Preliminary Environmental Information Report Volume 1

Chapter 20 Fish and Shellfish

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LIONLINK

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Glossary of Project Terminology

This Glossary has been provided to define terms used across a number of the LionLink Proposed Scheme documents.

Term	Definition
Applicant, the	National Grid Lion Link Limited (NGLLL)
Co-ordination	The process of people or entities working together.
Co-location	Where different elements of a project, or various projects, are located in one place.
Development Consent Order (DCO)	An order made by the Secretary of State pursuant to the Planning Act 2008 (as amended) granting development consent for a Nationally Significant Infrastructure Project. It grants consent to develop the approved project and may include (among other things) powers to compulsorily acquire land and rights where required and deemed marine licences for any offshore works.
Draft Order Limits	The area of land identified as being subject to the DCO application. The Draft Order Limits are made up of the land required both temporarily and permanently to allow for the construction, operation and maintenance, and decommissioning of the Proposed Scheme. All onshore parts of the Proposed Onshore Scheme are located within England and offshore parts of the Proposed Offshore Scheme are located within English territorial waters to 12 Nautical Miles and then up to the United Kingdom (UK) Exclusive Economic Zone (EEZ) boundary at sea.
Dutch Offshore Components	Is the term used when referring to the offshore elements of the Project within Dutch waters.
Environmental Impact Assessment (EIA)	The EIA is a systematic regulatory process that assesses the potential likely significant effects of a proposed project or development on the environment.
EIA Scoping Report	An EIA scoping report defines the proposed scope and methodology of the EIA process for a particular project or development. The EIA Scoping Report for the Proposed Scheme was submitted to the Planning Inspectorate with a request for the Secretary of State to adopt a scoping opinion in relation to the Proposed Scheme on 6 March 2024.

Term	Definition
Environmental Statement (ES)	The ES is a document that sets out the likely significant effects of the project on the environment. The ES is the main output from the EIA process. The ES is published as part of the DCO application.
Exclusive Economic Zone (EEZ)	The zone in which the coastal state exercises the rights under Part V of the United Nations Convention on the Law of the Sea. These rights relate principally to the water column and may extend to 200 nautical miles from baselines. This is distinct from territorial waters, which for the UK extend 12 nautical miles from the coast.
Landfall	The proposed Landfall is where the proposed offshore HVDC Submarine Cables are brought ashore and meets with the onshore proposed Underground HVDC Cables. This includes the Transition Joint Bay (TJB). The proposed Landfall will be located at Walberswick, and there will be no permanent above ground infrastructure at the proposed Landfall.
Landfall Site	The area where the Landfall may be located.
Multi-purpose interconnector (MPI)	A project where GB interconnection is combined with transmission of offshore generation within GB (and optionally within a connecting state).
National Grid Lion Link Limited (NGLLL)	The Applicant, a joint venture between National Grid Ventures and TenneT. NGLLL is a business within the wider National Grid Ventures portfolio.
National Grid Ventures (NGV)	Operates and invests in energy projects, technologies and partnerships to accelerate the development of a clean energy future. This includes interconnectors (such as the LionLink Project), allowing trade between energy markets and the efficient use of renewable energy resources.
Nationally Significant Infrastructure Projects (NSIP)	Major infrastructure developments in England and Wales for which development consent is required, as defined within Section 14 of the Planning Act 2008 (as amended). This includes any development which is subject to a direction by the relevant Secretary of State pursuant to Section 35 of the Planning Act 2008.
Offshore Hybrid Asset (OHA)	A project that combines cross-border interconnection with the transmission of offshore generation, this is an overarching term which covers both multi-purpose interconnectors (MPI) and non-standard interconnectors (NSI).
Order Limits	The maximum extent of land within which the Proposed Scheme may take place, as consented.

Term	Definition
Outline Offshore Construction Environmental Management Plan (Outline Offshore CEMP)	Describes the control measures and standards proposed to be implemented to provide a consistent approach to the environmental management of the construction activities of the Proposed Offshore Scheme.
Outline Onshore Code of Construction Practice (Outline Onshore CoCP)	Describes the control measures and standards proposed to be implemented to provide a consistent approach to the environmental management of the construction activities of the Proposed Onshore Scheme.
Planning Act 2008	The Planning Act 2008 being the relevant primary legislation for national infrastructure planning.
Planning Inspectorate (PINS)	The Planning inspectorate review DCO applications and make a recommendation to the Secretary of State, who will then decide whether to approve the DCO.
Preliminary Environmental Information Report (PEIR)	The PEIR is a document, compiled by the Applicant, which presents preliminary environmental information, as part of the statutory consultation process. This is defined by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 as containing information which "is reasonably required for the consultation bodies to develop an informed view of the likely significant environmental effects of the development (and of any associated development)" (Section 12 2. (b)). This PEIR describes the Proposed Scheme, sets out preliminary findings of the EIA undertaken to date, and the mitigation measures proposed to reduce effects. The PEIR is published at Statutory Consultation stage for information and feedback.
Project (the)	The LionLink Project (hereafter referred to as the 'Project') is a proposal by National Grid Lion Link Limited (NGLLL) and TenneT. The Project is a proposed electricity link between Great Britain (GB) and the Netherlands with a capacity of up to 2.0 gigawatts (GW) of electricity and will connect to Dutch offshore wind via an offshore platform in Dutch waters. The Project is the collective term used to refer to the proposal for all aspects (onshore and offshore) of the proposed interconnector between GB and the Netherlands.
Proposed Offshore Scheme	The term used when referring to the offshore elements of the Proposed Scheme, seaward of the

Term	Definition
	mean high-water springs to the EEZ boundary at sea.
Proposed Scheme	Used when referring to the GB scheme components of the Project, not including Dutch components. This includes both the onshore and offshore scheme components which are within UK territorial waters and up to the UK EEZ boundary at sea.
Scoping Opinion	A scoping opinion is requested from the Planning Inspectorate on behalf of the Secretary of State, to inform the requirements of EIA process and ultimately the ES which will be submitted as part of the application for development consent. Through the scoping process, the views of the statutory consultees and other relevant organisations on the proposed scope of the EIA are sought. A Scoping Opinion for the Proposed Scheme was issued by the Planning Inspectorate (on behalf of the Secretary of State) on 16 April 2024. The Applicant received a separate EIA Scoping Opinion from the Marine Management Organisation (MMO) (Reference DCO/2024/00005, dated 04 September 2024) as the MMO were unable to provide opinion to the Planning Inspectorate in time for the April 2024 deadline.
Scottish Power Renewables (SPR) East Anglia One North (EA1N) and East Anglia 2 (EA2) Consents (SPR EA1N and EA2 Consents)	The Orders made following the Scottish Power Renewables applications for development consent for the following projects: The East Anglia ONE North Offshore Wind Farm Order 2022; and East Anglia TWO Offshore Wind Farm Order 2022
Statutory Consultation	Consultation undertaken with the community and stakeholders in advance of the application for development consent being submitted to the Planning Inspectorate, on behalf of the Secretary of state, in accordance with the PA 2008.
TenneT	Operator of the electricity transmission network across the Netherlands.
Transition Joint Bay (TJB)	An underground structure at the Landfall Site that house the joints between the offshore cables and the onshore cables.

Terms and abbreviations specific to this technical chapter contained herein are provided at the end of the document in the **Topic Glossary and Abbreviations.**

20 FISH AND SHELLFISH

20.1 Introduction

20.1.1 This chapter provides a preliminary assessment of the potential likely significant effects in relation to fish and shellfish from the construction, operation and maintenance, and decommissioning of LionLink (hereafter referred to as 'the Proposed Scheme').

20.1.2 This chapter outlines legislation, policy and guidance that is relevant to fish and shellfish, summarises the engagement undertaken to date, sets out the scope and methodology of assessment, and describes the baseline environment. Following this, the likely significant effects of the Proposed Offshore Scheme on fish and shellfish are assessed taking account of mitigation measures within the design. The need for any additional mitigation is then considered along with any proposals for monitoring and/or enhancement. The chapter concludes with a summary of residual effects.

20.1.3 Fish and shellfish aspects considered within this chapter for the Proposed Offshore Scheme are:

a. Local fisheries landings (fish landing tonnage and value);
b. Fish counts (from scientific surveys); and
c. Predator-prey relationships

20.1.4 This chapter should be read in conjunction with **Chapter 2 Description of the Proposed Scheme** of this Preliminary Environmental Information Report (PEIR), which describes the development parameters against which the effects considered in this chapter have been assessed, and **Chapter 5 EIA Approach and Methodology** of this PEIR where the project-wide approach to the assessment methodology is set out.

20.1.5 In addition, there may be interrelationships related to the potential effects on fish and shellfish and other disciplines. Therefore, this chapter should be read alongside relevant parts of other chapters of this PEIR; namely:

a. **Chapter 18 Marine Physical Environment** of this PEIR - identifies the spatial extent of potential impacts from temporary sediment suspension and subsequent re-deposition;
b. **Chapter 19 Intertidal and Subtidal Benthic Ecology** of this PEIR - identifies the potential impacts on key benthic habitat which may provide spawning/nursery grounds for fish and shellfish receptors; and
c. **Chapter 24 Commercial Fisheries** of this PEIR - identifies the potential impacts on commercial fisheries which exploit some fish and shellfish species for market.

20.1.6 This chapter is supported by the following appendices and figures, contained within Volume 2 and Volume 3 of this PEIR, respectively:

a. **Appendix 2.2 Outline Offshore Construction Environmental Management Plan** of this PEIR;
b. **Appendix 29.1 Outline Schedule of Environmental Commitments and Measures** of this PEIR;
c. **Appendix 2.3 Electromagnetic Field Assessment** of this PEIR;
d. **Appendix 2.4 Offshore Thermal Emissions Technical Note** of this PEIR;
e. **Appendix 4.1 Legislation and Policy Register** of this PEIR;
f. **Appendix 4.2 Marine Plan Assessment** of this PEIR;
g. **Appendix 5.1 Transboundary Screening** of this PEIR;
h. **Appendix 19.1 Benthic Survey Report** of this PEIR;
i. **Appendix 20.1 Atlantic Herring and Sandeel Habitat Study** of this PEIR;
j. **Appendix 22.1 Underwater Noise Modelling Report** of this PEIR; and
a. **Figure 20.1** to **Figure 20.6** of this PEIR.

20.1.7 As set out in **Chapter 4 Policy and Legislation** of this PEIR, cable installation and some associated activities beyond 12 nautical miles (NM) are exempt under the Marine and Coastal Access Act 2009 (MCAA) as well as repair of the installed cable. This chapter presents a preliminary assessment of the Proposed Offshore Scheme from mean high water springs (MHWS) at the proposed Landfall Site to the boundary between the UK and Netherlands Exclusive Economic Zone (EEZ), including all exempt elements which will not be consented as part of the Development Consent Order (DCO). This is to provide a complete and holistic view of the Proposed Offshore Scheme and any associated impacts. Beyond 12 NM, only cable protection and dredging for sandwave levelling would be included in the Deemed Marine Licence (DML).

20.2 Legislation and policy framework

20.2.1 This section identifies the legislation, policy and guidance that has informed the assessment of the likely significant effects on fish and shellfish.

20.2.2 The legislation and planning policy which has informed the assessment of effects with respect to fish and shellfish is provided within **Appendix 4.1 Legislation and Policy Register** of this PEIR. A preliminary marine plan assessment is provided as **Appendix 4.2 Marine Plan Assessment** of this PEIR.

20.2.3 **Table 20.1** lists the legislation relevant to the assessment of the likely significant effects on fish and shellfish.

Table 20.1: List of relevant legislation for fish and shellfish assessment

Legislation	Relevance to assessment
Marine and Coastal Access Act 2009 (Ref 1)	The MCAA provides a framework for managing and protecting marine and coastal areas, promoting sustainable development, enhancing public access to the

Legislation	Relevance to assessment
	coast, and conserving marine biodiversity and habitats, including establishing marine protected areas and coastal access routes.
Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) (Ref 2)	The Marine Works (Environmental Impact Assessment)) Regulations 2007 require certain types of projects that have the potential to significantly affect the environment to submit an EIA before a marine licence decision is made.
The Conservation of Habitats and Species Regulations 2017 (as amended) (Ref 3)	The Conservation of Habitats and Species Regulations 2017 and the Conservation of Offshore Marine Habitats and Species Regulations 2017 are the principal secondary legislation that transposed the EU Habitats Directive into UK law, whereby the Regulatory Authority must consider any likely significant effects of a development on the qualifying features of European sites. The Conservation of Habitats and Species Regulations 2017 applies out to 12NM from the coastline; the Conservation of Offshore Marine Habitats and Species Regulations 2017 applies from 12NM to the boundary of the UK EEZ. Schedule 4 of the Conservation of Habitats and Species Regulations 2017 prohibits the capture or killing of fish such as allis shad, twaite shad and Atlantic salmon (using certain methods). These are collectively referred to as 'the Habitats Regulations'.
The Conservation of Offshore Marine Habitats and Species Regulations 2017 (Ref 4)	
Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) (Ref 2)	The Marine Works (EIA) Regulations 2007 require certain types of projects that have the potential to significantly affect the environment to submit an Environmental Impact Assessment before a marine licence decision is made.
The Planning Act 2008 (Ref 5)	An Act to establish the Infrastructure Planning Commission and make provision about its functions; to make provision about, and about matters ancillary to, the authorisation of projects for the development of nationally significant infrastructure.
The Wildlife and Countryside Act 1981 (Ref 5)	The Wildlife and Countryside Act 1981 (as amended) provides legal protection for marine habitats and species within the UK within 12NMof the coast. Schedule 5 provides a list of threatened fish/shellfish for which killing, injuring or taking is prohibited.
The Marine Strategy Regulations 2010 (Ref 6)	The Marine Strategy Regulations 2010 require action to be taken to achieve or maintain Good Environmental Status (GES) in seas.

Legislation	Relevance to assessment
The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Ref 7)	The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (the 'WFD') protects surface waters including rivers, lakes, transitional waters (referred to in this advice as estuarine waters), coastal waters and groundwater.
Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 (Ref 8)	Section 41 of the NERC Act 2006 refers to a published list of habitats and species which are of principal importance for the conservation of biodiversity in England, which includes certain fish and shellfish.
The Salmon and Freshwater Fisheries Act 1975 (Ref 9)	Aims to protect salmon and trout from commercial poaching, to protect migration routes, to prevent wilful vandalism and neglect of fisheries, ensure correct licensing and water authority approval.
Environment Act 2021 (Ref 10)	Aims to improve air and water quality, protect wildlife, increase recycling and reduce plastic waste. The act is part of a new legal framework for environmental protection, following the UK's exit from the European Union.
Prohibition of the fishing of sandeel within English waters of ICES Area IV (North Sea) (Ref 11)	Prohibits the fishing of sandeel in the English part of the North Sea, due to their ecosystem importance.
Common Fisheries Policy 2013 reform. (Ref 12)	The reform aimed to make EU fisheries more sustainable, economically viable, and socially responsible. Key changes included a ban on discarding fish (where exemptions do not apply), and a focus on fishing at Maximum Sustainable Yield (MSY).
The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Ref 13)	The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (Ref 2)

National policy

20.2.4 The primary policy basis for deciding whether to grant a Development Consent Order (DCO) for the Proposed Scheme are the National Policy Statements (NPSs), and of primary relevance the Overarching NPS for Energy (NPS EN-1) (Ref 14), the NPS for Renewable Energy Infrastructure (NPS EN-3) (Ref 15) and the UK Marine Policy Statement (Ref 22). These set out policies to guide how applications for development consent for energy infrastructure should be decided and how the effects of such infrastructure are considered.

20.2.5 **Table 20.2** lists the paragraphs from the NPSs and other national policy that are relevant to the fish and shellfish assessment. It also sets out where these policy requirements are addressed within the chapter.

Table 20.2: List of relevant national policy for fish and shellfish assessment

Relevant paragraph reference	Summary of policy requirement	Where addressed in PEIR
NPS EN-1		
Section 4.5	Section 4.5 of this policy looks at Marine Considerations establishing that Applicants for a DCO must take account of any relevant 'Marine Plans'.	This information is presented within **Appendix 4.2 Marine Plan Assessment** of this PEIR, and **Table 20.3.**
NPS EN-3		
Paragraph 2.8.111	Paragraph 2.8.111 of this policy looks at the physical environment and the knock-on effects on offshore habitats and biodiversity and in turn fish stocks effecting the commercial fishing industry.	The preliminary effects on fish and shellfish have been assessed in **Section 20.8**, which includes an evaluation of the potential impacts of the Proposed Offshore Scheme on fish and shellfish. Preliminary effects on commercial fisheries are assessed in **Chapter 24 Commercial Fisheries** of this PEIR.
UK Marine Policy Statement		
Paragraph 3.8.7	The policy acknowledges how sensitive fisheries are to changes by other sea users and how marine developments have the potential to prevent, displace or encourage fishing activities. There are also potential social, economic and environmental impacts of displacement of fishing activity caused by other sea uses, particularly if from well-established fishing grounds. In addition to marine fish stocks associated with commercial sea fishing, the coastal environment is important as a corridor for migrating Atlantic salmon and European eel, and in providing the marine feeding ground for sea trout. These important species that support coastal and inland commercial fishing and recreational angling could be vulnerable to a wide range of coastal activities.	Cumulative effects will be assessed for the Environmental Statement (ES). Displacement alone from the Proposed Offshore Scheme is assessed in **Chapter 24 Commercial Fisheries** of this PEIR. Migratory species have been covered within the baseline of this chapter (**Section 20.6**).
Paragraph 3.8.8	The policy notes how some fishing can have negative effects on the environment such as over exploitation of vulnerable or rare species. However, it also notes that some	The Applicant acknowledges this information; it is noted in **Chapter 24 Commercial Fisheries** of this PEIR.

