Shellfish and marine species with demersal life stages	**Permanent habitat loss** due to the deposit of external cable protection
Shellfish and marine species with demersal life stages	**Temporary increase and deposition of suspended sediments** due to pre-sweeping during construction and decommissioning
Shellfish and marine species with demersal life stages (including herring and cockles) North East of Farnes Deep HPMA	**Temporary increase and deposition of suspended sediments** due to other activities during construction and decommissioning
High and medium hearing sensitivity species	**Underwater noise changes** due to the presence of project vessels and equipment during all project phases and geophysical survey
High and medium hearing sensitivity species	**Underwater noise changes** from UXO detonation
Electrosensitive species	**Electromagnetic changes** / Barrier to species movement due to the presence of operational cables
Shellfish and marine species with demersal life stages	**Temperature increase** due to the presence of operational cables

20.7.6 The receptors/effects detailed in **Table 20-15** have been scoped out from being subject to further assessment because the potential effects are not considered likely to be significant.

Table 20-15 Summary of Effects Scoped out of the Fish and Shellfish Assessment

Receptors/potential effects	Justification
Species with fully pelagic lifecycle **Temporary habitat loss/seabed disturbance**	Species which have a fully pelagic lifecycle would not be significantly affected by disturbance of the seabed or localised seabed deposits and would therefore be scoped out of the assessment. The Planning Inspectorate agreed with this decision.
Species with fully pelagic lifecycle **Permanent habitat loss**	
All species (except certain shellfish including cockles and herring) **Temporary increase and deposition of suspended sediments**	The activity that would lead to the most significant contributor (relatively) to an increase is suspended sediment concentrations and subsequent deposition is cable trenching (pre-sweeping is assessed separately). The Scoping Report provided evidence from analogous cable projects that the spatial extent of heavy smothering is restricted to several metres either side of the trench and changes in water clarity from sediment plumes are limited in extent and duration; potential significant effects are unlikely. The Applicant proposed to scope out this impact on most species with the exception of certain sensitive shellfish such as cockles. The Planning Inspectorate agreed with this decision but requested that assessment be also provided for herring.
All species **Accidental spills due to presence of project vessels and equipment**	Projects' vessels and contractors would comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 which relate to pollution from oil from equipment, fuel tanks etc and release of sewage (black and grey water). It is a legal requirement that all vessels have a Shipboard Oil Pollution Emergency Plan. Compliance with Regulations would be sufficient to minimise the risk to the environment.
Shellfish **Introduction or spread of marine invasive non-native species (MINNS)**	Although the introduction of Projects' vessels, equipment, and external cable protection have the potential to introduce and spread MINNS, all relevant guidelines would be followed (GB Non-native Species Secretariat, 2015, REF 20.76) including vessel cleaning facilities and the use of anti-fouling paint. Projects' vessels and contractors would comply with the International Convention for the Control and Management of Ships' Ballast water and Sediments. All seabed deposits would be inert with no biologically active material. Projects' vessels will complete a biosecurity risk assessment prior to arriving on site which would include factors such as origins of the vessels and ensuring that relevant equipment is cleaned before use. Compliance with Regulations would be sufficient to minimise the risk to the environment.
Basking Shark	There have only been a couple of sightings of basking shark within the waters of the study area during the last

Receptors/potential effects	Justification
Collision risk	20 years (NBN Atlas, 2025, REF 20.77). This impact pathway has been scoped out due to the scarcity of the species within the study area. The Planning Inspectorate agreed with this decision.

20.8 Key parameters for assessment

Realistic worst-case design scenario

20.8.1 The assessment has followed the Rochdale Envelope approach as outlined in **Volume 1, Part 1, Chapter 4: Description of the Projects** and **Volume 1, Part 1, Chapter 5 PEIR Approach and Methodology.** The assessment of effects has been based on the description of the Projects and parameters outlined in **Volume 1, Part 1, Chapter 4: Description of the Projects**. However, where there is uncertainty regarding a particular design parameter, the realistic worst-case design parameters are provided below with regards to fish and shellfish along with the reasons why these parameters are considered worst-case. The preliminary 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, based on details within the Rochdale Envelope (e.g., different infrastructure layout within the draft Order Limits), to that assessed here be taken forward in the final design plan.

20.8.2 In relation to fish and shellfish the following assumptions presented in **Table 20-16** and **Table 20-17** are made regarding the Projects' design parameters in order to ensure a realistic worst-case assessment has been undertaken.

20.8.3 With regards to underwater noise changes, it is assumed that UXO clearance is undertaken under a separate Marine Licence application, subject to its own environmental assessments. A high-level overview of the noise modelling for clearance is provided in the preliminary environmental assessment and will be included in the ES, to provide a holistic overview of everything that may be needed during construction.

Table 20-16 - EGL 3 Project Worst-case Assumptions

Impact Pathway	Construction	Operation	Decommissioning	Most sensitive location or scenario
Temporary habitat loss/ seabed disturbance	13.20 km^2	To be confirmed	Similar footprint as is disturbed during construction and operation combined.	Herring or sandeel habitat
Permanent habitat loss	0.915 km^2	To be confirmed	No new deposits but assumes cable protection remains in place.	Herring or sandeel habitat

Impact Pathway	Construction	Operation	Decommissioning	Most sensitive location or scenario
Temporary increase and deposition of suspended sediments	**Volume 1, Part 3, Chapter 18** concluded that the majority of suspended sediment would settle within 700 m of the cable trench during trenching and very fine sands (<63 µm) may travel as far as 17.5 km dependant on the peak flow speed. However, sediment deposition beyond 700 m would be <2 mm. Material discharged from the trailing suction hopper dredger would settle within 3.15 km of the disposal location.			Herring habitat

Table 20-17 - EGL 4 Project Worst-case Assumptions

Impact Pathway	Construction	Operation	Decommissioning	Most sensitive location or scenario
Temporary habitat loss/ seabed disturbance	12.75 km^2	To be confirmed	Similar footprint as is disturbed during construction and operation combined.	Herring or sandeel habitat
Permanent habitat loss	1.135 km^2	To be confirmed	No new deposits but assumes cable protection remains in place.	Herring or sandeel habitat
Temporary increase and deposition of suspended sediments	**Volume 1, Part 3, Chapter 18 Coastal and Marine Physical Processes** concluded that the majority of suspended sediment would settle within 700 m of the cable trench during trenching and very fine sands (<63 µm) may travel as far as 17.5 km dependant on the peak flow speed. However, sediment deposition beyond 700 m will be <2 mm. Material discharged from the trailing suction hopper dredger would settle within 3.15 km of the disposal location.			Herring habitat

Consideration of construction scenarios

20.8.4 As detailed in **Volume 1, Part 1, Chapter 4: Description of the Projects**, the timing of construction activities set out within this PEIR is indicative. To allow for any unexpected circumstances and a realistic worst-case assessment, the impact assessment for the English Offshore Scheme considers the following construction

scenario to ensure the worst-case scenario for fish and shellfish can be identified and assessed.

