MachairWind Offshore Windfarm

Chapter 9 Fish (including Basking Shark) and Shellfish

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TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

GLOSSARY OF ACRONYMS

Term	Definition
AC	Alternating Current
ASA	Acoustical Society of America
AUV	Autonomous Underwater Vehicle
BGS	British Geological Survey
BWM	International Convention for the Control and Management of Ships' Ballast Water and Sediments
CBRA	Cable Burial Risk Assessment
CEA	Cumulative Effects Assessment
DAS	Digital Arial Surveys
DC	Direct Current
DDV	Drop-Down Video
DEP	Dudgeon Offshore Windfarm Extension
ECC	Export Cable Corridor
eDNA	Environmental DNA
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Electromagnetic Field
EMP	Environmental Management Plan
EPS	European Protected Species
ETG	Expert Topic Group
EU	European Union
EUNIS	European Nature Information System
FEPA	Food and Environmental Protection Act
FLO	Fisheries Liaison Officer
FMMCP	Fisheries Mitigation, Monitoring and Communication Plan
FMS	Fisheries Management Scotland
GBS	Gravity Based Structures
HRA	Habitats Regulations Appraisal
HWDT	Hebridean Whale and Dolphin Trust
IAC	Inter-Array Cable
ICES	The International Council for the Exploration of the Seas

Term	Definition
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
INNSMP	Invasive Non-Native Species Mitigation Plan
INTOG	Innovation and Targeted Oil and Gas
IPR	Iterative Plan Review
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
LSE	Likely Significant Effects
MarLIN	Marine Information Network
MARPOL	International Convention for the Prevention of Pollution from Ships
MD-LOT	Marine Directorate Licensing and Operations Team
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
NBN	National Biodiversity Network
NCMPA	Nature Conservation Marine Protected Area
NMP	National Marine Plan
O&M	Operation and Maintenance
OAA	Option Agreement Area
OnTDA	Onshore Transmission Development Area
OSP	Offshore Substation Platform
PAM	Passive Acoustic Monitoring
PDE	Project Design Envelope
PMF	Priority Marine Features
PSA	Particle Sediment Analysis
RBD	River Basin District
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SEP	Sheringham Shoal Offshore Windfarm Extension
SFF	Scottish Fishermen's Federation
SMP	Sectoral Marine Plan
SSC	Suspended Sediment Concentration
TTS	Temporary Threshold shift

Term	Definition
UK	United Kingdom
USV	Uncrewed Surface Vehicle
UWN	Underwater Noise
UXO	Unexploded Ordnance
WDA	Windfarm Development Area
ZoI	Zone of Influence

GLOSSARY OF TERMS

Term	Definition
Bedload	Sediment particles that travel near or on the seabed.
Cable protection	Protective measure to minimise the effects of scour and hazards along the offshore cables (e.g. to prevent cable exposure or snagging of vessel anchors or fishing gear), as well as for protecting these cables at infrastructure crossing points.
Collision	The act or process of two moving objects colliding.
Combined Assessment	A whole-Project assessment considering interactions between the Windfarm Development Area, Offshore Export Cable Corridor and Onshore Transmission Development Area (i.e. considering impact interactions and additive effects to determine if any effects would be materially elevated from those assessed for the Windfarm Development Area-alone assessment). Due to long delays in securing confirmation of the Project's grid connection location, the level of detail available for the Offshore Export Cable Corridor and Onshore Transmission Development Area is limited and therefore the assessment is commensurate with the level of detail available at the time of carrying out the assessment. Within the upcoming Offshore Export Cable Corridor and Onshore Transmission Development Area consent applications, their respective scoping and Environmental Impact Assessment Report / Environmental Report will take account of all likely effects predicted within the WDA EIA and present updated combined assessments using the latest available information covering all aspects of the Project.
Creel	Creel is a Scottish term for a pot or trap typically deployed by an inshore vessel. These are generally rigid structures which fish or shellfish are guided or enticed into through funnels that make entry easy but escape difficult. There are many designs which are created to suit the behaviour of its target species.
Cumulative Effects Assessment	Assessment of likely significant effects resulting from the incremental change caused by other past, present and reasonably foreseeable projects / activities together with the Project. This is separate to combined effects arising between the Project's separate Development Areas.
Demersal	Living on or near the seabed.
Development Area	Application boundary for consenting purposes which, for the Project, consists of a Windfarm Development Area, Offshore Export Cable Corridor, and Onshore Transmission Development Area. Separate consent and marine licence applications will be submitted for each Development Area where applicable.
EIA Scoping Windfarm Development Area (WDA) Boundary	The 510 km² WDA boundary presented at the Project's EIA Scoping Stage.
Embedded mitigation measure	Mitigation measures, including industry good practice measures, that are directly incorporated into the design for the MachairWind Windfarm Development Area to avoid or reduce environmental effects.
Environmental DNA (eDNA)	Environmental DNA that is collected from the environment, such as in seawater, rather than directly from an individual organism.
Environmental Impact Assessment (EIA)	The process of evaluating the likely significant environmental effects of a proposed development over and above the existing circumstances (or 'baseline').
Environmental Impact Assessment (EIA) Regulations	A collective term referring to The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 and The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