Relevant paragraph reference	Summary of policy requirement	Where addressed in PEIR
	fishing activities are compatible with other marine users.	

20.2.6 The local policies listed in **Table 20.3** are considered relevant to the fish and shellfish assessment of the Proposed Scheme.

Table 20.3: List of relevant local policy for fish and shellfish assessment

Local planning authority	Relevant local policy	Relevance to assessment
Marine Management Organisation (MMO)	East Inshore and East Offshore Marine Plans (Ref 15)	Marine plans set out the priorities and direction for future planning within the plan area and provide guidance on activities to avoid or promote. **Appendix 4.2 Marine Plan Assessment** of this PEIR outlines how the Proposed Offshore Scheme complies with the policies and objectives for the East Inshore and East Offshore Marine Plan area. Of relevance to this assessment is Policy FISH2, which requires Applicants to demonstrate that they will not have an adverse impact upon spawning and nursery areas and any associated habitat; if there are adverse impacts, how will they be minimised; if the adverse impacts cannot be minimised, how they will be mitigated; and if they cannot be mitigated justify the case for proceeding. The preliminary assessment of effects is presented in **Section 20.8** and embedded design mitigation and control measures are presented in **Section 20.7** of this chapter.

20.3 Consultation and engagement

20.3.1 This section describes the outcome of, and response to EIA Scoping Report (Ref 17) the EIA Scoping Opinion (Ref 18) in relation to the marine physical environment assessment.

20.3.2 It also provides details of the ongoing technical engagement that has been undertaken with key stakeholders and provides a brief overview of the non-statutory public consultation undertaken to date.

20.3.3 Feedback from engagement and consultation are used to define the assessment approach and to ensure that appropriate baseline information is used.

20.3.4 It should be noted that feedback is also used to drive the design of the Proposed Scheme to avoid, prevent and reduce any likely environmental effects. **Chapter 3 Alternatives and Design Evolution** of this PEIR reports how the Proposed Scheme design has evolved in response to feedback, and details of proposed

embedded design (Primary) mitigation and standard good practice (Tertiary) mitigation measures relevant to the fish and shellfish assessment are provided in **Section 20.7** of this chapter.

Consultation

Non-Statutory Consultation

20.3.5 Feedback received from stakeholders following the close of our 2022 and 2023 consultation is outlined within the **Interim Non-Statutory Consultation Feedback Summary Report 2023** (Ref 19) and **Supplementary Non-Statutory Consultation Summary Report 2024** (Ref 20) No feedback was received from either consultation in relation to the fish and shellfish assessment.

EIA Scoping Opinion

20.3.6 An EIA Scoping Opinion was adopted by the Planning Inspectorate on behalf of the Secretary of State on 16 April 2024 (Ref 18)

20.3.7 The Applicant received a separate EIA Scoping Opinion from the MMO (Ref 21) as the MMO was unable to provide its opinion to the Planning Inspectorate in time for the April 2024 deadline. MMO deferred to Natural England's comments received by the Planning Inspectorate with respect to the suitability of the assessment with regards to Marine Protected Areas.

20.3.8 Comments received from the Planning Inspectorate and MMO in relation to fish and shellfish are provided in **Table 20.4.**

Table 20.4: Preliminary response to Planning Inspectorate and MMO Scoping Opinion comments for fish and shellfish assessment

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
Planning Inspectorate ID 3.15.1 and 3.15.2	The Planning Inspectorate requested that the following impacts be scoped back into the environmental assessment: Effects to species with fully pelagic lifecycle from temporary habitat loss/ seabed disturbance during cable instruction and operation, and effects to species with fully pelagic lifecycle from permanent habitat loss during construction and operation.	Both impact pathways have been scoped 'in' to the assessment. A preliminary assessment is provided in **Section 20.8**.
Planning Inspectorate ID 3.15.3	**Effects to species with fully pelagic lifecycle from temporary increase and deposition of suspended sediments from pre-sweeping during construction and operation.** In the absence of findings from the marine physical environment	A preliminary environmental assessment of the effects to species with fully pelagic lifecycle from temporary increase and deposition of suspended sediments from

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
	assessment and information demonstrating clear agreement with the relevant statutory bodies, the Inspectorate is not able to agree to scope this matter out of assessment at this stage.	pre-sweeping during construction, and operations and maintenance has been provided in **Section 20.8**.
Planning Inspectorate ID 13.15.4	**Effects to all species from temporary increase and deposition of suspended sediments from seabed preparation (excluding pre-sweeping) and cable burial during construction and operation).** The EIA Scoping Report seeks to scope out this matter for similar reasons as discussed at ID 3.13.3 of this Opinion. The Inspectorate's comments at ID 13.3.3 apply equally to this matter. The Inspectorate advises that this matter should be scoped into the assessment or the ES should otherwise explain, with evidence of agreement from relevant consultation bodies, why significant effects are not likely to occur.	A preliminary environmental assessment of the effects to species with fully pelagic lifecycle from temporary increase and deposition of suspended sediments from seabed preparation and cable burial during construction, and operations and maintenance has been provided in **Section 20.8**.
Planning Inspectorate ID 13.15.5	**Effects to all species from underwater noise change due to the presence of project vessels and equipment during construction and operation**. The Inspectorate advises that this matter should be scoped into the assessment or the ES should otherwise explain, with evidence of agreement from relevant consultation bodies, why significant effects are not likely to occur.	Underwater noise impacts upon fish and shellfish receptors have been assessed in **Section 20.8** with supporting information provided in **Appendix 22.1 Underwater Noise Modelling Report** of this PEIR.
Planning Inspectorate ID 13.15.6	**Effects to all species from accidental spills during construction and operation.** The EIA Scoping Report proposes to scope this matter out on the basis that all project vessels and contractors will comply with the MARPOL 73/78, and all vessels are legally required to have a Shipboard Oil Pollution Emergency Plan (SOPEP.) There is a commitment to only use inert or biodegradable drilling fluid. The Inspectorate agrees that this matter can be scoped out on the basis that the control and management measures should be sufficient to address the likely impacts and avoid a likely significant effect. The ES should include details of the mitigation and	Details of control measures and how these are proposed to be secured through the DCO have been included in **Section 20.7**.

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
	explain how its delivery is assured with reference to relevant documents.	
Planning Inspectorate ID 13.15.7	**Effects to all species from introduction or spread of Marine Invasive Non Native Species (MINNS) during construction and operation**. The EIA Scoping Report states that relevant guidelines will be followed including vessel cleaning and use of anti-fouling paint. It is stated that all vessels will complete a biosecurity risk assessment and will comply with the International Convention for the Control and Management of Ships' Ballast water and sediments. The Inspectorate agrees that this matter can be scoped out on the basis that the mitigation measures proposed should be sufficient to address the likely impacts and avoid a likely significant effect. The ES should include details of the mitigation and explain how its delivery is secured with reference to relevant documents, for example a Code of Construction Practice (CoCP).	Details of control measures and how these are proposed to be secured through the DCO have been included in **Section 20.7**.
Planning Inspectorate ID 13.15.8	**Effects to all basking shark from collision risk during construction and operation**. Based on the limited number of basking shark sightings and limited number of vessel movements predicted as described in the EIA Scoping Report, the Inspectorate agrees that significant effects are not likely to occur, and this matter can be scoped out of the assessment.	No further action – this impact pathway remains scoped out.
Planning Inspectorate ID 13.15.9	**Effects to fish and shellfish species with demersal life stage from temperature increase due to the presence of cables during operation**. Please refer to the Inspectorate's comments at ID 3.14.9 of this Scoping Opinion, which also apply to this matter. This matter should be scoped into the assessment, or the ES should otherwise explain, with evidence of agreement from relevant consultation bodies, why significant effects are not likely to occur.	A preliminary environmental assessment of the effects to fish and shellfish due to subsea cable thermal emissions has been provided in **Section 20.8**. It has been informed by **Appendix 2.4 Offshore Thermal Emissions Technical Note** of this PEIR.
Planning Inspectorate ID 13.15.10	Transboundary effects from the impact pathways described at ID 3.15.4 to ID 3.15.6). The Inspectorate is not able to	The Applicant notes this opinion. Details of supporting information for transboundary

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
	agree to scope this matter out until it has undertaken its own transboundary screening. See the Inspectorate's comments at ID 2.2.2 of this Scoping Opinion.	screening are presented in **Appendix 5.1 Transboundary Screening** of this PEIR.
Planning Inspectorate ID 13.15.11	The EIA Scoping Report states that a more regional approach will be used to screen any designated sites, with 100km proposed as an initial screening distance. The EIA Scoping Report does not explain how this regional approach would be employed to decide which additional sites could be affected. The Applicant is advised to agree which designated sites should be included with relevant consultation bodies; the ES should explain how these sites have been identified.	A 40km screening distance has been used, as described in the **Habitats Regulations Assessment (HRA) Screening** In **paragraph 20.4.10** of this PEIR.
Planning Inspectorate ID 13.15.12	**Potential effects to shellfish and marine species with demersal life stage from increase and deposition of suspended sediments – contaminated sediments**. Whilst this matter is shown as being scoped in, the EIA Scoping Report states that suspension of contaminated sediments is not considered a significant risk for the Proposed Development and the Inspectorate is unclear whether it is proposed to assess this matter in the ES. The Inspectorate's comments at ID 3.13.3 regarding contaminated sediments also apply to this matter.	**Chapter 18 Marine Physical Environment** of this PEIR concludes that sediments are not contaminated. On this basis, this impact continues to be scoped 'out' of the assessment.
Planning Inspectorate ID 13.15.13	**Baseline data**. The EIA Scoping Report describes a range of desk-based sources to be used, including data collected for nearby offshore wind farm projects. Some of the datasets proposed to inform the baseline are more than 10 years old. The Applicant should ensure that the baseline data used in the ES assessments are sufficiently up to date to provide a robust baseline. If primarily existing data is to be used, the ES should provide evidence to justify that it constitutes a robust characterisation of the receiving environment, with reference to the date, seasonal period, and geographic coverage of the data. Use of existing data should be	**Table 20.7** summarises the data sources used within this PEIR. These are the most up to date data at the time of writing.

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
	done in agreement with relevant consultation bodies.	
Planning Inspectorate ID 13.15.14	**Assessment methodology.** The EIA Scoping Report provides limited description of the methods that will be used to assess impacts and if these will be quantitative or qualitative, other than paragraph 20.7.18 stating that where impacts are not predicted to be significant, simple assessments using an evidence-based, proportionate approach would be undertaken. The methodologies used must be described and their use justified with reference to appropriate guidance and/or agreement with relevant consultation bodies.	Noted. Methods, along with the data types, are described (in **Section 20.4** and **Table 20.7** respectively) and utilised throughout this chapter, as well as in **Chapter 5 EIA Approach and Methodology** of this PEIR where the project-wide approach to the assessment methodology is set out.
Planning Inspectorate ID 13.15.15	**Effects to the Alde and Ore waterbody and smelt.** The Applicant's attention is drawn to the consultation response from the Environment Agency (EA) (Appendix 2 of this Opinion). The ES should provide an assessment of effects on migratory fish species (particularly smelt) that pass through or are present in the Alde and Ore waterbody, as well as an assessment of effects to migrating smelt.	Consideration of smelt is given in **paragraph 20.6.35.**
Planning Inspectorate ID 13.15.16	**Eels**. The Applicant's attention is drawn to the consultation response from the EA (Appendix 2 of this Opinion). The ES should provide an assessment of effects on eels or otherwise demonstrate absence of Likely Significant Effects (LSE), with evidence of agreement from relevant consultation bodies.	Consideration of eels is given in **paragraph 20.6.31** and et seq.
MMO Paragraph 3.3.2	The report states the Project area overlaps with the Downs herring spawning ground; as well as spawning grounds for sandeel, cod (*Gadus morhua*), sole (*Solea solea*) and whiting (*Merlangius merlangus*). There appears to be some confusion regarding the spawning grounds presented by the report. This should be clarified.	Spawning and nursery grounds are presented in **Figure 20.5** of this PEIR. Reference to the Downs herring spawning ground is given in **paragraph 20.6.23.**
MMO Paragraph 3.3.3	The report has presented maps showing spawning and nursery grounds it is stated these are informed by Coull et al., (1998) and Ellis et al., (2012).	Nursery and spawning grounds are now presented from both Ellis et al. (2012) and Coull et al. (1998). These are shown in

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
	However, spawning grounds in these figures do not match up with those presented in these studies. For example, no herring spawning grounds are presented, only high and low intensity nursery grounds. In addition, high intensity nursery grounds are shown for cod and whiting across the majority of the study area, whereas Ellis et al., (2012) marks these as only low intensity spawning grounds. The spawning grounds for plaice and sole also show discrepancies between Ellis et al., (2012) and those presented in Figure 20-1. The maps presented should be reviewed and the necessary corrections made.	**Figure 20.2** to **Figure 20.6** of this PEIR.
MMO Paragraph 3.3.4	It should be noted that spawning off the east coast of Suffolk and Norfolk occurs at discrete coastal spawning locations rather than as a widespread activity as with other areas. As herring do not have spawning site fidelity as noted by the report, it is possible that spawning occurs off the coast near Southwold and Walberswick, as the substrate is suitable for herring spawning (as defined by Coull et al., 1998). Spawning could be infrequent, but we are unable to determine exactly where spawning is going to occur in terms of location (due to a lack of data for this region) in this area and spawning may happen anytime within the spawning season (August – December). It should also be noted that International Herring Larvae Surveys (IHLS) do not sample the coastal spawning grounds defined by Coull et al. (1998). For this reason, whilst a MarineSpace (2013) approach has been mentioned as the method by which the Applicant will assess areas of potential spawning habitat for herring, it should be recognised, that the IHLS data (which is used in the MarineSpace method) will not provide any coverage of presence/absence of coastal herring larvae. A precautionary approach should be taken when assessing the potential for herring spawning in these locations due to the lack of recent data on herring larvae in this location.	Nursery and spawning grounds are now presented from both Ellis et al. (2012) and Coull et al. (1998) throughout **Section 20.8**. These are given in **Figure 20.3** and **Figure 20.4** of this PEIR, where it is noted that spawning and nursery grounds (particularly, high intensity nursery ground) exist inshore. The limitation of the IHLS data is mentioned in **paragraph 20.6.23** and **Appendix 20.1 Atlantic Herring and Sandeel Habitat Study** of this PEIR examined site-specific survey data which has been used to determine the potential for herring spawning habitat.

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
MMO Paragraph 3.3.5	The potential impacts to fish and fish ecology and the scoping decisions made are generally appropriate, however the MMO do not agree with the decision to scope out the impacts of underwater noise. See Under Water Noise section 3.9 of this report.	Underwater noise impacts have been assessed in **paragraph 20.8.53** *et seq.*
MMO Paragraph 3.8.1	Seabed preparation (excluding pre-sweeping) and cable burial is scoped out, however the MMO would expect this to be scoped in as there is the possibility for high sand/fine sediment levels in the areas impacted. Localised smothering in the footprint of the cable burial and seabed preparation should be assessed for potential impact on more sedentary shellfish species.	Temporary increase and deposition of suspended sediments have been assessed in **paragraph 20.8.35** *et seq.* which includes pre-sweeping as a factor for this impact.
MMO Paragraph 3.8.2	The use of rock armour or other physical protection should be considered as this could result in a potential barrier to species movement which is scoped in.	The use of cable protection has been considered when assessing the impact pathway 'barrier to species movement.' (**paragraph 20.8.81** *et seq.*) As the extent of the use of rock protection is yet to be determined, a precautionary approach has been taken, assuming that cable protection could be used anywhere within the Draft Order Limits.
MMO Paragraph 3.8.3	Electromagnetic fields (EMF) may introduce a barrier to some species crossing for aggregations or movement to feed, however the MMO recognise that there may not be sufficient biological data within the region to evidence a risk of impact. Feedback should be sought from commercial fishers and the local Inshore Fisheries and Conservation Authorities (IFCA) who may assist with assessment of potential impact.	The impacts of EMF from the cable are assessed in **paragraph 20.8.81** *et seq.* Please refer to **Chapter 24 Commercial Fisheries** of this PEIR regarding consultation with fishers/IFCAs.
MMO Paragraph 3.8.4	Whelk (*Buccinum undatum*) is noted as the largest landed fishery within the study area and is a potting or trap fishery that has become an increasingly important fishery for the UK fleet. Due to this potential underrepresentation, other key shellfish data sources should be included, but not	Sources such as Eaton et al have been used within this PEIR (Ref 30) such as in **paragraph 20.6.46**, along with the most current fisheries landings data which incorporates MSAR data.