20.8.5 Each scenario's worst-case effects were combined and considered in coming to the conclusions discussed below. The effects in reality should be significantly less than this worst-case example.

- EGL 3 and EGL 4 are constructed sequentially, and construction activities do not overlap temporally. This is equivalent to the 6-year period, mentioned in **Section 20.7.2,** over which fish and shellfish would be subject to effects.
- EGL 3 and EGL 4 are constructed in parallel and construction activities overlap temporally. This would be within the 6-year period, mentioned in **Section 20.7.2**, reducing the time over which fish and shellfish would be subject to effects but potentially increasing the magnitude of impacts.

20.9 Assessment methodology

Overview

20.9.1 The generic project-wide approach to the assessment methodology is set out in **Volume 1, Part 1, Chapter 5: EIA Approach and Methodology**, and specifically in **Sections 5.4** to **5.6**. However, whilst this has informed the approach that has been used in this fish and shellfish assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of this fish and shellfish assessment. Details are provided below.

20.9.2 The criteria for characterising the value and sensitivity and magnitude for fish and shellfish are outlined in **Table 20-18** and **Table 20-19** respectively.

20.9.3 The assessment of sensitivity will be 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 will also vary depending on the impact pathway. For example, certain mobile demersal species are less sensitive to temporary habitat loss than shellfish species with limited mobility, whilst sensitivity to underwater noise changes differs between fish species depending on their anatomy.

20.9.4 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. These species will also be considered in the HRA and MCZ assessment processes. Screening has been provided with this preliminary environmental assessment as **EGL 3 and EGL 4 Draft HRA Report (May 2025) (document reference EGL-WSP-CONS-XX-RP-Y-001)** and **Volume 2, Part 3, Appendix 3.17.A Marine Conservation Zone (MCZ) Assessment Screening.** Where potential significant effects cannot be ruled out, the impacts on a relevant designated site would be considered in either a Report to Inform Appropriate Assessment or Stage 1 MCZ Assessment, to be submitted with the ES.

20.9.5 The assessment of magnitude will be 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.

20.9.6 The ecological impact assessment will use available evidence, professional judgement and knowledge of marine mammal ecology and behaviour to determine the level of impact.

20.9.7 The significance of an effect, either adverse or beneficial, will be determined using a combination of the magnitude of the impact and the sensitivity of the receptor. A matrix approach is used throughout all topic areas to ensure a consistent approach within the assessment. This is described further in **Volume 1, Part 1, Chapter 5:** EIA Approach and Methodology**,** and is replicated for ease in **Table 20-20**.

Table 20-18 - Criteria for Characterising the Sensitivity of Receptors

Receptor sensitivity/value	Definition
High	Receptor has low tolerance to change i.e., recovery will take longer than 10 years following the cessation of activity or will not occur. The receptor is a protected feature of an internationally or nationally designated site (e.g., SAC, MCZ) and the licensable activity is taking place during a sensitive season.
Medium	Receptor has intermediate tolerance to change i.e., recovery to pre-impact conditions is possible between 5 and 10 years.
Low	Receptor has high tolerance to change with recovery to pre-impact conditions between 1 and 5 years. Common and widespread habitats/species of no specific conservation value.
Negligible	Receptor is common or widespread. 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 20-19 - Criteria for Characterising the Magnitude of an Impact

Magnitude	Definition
High	Impacts are of long-term (>15 years) through to long-term/permanent duration and/or on a regional or population/habitat level or 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.

Magnitude	Definition
Medium	Impacts are of medium term (7-15 years) duration and/or 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, site specific and/or a minor shift away from the baseline condition such as that experienced under natural conditions. Impacts limited to within the Projects footprint. Negligible contribution to cumulative effects.
Negligible	Very little or no detectable change from baseline conditions. Disturbance is within the range of natural variability. Impacts predicted to be brief (one to two days) or for a short period (up to 3 months). No contribution to cumulative effects

Table 20-20 Significance Matrix

		Sensitivity			
		High	**Medium**	**Low**	**Negligible**
Negative 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

Preliminary assessment of cumulative effects

20.9.8 At the current stage of the Projects (PEIR stage), design information for the Projects is insufficient to allow for a robust cumulative assessment to be undertaken. Furthermore, given the current position in relation to baseline data collection, with much of the onshore environmental surveys still to be undertaken during 2025, the baseline identified at this PEIR stage cannot be taken as a complete picture of the potential presence and significance of sensitive receptors. Therefore, a cumulative assessment has not been undertaken at this stage; however, **Volume 1, Part 4, Chapter 28: Cumulative Effects**, presents the long and short lists of 'other developments' which will be considered at the ES stage, and the methodology which allowed for the identification of these other developments, to allow consultation bodies

to form a view and provide comment on the other developments included. The long-list will be reviewed and if necessary, updated, in the lead up to the ES, as the Projects design further evolves and in response to any comments raised at statutory consultation.

20.10 Preliminary assessment of Temporary habitat loss/seabed disturbance effects – All Project Phases

20.10.1 Several of the impacts established by the JNCC Marine Pressures-Activities Database v1.5 (2022) (REF 20.78) have been considered under this overarching category, namely: abrasion/penetration of the substrate on the surface of the seabed; penetration and/or disturbance of the substratum below the surface of the seabed including abrasion; changes in suspended solids (water clarity); and smothering and siltation rate changes.