Term	Definition
European site	Sites designated for nature conservation under the Habitats Directive and Birds Directive as transposed by the Habitats Regulations and comprise Special Areas of Conservation and Special Protection Areas. In accordance with Scottish Government and UK Government policy, candidate SACs, potential SPAs and Ramsar sites are also afforded equivalent protection for assessment purposes, despite not being formally designated European sites.
Fish Stock	Any natural population of fish made up of an isolated and self-perpetuating group of the same species.
Fishing ground	An area of water or seabed targeted by fishing activity.
Fleet	A physical group of vessels sharing similar characteristics (e.g., nationality).
Greenhouse gas	A gas in the Earth's atmosphere that traps heat by absorbing and emitting infrared radiation, a process known as the greenhouse effect. Also known by the collective shorthand "carbon".
Habitats Regulations	A collective term used to describe the Conservation of Habitats and Species Regulations 2017 and The Conservation (Natural Habitats, &c.) Regulations 1994.
Inter-array cables (IACs)	Armoured cable containing electrical and fibre optic cores which link the wind turbine generators to each other and to the offshore substation platform(s).
International Council for the Exploration of the Seas (ICES) statistical rectangles	The International Council for the Exploration of the Seas (ICES) standardise the division of sea areas to enable statistical analysis of data. Each ICES statistical rectangle is 30 min latitude by 1 degree longitude in size (approximately 30 x 30 nautical miles). A number of rectangles are amalgamated to create ICES statistical areas.
Landfall	The area from Mean Low Water Springs to a transition bay(s), where the offshore export cable(s) come ashore.
Landings	Quantitative description of the amount of fish returned to port for sale, in terms of value or weight.
MachairWind Offshore Windfarm	An offshore windfarm capable of exporting around 2 GW of renewable energy to the National Electricity Transmission System. MachairWind Offshore Windfarm comprises three Development Areas: • The WDA – located on the west coast of Scotland to the northwest of Islay and west of Colonsay; • The Offshore Export Cable Corridor – a preliminary boundary extending from the WDA to mean high water springs at a landfall location near Girvan, South Ayrshire; and • The Onshore Transmission Development Area – a preliminary boundary which extends landward from mean low water springs and includes the land required for the landfall of the offshore export cable(s) and their route up to but not including the proposed high voltage direct current (DC) switching station which will be developed and constructed by Transmission Owner, ScottishPower Transmission. Separate consent and licence applications will be submitted for each Development Area.
Offshore cables	The collective term for all offshore cables i.e. IACs, offshore substation platform link cables, offshore export cables and associated fibre optic cables.
Offshore export cable	Armoured cable containing electrical cores between the offshore substation platform(s) and landfall. Offshore export cables will include bundled fibre optic cables. The offshore export cables are subject to Marine Licence applications under the Marine (Scotland) Act 2010. The portion of the offshore export cable(s) located within the WDA is assessed as part of this MachairWind WDA EIA and a marine licence application to construct, alter or improve this portion has been submitted alongside the WDA application. A separate marine licence application will be submitted for the portion of the offshore export cable(s) from the WDA boundary to mean high water Mean High Water Springs.