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
	limited to: Monthly Shellfish Activity Returns (MSAR's), electronic logbook data, buyers and sellers' records and any IFCA inshore fishery reports. Other shellfish fishery and biological stock data sources can be included such as Centre for Environment Fisheries and Aquaculture Science (Cefas) Crab and Lobster assessments, Fisheries Management Plan (FMP) reports, publications such Eaton et al. (2003) (larval and spawning references for *Cancer pagurus*).	These data have been analysed alongside Database of trawl surveys (Datras) data to reduce any uncertainty in species presence. Consultation with relevant stakeholders will be ongoing; additional data or anecdotal information will be taken forward to the ES.
MMO Paragraph 3.8.6	Spawning and nursery grounds information noted from Ellis (2012) are related to fish species only. Table 20-6 does not include spawning times and nursery ground for Whelk, Edible Crab (*Cancer pagurus*) and Lobster (*Homarus gammarus*). Information in paragraphs 20.3.59 to 66 should be used to include these in the table. Modest data exist relating to the existence of specific spawning grounds or spawning migrations for the majority of commercially exploited shellfish species in UK waters. Some ontogenetic migration occurs in brown crab, with older females moving to deeper water in the North Sea. However, locations of fished stocks may serve as a useful proxy for spawning grounds for the majority of species, particularly the more sedentary ones. Therefore, indicative spawning and nursing maps should be highlighted within fished International Council for the Exploration of the Sea (ICES) rectangles.	Shellfish spawning times are presented in **Table 20.13.** Spawning and nursery grounds will be mapped within the ES, using spatiotemporal data from Fisheries Management Plans, subject to data availability from Cefas/ Department for Environment, Food and Rural Affairs (Defra).
MMO Paragraph 3.8.7	A reference source is Offshore Windfarm (OWF) fish and shellfish characterisation surveys in 2010 and 2013 which are now dated and did not use survey methods specific to shellfish species such as potting. If fisheries data is considered lacking detail at the fine scale range of the project area, a potting study should be considered.	The most recent fisheries landings data have been examined within the assessments, along with vessel monitoring system (VMS) data and consultation with the local IFCA, and fishers (**Chapter 24 Commercial Fisheries** of this PEIR). As such, the quality of data and anecdotal information is considered sufficient and

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
		proportionate to the Proposed Offshore Scheme.
MMO Paragraph 3.8.8	Species such as crab and lobster have been deemed to be of high vulnerability, medium sensitivity with medium to high recoverability and of regional importance within the North Sea. Crawfish is listed as vulnerable in The International Union for Conservation of Nature (IUCN.)Aspects of whelk biology, growth and recruitment may make this species susceptible to fishing or anthropogenic pressure on fishery sustainability and its vulnerability to impact may be increased. Therefore, mitigation considerations should be considered through consultation with fishing industry and stakeholders.	These sensitivities have been used in the assessment of impacts below for the impacts on such species. Any relevant mitigation is presented in **Section 20.9** and preliminary assessments in **Section 20.8** have concluded no significant impacts upon species such as whelk.
MMO Paragraph 3.8.9	Timing of works should be considered as a potential mitigation measure to minimise any impacts upon berried/spawning/overwintering shellfish or larval phases where possible.	The preliminary assessment presented in **Section 20.8** concludes no significant impacts. As such, no secondary mitigation is proposed.
MMO Paragraph 3.8.10	The MMO would expect cumulative and inter-related impacts to include: seabed disturbances from other current offshore projects such as aggregate extraction zones and OWF construction and cableways cumulatively increasing suspended sediment concentrations, temporary and permanent loss/disruption to the habitat with cumulative increased footprint of seabed impact area, EMF fields from several OWF projects, and potential interference with fishing.	Cumulative effects will be assessed within the ES.
MMO Paragraph 3.8.11	As indicated in Table 29-2, the EIA Scoping Report should note the potential for intra project effect of Fish and Shellfish, Commercial Fisheries and on Other Marine Users (namely the recreational fisheries/tourism element in inshore and coastal boundaries). To note the touristic attraction of 'crabbing' for small crab and prawn species at the Southwold/Walberswick harbour area.	Recreational crabbing is assessed within **Chapter 25 Other Marine Users** of this PEIR. Cumulative effects will be assessed within the ES.
MMO Paragraph 3.8.12	In light of recent crab and lobster die offs in the North Sea (2018 and 2021), attributed to multiple contributory factors, the	Following clarity from Cefas by the MMO on 7 July 2025, it was confirmed that it will be

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
	sensitivity of the shellfish populations may be elevated. The MMO recommend this is considered when reviewing potential shellfish impacts in these regions, particularly for crustaceans.	sufficient to include text that evidences a review of the scientific conclusions of the shellfish mortality events experienced in the North Sea. Text has been added to **paragraph 20.6.46** for crab, and **paragraph 20.6.50** for lobster.
MMO Paragraph 3.9.7	The MMO note that Underwater noise changes due to the presence of project vessels and equipment have also been scoped out for fish and shellfish species on the basis that the construction of the project will be a one-off event set against a background of existing shipping noise. A clear evidence base should be presented to demonstrate why the effects of underwater noise will not be significant. The MMO consider the duration of seabed preparation such as boulder removal and sandwave clearance, Unexploded Ordnance (UXO) clearance, cable trenching, burial and the addition of rock protection (where applicable) cannot be considered a “one off” event as this is likely to cover a period of several months. Whilst the MMO would not expect underwater noise from the presence of vessels or cable laying activities to result in significant impacts to fish receptors at a population scale, it would still be expected that that this impact be scoped into the assessment for the construction phase, albeit as a high-level assessment which recognises that impacts to fish may occur, particularly those with a close affiliation to the seabed (e.g., as habitat or demersal spawning ground) or those species with the greatest hearing capabilities.	Underwater noise impacts have been assessed in **paragraph 20.8.53** *et seq.* Please also refer to **Appendix 22.1 Underwater Noise Modelling Report** of this PEIR for the results of the underwater noise modelling that informed the assessment.
MMO Paragraph 3.9.9	It should be noted that when assessing UXO clearance, underwater noise modelling on the predicted range of effects to fish should be provided. See Popper et al. (2014) for hearing thresholds in fishes for explosions. It should be noted that due to the potentially larger impact ranges from UXO clearance, the MarineSpace method	The assessment for UXO clearance is provided for information only and will be a separate Marine Licence application. Activities associated with the lift and shift of any confirmed UXO are to be included in the

Scoping Opinion ID	Scoping Opinion Comment	How this is addressed
	will likely be required to assess whether herring will be impacted at the Banks and/or Downs herring spawning grounds. Unlike for historic coastal spawning areas, IHLS data for these spawning grounds is available. The most up to date MarineSpace methods should be utilised, see Kyle-Henney et al., (2024) for potential herring spawning habitat and sandeel habitat assessments, respectively.	application for development consent **Appendix 20.1 Atlantic Herring and Sandeel Habitat Study** of this PEIR establishes where these species are present within the Draft Order Limits. Kyle-Henney et al (2024) has been used to inform potential spawning habitat, and International Herring Larve Surveys (IHLS) data has been interrogated and used in **Figure 20.4** of this PEIR. Underwater noise impacts have been assessed in **paragraph 20.8.53** *et seq.* Please also refer to **Appendix 22.1 Underwater Noise Modelling Report** of this PEIR for the results of the underwater noise modelling that informed the assessment.

Engagement

20.3.9 This section provides details of the ongoing technical engagement that has been undertaken with stakeholders in relation to fish and shellfish, and is outlined below.

Key stakeholders

20.3.10 Key stakeholders with views and concerns regarding fish and shellfish have been identified as including:

a. Cefas; and
b. MMO.

20.3.11 Technical engagement with the key stakeholders is ongoing. A summary of the technical engagement undertaken since 2022 is outlined in **Table 20.5**. Whilst this engagement was primarily related to **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR, comments surrounding sediment modelling relates to sediment impacts on fish and shellfish, as assessed in **Section 20.8.**

Table 20.5: Key stakeholder feedback for fish and shellfish

Stakeholder	Comment	Applicant response
Cefas	Rates of sandwave migration should be estimated from areas where data allows.	Sandwave migration rates are presented in **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR and were used to inform the preliminary assessments presented in **Section 20.8.**
Cefas/MMO	Due to proximity of Sizewell C (a Nationally Important Structure), modelling needs to reference background concentrations in assessment of project impacts. Fine sediments and chalk are most noteworthy for their extended residence time in suspension.	A numerical model has been developed and applied to assess potential for increases in Suspended Sediment Concentration (SSC) at the Sizewell B (and planned Sizewell C) intake(s). Results are presented in **Chapter 18 Marine Physical Environment** of this PEIR**,** with additional detail provided in **Appendix 18.1 Sediment Dispersion Modelling** of this PEIR. Results from these documents were used to inform the preliminary assessments presented in **Section 20.8.**

20.4 Assessment methodology

20.4.1 This section outlines the methodology followed to assess the potential likely significant effects of the Proposed Offshore Scheme in relation to fish and shellfish including:

a. Effects scoped into the assessment;
b. Study area;
c. Assessment scenarios;
d. Methodology;
e. Assessment criteria; and
f. Assessment of cumulative effects.

20.4.2 This section provides a description of how receptor sensitivity, magnitude of impact and significance of effects are all described and assigned to the assessment.

20.4.3 The project-wide approach to the assessment methodology is set out in **Chapter 5 EIA Approach and Methodology** of this PEIR.

Scope of the assessment

20.4.4 Potential likely significant effects requiring assessment may be temporary or permanent and may occur during construction, operation and maintenance and decommissioning. Potential likely significant effects on fish and shellfish receptors within the scope of the assessment are summarised in **Section 20.8, Table 20.6**. The scope of the assessment has responded to feedback received as detailed in **Section 20.3**.

20.4.5 Potential impacts have been established by the Applicant's environmental team based on industry experience and professional judgement, and where applicable, reference to the list of marine pressures established by the Joint Nature Conservation Committee (JNCC) Marine Pressures-Activities Database v1.5 (Ref 23) and Natural England's advice on operations for relevant European protected sites.

Table 20.6: Summary of the scope for fish and shellfish assessment

Receptor	Construction	Operation and maintenance	Decommissioning
All species	Temporary habitat loss/seabed disturbance	Temporary habitat loss/seabed disturbance	Temporary habitat loss/seabed disturbance.
All species	Permanent habitat loss	Permanent habitat loss	-
All species	Temporary increase and deposition of suspended sediments	Temporary increase and deposition of suspended sediments	Temporary increase and deposition of suspended sediments
All species	Transboundary temporary increase and deposition of suspended sediments	Transboundary temporary increase and deposition of suspended sediments	Transboundary temporary increase and deposition of suspended sediments
All species	Underwater noise changes	Underwater noise changes	Underwater noise changes
All species	Transboundary underwater noise changes	Transboundary underwater noise changes	Transboundary underwater noise changes
All species	Changes in distribution of species	Changes in distribution of species	-
All species	-	Electromagnetic changes/barrier to species movement	-
Shellfish and marine species with demersal life stage	-	Temperature increase due to the presence of operational cables	-

Study area

20.4.6 This section describes the spatial scope (the area which may be impacted) for the assessment as it applies to fish and shellfish.

20.4.7 The spatial scope of the impact assessment for fish and shellfish covers the area of the Proposed Offshore Scheme contained within the Draft Order Limits, together with the study area, described as follows.

20.4.8 The Proposed Offshore Scheme routes from Walberswick across the Southern North Sea to the boundary between the English and Dutch EEZ. The Draft Order Limits for the Proposed Offshore Scheme are illustrated in **Figure 20.1** of this PEIR**.**

20.4.9 The study area includes the Draft Order Limits to MHWS plus an additional 15km buffer either side as illustrated in **Figure 20.1** of this PEIR. This is a precautionary maximum zone of influence (ZoI) that encompasses the worst-case scenario of potential impact pathways from increased suspended sediment concentrations. It is based on the conclusions of **Chapter 18 Marine Physical Environment** of this PEIR.

20.4.10 To ensure any protected migratory fish that may pass through the study area are considered, a more regional approach has been adopted in the screening of relevant designated sites. The HRA Screening undertaken is presented in **Habitats Regulations Assessment (HRA) Screening Report** of this PEIR. The HRA Screening considers a 40km radius from the Draft Order Limits; an appropriate screening distance for any protected sites designated for migratory fish. This 40km radius is due to Annex II migratory fish being mobile receptors which can travel within range to be impacted by vessel noise, such as vessels using dynamic positioning (DP) systems during the construction, operation and maintenance, and decommissioning phases of the Proposed Offshore Scheme. Behavioural disturbance is observed in fish because of DP vessels at a distance of up to 1,359m (Ref 24) although **Appendix 22.1 Underwater Noise Modelling Report** of this PEIR concludes that injury would not occur. However, there is the potential for underwater noise as a result of vessel noise and construction operations to impede fish migration within estuarine catchments. Although vessels would be restricted to conducting operations within the Draft Order Limits, it should be noted that this buffer is considered to be over precautionary with respect to capturing the zone of influence from impacts (e.g., underwater noise) associated with the Proposed Offshore Scheme, however, it allows for the possibility that migratory fish such as Atlantic salmon (*Salmo salar*), allis shad (*Alosa alosa*), twaite shad (*Alosa fallax*), sea lamprey (*Petromyzon marinus*) or river lamprey (*Lampetra fluviatilis*) from nearby Special Areas of Conservation (SACs) may be passing through the Draft Order Limits. Sites considered relevant by the HRA Screening of this PEIR are discussed from **paragraph 20.6.55**.

20.4.11 Reference has also been made in this chapter to the study area defined in **Chapter 24 Commercial Fisheries** of this PEIR. This considers an area encompassing seven International Council for the Exploration of the Sea (ICES) rectangles in which the Proposed Offshore Scheme lies, namely 33F1, 33F2, 34F2, 35F2 and 35F3. The ICES rectangles are used to record and collate

statistical commercial fisheries data, which also helps inform fish and shellfish presence.

20.4.12 **Figure 20.1** of this PEIR illustrates the extent of the fish and shellfish study area.

Assessment scenarios

20.4.13 **Chapter 5 EIA Approach and Methodology** of this PEIR, provides an overview of the project's approach to the temporal scope (the timescales over which impacts may occur) of the EIA. This section describes the temporal scope for the assessment as it applies to fish and shellfish.

20.4.14 The temporal scope has been informed by **Chapter 2 Description of the Proposed Scheme** of this PEIR. The temporal scope of the assessment of fish and shellfish is consistent with the period over which the Proposed Offshore Scheme would be carried out. It covers the period from award of consent to the anticipated end of the Proposed Scheme lifespan.

20.4.15 It assumes construction of the Proposed Offshore Scheme would commence at the earliest in 2028 and complete by 2032. Operation would commence in 2032 with periodical maintenance required during the operational phase of the Proposed Offshore Scheme. It is assumed that maintenance and repair activities could take place at any time during the lifespan of the Proposed Offshore Scheme.

20.4.16 The Proposed Offshore Scheme would be licensed for 40 years. At this point, either an extension to the licence would be requested, supported by the necessary environmental assessment, or decommissioning would take place. If decommissioning is required, 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 and, with the removal of visible infrastructure, effects would reduce over the course of that period.

20.4.17 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 a full assessment in accordance with the legislation and guidance at the time of decommissioning would be undertaken. In addition, it is expected that the DCO would include a requirement for a written scheme of decommissioning for approval by the relevant planning authority and in line with The Crown Estate requirements.

Baseline methodology

Data collection

20.4.18 Baseline data collection has been undertaken to obtain information over the study area. This section provides the approach to collecting baseline data.

20.4.19 The following sources of data have been utilised to inform the baseline with respect to fish and shellfish (**Table 20.7**). In addition to these data sources, the fish and shellfish assessment draws on environmental baseline data collated for other topics, specifically, baseline data presented in **Chapter 24 Commercial Fisheries** of this PEIR.

Table 20.7: Data sources used to inform the fish and shellfish assessment

Source of data	Baseline data
Spawning and nursery grounds of selected fish species in UK waters (Ref 25; Ref 27)	Spatial information of fish spawning/nursery grounds, and their intensities, around the UK.
UK Fisheries Annual Statistic reports (Ref 28)	Fisheries catch statistics (volume and value) by ICES rectangles for the year 2023.
Species Reference data (Ref 40)	Information on fish/shellfish sensitivities and tolerances.
Database of Trawl Surveys (DATRAS) (Ref 44)	Counts data of fish/shellfish from international scientific surveys in the North Sea for the year 2024.
Integrated database and portal for fish stomach records (DAPSTOM) (Ref 75)	Prey/predator information from fish stomachs caught within particular regions (i.e. Southern North Sea).
Offshore Energy Strategic Environmental Assessment 4 (OESEA4) (Ref 95)	Baseline information on the fish and shellfish literature review.
ICES (Ref 37)	International Herring Larvae Surveys (IHLS) and international research reports and publications ICES Scientific Reports from 2023.
Eaton et al. publication (Ref 30)	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.

20.4.20 Baseline data collection for the fish and shellfish assessment has been a combination of desk based and project specific survey data.

Site surveys

20.4.21 A marine characterisation survey consisting of geophysical, geotechnical and environmental survey techniques was undertaken on a nominal 500m wide corridor (an industry standard corridor width to allow for flexibility in the final

cable alignment) between May 2024 and February 2025. The scope of the geophysical and geotechnical surveys is described in **Chapter 18 Marine Physical Environment** of this PEIR. The scope of the environmental surveys is described in **Chapter 19 Intertidal and Subtidal Benthic Ecology** of this PEIR.

20.4.22 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 is presented as **Appendix 20.1 Atlantic Herring and Sandeel Habitat Study** of this PEIR.

Assessment methodology

20.4.23 The approach to assessment is set out in **Chapter 5 EIA Approach and Methodology** of this PEIR. This has informed the approach used in this fish and shellfish assessment.

20.4.24 **Chapter 5 EIA Approach and Methodology** of this PEIR sets out the standard EIA methodology and matrixes to be used for the assessment. The criteria for characterising the value and sensitivity and magnitude for commercial fisheries are outlined in **Table 20.8** and **Table 20.9** respectively.

20.4.25 The assessment of sensitivity would 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 would 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.

20.4.26 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.