20.10.2 Aspects of the English Offshore Scheme that physically disturb the seabed e.g., seabed preparation (including UXO identification and pre-sweeping of sand waves), cable burial, cable repair, and eventual cable removal, have the potential to disturb habitats and prey species that live in contact with the seabed. Typically, the extent of this disturbance would be up to 30 m wide along the entire English Offshore Scheme; 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 in **Section 20.8** and is summarised in **Table 20-21.**

Table 20-21 Summary of Footprint for Temporary Habitat Loss

Phase	Construction *	Operation	Decommissioning
EGL 3 Project	13.20 km^2	To be confirmed	Would be the same as the construction plus operation footprint
EGL 4 Project	12.75 km^2	To be confirmed	

* Equivalent to the footprint from the seabed clearance activity Pre-Lay Grapnel Run (PLGR), plus trial trenching and HDD exit pits. All other activities are assumed to be within these initial footprints.

20.10.3 Most Project 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 will occur in the same footprint and would be separated by several months e.g., seabed preparation followed by trenching. Certain fish and shellfish species may be more sensitive to the impact than others due to their ability to recover.

20.10.4 Abrasion and penetration of the substrate could result in the localised loss or 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 with demersal life stages. Less mobile fish, most shellfish species with the exceptions of squids and cuttlefish, larvae, and eggs are the most susceptible to the effects of this impact.

Shellfish and fish species with demersal life stages

20.10.5 Demersal fishes such as cod, whiting, Dover sole, plaice and sandeel (and their eggs and larvae), pelagic species with a demersal life stage e.g. herring, and shellfish that are sessile or have low mobility are most sensitive to seabed disturbance effects. During construction adults may be displaced, or juveniles, eggs and larvae may be damaged and/or killed. The preliminary assessment focuses on three key receptors, herring, sandeel and shellfish. Herring and sandeel, have specific sediment requirements for spawning and habitat, and are likely to be among the more sensitive receptors to temporary habitat loss/seabed disturbance.

Herring

20.10.6 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 Atlantic 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. The construction, maintenance or decommissioning works could take place during a sensitive season e.g. August to October, with the potential to detrimentally affect eggs in a highly localised area. However, it should be noted that Atlantic herring behaviour shows a lack of site fidelity in terms of annual return to spawning locations. In addition, they are of national conservation importance, are of commercial importance and ecologically important as a prey species.

20.10.7 The baseline has established that both the EGL 3 and EGL 4 Projects cross the Yorkshire section of the Banks herring spawning grounds. Preliminary analysis of sediment particle size data suggests that approximately 94 km of the EGL 3 Project and 65 km of the EGL 4 Project, would classify as Prime or Sub-Prime herring spawning habitat; noting that not all of this habitat lies within the spawning grounds as defined by (Coull *et al*. 1998 REF 20.1). The EGL 3 Project overlaps with the Yorkshire spawning ground for approximately 190 km, of which approximately 59 km has been classified as ‘Prime’ and/or ‘Sub-Prime’ herring habitat in the suitable water depth for herring spawning. This represents around 0.6% of the spawning ground (calculations based on a 30m wide construction corridor). Similarly, the EGL 4 Project overlap with the Yorkshire spawning ground for 181 km, with approximately 57 km identified as ‘Prime’ and ‘Sub-Prime’ habitat, impacting around 0.58% of the spawning ground (calculations based on a 30 m wide construction corridor). The Banks herring stock spawns from August to October. As identified by the assessment there is Prime and Sub-Prime habitat outside of the identified spawning grounds, meaning that alternative habitats are available over a wider area.

20.10.8 The majority of the North Sea is considered 'low intensity' herring nursery grounds by (Ellis et al., 2012, REF 20.2) though there is area of high intensity in ICES rectangle 35F0 and 40E8. The spatial extent of temporary habitat loss/seabed disturbance to herring grounds is considered low, given the availability of alternative available habitat surrounding the English Offshore Scheme, and the wider North Sea. The construction 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.

20.10.9 The overall significance of the effect on herring for all phases has been assessed as **Minor** and **Not Significant**.

Sandeel

20.10.10 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 has the potential to be detrimental to population numbers. In addition, they are of national conservation importance, are of commercial importance and ecologically important as a prey species.

20.10.11 The baseline has established that both the EGL 3 and EGL 4 Projects pass through discrete areas of Prime and Sub-Prime habitat sandeel habitat. The majority of the Prime and Sub-Prime locations along the EGL 3 Project lie either within the Lincolnshire or Northumberland spawning grounds, as defined by Coull et al. (1998) (REF 20.1). The EGL 3 Project overlaps with the Lincolnshire spawning ground for approximately 136 km, of which 10 km has been classified as ‘Prime’ and/or ‘Sub-Prime’ sandeel habitat; approximately 0.00074% of the spawning ground would be affected by construction. The EGL 3 Project also overlap with the Northumberland spawning ground for 83 km, with approximately 36 km identified as ‘Prime’ and ‘Sub-Prime’ habitat, impacting around 0.01204% of the spawning ground.

20.10.12 All of the Prime and Sub-Prime locations along the EGL 4 Project lie within either the Lincolnshire or Northumberland spawning grounds, as defined by Coull et al. (1998, REF 20.1). The EGL 4 Project overlaps with the Lincolnshire spawning ground for approximately 135 km, of which 48 km has been classified as ‘Prime’ and/or ‘Sub-Prime’ sandeel habitat; approximately 0.000067% of the spawning ground would be affected by construction. The EGL 4 Project also overlaps with the Northumberland spawning ground for 147 km, with approximately 25 km identified as ‘Prime’ and ‘Sub-Prime’ habitat, impacting around 0.0083% of the spawning ground.

20.10.13 The spawning grounds that the English Offshore Scheme cross are considered 'low intensity' spawning grounds by Ellis et al., (2012, REF 20.2).

20.10.14 The spatial extent of temporary habitat loss/seabed disturbance to sandeel grounds is considered low, given the availability of alternative available habitat surrounding the English Offshore Scheme, 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.