Term	Definition
Offshore Export Cable Corridor (ECC)	The preliminary boundary extending from the WDA to mean high water springs near Girvan, South Ayrshire and within which the offshore export cable(s) will be located. A separate marine licence application will be submitted for the offshore export cable(s) located within the Offshore ECC.
Offshore Export Cable Corridor (ECC)	The preliminary boundary extending from the WDA to mean high water springs near Girvan, South Ayrshire and within which the offshore export cable(s) will be located. A separate marine licence application will be submitted for the offshore export cable(s) located within the Offshore ECC.
Offshore Substation Platform (OSP)	An offshore platform with a fixed foundation located within the WDA which houses electrical equipment such as transformers, switchgear, protection and control systems, and enables the windfarm's renewable electricity to be collected via inter-array cables and exported to the National Electricity Transmission System via offshore export cables.
Offshore Substation Platform (OSP) link cables	Electrical cables which link OSPs (if more than one OSP is required). These cables will include fibre optic cores or bundled fibre optic cables. OSP link cables will be wholly located within the WDA.
Onshore Transmission Development Area (OnTDA)	The preliminary boundary which extends landward from mean low water springs and includes the land required for the landfall of the offshore export cables and their route up to but not including the proposed high voltage DC switching station which will be developed and constructed by Transmission Owner, ScottishPower Transmission. This Transmission Owner is responsible for consenting the high voltage DC switching station. Onward connections to the National Electricity Transmission System will be consented by National Grid Electricity Transmission and ScottishPower Transmission. Where relevant, these are considered as part of cumulative effects assessment in the EIA.
OnTDA infrastructure	The onshore transmission infrastructure, for which the Applicant is responsible, that is located primarily within the OnTDA, up to mean low water springs, and includes but is not limited to: landfall(s), onshore export cables, transition joint bays, telecom/SCADA infrastructure including vehicular access, joint bays, link boxes and temporary construction compounds. The OnTDA infrastructure will be subject to a planning application under the Town and Country Planning (Scotland) Act 1997.
Operational life	The operational life is the expected length of time from final commissioning of the WDA until the cessation of commercial operations. This is anticipated to be 35 years.
Option Agreement Area (OAA)	The seabed area awarded to ScottishPower Renewables in January 2022 through the Scotwind leasing round.
OSPAR	OSPAR started in 1972 with the Oslo Convention against dumping and was broadened to cover land-based sources of marine pollution and the offshore industry by the Paris Convention of 1974. These two conventions were unified, updated and extended by the 1992 OSPAR Convention. OSPAR is so named because of the original Oslo and Paris Conventions ("OS" for Oslo and "PAR" for Paris).
Pelagic	Of or relating to the open sea.
Plan Option	A spatial plan area proposed through the Sectoral Marine Plan for offshore wind energy (as adopted in 2020). As part of the ScotWind leasing round, offshore wind developers submitted bids for Plan Options which, following a successful bid, become OAAs.
Safety zones	An area of water around or adjacent to a wind turbine generator or Offshore Substation Platform and associated substructure which is to be constructed, extended, operated or decommissioned, from which certain or all classes of vessels are excluded and within which activities can be regulated for the purpose of securing safety of the wind turbine generator, substructure or vessels in that vicinity, and individuals on both the wind turbine generator, substructure or vessel, in line with Section 95 of the Energy Act 2004.