Table 20.8: Definitions of value and sensitivity for fish and shellfish ecology

Receptor Value and Sensitivity	Description
High	The receptor is a designated feature of an internationally protected site (e.g., Highly Protected Marine Areas (HPMA), SAC, Marine Conservation Zone (MCZ)) and the licensable activity is taking place during a sensitive season and/or Receptor has low tolerance to change i.e., recovery will take longer than 10 years following the cessation of activity or will not occur.

Receptor Value and Sensitivity	Description
Medium	The receptor is a designated species of a nationally protected site (e.g., MCZ) and/or Receptor has intermediate tolerance to change i.e., recovery to pre-impact conditions is possible between 5 and 10 years.
Low	Common and widespread species of no specific conservation value and/or Receptor has high tolerance to change with recovery to pre-impact conditions between 1 and 5 years.
Negligible	Low importance and rarity, local scale and/or the receptor has some tolerance to change without detriment to its character. Recovery expected to be relatively rapid, i.e., less than approximately six months following cessation of activity.

Table 20.9: Definitions of impact magnitude criteria for fish and shellfish ecology

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.
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 Project 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.

20.4.27 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 **Chapter 5 EIA Approach and Methodology** of this PEIR and is replicated for ease in **Table 20.10.**

Table 20.10: Significance matrix

Magnitude of Impact	Receptor value and sensitivity			
	High	**Medium**	**Low**	**Negligible**
High	Major	Moderate	Moderate	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

Cumulative assessment

20.4.28 **Chapter 28 Cumulative Effects** of this PEIR defines the methodology for the assessment of cumulative effects. The fish and shellfish assessment of intra- and inter-project cumulative effects would be carried out and reported within the ES to be submitted with the application for development consent.

20.4.29 The ZoI for the inter-project cumulative effects assessment of fish and shellfish comprises the Draft Order Limits, plus an additional 15km buffer each side. This is a precautionary maximum ZoI that encompasses the worst-case scenario of potential impact pathways from increased suspended sediment concentrations, as calculated in **Chapter 18 Marine Physical Environment** of this PEIR.

Guidance

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

a. Natural England Designated sites view (Ref 32), which provides data and guidance about designated sites and protected species within the UK;
b. Joint Nature Conservation Committee UK Protected Areas (Ref 33), which also provides data and guidance about designated sites and protected species within the UK;
c. Popper et al, 2014 (Ref 34), which provides sound exposure guidelines for fishes; and
d. Natural England Offshore wind cabling: ten years' experience and recommendations (Ref 35), which makes recommendations to help avoid cabling in sensitive/protected habitats.

20.5 Assessment assumptions and limitations

20.5.1 This section provides a description of the assumptions and limitations to the fish and shellfish assessment. The information provided in this PEIR is preliminary, the final assessment of significant effects will be reported in the ES.

20.5.2 The PEIR has been produced to fulfil the Applicant's consultation duties in accordance with Section 42 of the Planning Act 2008 (PA2008) and enable consultees to develop an informed view of the likely significant effects of the Proposed Offshore Scheme.

20.5.3 This PEIR has been collated based on a range of publicly available data and information. 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.

20.5.4 Where commercial fisheries landings data have been used to inform fish/shellfish presence, it is acknowledged that these data are of landings only; they do not consider fish/shellfish which may have been caught, but returned back to the sea (discards) for reasons such as a species having no/little commercial value, being in poor condition, being a protected species, or a species which a fisher has insufficient quota to land (where the species may be exempt from landing obligations of the Common Fisheries Policy reform). As such species are discarded, there is no obligation for fishers to record them.

20.5.5 For many species information on spawning and nursery grounds is largely from the data published by Coull *et al*. (Ref 25), and Ellis *et al*. (Ref 26) which remain primary data sources for UK waters. For many demersal and pelagic fish species, the underlying data sets provide good coverage of the Proposed Offshore Scheme, however for others, such as elasmobranchs and shellfish, there is limited information about their spawning grounds, particularly for species which show high adaptability to climate changes, such as squids, which have shown rapid population expansion throughout the North Sea in recent years (Ref 69). 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. For species such as edible crab, information from Ref 30 has been used, and for whelk, Ref 36 has been used.

20.5.6 The 2023 MMO annual catch statistics were the most recent data available at the time of this PEIR 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 ICES reporting rectangle. If newer data are published ahead of the ES this would be used. It is important to understand that catch statistics focus on the commercial species present, but other species are also found within the Proposed Offshore Scheme. Data from ICES biannual bottom trawl surveys (Ref 44), and data from specific marine characterisation surveys have been used to fill this potential data gap.

20.5.7 The regulators will be contacted in the Dutch jurisdiction regarding transboundary issues. To inform these discussions the most up to date information on fisheries data and European projects would be used as part of the assessment in the ES.

20.5.8 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.

20.6 Baseline conditions

20.6.1 To provide an assessment of the likely significance of the Proposed Offshore Scheme (in terms fish and shellfish), it is necessary to identify and understand the baseline conditions in the study area. This provides a reference point against which potential changes in fish and shellfish can be assessed.

20.6.2 The baseline section should be read in conjunction with the following supporting Appendices and Figures as found within Volume 2 and Volume 3 of this PEIR respectively:

a. **Appendix 20.1 Atlantic Herring and Sandeel Habitat Study** of this PEIR;
b. **Figure 20.1 Fish and shellfish study area;**
c. **Figure 20.2 Sandeel larvae spawning and nursery grounds;**
d. **Figure 20.3 Herring larvae spawning and nursery grounds;**
e. **Figure 20.4 North Sea herring larval and egg abundance from IHLS surveys;**
f. **Figure 20.5 Fish nursery and spawning grounds with intensity within the study area;** and
g. **Figure 20.6 Nephrops nursery and spawning grounds with intensity within the study area**

Current baseline

20.6.3 Over 330 species of fish have been recorded in UK waters (Ref 41), with the Southern North Sea supporting a wider variety of both pelagic (species that live in the water column) and demersal (species that live on or feed on the seabed) species than the central or northern North Sea (Ref 41). The species most likely to be affected by the Proposed Offshore Scheme are those with demersal life stages, those sensitive to EMFs, and underwater noise changes e.g., hearing specialists such as clupeoids (e.g., Atlantic herring, shad, sprat).

Analysis of fisheries statistics

20.6.4 The North Sea is an important fishing ground for the local English and Scottish fleet, and also for international vessels from Belgium, the Netherlands, Denmark, France, Ireland, Spain and Germany. To enable accurate monitoring and for ease of making policy decisions, the sea is divided into rectangles by ICES. Each ICES rectangle is approximately 30 NM squared and is 30 minute latitude and 1° longitude in size (Ref 50). 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, though it is recognised that it does not provide a definitive list of species present.

20.6.5 The MMO produces an annual report and accompanying supporting data, (Ref 28). The reports are normally issued in September of the following year. The newest data available currently is for 2023. The ES will use the most up to date data available at the time.

20.6.6 Within the study area, the demersal fishing fleet contributed to the largest value of catch in 2023 (57.9% of the overall value). Shellfish species accounted for 37%, whilst pelagic species accounted for less than 5% of total catch value. In terms of catch volume, demersal catch accounted for 41.5% of total volume, with shellfish contributing 34.5%, and pelagic catch accounting for less than 24%.

20.6.7 **Table 20.11** shows the top five species caught by catch value in GBP within the study area. The Draft Order Limits interacts with five ICES rectangles (shown in **Figure 20.1** of this PEIR). From rectangle 33F1, bass (*Labrax dicentrarchus*), whelks (*Buccinum undatum*) and sole (*Solea solea*) were the most valuable species, whereas from rectangle 33F2, the most valuable species were squid (species not given), whelks, and horse mackerel (*Trachurus trachurus*). From rectangle 34F2, the most valuable species were squid, surmullet (*Mullus surmuletus*) and whelks, whereas from rectangles 35F2 and 35F3, the most valuable species were sole, plaice (*Pleuronectes platessa*), and turbot (*Scophthalmus maximus*).

Table 20.11: Top five landed species by value (GBP) in 2023 in ICES rectangles within the study area

Rank	33F1	33F2	34F2	35F2	35F3	Total
1	Bass	Squid	Squid	Sole	Sole	Sole
2	Whelk	Whelk	Surmullet	Plaice	Plaice	Squid
3	Sole	Horse mackerel	Whelk	Turbot	Turbot	Whelk
4	Lobster	Whiting	Mackerel	Crab	Thornback ray	Plaice
5	Herring	Cod	Tub gurnard	Surmullet	Tub gurnard	Turbot

Source MMO (2024) (Ref 29)

20.6.8 **Table 20.12** shows the top five species caught by catch volume (tonnes) within the study area. Across all five rectangles, whelk was the highest landed species in volume (298 tonnes). From individual rectangles, whelk was also the highest volume catch in rectangle 33F1, and in 33F2, the highest landing was for horse mackerel, in rectangle 34F2 the highest landing was for squid, and in 35F2 and 35F3, the highest landing was for plaice.

Table 20.12: Top five landed species by volume (tonnes) in 2023 in ICES rectangles within the study area

Rank	33F1	33F2	34F2	35F2	35F3	Total
1	Whelk	Horse mackerel	Squid	Plaice	Plaice	Whelk
2	Herring	Whelk	Whelk	Sole	Sole	Horse mackerel
3	Sole	Squid	Surmullet	Crab	Thornback ray	Plaice
4	Thornback ray	Whiting	Whiting	Thornback ray	Turbot	Squid
5	Flounder	Surmullet	Mackerel	Surmullet	Tub gurnard	Herring

Source MMO (2024) (Ref 29)

20.6.9 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 and identifies all species present, unlike the MMO catch statistics, which focusses only on commercially marketable species.

20.6.10 Species counts observed from Datras during Q3 in 2024 are given in **Table 20.13** (Ref 44). The five most encountered species are displayed. Data were not recorded from 33F1 during this quarter. A total of 115 species of fish/shellfish were recorded, though in some cases records were to genus or family level, meaning more than one species may be represented. Of these 115 species, seven are shellfish. From rectangle 33F2, herring, whiting, American plaice (*Hippoglossoides platessoides*), sprat (*Sprattus sprattus*) and haddock were the most abundantly caught, whereas from rectangle 34F2, the most abundantly caught species were dab, plaice, and blue whiting (*Micromesistius poutassou*), greater weever (*Trachinus draco*) and Norway pout (*Trisopterus esmarkii*). From rectangle 35F2, the most abundantly caught species were whiting, haddock, herring, Norway pout and sprat, and from rectangle 35F3, were whiting, herring, sprat, dab and haddock. All these species are commercially important, except greater weever. Shellfish did not contribute to the top five species counts.

Table 20.13: Top five species counts in Q3 2024 Datras survey

Rank	33F2	34F2	35F2	35F3
1	Herring	Dab	Whiting	Whiting
2	Whiting	Plaice	Haddock	Herring
3	American plaice	Blue whiting	Herring	Sprat
4	Sprat	Greater weever	Norway pout	Dab
5	Haddock	Norway pout	Sprat	Haddock

Source ICES (2024) (Ref 44)

Prey species and food web linkages

20.6.11 Several species which occur within the study area have an important role in the Southern 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. Changes to an ecosystem, such as the removal of a prey species, could have impacts upon predator species which could affect food web linkages.

20.6.12 Sandeel is listed as a Species of Principal Importance under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 (formerly a UK Biodiversity Action Plan (BAP) priority marine species). They are consumed 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 species and harbour porpoise (*Phocoena phocoena*).

20.6.13 Like sandeel, herring are a Species of Principal Importance under Section 41 of the NERC Act 2006, and are a prey item for several species of sea bird and fish species such as whiting, cod, mackerel and horse mackerel (Ref 47,Ref 48). Herring eggs are also known to attract predators such as haddock, spurdog, mackerel, lemon sole and other herring.

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

Sandeel (*Ammodytes* spp.)

20.6.15 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, namely Corbin's sandeel (*Hyperoplus immaculatus*) and smooth sandeel (*Gymnammodytes semisquamatus*).

20.6.16 The Draft Order Limits cross several known sandeel spawning grounds which are illustrated in **Figure 20.2** of this PEIR. The Draft Order Limits pass through areas considered 'low intensity' spawning grounds (Ref 27), with almost the entirety of the Proposed Offshore Scheme within an area considered in the 'low intensity' nursery grounds for Ammodytidae (lesser Sandeel and Raitt's Sandeel).

20.6.17 Sandeel hibernate in specific types of seabed during the autumn and winter, particularly generally coarse sand or fine gravel, where they bury themselves in up to 50cm of sediment (Ref 49). Sandeel briefly come out of hibernation between December and January to spawn.

20.6.18 Particle size distribution (PSD) data has revealed several locations along the Proposed Offshore Scheme as 'Preferred' habitat. **Table 20.14** gives the kilometre point (KP) locations between which 'Prime' or 'Sub-Prime' habitat was identified. In accordance with (Ref 42) classification has been given based on the station that recorded the most suitable conditions for sandeel spawning where multiple samples were recorded as Prime' and 'Sub-Prime.'

20.6.19 It has been concluded that approximately 47% (85km) of the Proposed Offshore Scheme consists of "Prime" sandeel habitat and approximately 7% (14km) as "Sub-Prime" habitat, totalling approximately 99km. The majority of the 'Prime' and 'Sub-Prime' locations within the Proposed Offshore Scheme lie within the Norfolk and Suffolk spawning grounds, as defined by Ref 27. The Proposed Offshore Scheme overlaps with the Norfolk and Suffolk spawning ground for approximately 76km; of this 53km has been classified as 'Prime' and/or 'Sub-Prime' sandeel habitat from acquired PSD data.The presence of sandeel was noted from 19 of the 104 transect locations where seabed imagery was acquired. Sandeel were also noted at a single grab location which was considered unsuitable for sandeel spawning from the PSD data. For full survey information, refer to **Appendix 20.1 Atlantic Herring and Sandeel Habitat Study** of this PEIR.

Table 20.14: Summary of data analysed for the 'Prime' and 'Sub-Prime' locations overlapping a spawning ground defined by Coull et al (Ref 24)

Locations (KPs)	Length of section (km)	PSA Data (Greenstreet et al (Ref 37))	Modified Folk (Latto et al (Ref 38	Spawning Ground (Ref 22)	Suitable Depth (approx. 30m to 70m)
KP22 to K23	1	Prime	Preferred	No	Yes
KP27 to KP33	6	Prime	Preferred	Norfolk/Suffolk	Yes
KP40 to KP56	16	Prime	Preferred	Norfolk/Suffolk	Yes
KP57 to KP58	1	Sub-Prime	Unsuitable	Norfolk/Suffolk	Yes
KP59 to KP64	5	Prime	Preferred	Norfolk/Suffolk	Yes
KP67 to KP71	4	Prime	Preferred	Norfolk/Suffolk	Yes
KP74 to KP76	2	Sub-Prime	Preferred	Norfolk/Suffolk	Yes
KP79 to KP86	7	Prime	Preferred	Norfolk/Suffolk	Yes
KP89 to KP91	2	Prime	Preferred	Norfolk/Suffolk	Yes

Locations (KPs)	Length of section (km)	PSA Data (Greenstreet et al (Ref 37))	Modified Folk (Latto et al (Ref 38	Spawning Ground (Ref 22)	Suitable Depth (approx. 30m to 70m)
KP92 to 108	16	Prime	Preferred	Norfolk/Suffolk	Yes
KP112 to KP123	13	Prime	Preferred	No	Yes
KP129 to KP133	4	Prime	Preferred	No	Yes
KP140 to KP151	11	Sub-Prime	Preferred	No	Yes

1 Coull et al. (Ref 24) data intersects the Proposed Offshore Scheme at KP101.

20.6.20 Further detail is provided in **Appendix 20.1 Atlantic Herring and Sandeel Habitat Study** of this PEIR**.**

20.6.21 During the spring and summer, they feed in the water column during the day and then bury themselves in the seabed at night. Their lifecycle makes them sensitive to seabed disturbance, especially during hibernation season. Studies have found that sandeel are largely resident and do not disperse over distances greater than 30km (Ref 51), and that they do not migrate between grounds suggesting that they are not successful re-colonisers (Ref 54). Sandeel are not however considered to be sensitive to increased suspended sediment concentrations and deposition. Spawning and nursery areas in relation to the Proposed Offshore Scheme are illustrated in **Figure 20.2** of this PEIR.

Atlantic herring

20.6.22 Atlantic herring is a pelagic species which spawns on the seabed. As benthic spawners, the species has a specific habitat preference of gravel and partly sandy gravel (Ref 59) which limits the spatial extent of their spawning grounds. As such, they are particularly sensitive to any seabed disturbance.

20.6.23 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 (Ref 27) and are characterised by different growth rates, recruitment patterns and migration routes. The Proposed Offshore Scheme crosses the Downs autumn spawning grounds (Ref 67)..This spawning ground is an important area for a large population of Atlantic herring stock in the North Sea. Further detail is provided in **Appendix 20.1 Atlantic Herring and Sandeel Habitat Study** of this PEIR**.**

20.6.24 The coastal area around the Proposed Offshore Scheme has been identified as a high intensity Atlantic herring spawning ground; part of the Downs stock (Ref 27). Spawning takes place between November and January. Spawning and nursery

areas in relation to the Proposed Offshore Scheme are illustrated in **Figure 20.3** of this PEIR and herring larvae abundances in the North Sea are illustrated in **Figure 20.4** of this PEIR; this latter figure shows a patch of high herring larvae densities southeast of the fish and shellfish study area in January 2023, with some presence (average counts <10 specimens) along the Proposed Offshore Scheme. In January 2024 and January 2025, this southeasterly cluster was not recorded and in January 2025, herring larvae were also not recorded within the study area.