20.10.15 The overall significance of the effect on sandeel during all phases has been assessed as **Minor** and **Not Significant**.

Shellfish

20.10.16 There is potential for shellfish to be affected by temporary habitat loss/seabed disturbance during construction. Within the study area, cockles are an important, commercially targeted species (>500 t landed in 2023 from the area). Crabs, lobsters,

are also landed from the study area, but in trivial quantities compared to cockles. Cockles, crabs and lobsters are more limited in their mobility than demersal fish and are therefore often less able to avoid or move away from sources of disturbance.

20.10.17 Some species can disperse over short distances whilst others are sessile. At all life stages, shellfish are considered to have a **medium sensitivity** to physical damage due to limited dispersal. In addition, many species are of high economic value in the study area.

20.10.18 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.

20.10.19 The overall significance of the effect on shellfish during all phases has been assessed as **Minor** and **Not Significant**.

20.11 Preliminary assessment of Permanent habitat loss due to the deposit of external cable protection

20.11.1 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.

20.11.2 The worst-case installation footprint for temporary habitat loss is presented in **Section 20.8** and summarised in **Table 20-22**.

Table 20-22 Summary of Footprint for Permanent Habitat Loss

Phase	Construction *	Operation	Decommissioning
EGL 3 Project	0.915 km^2	To be confirmed	No new deposits but assumes cable protection remains in place.
EGL 4 Project	1.135 km^2	To be confirmed	

* Infrastructure crossings and remedial rock protection

20.11.3 The deposition of external cable protection would result in a permanent change of habitat type within the footprint of the activity. The change in substrate would make it unsuitable habitat for fish species or unsuitable for fish spawning grounds.

20.11.4 As migratory fish are only transient within the English Offshore Scheme, 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.

20.11.5 Two options will be considered at decommissioning: leaving the cables in-situ and removing them. If the cables are left in-situ there would be no additional effects on herring during decommissioning. No additional external cable protection would be installed, but the existing external cable protection would not be removed meaning the localised change in habitat is permanent. However, if the option to remove the cables (and any associated protection) is selected, this process would essentially be the same as installation activities but in reverse. Depending on water depth, the type of external cable protection deployed, technological advances and the structural integrity of the cable protection it may or may not be possible to remove it from the seabed. Removing it from the seabed would remove the anthropogenic impact allowing the seabed to return to natural conditions, but it may also remove an ecologically important habitat that has become established e.g. similar to an artificial reef. The environmental impact of decommissioning would be assessed at the time, but it is predicted that it would not be more significant than effects during construction.

Shellfish and fish species with demersal life stages

20.11.6 Research has shown that some fish and shellfish species utilise rocky areas for shelter when guarding eggs/nests, and protection from predators (Barrett et al., 2014, REF 20.[79]). The English Offshore Scheme is primarily sand, gravelly sand and slightly gravelly sand habitat, meaning permanent habitat loss due to external cable protection could be beneficial. 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.

20.11.7 However, some fish (particularly flatfish such as lemon sole, Dover sole, plaice, and flounder) are associated with sandy seabeds and as such, 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.

Herring

20.11.8 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.

20.11.9 The locations requiring rock protection that fall within Prime and Sub-Prime spawning grounds will be identified and provided within the ES. These are high intensity nursery grounds as identified by Coull et al. (1998, REF 20.1) and Ellis et al. (2012, REF 20.2) 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 in herring grounds is extremely localised, given the availability of alternative available habitat surrounding the English Offshore Scheme, and within the wider North Sea. Localised changes would not have a significant effect on overall herring abundance.

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

Sandeel

20.11.11 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 and ecologically important as a prey species. The locations requiring rock protection that fall within Prime and Sub-Prime spawning grounds will be identified and provided within the ES.

20.11.12 The **magnitude** of the impact has been assessed as **low** because the spatial extent of permanent habitat loss in sandeel grounds is extremely localised, given the availability of alternative available habitat surrounding the English Offshore Scheme, and within the wider North Sea. The localised change in habitat would not alter overall sandeel abundance.

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

Shellfish

20.11.14 This receptor has been 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.

20.11.15 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 English Offshore Scheme.

20.11.16 The significance of the effect on shellfish has been assessed as **Minor** and **Not Significant** during construction and operation.

20.12 Preliminary assessment of Temporary increase and deposition of suspended sediments due to pre-sweeping.

20.12.1 Temporary increases and depositions 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 either immediate alongside the cable route, or to a separate disposal location. Depending on the technique used and the

size of sand waves requiring pre-sweeping, the redeposition of sediment can cause smothering >10 cm deep over relatively wide areas of seabed (in the order of tens of thousands square metres). Effects could potentially be significant if the disposal site contains sensitive spawning grounds or shellfish beds. It should be noted that the baseline established no cockle, oyster or mussel beds are present within the draft Order Limits.

20.12.2 The majority of the draft Order Limits is over sand, gravelly sand and slightly gravelly sand sediment type. **Volume 1, Part 3, Chapter 18: Coastal and Marine Physical Processes** provides an assessment of the area of seabed impacted by temporary increases and depositions of suspended sediments from pre-sweeping. In summary, it estimates that all sediment coarser than very fine sand would settle within the draft Order Limits. Fine particles (very fine sand 125 µm) would settle within 3.15 km of the disposal location. Fines (<63 µm) would remain in suspension (potentially indefinitely) and may travel up 11.77 km but sediment deposition would be <2 mm, and unnoticeable against background levels of sediment deposition. The maximum distance the suspended sediment concentrations (SSC) exceed 10 mg/l is 4 km from the source. As such, any impact from SSC is expected to be small and localised, and any measurable change in SSC would be temporary and localised.

20.12.3 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.

Shellfish and fish species with demersal life stages

20.12.4 Shellfish present in the study area include European lobster, crabs (edible, green, velvet and spider), crawfish, scallops, whelks, cockles and squids. 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 European 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.

20.12.5 When not buried, edible lobster, European lobster, and king scallops are considered mobile, capable of tolerating a sediment smothering depth of 5 cm (Neal & Wilson, 2008, REF 20.27). 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.