Term	Definition
Scottish Marine Area	The area of Scotland's territorial sea limit (up to 12 nautical miles from baseline) as defined in the Marine (Scotland) Act 2010.
ScotWind	A Crown Estate Scotland seabed leasing round which enabled developers propose for offshore wind projects and apply for seabed rights to plan and build windfarms in Scottish waters.
Scour protection	Protective measures to avoid sediment being eroded away from the base of the wind turbine generator foundations as a result of the flow of water.
The Applicant	The legal entity submitting consent applications for the MachairWind Offshore Windfarm, namely Machairwind Limited.
The Lighthouse	The Dubh Artach lighthouse.
The Project	MachairWind Offshore Windfarm including all its Development Areas and associated infrastructure.
WDA infrastructure	The offshore generation and transmission infrastructure located within the WDA including but not limited to: WTGs, WTG fixed foundations (and associated scour protection), OSP(s), OSP fixed foundations (and associated scour protection), IACs, OSP link and offshore export cable(s) and their associated external cable protection (insofar as these are located within the WDA) and fibre optic cables.
Wind Turbine Generator (WTG)	A wind turbine generator which converts wind energy into electrical energy. Each wind turbine generator is a complex system composed of a high number of components. Typically, the main components include the rotor assembly (composed of three blades and a hub); the nacelle (containing a generator, shaft and gearbox, power electronic converter and transformer); and the tower (containing lifting equipment and the switchgear).
Windfarm Development Area (WDA)	The application boundary within the OAA where consent will be sought for the proposed WDA infrastructure. The WDA infrastructure is subject to Section 36 consent and marine licence applications (generation and transmission) which are being applied for separately from the Offshore ECC infrastructure and OnTDA infrastructure.

9 FISH (INCLUDING BASKING SHARK) AND SHELLFISH

9.1 INTRODUCTION

1. This chapter presents an assessment of potential impacts and likely significant effects (LSE) on fish and shellfish ecology that may arise from the construction, operation and maintenance (O&M), and decommissioning of the MachairWind Windfarm Development Area (WDA) infrastructure.

2. Due to the delay in the confirmation of the Project's grid connection location (see **Chapter 1 Introduction** for further information), this topic chapter considers the WDA Study Area and existing environment only. A combined assessment of the construction, O&M and decommissioning of the WDA activities, Offshore Export Cable Corridor (ECC) and Onshore Transmission Development Area (OnTDA) activities (commensurate with the level of detail that is available at the time of carrying out that appraisal) is also provided. This approach will ensure a holistic view is undertaken of the entire Project. As noted in **Chapter 1 Introduction**, the assessment of potential effects on all receptors associated with the Offshore ECC and OnTDA will be presented in individual Environmental Impact Assessment (EIA) Reports (EIARs) / Environmental Reports, which will be submitted separately in accordance with the relevant EIA) Regulations.

3. This chapter considers the following WDA infrastructure: wind turbine generators (WTGs), Offshore Substation Platforms (OSP) and associated fixed foundations and scour protection, inter-array cables (IACs), OSP link cables, the portion of the offshore export cable located within the WDA and associated cable protection.

4. This chapter has been prepared to provide the Marine Directorate Licensing and Operations Team (MD-LOT) (administering on behalf of the Scottish Ministers) and stakeholders with sufficient information to determine the likely significant effect(s) of the Project on the receiving environment.

5. This chapter should be read in conjunction with the following related EIAR chapters:

- **Chapter 7 Marine Physical Environment** – describes aspects of the abiotic environment that can influence the nature of the fish and shellfish ecology environment;
- **Chapter 8 Benthic Ecology** – provides a detailed account of benthic habitats which can influence the fish and shellfish habitat described in this chapter;
- **Chapter 10 Marine Mammals and Leatherback Turtle –** describes marine mammal species which prey on fish and shellfish species;
- **Chapter 11 Offshore Ornithology –** describes offshore ornithology species which prey on fish and shellfish species; and
- **Chapter 12 Commercial Fisheries** – describes potential impacts on commercial fisheries which can be influenced by potential ecological impacts on those fish and shellfish populations which are commercially exploited.

6. Key inter-relationships between this chapter and those listed above will be considered where relevant and presented in this chapter.

7. Additional information to support the fish (including basking shark) and shellfish assessment includes:

- **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report** - provides a detailed baseline characterisation of the fish and shellfish ecology (e.g. species, communities and habitats) of the WDA.

8. This chapter was prepared by Haskoning.

9.2 LEGISLATION, POLICY AND GUIDANCE

9. The overarching policy and legislation relevant to the EIA is described in **Chapter 2 Policy and Legislative Context**. **Table 9.1** sets out the relevant legislation, policy and guidance that informs the assessment for fish and shellfish.