20.6.25 A programme of annual surveys has taken place since 1967 by the International Herring Larvae Survey (IHLS) monitoring the abundance of herring larvae (Ref 37). It is acknowledged that IHLS data does not sample coastal waters, and as such, an absence of herring counts shown in **Figure 20.4** of this PEIR may not mean species absence. As such, caution should be used when interpreting these data and it should be acknowledged that herring spawning and nursery grounds do exist inshore and around the proposed Landfall Site, according to Ref 25 and Ref 27 and presented in **Figure 20.4** of this PEIR. Atlantic herring numbers fluctuate annually with the species leaving, and returning to, suitable areas. This means all suitable areas of spawning habitat are important to maintain a resilient population.

20.6.26 An assessment of the sediment PSD data from the 2024 survey along the Proposed Offshore Scheme has identified occasional areas of 'Prime' and 'Sub-Prime' areas. Grab samples identifying suitable ‘Prime’ and ‘Sub-Prime’ habitat were isolated; a single grab station (LL_03-TR) was classified as 'Prime' herring habitat and three grab stations (LL_42_SG, LL_45_SG_SS and LL_62_SG) as 'Sub-Prime,'. Each station was considered as representative of around 2km of the Proposed Offshore Scheme.

20.6.27 Of the stations identified as 'Prime' and 'Sub-Prime' locations, only Station LL_03-TR was situated within the spawning grounds off the Suffolk coast, as defined by Coull et al. (Ref 25). The Proposed Offshore Scheme overlaps with the Suffolk spawning ground for approximately 17.5km, of which approximately 2km has been classified as ‘Prime’ and/or ‘Sub-Prime’ herring habitat in the suitable water depth for herring spawning.

20.6.28 All remaining stations were characterised as ‘Unsuitable’ for herring grounds due to the predominant proportions of sand and fine sediments. Very few stations were classified as a preferred sediment type for herring spawning and no consecutive stations were recorded suggesting that any sediment potentially suitable for herring spawning is infrequent and patchy along the Proposed Offshore Scheme.

Sprat

20.6.29 European sprat are found throughout the North Sea, although they tend to remain within the 50m 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 100km offshore in deep basins (Ref 52). Sprat are pelagic spawners with their eggs and larvae being subject to larval drift, moving to inshore nursery areas (Ref 25). Juvenile sprat are often found close inshore in schools with juvenile herring (Ref 52). Spawning and nursery areas in relation to the study area are illustrated in **Figure 20.5** of this PEIR, which shows spawning grounds over most of Proposed Offshore Scheme and nursery grounds exist at the most southern extent of the Proposed Offshore Scheme, and the most northerly section of the Proposed Offshore Scheme.

20.6.30 Sprat are important prey species for several species, including piscivorous fish, marine mammals and seabirds. They themselves tend to feed on small planktonic crustaceans, including copepod nauplii and bivalve larvae (Ref 52).

Diadromous and Catadromous Fish

20.6.31 Diadromous fish migrate between salt water and freshwater, usually at the time of spawning. Catadromous fish migrate between freshwater and salt water to spawn. Diadromous and catadromous fish species which may be present in the study area include:

a. Diadromous
   i. Allis shad (*Alosa alosa*); and
   ii. Twaite shad (*Alosa fallax*);
b. Catadromous
   i. River lamprey (*Lampetra fluvaiatilis*);
   ii. Sea lamprey (*Petromyzan marinus*);
   iii. Atlantic salmon (*Salmo salar*);
   iv. European eel (*Anguilla anguilla*); and
   v. Smelt (*Osmerus eperlanus*).

20.6.32 Some of these fish species are more sensitive to disturbance or injuries caused by noise than others. Diadromous species such as Atlantic salmon, sea lamprey and river lamprey are sensitive to noise and are electrosensitive. Whilst these species do not have specialised electroreceptors, they can detect induced voltage gradients associated with water movement through the geomagnetic field (Ref 55).

20.6.33 There are no Special Areas of Conservation (SAC) which have migratory fish as a qualifying feature within 40km of the study area. However, Atlantic salmon, brown trout, smelt and sea and river lamprey are known to use the River Blyth which is adjacent to the proposed Landfall and therefore may be present within the Draft Order Limits.

20.6.34 Some of these fish are on the protected species list presented in **Table 20.15**: Spawning and nursery grounds that overlap with the study area**,** including twaite and allis shad and European eel. Allis and twaite shad are known to have spawning migrations between April and May, although are rarely observed within

the study area. There are a few other species such as sea and river lamprey and Atlantic Salmon which have been sighted but only on rare occasions.

Smelt (*Osmerus eperlanus*)

20.6.35 Smelt have been seen to congregate in large shoals in lower estuaries and near river mouths during winter, before ascending the river between February and April as they migrate into freshwater where they spawn. The species lay their eggs on the seabed, where they adhere to gravel and stone.

20.6.36 The Alde Ore estuary, which lies south from the Draft Order Limits by ~14km, provides a critical habitat for this species where it can complete its whole life cycle. In 2012 – 2013 the Alde Ore estuary was put forward as a recommended Marine Conservation Zone (MCZ) in Tranche 1 of the designations, with smelt listed as a species of conservation importance (SOCI). However, to date the Alde Ore Estuary has not been designated as an MCZ, and no records of smelt have been collected in Datras surveys within the Draft Order Limits (**Table 20.13**).

European eel

20.6.37 European eel (*Anguilla anguilla*) are likely to be present within the Draft Order Limits during their migration through the North Sea, to and from the Sargasso Sea. Though European eel were not recorded within Datras surveys (**Table 20.13**), records of nine specimens exist from Alde Estuary, caught in September 2024 (Ref 56).

Elasmobranchs (Sharks, Rays and Skates)

20.6.38 Elasmobranchs are vulnerable marine fish due to their slow growth rates, late maturity, low fecundity and reproductive productivity which limits their ability for population recovery should it decline. All sharks and rays are on the Oslo and Paris Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) list of threated or declining species. Both the thornback ray and tope are known to use the study area as spawning and nursery grounds with peak spawning between April and August (**Table 20.14**). Fisheries landings data, and scientific trawl data also recorded spotted ray (*Raja montagui*), smoothhound (*Mustelus mustelus*), dogfish (*Scyliorhinus canicula*), spurdog (*Squalus acanthias*), and tope (*Galeorhinus galeus*) within the Draft Order Limits. Further, elasmobranchs are electroreceptive due to their specialist electroreceptive organs (Ref 52) which are sensitive to 5 to 20 nV/m (Ref 53) and are used to detect the bioelectric fields of prey and predators as well as being used for navigational purposes.

Thornback ray (*Raja clavata*)

20.6.39 Thornback ray is associated with soft sediment including mud, sand, shingle and gravel, though less frequently observed on coarser sediment types. They appear to be more widely distributed in the southern North Sea during the autumn and winter. Their spawning grounds are thought to broadly overlap with nursery

grounds. Spawning occurs over a considerable period from February to October peaking from April to August (Ref 27). Spawning and nursery areas in relation to the study area are illustrated in **Figure 20.5** of this PEIR, which shows low intensity nursery grounds inshore.

20.6.40 Young thornback ray feed largely on small crustaceans (amphipods, mysids and crangonid shrimps), with larger individuals eating larger crustaceans (e.g. swimming crabs) and fish (e.g. sandeel, small gadoids and dragonet).

20.6.41 As with all elasmobranchs the thornback ray is included on the OSPAR list of threatened and/or declining species. In addition, the species has been classified as 'Near Threatened' by the IUCN.

Basking shark (*Cetorhinus maximus*)

20.6.42 The basking shark is a planktivore (i.e. it eats small animals and algae which move in the water column), and the largest fish resident to UK waters measuring up to 12m in length. 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; according to the National Biodiversity Network, only one record of basking shark has been observed off the Norfolk coast, in July 1995. Basking shark is not a commercially important species so is never recorded in fisheries landings data, and, although rare bycatch of basking shark can occur, it is unlikely to be encountered in trawl surveys.

Shellfish

20.6.43 Shellfish is a collective term for crustaceans (e.g., shrimp, lobsters, crabs) and molluscs (e.g. cockles, mussels, oysters, whelk, squids) - 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 (such as those listed in **Table 20.12**) or may be present as part of the ecosystem.

Whelk (*Buccinum undatum*)

20.6.44 Whelk is a valuable species, caught exclusively in rectangles 33F1, 33F2, and 34F2 during 2023 (**Table 20.11**). Whelk is encountered around British coasts and inhabits a range of seabed types including hard and soft subtidal substrates and occasionally intertidal fringes (Ref 35). 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 (Ref 36).

Squids

20.6.45 Multiple species of squids exist around British coasts, though landings data do not specify species due to the difficulty in accurate identification. In 2023, squids were the most valuable shellfish to the fishing industry, and caught primarily in rectangles 33F2 and 34F2 (**Table 20.11**). Some squids (ommastrephids) spawn in

the water column and release masses of pelagic eggs, whereas loliginid squids release eggs which become attached to structures on the seabed. Squids die shortly after spawning and typically at around 1 year of age. Due to their rapid population expansions and movements (Ref 50) and varied reproductive strategies and timings, spawning times and locations are not determined by the ICES Working Group for Cephalopods (WGCEPH).

Edible crab *(Cancer pagurus)*

20.6.46 Edible crab 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 (Ref 30). Edible crab migrate long distances to offshore overwintering grounds where eggs then hatch (Ref 30, Ref 60). 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 (Ref 30). In 2021, a mass mortality event occurred along the north east coast of England (between Hartlepool and Whitby; approximately 325km from Walberswick), with an independent expert panel concluding that a new pathogen, such as a disease or parasite) caused the event (Ref 38. No mass mortality events have occurred since this 2021 event, and given its distance to Walberswick, it is highly unlikely to have affected local crab stocks. In 2023, edible crab was among the most valuable shellfish, and caught primarily in rectangles 33F1, 35F2, and 35F3 (**Table 20.11**).

European lobster (*Homarus gammarus*)

20.6.47 European lobster is an opportunistic scavenger with their diet consisting of small crustaceans, molluscs and polychaetes.

20.6.48 European lobster is cosmopolitan to rocky areas of UK and Europe coasts, from below mean low water to depths of 150m (Ref 31). Both sexes are thought to be sedentary and have not been found to undertake extensive migrations.

20.6.49 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). 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 (Ref 26).

20.6.50 In 2018, a mass mortality event of lobster (along with other benthic species) occurred along parts of England's northeast coast, following a severely cold winter (a 3°C sea temperature drop was noted) and storm events along the Yorkshire coast (including Bridlington, approximately 232km from Walberswick), (Ref 39). No weather-related

mass mortality events have occurred since this 2018 event, and the event did not appear to affect local lobster stocks.

20.6.51 In 2023, European lobster was among the most valuable shellfish (double the value of edible crab), and caught within all rectangles but with a landings peak in 33F1 (**Table 20.11**).

Spawning and nursery ground

20.6.52 **Table 20.14** summarises the species which use the study area as spawning and nursery grounds and the months within which this occurs.

20.6.53 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 (Ref 25). Where information is available in the form of mapped data this has been presented in **Figure 20.5** and **Figure 20.6** of this PEIR. Nursey periods have been assumed to be the same as spawning but continue for two further months.

20.6.54 Further to the species listed in **Table 20.13**, there is evidence of 0 Group species (those which are less than one years old) present within the study area. These species include haddock, Norway pout, hake, anglerfish and ling. Whilst some of the species are not included in (Ref 27), such as haddock and Norway pout, nursery grounds for the other species (hake, anglerfish and ling) are mapped by Ref 26, but appear as low intensity and confined to the northern and central North Sea. However, Ref 28, for example, shows potential 0 Group Norway pout, and hake, distributions all around the UK coast, albeit in low probability of presence. Inclusion of these 0 Group species helps to reduce any uncertainty in assessments and acknowledges these species as occupying sensitive areas which may be prone to impingement by anthropogenic activities (Ref 28).

Table 20.15: Spawning and nursery grounds that overlap with the study area, based on Ref 24 and Ref 26

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
Tope Shark	*Galeorhinus galeus*	-	-	Viviparous	Low	-												
Thornback Ray	*Raja clavata*	Demersal	Low	Demersal	Low	-				*	*	*	*	*				
Atlantic Herring (Downs)	*Clupea harengus*	Demersal	High	Pelagic	High	Moderate												
Atlantic Cod	*Gadus morhua*	Pelagic	Low	Demersal	Low	Low		*	*									
Whiting	*Merlangius merlangus*	Pelagic	Low	Pelagic	Low	Moderate												
Horse mackerel	*Trachurus trachurus*	Pelagic	Low	Pelagic	Low	Moderate												

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
Sandeel	Ammodytidae	Demersal	Low	Demersal	Low	-												
Atlantic Mackerel	*Scomber scombrus*	Pelagic	Low	Pelagic	Low	Low					*	*	*					
European Plaice	*Pleuronectes platessa*	Pelagic/Demersal	High	Demersal	High	Low	*	*										
Common Sole	*Solea solea*	Pelagic/Demersal	High	Demersal	High	Moderate				*								
Lemon Sole	*Microstomus kitt*	Demersal	Low	Demersal	Low	-												
European Sprat	*Sprattus sprattus*	Pelagic	Low	Pelagic	Low	Moderate					*	*						
Nephrops	*Nephrops norvegicus*	Demersal	Low	Demersal	Low	-				*	*	*						
European lobster	*Homarus gammarus*	Demersal	Unknown	Demersal	Unknown	Unknown												

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
Edible crab	*Cancer pagurus*	Demersal	Unknown	Demersal	Unknown	Unknown												
Whelk	*Buccinum undatum*	Demersal																

* Peak Spawning

	Spawning Only		Nursery Only		Both

Protected sites

20.6.55 There are several protected sites within the study area, as illustrated in **Figure 19.1** of **Chapter 19 Intertidal and Subtidal Benthic Ecology** of this PEIR, none of which have fish or shellfish as a qualifying interest.

Protected species

20.6.56 presents 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:

a. 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;
b. Convention for the Protection of the Marine Environment of the North-East Atlantic – OSPAR Convention. The OSPAR Convention aims to protect the marine environment of the North-East Atlantic;
c. 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;
d. The Habitats Regulations (The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended), The Conservation of Species and Habitats Regulations 2017 (as amended));
e. Natural Environment and Rural Communities (NERC) Act; and
f. Wildlife and Countryside Act 1981 (as amended in 1985).

Table 20.16: Protected species observed in the study area

Species	Wildlife and Countryside Act 1981	Habitats Regulations	OSPAR	CITES	IUCN	NERC Species of Principal Importance
Pelagic Species						
Mackerel					Least Concern	Yes
Herring					Least concern	Yes
Pilchard					Least Concern	
Horse mackerel					Vulnerable	Yes
Sandeel					Least Concern	Yes
Demersal Species						
Atlantic cod			Y		Vulnerable	Yes

Species	Wildlife and Countryside Act 1981	Habitats Regulations	OSPAR	CITES	IUCN	NERC Species of Principal Importance
Whiting					Least concern	Yes
Ling					Least concern	Yes
Plaice					Least concern	Yes
Sole					Data deficient	Yes
Halibut (*Hippoglossus hippoglossus*)					Vulnerable	Yes
Elasmobranch species						
Basking shark	Schedule 5		Y	Appendix II	Endangered	Yes
Tope					Critically endangered	Yes
Blonde ray					Near threatened	
Cuckoo ray (*Leucoraja naevus*)					Least concern	
Spotted ray			Y		Least Concern	
Undulate ray (*Raja undulata*)					Endangered	Yes
Smoothhound					Vulnerable	
Starry smoothhound					Near threatened	
Big-eye thresher (*Alopias superciliosus*)					Vulnerable	
Diadromous species						
Allis shad	Schedule 5	Y	Y		Least Concern	Y
River Lamprey		Y			Least Concern	Y
Sea Lamprey		Y	Y			Y
Smelt (*Osmerus eperlanus*)					Least Concern	Y
Twaite shad (*Alosa fallax*)	Schedule 5	Y			Least Concern	Y
Anadromous species						

Species	Wildlife and Countryside Act 1981	Habitats Regulations	OSPAR	CITES	IUCN	NERC Species of Principal Importance
Atlantic Salmon *(Salmo salar)*		Y	Y		Vulnerable	
European eel (*Anguilla Anguilla*)		Y	Y		Critically endangered	Y
Commercial Shellfish Species						
Crawfish (*Palinurus elephas*)					Vulnerable	Yes

Future baseline

20.6.57 Accurate predictions of the future baseline scenario for fish and shellfish ecology are difficult, given the spatiotemporal changes to the marine environment and considering the Proposed Offshore Scheme is likely to be in operation for up to 40 years. The baseline environment for fish and shellfish will change, due to natural costal processes and weather events (such as storms), and effects of climate change.

20.6.58 Fish and shellfish populations naturally fluctuate in size and distribution due to annual variations in recruitment success. These trends are further shaped by large-scale climatic and hydrological changes, as well as human influences like climate change and overfishing (Ref 45). As key contributors to energy transfer across trophic levels, fish and shellfish help recycle nutrients by consuming detritus. Consequently, their populations are regulated by both top-down forces, such as predation, and bottom-up factors, including ocean climate and plankton availability.

20.6.59 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 (Ref 63) due to increases in water temperatures. Indirectly, it could be expected that large fish populations could add additional pressure on prey species (such as mackerel, herring, whiting and haddock; Ref 48), and also provide additional prey resources for squid predators such as spurdog and whiting (Ref 59).