20.12.6 Bivalve species such as cockles, scallops and ocean quahog are adapted to a sedimentary environment and changes in suspended sediment concentrations do not necessarily lead to adverse effects. Cockles can cope with light smothering (<2 - 5 cm) as they can quickly burrow through the sediment, however, would struggle if smothering is >5 cm (REF 20.[80]). Similarly juvenile and adult scallop could probably lift themselves clear of a new layer of sediment <5 cm, since they are capable of jumping and swimming (REF 20. [81]). According to MarLIN Ocean quahog are not sensitive to light or heavy smothering (REF 20.[82]). It should be noted that the commercial cockle

area is approximately 17 km from the draft Order Limits (at the closest point) in The Wash and would therefore not experience any direct impacts.

20.12.7 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 (REF 20.[83]). 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.

20.12.8 It is considered that the sensitivity of herring and sandeel represent the worst case. Taking the above discussion into consideration, the commercial importance of shellfish 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**.

20.12.9 Modelling of the disposal of dredged material from pre-sweeping for the NeuConnect project (an analogous activity; modelling of deposition of 175,000 m^3) predict that instantaneous values of <15 mg/l are predicted proximal to the release location from a trailing suction hopper dredger. This increase is transient, decreasing rapidly as the sand sized particles settle out of suspension. At the disposal locations, deposits of dredge material are predicted in the order of several metres, but these deposits are extremely localised (immediately beneath the dredger) and reduce to <0.25 cm as a result of associated sediment plumes, as discussed further below (REF 20.84)

20.12.10 Whilst it is acknowledged that the sediment deposition in the pre-sweeping disposal 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. Outside of these disposal locations, which will be defined in the ES, the sediment deposition would be minimal (2 mm), within levels that species can tolerate. The **magnitude** of the impact has been assessed as **low,** given the small spatial scale.

20.12.11 The **significance** of the effect has been assessed as **Minor** and **Not Significant,** during construction. During operation and 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 the other project phases.

20.13 Preliminary assessment of Temporary increase and deposition of suspended sediments due to all other activities.

20.13.1 Temporary increases and deposition of suspended sediments are likely to occur from any activities which disturb the seabed e.g., seabed clearance works such as PLGR, boulder clearance, UXO identification, as well as anchoring, but relatively cable trenching has the highest magnitude of impact. The discussion therefore focuses on this aspect of construction.

20.13.2 During cable trenching, suspended sediments would be increased in the immediate vicinity of the installation tool. If a jetting tool is used for installation (worst case), approximately 75% of sediment is expected to fall directly back into the installation trench, with approximately 25% of the sediment dispersing. For plough trenching sediment disturbance is far less but as there is no publicly available information on

likely proportion, it has been assumed that similar proportions of sediment would be suspended. While the larger grain sediments such as gravel and sand would settle quickly within metres of the cable trench, finer grain sediment would be dispersed further and remain in the water column for a longer period, potentially reducing water clarity and increasing the concentration of suspended solids over a wider area.

20.13.3 The majority of the draft Order Limits is over primarily sand, gravelly sand and slightly gravelly sand sediment type. **Volume 1, Part 3, Chapter 18: Coastal and Marine Physical Processes** provides an assessment of the area of seabed impacted by temporary increases and depositions of suspended sediments from cable burial. In summary, it estimates that all sediment coarser than fine sand would settle within the draft Order Limits and very coarse gravels would settle back into the trench. Beyond the draft Order Limits, fine particles may travel up to 17.5 km, but sediment deposition would be <2 mm, and unnoticeable against background levels of sediment deposition. The maximum distance the SSC exceed 10 mg/l is 8 km from the source (but note that this is within nearshore sections of the draft Order Limits, further offshore it reduces to 2.7 km due to the reduced percentage of fines in sediments). As such, any impact from SSC is expected to be small and highly localised, and any measurable change in SSC would be temporary and localised, i.e., mostly within the bottom 5 m of the water column. 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.

Shellfish and fish species with demersal life stages

20.13.4 The **sensitivity** of shellfish (including cockles) and fish with demersal life stages (including sandeel and herring) has been assessed as **medium** based on the justification provided in **Sections 20.12.4** to **20.12.8** for a temporary increase and deposition of suspended sediments due to pre-sweeping. Whilst the deposit of pre-swept material generates significantly higher sediment deposition thicknesses than other activities during construction, the sensitivity of species to the overall impact pathway would not change.

20.13.5 Other activities which disturb the seabed would occur throughout the draft Order Limits, but over a localised footprint. Seabed disturbance is limited to a 30 m wide corridor (maximum width of seabed clearance work) per Project, noting that a large portion of the works would not require this full width and actual effects are likely to be over a limited portion of the corridor. As the majority of the draft Order Limits are sand, gravelly sand and slightly gravelly sand sediment types, sediment grains would be suspended briefly (about 1 minute for sand and less than 10 seconds for gravel) and would settle within the trench or within the draft Order Limits. Maximum settling depths depend on the proportion of sand and gravel in the sediments and the depth of the trench but would be <5 cm. Finer silt and clay fraction would remain in suspension for a longer period and have the potential to travel further before being deposited over a wider area, but deposition thicknesses past the draft Order Limits would be <2 mm thick.

20.13.6 The baseline has established that both the EGL 3 and EGL 4 Projects cross the Yorkshire section of the Banks herring spawning grounds. Preliminary analysis of sediment particle size data suggests that approximately 94 km of the EGL 3 Project and 65 km of the EGL 4 Project, would classify as Prime or Sub-Prime herring spawning habitat; noting that not all of this habitat lies within the spawning grounds as

defined by Coull *et al*. (1998) (REF 20.1). The EGL 3 Project overlaps with the Yorkshire spawning ground for approximately 190 km, of which approximately 59 km has been classified as 'Prime' and/or 'Sub-Prime' herring habitat in the suitable water depth for herring spawning. Similarly, the EGL 4 Project overlaps with the Yorkshire spawning ground for 181 km, with approximately 57 km identified as 'Prime' and 'Sub-Prime' habitat. The Banks herring stock spawns from August to October. As identified by the assessment there is Prime and Sub-Prime habitat outside of the identified spawning grounds, meaning that alternative habitats are available over a wider area.