Table 9.1 Summary of relevant legislation, policy and guidance for fish and shellfish

Relevant Policy or Guidance	Relevance to the Assessment
Legislation	
Marine (Scotland) Act 2010	Applies to Marine Licence applications within the Scottish marine area (0-12 nautical miles (nm)). The Act provides a framework to help balance competing demands on Scotland's seas. It introduces a duty to protect and enhance the marine environment and includes measures to help boost economic investment and growth in areas such as marine renewables.
The Wildlife and Countryside Act 1981	Provides a list of threatened species for which killing, injuring, or taking by any method is prohibited. Basking sharks (*Cetorhinus maximus*) are protected from intentional or reckless disturbance or harassment. If a risk of disturbance or harassment that cannot be removed or sufficiently reduced by using alternatives or mitigation measures, then the activity may still go ahead under licence (Basking Shark Licence). The Nature Conservation (Scotland) Act 2004, Part 3 and Schedule 6 makes amendments to the Wildlife and Countryside Act 1981, strengthening the legal protection for threatened species to include 'reckless' acts.
The Conservation of Natural Habitats and Species Regulations 2017 and The Conservation (Natural Habitats, &c.) Regulations 1994 (Habitats Regulations)	Applies to Marine Licences and Section 36 applications within the Scottish inshore region. It applies European Protected Species (EPS) protections in waters within 12 nm from shore.
Eel European Union (EU) Regulation (EU 1100/2007)	EC Regulation 1100/2007 requires EU Member States to put in place Eel Management Plans. Scotland developed its own Eel Management Plan in 2010 under this Regulation for the Scotland river basin district (RBD) area; and shares responsibility for the Solway-Tweed RBD area with England.
Policy	
Argyll and Bute Local Development Plan 2 (2024)	The Argyll and Bute Local Development Plan 2 sets the planning framework for how development should be managed across the region, including along the coast and in marine areas. It aims to support sustainable growth while ensuring that sensitive habitats, species, and designated sites are safeguarded. Its policies require marine and coastal developments to avoid significant adverse effects on protected sites, PMFs, and key species, and to comply with national legislation and conservation objectives. This means any proposed development must demonstrate strong environmental protection measures and may require additional assessment where international designations could be affected. **The relevant policies are:** **Policy 28: Supporting Sustainable Aquatic and Coastal Development** – *"Proposals for marine and freshwater aquaculture,*

Relevant Policy or Guidance	Relevance to the Assessment
	marine and coastal developments will be supported where it can be demonstrated that there will be no significant adverse effects, directly, indirectly or cumulatively on: Designated sites, habitats and species for nature conservation, (including Priority Marine Features, wild migratory salmonids, and European Protected Species).” **Policy 73: Development Impact on Habitats, Species and Biodiversity** – *“When considering development proposals Argyll and Bute Council will give full consideration to the legislation, policies and conservation objectives, contained within the following: i) Wildlife and Countryside Act 1981; (and as amended by the Nature Conservation (Scotland) Act 2004)”.* **Policy 74: Development Impact on Sites of International Importance** – *“Unless development is directly connected with or necessary to their conservation, proposals likely to have a significantly adverse effect, including cumulative, upon an existing or proposed Special Protection Area, existing or candidate Special Area of Conservation, or Ramsar Site (i.e. European Sites), including development out with the site, shall require appropriate assessment”.*
Scottish Biodiversity Strategy to 2045 (Scottish Government, 2024)	The Scottish Biodiversity Strategy to 2045 sets out Scotland’s vision to be Nature Positive by 2030 and to deliver restored and regenerated biodiversity by 2045 across land, freshwater, and marine environments. The Strategy includes commitments to protect and effectively manage at least 30% of Scotland’s seas, enhance ecological connectivity, reduce pressures on marine ecosystems, and integrate nature restoration across all sectors. It emphasises the need for transformative, cross-government action, long-term monitoring, and strengthened statutory biodiversity targets. For assessments, the Strategy provides high-level direction requiring developments to consider biodiversity enhancement, ecosystem resilience, nature networks, and alignment with restoration and climate-adaptation goals.
National Planning Framework 4 (Scottish Government, 2023a)	The National Planning Framework 4 (NPF4) sets out Scotland’s spatial principles, regional priorities, national developments and national planning policy. NPF4 presents Sustainable Places, Liveable Places and Productive Places to achieve national outcomes including benefits to the environment, communities, and health. NPF4 contains a notable focus on tackling both the climate and nature crises. **The key reference is:** **Policy 3: Biodiversity:** *“Development proposals will contribute to the enhancement of biodiversity, including where relevant, restoring degraded habitats and building and strengthening nature networks and the connections between them…”*
Scottish Wild Salmon Strategy and Implementation Plan (Scottish Government, 2022a; 2023b)	The Scottish Wild Salmon Strategy sets out the vision, objectives and priority themes to ensure the protection and recovery of Scottish Atlantic wild salmon (*Salmo* salar) populations. The Implementation Plan is a companion piece to the Strategy and should be read in conjunction with it. It sets out a suite of actions and initiatives that will be the focus of collective efforts across a range of government and non-government stakeholders over a five-year period to 2028.
Sectoral Marine Plan (SMP) for Offshore Wind Energy (Scottish Government, 2020); and Scottish Government (2025) Draft	The SMP for Offshore Wind Energy identifies sustainable areas for the future development of commercial scale offshore wind energy in