20.6.60 Changes occurring during the lifespan (construction through to completion of decommissioning) of the Proposed Offshore Scheme should be considered against trends on national and international scales.

20.7 Embedded design mitigation and control measures

Design and embedded mitigation measures

20.7.1 As described in **Chapter 2 Description of the Proposed Scheme** of this PEIR, a range of measures have been embedded into the Proposed Offshore Scheme design to avoid or reduce environmental effects. These mitigation measures form part of the design that has been assessed, which for fish and shellfish are listed in **Table 20.17**.

Table 20.17: Design and embedded mitigation measures of fish and shellfish

Commitment Reference Code	Measure	Compliance Mechanism
OD01	All cables will be installed in one trench.	CEMP secured by DML
OD02	HVDC cables will be bundled together to minimise the EMF profile.	CEMP secured by DML
OD04	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.	CEMP secured by DML
OD05	External cable protection shall only be used where it can be demonstrated that adequate burial depth cannot be achieved (e.g., where ground conditions do not allow burial or at infrastructure crossings); the footprint of any external protection shall be the minimum required to ensure adequate cable protection and stability.	CEMP secured by DML
OD06	In sites designated for benthic features, cable protection materials will be selected to match the environment (e.g. rock of similar grade as the receiving environment) where feasible.	CEMP secured by DML
OD07	Design and construction will be carried out in accordance with International Cable Protection Committee (ICPC) recommendations.	CEMP secured by DML
OD08	Micro-routeing within the Order Limits to avoid sensitive environmental constraints and minimise the risk of exposure by seabed mobility.	CEMP secured by DML
OD09	The profile of rock berms used for cable protection will be designed to minimise the potential for scour to occur as much as possible (including alignment with flow and profiling).	CEMP secured by DML

Control measures

20.7.2 Control measures are set out in **Appendix 2.2 Outline Offshore Construction Environmental Management Plan** which will manage the effects of construction.

The measure of particular relevance to fish and shellfish is shown below in **Table 20.18.**

20.7.3 Several management plans will be provided as Outline Management Plans with the application for development consent to support the DML. These will include an Outline Offshore Construction Environmental Management Plan (CEMP) (including biosecurity plan details) and an Outline Marine Pollution Contingency Plan. An Outline Offshore CEMP can be found in **Appendix 2.2** of this PEIR. These documents will outline control measures to be implemented to comply with legislation (e.g., in relation to the prevention of oil and chemical spills) and best industry practice during all phases of the Proposed Offshore Scheme. Final management plans would be submitted in accordance with the DML to discharge the licence conditions.

20.7.4 The Applicant would ensure that all work that is undertaken during construction, operation and maintenance and decommissioning complies with the requirements of relevant national and international legislation.

Table 20.18: Control measures relevant to fish and shellfish assessment

Commitment Reference Code	Measure	Compliance Mechanism
OC01	An offshore Construction Environmental Management Plan (CEMP) including an Emergency Spill Response Plan (ESRP), Waste Management Plan, Marine Pollution Contingency Plan (MPCP), Marine Mammal Mitigation Plan (MMMP) and a dropped objects procedure will be produced prior to installation.	DML secured through DCO

20.8 Assessment of effects

20.8.1 This section presents the preliminary assessment of likely significant effects on fish and shellfish resulting from the construction, operation (including maintenance) and decommissioning of the Proposed Offshore Scheme. The likely significant effects of the Proposed Offshore Scheme are identified taking into account the embedded design mitigation and control measures.

20.8.2 Following assessment, further mitigation is proposed as required which is presented in **Section 20.9**.

Construction

20.8.3 It is anticipated that the construction programme for the Proposed Offshore Scheme would be split into multiple campaigns, comprising of route preparation and cable lay and burial campaigns. Pre-construction phase activities, such as surveys, route preparation, boulder clearance, pre-sweeping and infrastructure crossing preparation, are expected to take up to one year to complete. As set out in **Chapter 2 Description of the Proposed Scheme** of this PEIR, installation

vessels would install the cables at an indicative speed of between 100m and 500m per hour, depending on seabed conditions and the vessels used.

20.8.1 The Offshore HVDC Submarine cables would be installed in one trench, with installation methodologies including simultaneous cable lay and trenching, and surface cable lay followed by post lay trenching. Cable burial tools which may be used include jet trenching machines, mechanical trenchers, control flow excavators and ploughs. Overall, displacement ploughs/boulder clearance ploughs would result in the greatest seabed disturbance, however this method may only be required within discrete sections **(Chapter 2 Description of the Proposed Scheme** of this PEIR).

20.8.2 Additional information on potential construction techniques is provided in **Chapter 2 Description of the Proposed Scheme** of this PEIR**.**

Temporary habitat loss/seabed disturbance

20.8.3 Temporary habitat loss/seabed disturbance could be caused through various seabed preparation and cable installation activities during construction.

20.8.4 The sensitivity to the effects of temporary habitat loss/seabed disturbance varies between receptors, with mobile, marine species the more resilient to said effects (due to their ability to move away from a source of disturbance), whilst less mobile (usually demersal) fish, most shellfish species (usually with the exceptions of squids and cuttlefish), larvae, and eggs being the most susceptible to the effects of this impact. Diadromous fishes, such as salmon, river lamprey, twaite shad, allis shad, European eel, smelt and sea trout) also tend to be less sensitive the effects of temporary habitat loss/seabed disturbance, as they utilise the marine environment for only part of their life cycle (their presence within the Proposed Offshore Scheme is considered transient) and are not functionally associated with particular seabed habitats.

Shellfish and marine species with demersal life stages

20.8.5 Any disturbance of the seabed has the potential to affect species which use the seabed for part/all their lifecycle. Activities during construction would include route clearance, horizontal directional drilling (HDD) (trenchless cabling technique) duct excavation, cable burial and trenching. Species most at risk are those that live in the upper layers of sediment, those that live on the seabed with limited mobility (e.g., whelk, crab, lobster, hibernating sandeel) or those which lay their eggs on the seabed (demersal spawners such as herring). The study area crosses many spawning and nursery grounds and whilst these cover large areas of the Southern North Sea suitable habitats within these areas may be limited. Disturbance during the spawning season could have a direct impact on the spawning biomass for a specific year group. The assessment focuses on the effect on shellfish and marine species with demersal life stages; shellfish species due to their limited mobility, and high commercial values and sandeel and herring as significant prey species.

20.8.6 Aspects of the Proposed Offshore Scheme that physically disturb the seabed e.g., seabed preparation (including UXO identification and pre-sweeping of sand waves) and cable burial, have the potential to disturb subtidal habitats and species and cause temporary habitat loss. Typically, the extent of this disturbance will be 30m wide along the entire Proposed Offshore Scheme. 30m is the representative of the clearance swathe of the pre-lay grapnel run which would take place along the entire 182km length of the Proposed Offshore Scheme and represents the worst-case scenario. Most of the cable clearance and lay activity would take place within the width of this corridor.

20.8.7 Demersal fishes such as cod, whiting, plaice and sandeel (along with their eggs and larvae) are most sensitive to seabed disturbance effects and during construction, adults may be displaced, or juveniles, eggs and larvae may be damaged and/or killed.

20.8.8 The impact is predicted to be of local spatial extent (limited to a narrow corridor within the Draft Order Limits, short-term duration, and affecting only a small proportion of the total area at any one time. Any impacts are predicted to be intermittent and of high reversibility.

20.8.9 Herring and sandeel, which have specific sediment requirements for spawning, are likely to be among the more sensitive receptors to temporary habitat loss/seabed disturbance (Ref 26).

Herring

20.8.10 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, along with the impacted area being localised and of short duration. If spawning is interrupted or herring eggs are damaged this could lead to a decrease in recruitment for the year, leading to decreased fish stocks and lack of prey availability for the species preying upon herring. The construction works could take place during a sensitive season e.g. November to January, with the potential to detrimentally affect eggs in a highly localised area. However, it should be noted that herring behaviour shows a lack of site fidelity in terms of annual return to spawning locations. In addition, they are of national conservation importance, are of commercial importance and ecologically important as a prey species.

20.8.11 The spatial extent of temporary habitat loss/seabed disturbance to herring grounds is low, given the conclusion of **Appendix 20.1 Atlantic Herring and Sandeel Habitat Study** of this PEIR. The study found that sediment potentially suitable for herring spawning is infrequent and patchy along the Proposed Offshore Scheme, with only one survey station identified as Prime herring habitat within the spawning ground off the Suffolk coastline. The potential for construction activities to result in the loss and/or disturbance of herring spawning grounds along the Draft Order Limits is limited, would be highly localised and of temporary duration; there would be no change in sediment

composition. The impact of temporary habitat loss/seabed disturbance upon herring spawning habitat is predicted to be of negligible magnitude. Combined with the medium sensitivity of this receptor, the effect is predicted to be **Negligible** and **Not Significant.**

Sandeel

20.8.12 This receptor has been identified as having a value and sensitivity of medium because of its intermediate tolerance to change, and due to its strong habitat preferences and ecology. Sandeel bury themselves in sediments and hibernate within the sediment during winter months. If seabed disturbance is significant during the period November to February in areas of Prime sandeel habitat, this 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. However, the Draft Order Limits passes through areas identified to be 'low intensity' spawning grounds (Ref 23), with almost the entirety of the Offshore HVDC Submarine Cable Corridor within an area identified to be 'low intensity' nursery grounds for Ammodytidae (**Figure 20.2** of this PEIR). Furthermore, **Appendix 20.1 Atlantic Herring and Sandeel Habitat Study** of this PEIR concluded that approximately 47% (85km) of the Proposed Offshore Scheme consists of "Prime" sandeel habitat and approximately 7% (14km) as "Sub-Prime" habitat, totalling approximately 99km. The majority of the 'Prime' and 'Sub-Prime' locations within the Proposed Offshore Scheme lie within the Norfolk and Suffolk spawning grounds (**Figure 20.2** of this PEIR). However, it is important to note that even in optimal habitats, sandeel communities may remain absent if populations are below the area's carrying capacity.

20.8.13 The spatial extent of temporary disturbance to sandeel grounds is considered low in the context of alternative available habitat surrounding the Proposed Offshore Scheme and the wider North Sea. Construction works are not of a continuous nature (e.g. compared to marine aggregate extraction which causes continuous seabed disturbance). Disturbance along the Draft Order Limits will be temporary, with the recovery of any sandeel species and their habitats expected following cable burial. Recovery would be expected over the short to medium term (one to five years) with individuals able to recolonise suitable substrates following completion of cable installation. As such, the magnitude of the impact has been assessed as low.

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

Shellfish

20.8.15 There is potential for shellfish to be affected by temporary habitat loss/seabed disturbance during construction. Within the study area, whelks are an important, commercially targeted species (>500 tonnes landed in 2023 from the area). Crabs, lobsters, and squids and cuttlefish are also landed from the study area, but in limited quantities compared to whelks. Whelks, crabs and lobsters are

more limited in their mobility than fish and are therefore often less able to avoid or move away from sources of disturbance. Some species can disperse over short distances (particularly squids and cuttlefish, which tend to be very resilient to changes to the marine environment; Ref 64, whilst others are sessile. At all life stages, shellfish are considered to have a medium to high sensitivity to physical damage caused during construction works due to limited dispersal (particularly in the case of whelks, which in one study, moved only <10m in six hours (Ref 65).

20.8.16 Due to the temporary and localised nature of construction activities and the small-scale installation footprint (5.46km^2 for the maximum area of seabed disturbed by cable construction), the temporary habitat loss/seabed disturbance of shellfish habitat is predicted to be of low magnitude. Combined with the medium sensitivity value of shellfish of commercial and/or conservation importance, the effect is predicted to be **Minor** and **Not Significant.**

Marine species with a fully pelagic lifecycle

20.8.17 Marine species with a fully pelagic lifecycle around the Draft Order Limits include horse mackerel, sprat, and blue whiting. As pelagic species, these fish will not be significantly affected by disturbance occurring on the seabed, or by localised seabed deposits. Whilst most of the Draft Order Limits cover sprat spawning zone and a small amount of nursery ground (**Figure 20.5** of this PEIR), these fish swim continuously over large distances and are able to move away from disturbance and return following disturbance cessation. Ref 27 has no record of horse mackerel, or blue whiting spawning or nursery grounds over the Draft Order Limits. The sensitivity of pelagic species has been assessed as negligible.

20.8.18 The magnitude of the impact of temporary habitat loss/seabed disturbance has been assessed negligible, given pelagic fish are associated with the middle of the water column, where disturbance would be low. The overall significance of the effect on species with a fully pelagic lifecycle has been assessed as **Negligible** and **Not Significant**.

Permanent Habitat Loss

20.8.19 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 sufficient cable burial is not possible.

20.8.20 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. The anticipated footprints during construction are:

a. Remedial cable protection – would be confirmed in the ES; and
b. Cable protection for infrastructure crossings - 0.0378 km^2.

20.8.21 As migratory fish are only transient around the Proposed Offshore Scheme, they do not have functional associations with seabed types; as such, this receptor group has not been considered further.

Shellfish and marine species with demersal life stages

20.8.22 Research has shown that some fish and shellfish species utilise rocky areas for shelter when guarding eggs/nests, and protection from predators (Ref 26). The study area is primarily sand, slightly gravelly sand or 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.

20.8.23 However, some fish (particularly flatfish such as lemon 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 bury themselves in the seabed) and herring utilise gravelly sediments. The assessment focuses on herring, sandeel and shellfish as representatives of sensitive species with demersal life stages.

Herring

20.8.24 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. Herring are of national conservation importance, are of commercial importance and ecologically important as a prey species.

20.8.25 Wider herring spawning grounds are present off north Norfolk, along the Lincolnshire and Yorkshire coast, and to the south, offshore from the Thames estuary (Ref 27). **Appendix 20.1 Atlantic Herring and Sandeel Habitat Study** of this PEIR found that sediment potentially suitable for herring spawning is infrequent and patchy along the Proposed Offshore Scheme, with only one survey station identified as Prime herring habitat within the spawning ground off the Suffolk coastline. The spatial extent of permanent habitat loss to herring grounds is therefore negligible, given the conclusion of **Appendix 20.1 Atlantic Herring and Sandeel Habitat Study** of this PEIR. The potential for the loss of potential herring spawning habitat because of the Proposed Offshore Scheme is limited and the sediment types present for most of the Draft Order Limits are unsuitable for herring spawning. As such, the magnitude of the impact on herring has been assessed to be negligible. The overall significance of the effect has been assessed to be **Negligible** and **Not Significant**.

Sandeel

20.8.26 The sensitivity of sandeel to this impact is medium because the species is associated with habitat types where they can bury into the seabed. A change to a hard substrate limits these opportunities. Sandeel are of national conservation importance, commercial importance and ecologically important as a prey species.

20.8.27 The locations requiring cable protection that fall within Prime and Sub-Prime spawning grounds will be identified and provided within the ES.

20.8.28 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 Proposed Offshore Scheme, and within the wider North Sea. The localised change in habitat would not alter overall sandeel abundance.

20.8.29 The overall significance of the effect has been assessed to be **Minor** and **Not Significant**.

Shellfish

20.8.30 Some shellfish are moderately sensitive to habitat loss, such as scallop and edible crab, as these species tend to be associated with habitat types in which they can partially bury. A change to a hard substrate limits 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. Many shellfish species are of commercial importance and ecologically important as a prey species, such as cephalopods (Ref 46).

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

20.8.32 The overall significance of the effect has been assessed to be **Minor** and **Not Significant**.

Marine species with a fully pelagic lifecycle

20.8.33 Marine species with a fully pelagic lifecycle around the Draft Order Limits include horse mackerel, sprat, and blue whiting. As pelagic species, these fish spend most of their time in the water column, though adult horse mackerel are documented to consume decapod crustaceans such as nephrops (Ref 81), though these only account for a small portion of the diet, with the remaining prey items being those found in the water column. The diets of sprat and blue whiting are seemingly solely restricted to prey items in the water column. Therefore, due to the very limited association with the seabed, marine species with a fully pelagic lifecycle would not be significantly affected by localised changes in seabed

habitats as they do not rely on the seabed for spawning. The sensitivity of pelagic species has been assessed as negligible.

20.8.34 The magnitude of the impact of permanent habitat loss has been assessed negligible, given pelagic fish are associated with the middle of the water column. The overall significance of the effect on species with a fully pelagic lifecycle has been assessed as **Negligible** and **Not Significant**.

Temporary increase and deposition of suspended sediments

20.8.35 Temporary increases and depositions of suspended sediments are likely to occur from pre-sweeping, and jetting/trenching for cable installation. Pre-sweeping 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. Coarse sediment from these activities will settle from the water column within close proximity to the disturbance site. Sedimentation from fine sediment will cause light smothering of less than 1mm along the Proposed Offshore Scheme except for a localised area between KP8 and KP11 where increased fines content would lead to a higher level of sedimentation not exceeding 12mm. Fine sediment would not exceed 0.1mm outside of the study area from pre-lay and cable trenching activities.

20.8.36 Effects could potentially be significant if the disposal site contains sensitive demersal spawning grounds or shellfish beds. It should be noted that the baseline established no commercial cockle, oyster or mussel beds are present within the Draft Order Limits.