20.13.7 With respect to sandeel, the baseline established that both the EGL 3 and EGL 4 Projects pass through discrete areas of Prime and Sub-Prime habitat sandeel habitat. The EGL 3 Project overlaps with the Lincolnshire spawning ground for approximately 136 km, of which 10 km has been classified as 'Prime' and/or 'Sub-Prime' sandeel habitat; and the Northumberland spawning ground for 83 km, with approximately 36 km identified as 'Prime' and 'Sub-Prime' habitat. The EGL 4 Project overlaps with the Lincolnshire spawning ground for approximately 135 km, of which 48 km has been classified as 'Prime' and/or 'Sub-Prime' sandeel habitat; and the Northumberland spawning ground for 147 km, with approximately 25 km identified as 'Prime' and 'Sub-Prime' habitat.

20.13.8 The area where fine sediments may be re-deposited is negligible in the context of the overall distribution of the North Sea stocks for herring and sandeel. If activities were to take place during the most sensitive period for the species (August to October for herring, November to February for sandeel) the affected area would be small due to the extremely small settling depths and suspension distances. Therefore, a significant proportion of herring eggs / larvae or sandeel would not be affected. Shellfish (including cockles) have a natural tolerance to moderate changes in suspended sediment concentrations, due to temporary localised natural changes during storm events and periods of strong wave action when sediment is mobilised. The **magnitude** of the impact has therefore been assessed as **low**.

20.13.9 The **significance** of the effect has been assessed as **Minor** and **Not Significant,** during construction. During operation and decommissioning, the level of seabed disturbance required and subsequent suspended sediment concentrations and sediment deposition, would be lower or the same in magnitude to that required during construction therefore this preliminary conclusion is also relevant for the other project phases.

20.14 Preliminary assessment of Underwater noise changes

20.14.1 Sound is readily transmitted into the underwater environment and there is potential for the noise emissions from construction, operation, maintenance and decommissioning activities. Noise can be categorised into impulsive sources or continuous sources. Impulsive noises are typically transient, brief (less than one second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay (ANSI, 1986, REF 20.85 and 2005, REF 20.86; NIOSH, 1998, REF 20.87). This category includes noise sources such as seismic surveys and underwater explosions. Continuous (non-impulsive) noises can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent and typically do not have a high peak sound pressure with rapid rise/decay time that impulsive noises do (ANSI, 1995, REF 20.88; NIOSH, 1998, REF 20.87). This category includes noise sources such as continuous running machinery, sonar, and vessels.

20.14.2 Underwater noise propagation modelling has been undertaken for the English Offshore Scheme to inform the EIA. **Volume 2, Part 3, Appendix 3.22.A Underwater Noise Assessment** provides a summary of acoustic concepts and terminology, acoustic assessment criteria, estimated source noise levels and provides the approach taken and results of the underwater noise propagation modelling. The report uses sound propagation models to calculate the impact ranges for fish from each phase of the English Offshore Scheme for three key modelled sources, referencing them back to impact criteria from Popper et al., (2014) (REF 20.5) and the Washington State Department of Transport (2011) (REF 20.89):

- Geophysical surveys – non-impulsive sound sources;
- Vessels and equipment – non-impulsive sound sources; and
- Clearance of UXO – an impulsive sound source.

20.14.3 Sound allows fish to communicate and detect prey and predators. Fish sensitivity to sound depends upon the sound frequency, and their responses depend on the noise levels within the frequency ranges the fish is sensitive to. Generally, most fish do not detect frequencies above 1 kHz, except for shads, which are known to detect frequencies above this (Popper et al., 2014, REF 20.5)

20.14.4 Fish are not all equally sensitive to noise. Three categories of fish hearing sensitivity groups have been assigned, based on their physiologies:

- **High hearing sensitivity fish**: these species which rely on a swim bladder to assist hearing. As swim bladders are gas-filled, these fish are susceptible to barotrauma (a condition seen in many fish caught at depths greater than 50 feet caused by pressure changes leading to an expansion of gases in the swim bladder) and can detect particle motion and sound pressure (includes Atlantic cod, herring and other clupeids).
- **Medium hearing sensitivity fish**: those species which have swim bladders, but do not rely on said swim bladders for hearing. Like high hearing sensitivity fish, these fish may be susceptible to barotrauma (includes Atlantic salmon, sea trout, European eel).
- **Low hearing sensitivity fish**: those species which lack a swim bladder and detect particle motion rather than sound pressure (includes flatfish, elasmobranchs, and lampreys).

20.14.5 Shellfish tend to be more sensitive to particle motion rather than sound pressure (Popper & Hawkins, 2018, REF 20.[90]), though the impacts of underwater noise upon these receptors has been seldom researched. It is known that some crustaceans have tactile hairs which respond to particle displacement of an impinging sound, though not to the sound's pressure component (Popper al., 2001, REF 20.91). This sense is important for intraspecific communication, limited research has found potential for injury in adult/developmental stages of crustacea from underwater noises, only when they are in very close proximity a few metres away to high intensity sounds.

20.14.6 The preliminary assessment focuses on species regarded as having high to medium hearing sensitivity. In all of the assessments presented below, fish species have been assessed as having a **sensitivity** of **medium** due to the hearing sensitivity, commercial, conservation and ecological importance within the study area.

Geophysical survey

20.14.7 During construction, operation and decommissioning, several sonar-like survey types would be used e.g., multi-beam echosounder (MBES), side scan sonar (SSS), sub-bottom profiler (SBP) and USBL (ultra short baseline). These are classed as non-impulsive noise because they generally comprise a single (or multiple discrete) frequency as opposed to a broadband signal. The equipment can typically work at a range of signal frequencies, depending on the distance to the bottom and the required resolution. The signal is highly directional and acts as a beam, with the energy narrowly concentrated within a few degrees of the direction in which it is aimed.