Relevant Policy or Guidance	Relevance to the Assessment
updated Sectoral Marine Plan for Offshore Wind Energy, Option Area W1 – May 2025	Scotland, including a spatial strategy to inform the seabed leasing process for the purposes of offshore wind energy. The WDA is located in Plan Option W1, as identified in the SMP for Offshore Wind. Plan Options including W1 were subject to testing, refinement and area reduction through Strategic Environmental Assessment (SEA), Habitats Regulations Appraisal (HRA) and plan development processes. The SEA identified relevant characteristics of Plan Option W1 and identified key risks to be addressed in consenting applications. A key risk factor identified for the W1 area is potential impacts on migratory fish species. The SMP is undergoing an Iterative Plan Review (IPR) to reflect the outcomes of the ScotWind and Innovation and Targeted Oil and Gas (INTOG) leasing rounds and Test and Demonstration (T&D) projects. A draft updated SMP, published for consultation in May 2025, builds on this framework by incorporating new spatial data, environmental evidence, and planning considerations for future leasing rounds, including ScotWind and INTOG. It proposes refined mitigation strategies and updated policy direction to address emerging pressures and opportunities. This assessment aligns with both the adopted 2020 SMP and the emerging direction of the 2025 draft update to ensure compliance with relevant national and sectoral planning frameworks, and to support best practices in marine environmental protection and sustainable development.
Priority Marine Features (PMF) in Scotland's Seas (NatureScot, 2020)	PMFs in Scotland's Seas sets out a list of 81 marine habitats and species identified as conservation priorities in Scottish waters. They guide decision-making by focusing attention on features considered under threat, declining, or of major functional importance in Scotland's seas. PMFs help inform marine planning, licence applications, and development management by ensuring that proposed activities do not significantly impact habitats or species of recognised importance. PMFs are embedded in the National Marine Plan (NMP) (GEN 9) and must be considered when assessing potential effects on marine biodiversity, including diadromous fish and sensitive benthic habitats
The Scottish Government NMP (Scottish Government, 2015a)	Scotland's NMP sets out strategic policies for the sustainable development of Scotland's marine resources out to 200 nautical miles (nm), whilst highlighting salmon and many other key species of diadromous fish have been identified as PMF and UKBAP Priority Species. **The key references are:** **GEN 9: Natural heritage:** "*Development and use of the marine environment must: a) Comply with legal requirements for protected areas and protected species. b) Not result in significant impact on the national status of Priority Marine Features. c) Protect and, where appropriate, enhance the health of the marine area.*" **GEN 13: Noise**: "*Development and use in the marine environment should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects.*" **WILD FISH 1:** *"The impact of development and use of the marine environment on diadromous fish species should be considered in marine planning and decision-making processes."*.