20.8.37 **Chapter 18 Marine Physical Environment** of this PEIR provides an assessment of the area of seabed impacted by temporary increases and depositions of suspended sediments from construction (pre-sweeping and cable burial). In summary it estimates that all sediment coarser than fine sediment will settle within the Draft order Limits with fine particles being deposited over the study area in thicknesses of <0.1mm. The only increases in suspended sediment concentration (SSC) outside of the study area were associated with cable burial between KP5 and KP10 where increases in SSC of 15mg/l extend 1.5km beyond the northern boundary of the study area. This is due to the high percentage of fines and the closer alignment of the cable route with the flow direction in this area. The maximum distance from trenching activities where suspended sediment concentrations exceed 20mg/l, is 10km south west and 5km north east of KP8 aligned with the predominant current where areas of fine sediment contribute to the increase in SSC. SSCs of around 50mg/l occur along the dredge track from the trailing suction hopper dredger (TSHD) sand wave clearance activities but these concentrations are short lived generally occurring for less than an hour before reducing to SSCs of <10mg/l. SSC concentrations at selected disposal sites were noted to be the highest modelled (up to 1000mg/l in some instances) but again impacts were determined to be short lived over a period of a few hours.

20.8.38 The Marine Evidence-based Sensitivity Assessment (MarESA) threshold for changes in suspended solids is "A change in one rank on the WFD scale (e.g., from clear to intermediate) for one year" (Ref 81). Background values of SSC inshore are high at with an annual average of 47mg/l and sometimes as high as 170mg/l during discrete high energy events. The annual average background concentration offshore was recorded at 5 mg/l. The increases by the Proposed Offshore Scheme are generally within the levels of natural variability noted in the wider area and do not exceed the MarESA benchmark. Increases in SSC outside the study area are short lived, with increases of more than 5mg/l only occurring for less than 2 hours.

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

Shellfish and marine species with demersal life stages

20.8.40 The sensitivity of fish species to a temporary increase and deposition of suspended sediment is species-specific (demersal or pelagic) and depends on a species' life stage; juveniles tend to be the least resilient to change due to their lower ability to move away from a disturbance source. Herring and sandeel are the more sensitive of finfish to the effects of smothering from increases and depositions of suspended sediment due to both species spawning close to/on the seabed. Due to their sensitivities, herring and sandeel have been assessed, along with shellfish as they represent the most sensitive species in this receptor group.

Shellfish

20.8.41 Shellfish present in the study area include octopus, European lobster, common cuttlefish, crabs (edible, and spider), scallops (albeit at small quantities), whelks, and squids (Ref 28 and **Table 20.12**). 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 (Ref 71) and as such, 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.

20.8.42 When not berried, edible lobster, European lobster, and king scallops are considered mobile, capable of tolerating a sediment smothering depth of 5cm. Further, these species show avoidance behaviour 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.

20.8.43 Whilst it is acknowledged that sediment disposal from sandwave clearance may cause mortality of shellfish due to smothering from the depth of the deposition between KP8 and KP11, where increased fines content would lead to a higher level of sedimentation not exceeding 12mm), the footprint would be very localised. Outside of these disposal locations, which will be defined in the ES, the sediment deposition would be minimal (<1mm), within levels that species can tolerate. The effects from cable burial would be greatest close to the construction works (within a few hundred metres), and will decrease as the distance from the route centreline increases. The overall magnitude of impacts to shellfish by an increase in suspended sediment concentration, and in deposition of suspended sediments has been assessed as low, given that deposition thicknesses are limited. The overall significance of the effect has been assessed to be **Negligible** and **Not Significant.**

Herring and Sandeel

20.8.44 Herring and sandeel are demersal spawners with specific habitat preferences and are regarded as having low 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 300mg/l) and can tolerate short term exposure to 500mg/l (Ref 68). 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.

20.8.45 Suitable herring habitat across the study area is scarce compared to surrounding areas. Sandeel prefer coarse sediment habitats which settle quicker than light sediments and have limited dispersion following sediment mobilisation. Suitable sandeel habitat is found across approximately 99km of the Proposed Offshore Scheme.

20.8.46 Taking the above into consideration, and the national and ecological importance of both species, the sensitivity of the receptors has been assessed as medium.

20.8.47 Whilst it is acknowledged that sediment disposal from sandwave clearance could cause smothering, and thus mortality of herring larvae and eggs and sandeel due to the depth of the 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 (<1mm), within levels that species can tolerate. The magnitude of the impact has been assessed as low, given the small spatial scale.

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

Diadromous fish

20.8.49 The Proposed Offshore Scheme passes offshore of the river Blyth, Waveney river, and Yare river (from south to north, respectively). These rivers are used by migratory fish, including Atlantic salmon, brown trout, smelt, sea and river

lamprey. Salmonids can be affected by an increased SSC through reduced vision of prey (Ref 70).

20.8.50 Temporary increases and depositions of suspended sediments may cause a migration barrier for some diadromous fish, impacting their marine to freshwater movements, though the aforementioned (**paragraph 20.8.51**) fishes tend to predominantly inhabit the upper water column, whereas mobilised sediment would be apparent primarily up to 5m off the seabed (**Chapter 18 Marine Physical Environment** of this PEIR). Whilst these diadromous fishes are of high value, their sensitivities to temporary increases and depositions of suspended sediments are low. Further, as any sediment increases and depositions will be of short duration during cable installation, the magnitude of the impact is negligible. Therefore, the effect to diadromous fish species is predicted to be **Negligible** and **Not Significant**.

Other marine fish

20.8.51 The effects to all remaining fish and shellfish species from temporary increases and deposition of suspended sediments is predicted to be of negligible magnitude for the cable installation. Combined with the low to medium value of fish and shellfish and low sensitivity, the short duration of temporary increased suspended sediment concentrations, and subsequent settlement of sediment, the effect is predicted to be **Negligible** and **Not Significant**.

Transboundary impacts - temporary increases and deposition of suspended sediments

20.8.52 As a linear project, cable installation activities will continue across the UK/Netherlands EEZ border into Dutch waters. The effects from marine activities in UK waters would be limited in spatial extent close to the jurisdictional boundary i.e., concentrations of suspended sediments would be exceeded across the border, but only to the same extent that sediment is travelling in UK waters – within 15km. The preliminary assessment of the impact of temporary increases and re-deposition of suspended sediments on fish and shellfish in UK waters concluded that the effect was Not Significant. As the baseline characteristics in Dutch waters immediately adjacent to the EEZ boundary are the same as in UK waters, the conclusion remains valid for the Netherlands. Transboundary impacts have been assessed as **Negligible** and **Not Significant**.

Underwater noise

20.8.53 Sound is readily transmitted into the underwater environment and there is potential for noise emissions from construction 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 (Ref 77, Ref 78, Ref 79). This category includes noise sources such as seismic surveys and underwater explosions. Continuous (non-impulsive) noises can be broadband (which contains

a wide range of frequencies), narrowband (concentrated within a narrow range of frequencies) or tonal (a single frequency), 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 (Ref 80, Ref 79). This category includes noise sources such as continuous running machinery, sonar, and vessels.

20.8.54 Underwater noise propagation modelling has been undertaken for the Proposed Offshore Scheme to inform the EIA. **Appendix 22.1 Underwater Noise Modelling Report** of this PEIR 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 Proposed Offshore Scheme for three key modelled sources, referencing them back to impact criteria from and Ref 52:

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

20.8.55 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 (Ref 34).

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

a. High hearing sensitivity fish: these species 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);
b. 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); and
c. Low hearing sensitivity fish: those species which lack a swim bladder and detect particle motion rather than sound pressure (includes flatfish, elasmobranchs, and lampreys).

20.8.57 Shellfish tend to be more sensitive to particle motion rather than sound pressure (Ref 71) 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 (Ref 72). 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.

20.8.58 The preliminary assessment focuses on species regarded as having high to medium hearing sensitivity. In all 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

20.8.59 During construction, operation and maintenance, 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.

20.8.60 USBL, MBES, and SSS equipment operate at frequencies over 3kHz. As fish are not sensitive to noises over 1kHz, these three equipment types have not been assessed further. SBP systems operate at frequencies within the hearing range of fish; between 0.2-14kHz, with a sound pressure level (SPL) of 240dB re 1µPa re 1 m. Whilst conservative (the actual thresholds are likely to be significantly higher), the Ref 34 threshold criteria for mid-frequency sonar (1-10kHz) can be used as a proxy for the SBP. For medium to high hearing sensitivity fish the threshold for injury is a SPLrms of 210dB dB re 1µPa with a threshold for behavioural responses at a SPLrms of >209dB 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 (Ref 34). 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.

20.8.61 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 a decline in catch records have been noted following geophysical survey activities (Ref 74), which suggests that fish return to areas after the temporary displacement.

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

Vessels and equipment

20.8.63 **Appendix 22.1 Underwater Noise Modelling Report** of this PEIR models impact ranges for a range of fish groups, based on their physiology, from the various

vessels and construction equipment (including activities such as boulder clearance and cable lay activities) that could be deployed within the Proposed Offshore Scheme. The report concludes that the range for a temporary threshold shift in medium and high sensitivity hearing fish species is 54m. 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.

20.8.64 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. The sensitivity of fish to noise from vessels and equipment has been assessed as medium. Combined with the low magnitude and medium sensitivity, the significance of the effect has been assessed as **Minor** and **Not Significant.**

UXO clearance

20.8.65 UXO clearance is not being consented under the DCO; a separate Marine Licence would be applied for. Activities associated with the lift and shift of any confirmed UXO are to be included in the application for development consent. The below high-level assessment is provided for information only to provide an understanding of all impacts associated with the Proposed Offshore Scheme.

20.8.66 A UXO 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 by 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.

20.8.67 **Appendix 22.1 Underwater Noise Modelling Report** of this PEIR models impact ranges for medium and high sensitivity fish species from several scenarios including low order disposal (0.08kg donor charge), clearance charge (0.5kg charge) and high order disposal (295kg charge and 697kg charge). It predicts that impact ranges for injury range from 27m – 81m for the low order disposal and clearance charge and to 405m - 900m for a high order disposal. Recoverable injury effects are likely in the near (tens of metres) to intermediate (hundreds of metres) fields.

20.8.68 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.

20.8.69 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:

a. The use of noise abatement systems (such as bubble curtains) would be discussed with the MMO, JNCC, NE and Cefas; and
b. 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.

20.8.70 Given that the size and location of the UXO is unknown and the assessment is based on theoretical worst-case scenarios, it is highly precautionary. Mitigation would need to be discussed with the statutory nature conservation bodies (SNCBs) for the Marine Licence and Wildlife Licence, but given that consent would only be granted if it could be demonstrated by the Applicant that there would not be a significant adverse effect the assessment concludes that effects would be Not Significant.

Transboundary impacts – underwater noise

20.8.71 As a linear project, cable installation activities will continue across the UK/Netherlands EEZ border into Dutch waters. The effects from marine activities in UK waters would be limited in spatial extent close to the jurisdictional boundary i.e., underwater noise changes will be exceeded across the border, but only to the same extent that they are within the UK. The preliminary assessment of the impact of construction underwater noise changes on fish and shellfish in UK waters concluded that the effect was Not Significant. As the baseline characteristics in Dutch waters immediately adjacent to the EEZ boundary are the same as in UK waters, the conclusion remains valid for the Netherlands. Transboundary impacts have been assessed as **Minor** and **Not Significant**.

20.8.72 If UXO clearance was required adjacent to the UK/Netherlands boundary the same conclusion as reached in **paragraph 20.8.70** would apply that the significance of the effect would be assessed as **Minor** and **Not Significant.**

Changes in distribution of species

20.8.73 Changes in distribution of species may occur due to construction activities such as pre-sweeping, cable burial, and deposition of external cable protection, which could lead to alterations to ecosystem functions. Distributions of fish and shellfish populations have the potential to be affected by the combined effects of multiple impacts on fish and shellfish. This assessment considers the intra-project effects of the previously assessed impacts such as changes in underwater noise, seabed disturbance during sensitive periods for species with demersal life cycles, and permanent changes in seabed habitat, all which may lead to a change in distribution of target species. The preliminary assessments

above concluded that individually, these impacts will be **Not Significant**. It can therefore be assumed that changes in distribution of species are unlikely to be affected, though consideration on prey items of important receptors is also required to understand indirect effects of this impact (i.e. if prey items are affected, so might the predator species). Horse mackerel is examined as a proxy species, given its high catch abundance in the study area (the highest volume of catch landings across rectangles 33F1, 33F2, 34F2, and 35F3 was for horse mackerel, in 2023 (**Table 20.12**).

20.8.74 Data from stomach records of horse mackerel in the North Sea, observed during scientific surveys, found this species to be a generalist, with records of its prey items presented in **Table 20.19**. The largest contributor to the diets of horse mackerel were calanoid copepods, which are major food sources for many fish species and are abundant throughout the North Sea (Ref 62). As such, it is likely that fish predators' prey would remain readily available; even if horse mackerel were temporarily displaced, copepod prey items would likely still be readily available in other areas, and as planktonic species, copepods would also likely remain within the study area.

Table 20.19: Prey items (numbers) of horse mackerel in the North Sea, from survey hauls (Ref 74)

Common name	Scientific name	Total Number	Number of hauls
(Calanoid copepod)	*Acartia clausi*	1	1
(Calanoid copepod)	*Acartia longiremis*	26	7
(Calanoid copepod)	*Centropages typicus*	208	11
Water flea	*Cladocera*	54	9
Copepoda (Nauplii)		265	9
Copepoda-calanoida		2	2
(Calanoid copepod)	*Corycaeus anglicus*	2	1
Digested Remains		2	2
Krill	Euphausiidae	1	1
Harpactacoid copepod	*Euterpina acutifrons*	3	3
Fish remains		1	1

Common name	Scientific name	Total Number	Number of hauls
Hyperiid amphipods		1	1
Invertebrate (eggs)		6	3
Harpactacoid copepod	*Microsetella norvegica*	1	1
(Calanoid copepod)	*Oithona helgolandica*	83	12
(Calanoid copepod)	*Paracalanus parvus*	110	12
(Calanoid copepod)	*Pseudocalanus spp.*	3	3
(Calanoid copepod)	*Temora longicornis*	79	13
(Calanoid copepod)	*Temora spp.*	3	3

20.8.75 The same is likely true for shellfish; the highest volume of fish landings across rectangles 33F1, 33F2, 34F2, and 35F3 was for whelks, in 2023 (**Table 20.12**). Whelks are generalist scavengers, primarily upon carrion and polychaetes (the latter contributed to 60% of whelk diet in the Northwest Atlantic (Ref 61). Carrion and polychaetes are abundant throughout the North Sea (at least 651 species of polychaete exist in the North Sea; Ref 78), so it is likely that prey items would likely still be readily available in other areas, even if temporary displacement of a shellfish receptor should occur.

20.8.76 Further, if any species do experience distribution changes ecosystem biodiversity may be temporarily increased, according to the Intermediate Disturbance Hypothesis (Connell, 1978) (Ref 96). This hypothesis suggests that at intermediate disturbance levels, competitive interactions and species establishments are balanced (due to the temporary decrease in predators), leading to higher biodiversity.

20.8.77 The impact is predicted to be of local spatial extent (limited to the Proposed Offshore Scheme fish and shellfish ecology study area), short-term duration, and affecting only a small proportion of the total area at any one time. The magnitude of the impact to receptors has been assessed as negligible, and combined with the medium sensitivity of species, the effect of the impact for all species is predicted to be **Negligible** and **Not Significant**.

Operations and maintenance

20.8.78 It is anticipated that the following activities may be required during the operational phase:

a. Inspection surveys;
b. Cable Repair (if required); and
c. Reburial, remedial protection, or maintenance and reinstatement of external cable protection features.

20.8.79 These activities are described in **Chapter 2 Description of the Proposed Scheme** of this PEIR**.**

20.8.80 The associated impacts of operations and maintenance would be less than those experienced during the construction phase of the Proposed Offshore Scheme. Consequently, as a worst-case scenario, operational impacts would be equal to or less than the magnitude to construction. Therefore, the following conclusions reached for construction are applicable:

a. Temporary habitat loss/seabed disturbance:
   i. Shellfish and marine species with demersal life stages – **Minor** and **Not Significant**; and
   ii. Marine species with a fully pelagic lifecycle – **Negligible** and **Not Significant**.
b. Permanent habitat loss:
   i. Shellfish and marine species with demersal life stages – **Minor** and **Not Significant**; and
   ii. Marine species with a fully pelagic lifecycle – **Negligible** and **Not Significant.**
c. Temporary increase and deposition of suspended sediments:
   i. Shellfish and marine species with demersal life stages – **Minor** and **Not Significant**;
   ii. Diadromous fish - **Negligible** and **Not Significant**; and
   iii. Other marine fish – **Negligible** and **Not Significant**.
d. Transboundary impacts - temporary increases and deposition of suspended sediments – **Negligible** and **Not Significant**.
e. Underwater noise (note, no UXO clearance would be undertaken during the operations and maintenance phase)
   i. Geophysical survey - **Minor** and **Not Significant**;
   ii. Vessels and equipment - **Minor** and **Not Significant**.
f. Transboundary impacts - Underwater noise – **Minor** and **Not Significant**.
g. Changes in distribution of species – **Negligible** and **Not Significant**.

Electromagnetic changes/barrier to species movement.

20.8.81 During the operation of a proposed Offshore submarine HVDC cable electromagnetic fields (EMFs) are generated. A single scenario was modelled to calculate the EMF emissions. The calculations are presented in **Appendix 2.3 Electromagnetic Field Assessment** of this PEIR. These calculations show that for bundled HVDC poles, the magnetic field generated by the cables dissipates to below background geomagnetic levels (49μT) within 10m, when cables are buried at 1 m below the seabed. The magnetic field directly above the cables at the seabed is 99.3μT (or 51.9μT without the earth's magnetic field).