20.14.8 USBL, MBES, and SSS equipment operate at frequencies over 3 kHz. As fish are not sensitive to noises over 1 kHz, these three equipment types have not been assessed further. SBP systems operate at frequencies within the hearing range of fish; between 0.2-14 kHz, with a sound pressure level (SPL) of 240 dB re 1µPa re 1 m. Whilst conservative (the actual thresholds are likely to be significantly higher), the Popper et al., (2014, REF 20.5) threshold criteria for mid-frequency sonar (1-10 kHz) can be used as a proxy for the SBP. For medium to high hearing sensitivity fish the threshold for injury is a SPL_{rms} of 210 dB dB re 1µPa with a threshold for behavioural responses at a SPL_{rms} of >209 dB re 1µPa. Noise attenuates rapidly and disturbance and injury ranges are very limited, with fish more likely to be disturbed by moving, oncoming vessels, from which fish can swim away from before being subjected to injury (Popper et al., 2014, REF 20.5). Further, as avoidance may be exhibited in response to moving vessels, the impact zone would be transitory; once vessels pass, fish are able to return to their original position and resume normal activity.

20.14.9 The **magnitude** of the impact has been assessed as **low,** as impact ranges are negligible, the zone of impact would be transient as the survey vessels move slowly at a constant speed and direction along the draft Order Limits. No conclusive records of decline in catch records have been noted following geophysical survey activities (Thompson et al. 2014, REF 20.[92]), which suggests that fish return to areas after the temporary displacement.

20.14.10 The significance of the effect has been assessed as **Minor** and **Not Significant,** during all phases of the Projects, where geophysical survey is used.

Vessels and equipment

20.14.11 **Volume 2, Part 3, Appendix 3.22.A Underwater Noise Assessment** models impact ranges for fish medium and high sensitivity fish species from the various vessels and construction equipment that could be deployed within the English Offshore Scheme. The report concludes that the range for a temporary threshold shift in medium and high sensitivity hearing fish species is 17 m. It should be noted that fish would need to be exposed within this potential impact range for a period of 48 hours continuously in the case of recoverable injury and 12 hours continuously in the case of TTS for the effect to occur. It is therefore considered that these ranges are highly precautionary, and injury is unlikely to occur.

20.14.12 The **magnitude** of the impact has been assessed as **low** as impact ranges are negligible, the zone of impact would be transient as the construction vessels move slowly at a constant speed and direction along the draft Order Limits.

20.14.13 The significance of the effect has been assessed as **Minor** and **Not Significant,** during all phases of the Projects.

UXO Clearance

20.14.14 UXO clearance is not being consented under the DCO; a separate Marine Licence would be applied for. The below high-level assessment is provided for information only to provide an understanding of all impacts associated with the English Offshore Scheme.

20.14.15 A UXO survey and identification campaign would be completed as part of the seabed preparation works during construction. Any confirmed UXO would be marked and the UXO mitigation hierarchy would be followed. The first objective would be to avoid the UXO but micro-routeing the cables to a safe distance away. If the UXO cannot be avoided that a clearance strategy would be developed with consideration given to whether it can be safely removed to an alternative seabed position, could be removed to the surface and dealt with onshore or whether it needs to be cleared in-situ through detonation. The January 2025 guidance from the UK Government "*Supporting minimising environmental impacts from unexploded ordnance clearance"* would be followed. This sets out that when applying for a marine licence if no alternatives exist the default method of clearance should be low noise methods e.g., low order detonation/deflagration as opposed to high order clearance, though high order may be considered on exception as per Defra guidance.

20.14.16 **Volume 2, Part 3, Appendix 3.22.A Underwater Noise Assessment** models impact ranges for fish medium and high sensitivity fish species from several scenarios including low order disposal (0.08 kg donor charge), clearance charge (0.5 kg charge) and high order disposal (295 kg charge and 697 kg charge). It predicts that impact ranges for injury range from 27 m – 81 m for the low order disposal and clearance charge and to 405 m - 900 m for a high order disposal. Recoverable injury effects are likely in the near (tens of metres) to intermediate (hundreds of metres) fields.

20.14.17 The **magnitude** of the impact has been assessed as **medium** as impact ranges indicate that injury is possible with a high order detonation. Depending on the season and location of the clearance activity this could affect recruitment.

20.14.18 The significance of the effect has been assessed as **Moderate** and **Significant Without Mitigation.**

20.14.19 Mitigation would need to be agreed with JNCC / NE / Cefas once the details of the UXO is known but would likely include some or all of the following:

- No UXO clearance between August and October in areas identified as Prime herring spawning ground to avoid impact to Banks herring spawning ground. Further work would be undertaken to define the exact locations along the draft Order Limits that this restriction would apply.
- The use of noise abatement systems (such as bubble curtains) would be discussed with the MMO, JNCC, NE and Cefas.
- High order detonation would only be considered if the low order method has failed after a minimum of three attempts and there is prior agreement with the Marine Management Organisation.

20.14.20 Following the application of mitigation the magnitude of the impact would be reduced to low. The significance of the impact would be assessed as **Minor** and **Not Significant with Mitigation**.

20.15 Preliminary assessment of Electromagnetic changes / Barrier to species movement due to the presence of cables

20.15.1 During the operation of an HVDC cable electromagnetic fields (EMFs) are generated. To inform the assessment, a number of scenarios were modelled to calculate the EMF emissions. The calculations are presented in **Volume 2, Part 1, Appendix 1.4.A Electromagnetic Field (EMF) Study.** 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 123.8 µT (or 76.4 µT without the earth's magnetic field).

Shellfish and fish species with demersal life stages

20.15.2 Sensitivity to EMF is species dependant. 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, REF 20.93). 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.

20.15.3 Flatfishes like plaice can use magnetic fields as navigational cues (Lacy-Hulbert et al., 1998, REF 20.[94]) 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, REF 20.[95])

20.15.4 Research on edible crab and lobster responses to EMFs have found effects only at strengths well beyond those modelled for the English Offshore Scheme; 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, REF 20.[96]). In another study, the blue mussel, *Mytilus edulis*, the brown shrimp, *Crangon crangon* and the crab, *Rhithropanopeus harrisii*, were all exposed to a static field of 3,700 µT for three months, and no differences in survival between experimental and control animals were detected.

20.15.5 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, REF 20.[97]).

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

20.15.7 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.

20.15.8 The **significance** of the effect on these receptors is assessed to be **Negligible** and **Not Significant** during operation.