Relevant Policy or Guidance	Relevance to the Assessment
	It is however acknowledged that *"there is uncertainty around the likelihood and severity"* of wind energy impacts and *"continued efforts to better understand potential impacts should be encouraged*".
UK Marine Policy Statement (UK Government, 2011)	The UK Marine Policy Statement provides the overarching policy framework for marine planning across the UK, guiding sustainable use of marine resources while protecting the marine environment. It sets out the principles and considerations that marine authorities must apply when assessing development proposals, including those for offshore renewable energy. It identifies potential environmental impacts from marine developments, particularly noting that renewable energy projects may adversely affect marine fish and mammals through construction noise and other pressures. This means proposed activities must demonstrate that such impacts are understood, minimised, and appropriately mitigated to comply with national policy expectations. **The key reference is:** **3.3.24: Potential impacts:** *"Renewable energy developments can potentially have adverse impacts on marine fish and mammals, primarily through construction noise …"*
Eel Management plans for the United Kingdom (UK) Scotland RBD (2010)	The aim of this Eel Management Plan is to describe the nature of the European eel (*Anguilla Anguilla)* population and fishery in the RBDs; to assess whether the stock is meeting its 40% escapement target; and to present management actions that will ensure the long-term viability of the eel population.
Guidance	
Offshore Wind Marine Environmental Assessments: Best practice advice for evidence and data standards. Phase 1: (Parker et al., 2022)	Sets out Natural England's expectations for pre-application baseline data for designated nature conservation and landscape receptors to support offshore wind applications. Whilst led by Natural England, the findings remain relevant to the Project.
Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2022)	These Guidelines have been produced to promote good practice in Ecological Impact Assessment relating to terrestrial, freshwater, coastal and marine environments in the UK and Ireland.
Sound exposure guidelines for fishes and sea turtles: A technical Report (Popper et al., 2014)	Peer reviewed guidelines providing directions and recommendations for setting underwater noise (UWN) impact criteria (including injury and behavioural criteria) for fish, based on their anatomy and available information on hearing thresholds.
Strategic Review of Offshore Wind Farm Monitoring Data Associated with Food and Environmental Protection Act Licence Conditions: Fish (Report No. ME1117). Report by Cefas (Walker et al., 2009)	This report considers the Food and Environmental Protection Act (FEPA) licence conditions relating to fish for nine offshore windfarms for which fish surveys were undertaken under the FEPA licence. It draws conclusions as to which license conditions have been successfully applied, those that might no longer be necessary, and how data collection could be improved.
Guidance and publications from Scottish Natural Heritage (SNH) (now NatureScot) and Marine Scotland (now Marine Directorate) on PMFs and MPA search features (Tyler-Waters et al. 2016)	Provides guidance on the PMF and MPA features.

Relevant Policy or Guidance	Relevance to the Assessment
NatureScot guidance on marine invasive non-native species (INNS) (NatureScot, 2023)	Provides guidance on INNS known to threaten Scotland.
Guidance on Non-Native Species, approved by the Scottish Parliament (Scottish Government, 2012)	Provides information on the marine INNS that could be a threat to the natural ecology of Scottish waters.

9.3 CONSULTATION

10. This fish and shellfish ecology chapter has been informed by engagement with stakeholders, including those listed below:

- Argyll and Bute Council;
- Argyll District Salmon Fishery Board;
- Fisheries Management Scotland (FMS);
- MD-LOT;
- NatureScot; and
- Scottish Fishermen's Federation (SFF).

11. As part of the consultation process, the Applicant presented the approach to assessment to stakeholders to offer transparency around the scoping methodology and rationale, capture stakeholder advice and guidance, and incorporate stakeholder feedback, where appropriate. A summary of the approach to stakeholder communication and consultation is outlined in **Chapter 6 Consultation and Stakeholder Engagement**.

12. The consultation outcomes in relation to the fish and shellfish ecology are outlined in **Table 9.2,** which summarises stakeholder feedback, outlines how the Applicant has responded to the feedback received, and details how it has been considered within this chapter.