20.8.82 Sensitivity to EMF is species dependent. Any impacts would mostly affect those species on the seabed, such as flatfish and shellfish species rather than pelagic species or demersal species, which tend to swim a few meters above the seabed, and which would be outside the range of EMF emissions. An increase in EMF emissions has the potential to create a barrier to migration and/or movement of fish and shellfish; particularly diadromous/catadromous fishes which undertake large migrations as part of their life history (such as to spawn). For some species, like European eel, EMF impacts include swimming speed reduction, whereas for some species of elasmobranch, a reduction in swimming activity and attraction to cables is noticed (Ref 67).

20.8.83 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 (Ref 89) and further, this water permeability was observed at an EMF strength of 2,000μT; far above the bundled cable's 51.9μT at the seabed.

20.8.84 As their sensitivities differ, the appraisal of effect of electromagnetic changes/barriers to movement generated during electricity transmission is divided into the key receptor groupings.

Diadromous species

The Proposed Offshore Scheme passes close to migratory routes of several diadromous species including allis shad, twaite shad, salmon, smelt, river lamprey, and sea lamprey, and the catadromous European eel. The exact paths of migration to natal rivers for these species are not well understood, and are expected to be highly diffuse, but there are several rivers of importance along the coast (namely, the river Blyth, Waveney river, and Yare river (from south to north, respectively)), from, or to which, migrating fish from/to the marine environment may have to pass over the submarine cables. The river closest to the proposed Landfall is the river Blyth.

20.8.85 Studies on salmonids have shown evidence that EMFs from cables can affect the behaviour of migratory fish; tagged European eel swimming speeds were reduced (Ref 83) and swimming trajectories during passage over a cable differed to their normal behaviour (Ref 83). Conversely, another study in the USA found no significant difference to migration success in juvenile salmon in response to a proposed Offshore submarine HVDC cable (Ref 88), 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 (Ref 83) were deemed to be neither adverse nor beneficial.

20.8.86 Research suggests that EMFs from cables do not cause a movement barrier to migrating European eels (Ref 83), despite the species being considered EMF-sensitive; whilst small perturbations were noticed in their directional movements whilst passing over the propose Offshore submarine HVDC cable, these were not considered avoidance actions (Ref 83).

20.8.87 During operations and maintenance of the proposed Offshore submarine HVDC cables migratory species may respond by changes in swimming speed or adjustments in swimming direction, though those species mentioned above have been shown to spend most of their time in the top 10m of the water column, whereas the EMF of the bundled cables does not exceed the upper range of the background EMF, and, furthermore, at only 0.5m above the seabed, the magnetic field from the bundled cables are 20.7μT, which is below the minimum range of background EMF.

20.8.88 Electromagnetic changes may cause a migration barrier for some diadromous fish, impacting their marine to freshwater movements, though these fishes tend to predominantly inhabit the upper water column. Whilst these diadromous fishes are of high value, their sensitivities to EMF changes are low.

20.8.89 The magnitude of the impact of EMF changes and barriers to movement is negligible, as the EMFs emitted from the bundled cables dissipate to below background levels within 10m of the cables. Combined with a high sensitivity, EMF changes and barrier to movement from the proposed cables have been assessed to have a **Negligible** and **Not Significant** effect on diadromous fish.

Pelagic species

20.8.90 Pelagic species such as herring, mackerel, and to a lesser amount, sprat, are found in the waters around the Draft Order Limits.

20.8.91 Given the pelagic nature of these species (they occupy the middle of the water column as opposed to being on/close to the seabed), they are unlikely to be subjected to any EMF emissions from a cable, nor have these emissions act as a barrier to movement. Further, pelagic fishes tend to swim continually and over large distances, which again reduces the likelihood of these species being close to areas of increased EMF strengths. Snyder *et al.* (Ref 84) imply pelagic species (particularly clupeids or scombrids) are unaffected by EMFs, and as such, have a low sensitivity to its effects.

20.8.92 The magnitude of the impact of EMF changes and barriers to movement has been assessed as negligible, as the EMFs emitted from the bundled cables dissipate to background levels within 10m. Combined with a low sensitivity of the receptors, EMF changes and barrier to movement from the proposed cables have been assessed to have a **Negligible** and **Not Significant** effect on pelagic fish.

Demersal species

20.8.93 Several demersal teleost fish species (i.e. excluding elasmobranchs), including European seabass, cod, horse mackerel, whiting, plaice, turbot, and sandeel, are recorded as abundant along the cable route (**Table 20.12**).

20.8.94 Whilst demersal fish spend the majority of their time on or above the seabed, which could make them one of the more susceptible marine receptors to the effects of EMF changes and barriers to movement, the maximum EMF estimated

to be generated by the cables (51.9µT) is not thought to be high enough to elicit any physiological or behavioural responses of these fishes. When flounder (which could be considered a suitable proxy for turbot, owing to its morphology) was exposed to 3,700µT, no adverse effects were noticed (Ref 88). Flatfishes like plaice can use magnetic fields as navigational cues (Ref 88) 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 (Ref 81).

20.8.95 The magnitude of the impact of EMF changes and barriers to movement is considered to be negligible, as the EMFs emitted from the bundled cables dissipate to background levels within 10m. Combined with a low to medium sensitivity of the receptors, EMF changes and barrier to movement from the proposed cables have been assessed to have a **Negligible** and **Not Significant** effect on pelagic fish.

Elasmobranchs

20.8.96 The cable route passes through areas of suitable habitat for a range of elasmobranchs including blonde ray, spotted ray, thornback ray, and to a lesser amount, spurdog. 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 (Ref 86)

20.8.97 Regarding thornback ray specifically, laboratory experiments which replicated a functioning cable carrying 600 to 1,000V and from 25 to 730A (Ref 86) found no significant difference in their distribution between the active and inactive periods of cable operation, although dogfish were repelled by EMFs representing an operational cable. When exposed to EMFs generated by cables, little skate (*Leucoraja erinacea*), an American ray which may act as a suitable proxy for small specimens of the aforementioned 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 (Ref 85), and rather, the species was intrigued by the introduced EMFs. Since, studies have observed similar responses, with little skates traveling longer distances at slower speeds when exposed to EMF levels of 65.3µT. This suggests increased exploratory or area-restricted foraging behaviour (Ref 86).

20.8.98 Both lesser spotted dogfish and thornback ray have sometimes exhibited increased searching effort to find prey around operational subsea cables (Ref 89), though this behaviour did not always occur, and subsequently, the Scottish Government 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 (Ref 85) found that the species could potentially

confuse EMF emissions from subsea cables with those naturally produced from their prey.

Avoidance and/or repulsion to/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 10μV/cm (Ref 88), though it is acknowledged that 10μV/cm is higher than typical offshore cable levels. Spurdog were, however, noted to be attracted to DC emissions at emission levels like their prey (~0.1 to 10μV/cm, or 1-5μV/cm for passive, buried prey; Ref 89).

20.8.99 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 (0-20Hz), 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 (Ref 90). As bamboo shark share the same family as dogfish (Scyliorhidae), it is plausible that behaviour may be similar.

20.8.100 The magnitude of the impact of EMF changes and barriers to movement has been assessed as low for elasmobranchs, as the EMFs emitted from the bundles cables dissipate to below background levels within 10m. Due to the above discussion, the sensitivity of elasmobranchs to EMF changes has been assessed as medium. The significance of the effect on these receptors is assessed to be **Minor** and **Not Significant** during operations and maintenance.

Spawning, eggs, larvae, and juvenile fish

20.8.101 The Draft Order Limits passes through known spawning and nursery grounds of a number of species including, cod, and whiting (low intensity spawning grounds exist offshore for both species; (Ref 27), sandeel (low intensity spawning grounds exist throughout the North Sea; (Ref 27), and herring (spawning grounds exist in a small area of coastal waters off the Norfolk/Suffolk coast, and high intensity nursery grounds exist around the Suffolk coast, with low intensity grounds being apparent throughout the North Sea; (Ref 27). Any EMF changes/barrier to movement from the cable has the potential to disrupt fish behaviour such as spawning and could have a direct impact on the eggs, larvae and juveniles of these species.

20.8.102 The magnitude of the impact of EMF changes and barriers to movement has been assessed as low for spawning, eggs, larvae, and juvenile fish, as the EMFs emitted from the bundled cables dissipate to below background levels within 10m. Combined with a low to medium sensitivity, EMF changes and barrier to movement from the proposed cables have been assessed to have a **Minor** and **Not Significant** effect on these receptors.

Shellfish

20.8.103 Important commercial shellfish species are found within the study area, including European lobster, edible crab, and whelks.

20.8.104 Research on edible crab and lobster responses to EMFs have found effects only at strengths well beyond those modelled for the Proposed Offshore Scheme (99.3µT at the seabed); at 250µT, edible crab were found to have a behavioural response, and at 2,800µT, 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 (Ref 89).

20.8.105 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 60µT) compared to an experimental environment (500µT) (Ref 75).

20.8.106 **Appendix 2.3 Electromagnetic Field Assessment** of this PEIR models the EMF strength for the Proposed Offshore Scheme (99.3µT at the seabed) as not high enough to adversely affect crustaceans and gastropods (Ref 84). The sensitivity of crab, lobster, and whelk is therefore predicted to be negligible.

20.8.107 The magnitude of the impact of EMF changes and barriers to movement has been assessed as low for shellfish, as EMFs emitted from the bundled cables dissipate to below background levels within 10m. Combined with a low sensitivity, EMF changes and barrier to movement from the proposed cables have been assessed to have a **Negligible** and **Not Significant** effect on these receptors.

Temperature increase due to the presence of operational cables

20.8.108 During the operation of a proposed Offshore submarine HVDC cable, electrical resistance within the conductor generates heat, causing surface temperatures of the cables to reach up to 70°C (Ref 91). This heat loss can lead to localised warming of the surrounding environment. For buried cables, this affects the sediment and whilst no specific regulatory limits exist for temperature changes in the seabed, Germany uses a guideline of a 2°C increase between the seabed surface and a depth of 0.2m. In contrast, the MarESA sensitivity benchmark considers a temperature rise of 5°C for one month or 2°C for one year as a significant threshold. To inform a robust assessment, the most conservative benchmark has been used to ensure a worst-case assessment scenario.

20.8.109 The heat loss from the cable is related to the physical and thermal properties of the cables. To inform the assessment, a desk-top literature review was conducted to evaluate the thermal performance of submarine cables of analogous projects, including recorded temperature changes surrounding the cables at differing depths (**Appendix 2.4 Offshore Thermal Emissions Technical Note** of this PEIR). The technical note concludes that for cables

operating at full power, the temperature is raised in the immediate vicinity of the cable but reduces with distance.

20.8.110 In 2024, the average ambient temperature 0.5m below seabed in the North Sea was 15°C. Assuming a maximum cable burial depth of 1.8m below the seabed, modelling from analogous projects outlined in **Appendix 2.4 Offshore Thermal Emissions Technical Note** of this PEIR demonstrated seabed temperatures are estimated to be between 13 - 15°C at this depth, with the cables operating at maximum operating temperatures. To reach these temperatures the system would have to operate at full load continuously for an extended period of time. In reality, the system will not be at full load for this long and therefore the temperature will fluctuate and be unlikely to reach these maximums for extended periods. Although thermal effects would be long-term and occurring continuously for the operational lifetime of the Proposed Offshore Scheme, the temperature increase is low level and likely to be only 1 – 2°C higher than ambient at the shallow sediment depths (<0.2m) at which infaunal species are typically found. 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.

20.8.111 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 (Ref 60). These burrow systems typically extend to a depth of approximately 20cm. However bottom temperatures within their inhabited distribution ranges from 7 – 15°C, although the maximum and minimum temperatures limiting Nephrops are not known (Ref 90).

20.8.112 Literature on the effect of thermal emissions on whelk appear scarce, though it has been documented that whilst whelk grow faster in warmer waters during their infancy than in cooler waters, a cold-water environment does allow whelk to reach a larger size after maturity (Ref 93). Further, whelk are documented to survive in waters up to 22°C (Ref 93) and it is likely that even if growth rate is hindered, whelk are still able to reach maturity and reproduce below this temperature.

20.8.113 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 (Ref 66).

20.8.114 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.

20.8.115 For all demersal and burrowing fish and shellfish species, the significance of the effect of increased thermal emissions has been assessed to be **Minor** and **Not Significant**.

Decommissioning

20.8.116 The Proposed Scheme is expected to have a life span of 40 years. If decommissioning requires cessation of operation and removal of visible infrastructure at this point, then activities and effects associated with the decommissioning phase are expected to be no worse than during construction; and with the removal of visible infrastructure, effects would reduce over the course of that period. The Proposed Scheme could also remain operational for a period after the 40 years or be taken out of service and left within the Draft Order Limits after 40 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 project has concluded that impacts from decommissioning would be no greater than those during the construction phase. The following conclusions reached for construction are therefore applicable:

a. Temporary habitat loss/seabed disturbance:
   i. Shellfish and marine species with demersal life stages – **Minor** and **Not Significant**; and
   ii. Marine species with a fully pelagic lifecycle – **Negligible** and **Not Significant**.
b. Permanent habitat loss:
   i. Shellfish and marine species with demersal life stages – **Minor** and **Not Significant**; and
   ii. Marine species with a fully pelagic lifecycle – **Negligible** and **Not Significant.**
c. Temporary increase and deposition of suspended sediments:
   i. Shellfish and marine species with demersal life stages – **Minor** and **Not Significant**;
   ii. Diadromous fish - **Negligible** and **Not Significant**; and
   iii. Other marine fish – **Negligible** and **Not Significant**.
d. Transboundary impacts - temporary increases and deposition of suspended sediments - **Negligible** and **Not Significant**.
e. Underwater noise
   i. Geophysical survey - **Minor** and **Not Significant;**
   ii. Vessels and equipment - **Minor** and **Not Significant**.
f. Transboundary impacts - Underwater noise – **Minor** and **Not Significant.**
g. Changes in distribution of species – **Negligible** and **Not Significant**.

20.9 Mitigation and monitoring

20.9.1 Mitigation measures are defined in **Chapter 5 EIA Approach and Methodology** of this PEIR, with embedded control measures for fish and shellfish being presented in **Section 20.8** of this chapter.

20.9.2 With respect to UXO clearance, a separate Marine Licence would be applied for once locations and details of confirmed UXO are known. The Marine Licence application would be accompanied by specific environmental assessments. Mitigation in line with the 2025 UK Guidance "*Supporting minimising environmental impacts from unexploded ordnance clearance"* would be agreed with the relevant SNCB and the MMO prior to application submission.

20.9.3 The preliminary environmental assessment has concluded that the Proposed Offshore Scheme alone will not have any significant adverse effects on fish and shellfish during construction, operations and maintenance, or decommissioning that require additional mitigation or monitoring over and above that outlined in **Section 20.8** of this chapter.

20.10 Summary of residual effects

20.10.1 The preliminary assessment has concluded that no significant effects on fish and shellfish are expected from the Proposed Offshore Scheme alone during construction, operations and maintenance, and decommissioning, provided design and control measures are implemented. No additional mitigation has been proposed at this stage.

Topic Glossary and Abbreviations

Term	Definition
A	Amps
Anadromous	Fish which migrate up rivers from the sea to spawn
Catadromous	Fish which live in freshwater for most of their lives, but migrate to the sea to spawn
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
Cephalopod	A marine mollusc which includes octopuses, squids, cuttlefish, and nautiluses
DCO	Development Consent Order
Diadromous	Fish which migrate between freshwater and seawater for various stages of their life cycles
dML	Deemed Marine License
DOL	Draft Order Limits
DP	Dynamic Positioning
EEZ	Exclusive Economic Zones
EIA	Environmental Impact Assessment
EIFCA	Eastern Inshore Fisheries and Conservation Authority
Elasmobranch	Fish which possess cartilage, rather than bones, which include sharks, rays, and skates.
EMF	Electromagnetic field
ES	Environmental Statement
EU	European Union
Finfish	Bony fish which possess fins
GBP	Great Britain Pound
HDD	Horizontal Directional Drilling
HPMA	Highly Protected Marine Areas
HRA	Habitat Regulations Assessment
HVDC	High Voltage Direct Current
Hz	Hertz
IBTS	International Bottom Trawl Survey
ICES	International Council for the Exploration of the Sea
IFCA	Inshore Fisheries and Conservation Authority
IHLS	International Herring Larvae Surveys

Term	Definition
km	Kilometres
KW	Kilowatt
M	Metre
MBES	Multibeam Echosounder
MCAA	Marine and Coastal Access Act
MCA	Maritime and Coastguard Agency
MCZ	Marine Conservation Zone
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
Mg/l	Milligrams per Litre
MMO	Marine Management Organisation
MSY	Maximum Sustainable Yield
NM	Nautical Mile
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Projects
Nursery	An area where juvenile fish grow and develop
OSPAR	Oslo and Paris Convention for the Protection of the Marine Environment of the North-East Atlantic
OWF	Offshore Windfarm
µPa	Micropascal
PEIR	Preliminary Environmental Information Report
PLGR	Pre Lay Grapnel Run
PSD	Particle Size Distribution
SAC	Special Area of Conservation
SBP	Sub bottom Profiler
Shellfish	An aquatic animal with a shell or exoskeleton
SOCI	Species of conservation importance
Spawning	The process of fish reproduction
SSC	Suspended Sediment Concentration
SSS	Sidescan Sonar
SSSI	Site of Special Scientific Interest
TTS	Temporary Threshold Shift
µT	Microtesla
UK	United Kingdom
USBL	Ultra-short baseline

Term	Definition
UXO	Unexploded Ordnance
V	Voltage
VMS	Vessel Monitoring System

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