Diadromous species

20.15.9 The EGL 4 Project is approximately 30 km from the Tweed Estuary SAC (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, REF 20.[98]), 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, REF 20.[99]) 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.

20.15.10 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, REF 20.[100]) 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 draft Order Limits.

20.15.11 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 English Offshore Scheme 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 has therefore been assessed as **negligible.**

20.15.12 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.

20.15.13 The **significance** of the effect on these receptors is assessed to be **Negligible** and **Not Significant** during operation.

Elasmobranchs

20.15.14 The English Offshore Scheme passes through areas of suitable habitat for a range of elasmobranchs including blonde ray, spotted ray, and thornback ray. 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, REF 20.[101]).

20.15.15 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, REF 20.101), 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, REF 20.[102]), 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.

20.15.16 Both lesser spotted dogfish and thornback ray have exhibited increased searching effort to find prey around operational subsea cables (Gill et al., 2009, REF 20.[103]), though this behaviour did not always occur, and subsequently, from the study of Gill et al. (2009, REF 20.103), the Scottish Government (2022, REF 20.[104]) 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, REF 20.105) found that the species could potentially confuse EMF emissions from subsea cables with those naturally produced from their prey.

20.15.17 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, REF 20.106). As bamboo shark share the same family as dogfish (Scyliorhidae), it is plausible that behaviour may be similar.

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

20.15.19 **Volume 2, Part 1, Appendix 1.4.A Electromagnetic Field (EMF) Study** calculate that EMF generated by the bundled cables would fall to 67.8 µT within 1 m of the cables, and to 57.6 µT within 2 m of the cables. 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.

20.15.20 The **significance** of the effect on these receptors is assessed to be **Minor** and **Not Significant** during operation.

20.16 Preliminary assessment of temperature increase - operation

20.16.1 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.

20.16.2 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 cockles, Nephrops, 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 (REF 20. [107]).

20.16.3 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 in order to survive (Holland et al 2005).

20.16.4 Overall, the receptor shellfish and species with a demersal life stage have 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.

20.16.5 The heat loss from the cable is related to the physical and thermal properties of the cables. To inform the assessment, a number of scenarios were modelled to evaluate the thermal performance of the cables, including directly buried in a bundle to differing depths and contained within a duct at the Anderby Creek Landfall at various depths. The calculations are presented in **Volume 2, Part 1, Appendix 1.4.B: EGL 3 Heat Calculations** and **Volume 2, Part 1, Appendix 1.4.C: EGL 4 Heat Calculations**. They show that for cables operating at full power, the temperature is raised in the immediate vicinity of the cable but reduces with distance. 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 of time (months/years) to meet these temperatures. In reality 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 English Offshore Scheme, 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 would be no effects on demersal species.

20.16.6 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**.

20.16.7 The **significance** of the effect on shellfish and fish species with demersal life stages has been assessed as **Minor** and **Not Significant**.

20.17 Transboundary Effects

20.17.1 The EIA Regulations require an ES to consider the transboundary effects of a development (paragraph 5 of Schedule 4). Given the nature of the English Onshore Scheme and its proposed location, potential significant transboundary effects are unlikely as there are no pathways for effects to occur outside of the UK. Similarly, the English Offshore Scheme lies wholly in UK waters. Separate applications will be submitted to the relevant statutory authority for the Scottish Schemes. Where the English and Scottish Schemes meet, collaborative environmental assessments will ensure impacts are fully assessed. As outlined in the Planning Inspectorate's Advice Note Twelve the screening process for transboundary effects will be carried out by the Planning Inspectorate. Information to inform this screening assessment will be provided as part of the application for the DCO. No transboundary impacts are predicted for fish and shellfish.

20.18 Further work to be undertaken

20.18.1 The information provided in this PEIR is preliminary, the final assessment of potential significant effects will be reported in the ES. This section describes the further work to be undertaken to support the fish and shellfish assessment presented in the ES.

Baseline

20.18.2 An extensive programme of marine characterisation surveys has been undertaken for the English Offshore Scheme as outlined in **Volume 1, Part 3, Chapter 19: Intertidal and Subtidal Benthic Ecology**. Survey reports were being issued by the Contractor as the Preliminary Environmental Assessment was nearing completion. Whilst efforts have been made to include initial survey findings, further work will be undertaken for the ES to ensure all survey results and analyses are incorporated and cross referenced. It is expected that for the final ES the following would be provided for fish and shellfish:

- Consideration of the eDNA survey results.
- Reference to shellfish or fish species identified in drop down video data.

20.18.3 The Datras survey data and MMO catch statistics are updated annually and the latest version of the data sets will be included within the ES.

Assessment

20.18.4 A preliminary herring and sandeel habitat suitability assessment has been undertaken for the English Offshore Scheme. The report uses publicly available literature, third-party survey information and GIS data to identify potential habitat suitable for herring and sandeel within the draft Order Limits. The report was first drafted to inform the environmental baseline sampling strategy for the marine characterisation survey to ensure sufficient data was collected to inform the EIA. The report will be updated with sediment particle size distribution data that was acquired during the marine characterisation survey. Once all survey data from the environmental surveys is

available the report will be completed and the preliminary assessment provided in this chapter will be updated for the ES. The herring and sandeel assessment will be included as part of the ES.

20.18.5 The assessments undertaken for the PEIR will be reviewed following stakeholder consultation feedback, further design refinement and review of final marine characterisation survey results and the most recent publicly available data. However, a worst-case scenario has been adopted for PEIR, and preliminary environmental survey results have informed the assessments presented.

20.18.6 With respect to the temporary quay, if the option is taken forward, further information would be gathered in respect to the riverine fish that use this area. Assessment would be included in **Volume 1, Part 2, Chapter 6: Biodiversity** of the ES**.**

Further environmental measures

20.18.7 If it is identified that additional environmental measures are required, these would be discussed and agreed with technical stakeholders and detailed as part of the ES. These could take the form of a seasonal restriction for certain activities within discrete locations within the draft Order Limits to avoid herring spawning. Whilst the preliminary assessment presented above has concluded that impacts on herring would not be significant, it is recognised that the cumulative effects assessment has not been completed.

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