13. In addition to the engagement outlined in **Table 9.2**, the points of agreement between the Applicant and NatureScot are listed below:

- The proposed approach to Habitats Regulations Appraisal (HRA) Screening, i.e. the Special Areas of Conservation (SACs) for diadromous fish species should be considered through the EIA only and not through the HRA; and
- A qualitative approach to the consideration of seabed particle motion effects is appropriate.

14. The Applicant reached agreement with both NatureScot and Argyll and Bute Council in relation to:

- Defining the Local Study Area as the boundaries of the International Council for the Exploration of the Sea (ICES) statistical rectangles 41E3 and 40E3;
- The approach to characterising the baseline environment;
- The proposed outline approach to UWN modelling, including sandeel (*Ammodytes marinus*), spawning herring (*Clupea harengus*), and eggs being treated as stationary receptors;
- The impacts scoped in for basking shark being satisfactory; and
- Screening in UWN impacts on the basking shark feature of the Sea of the Hebrides Nature Conservation Marine Protected Area (NCMPA).

15. The Applicant reached agreement with NatureScot in relation to:

- The Local Study Area definition;

- The acknowledgement of permanent habitat loss as beginning during construction and continuing through decommissioning;
- The proposed UWN assessment approach using Popper et al., 2014 and with the classification of stationary and fleeing fish;
- The use of a 90 km buffer for the screening of other plans, projects and activities for the cumulative assessment; and
- The proposal to assess EMF impacts qualitatively.

Table 9.2 Summary of consultation relevant to fish and shellfish ecology

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
Pre-Scoping Opinion				
1.	FMS	08 February 2023: FMS-MachairWind Update Meeting	FMS explained that the ScotMER evidence mapping process identifies substantial evidence gaps in terms of potential impact pathways for diadromous fish.	ScotMER Diadromous Fish Evidence Map is included as an existing data source in **Table 9.3** and has informed the EIA.
2.	NatureScot	23 June 2023 and 28 August 2023: email correspondence	NatureScot confirmed that the Benthic Sampling Strategy document shared by the Applicant on 23 June 2023 was appropriate.	Noted.
3.	NatureScot	04 December 2023: Marine Mammals Expert Topic Group (ETG)	Speedie and Witt data sources should be included specifically for basking sharks.	Speedie and Witt data sources have been reviewed and referenced in **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report** where relevant.
4.	FMS	12 March 2024: FMS-MachairWind Update Meeting	FMS highlighted that Atlantic salmon (*Salmo salar*) are now considered near threatened by the International Union for Conservation of Nature (IUCN). FMS stated that all rivers entering the Clyde could be affected by the Project.	This EIAR considers the potential impacts from the construction of the WDA infrastructure on Atlantic salmon. A separate scoping report and EIAR will be provided for the Offshore Export Cable Corridor (ECC) once a route to the landfall location near Girvan, South Ayrshire has been more accurately defined (see **Chapter 1 Introduction**). However, as appropriate, potential impacts from construction of the Offshore ECC components on Atlantic salmon are considered within this EIAR (**Section 9.12**) (commensurate with the level of detail that is available at the time of carrying out that assessment). Within the Scoping Opinion, Argyll District Salmon Fishery Board noted that in the latest species reassessment by the IUCN Red List of Threatened Species, released in December 2023, Atlantic salmon have been reclassified from 'Least Concern' to 'Endangered' in Great Britain (as a result of a 30-50% decline in British populations since 2006 and 50-80% projected between 2010-2025), and from 'Least

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
				Concern' to 'Near Threatened' in terms of global populations (as a result of global population declines of 23% since 2006), This has been noted and has been considered to inform this EIA. **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report** provides detailed baseline analysis on river systems that have a recognised geographic or ecological connection to the WDA. The baseline identifies only those west-coast rivers, that drain into marine waters intersecting the defined Study Areas. Rivers entering the Clyde lie outside these areas and are not identified in the baseline as having any relationship with the WDA, either spatially or through known marine migration corridors.
5.	NatureScot and Argyll and Bute Council	01 May 2024: Fish and Shellfish Ecology Scoping Workshop (NatureScot) 13 May 2024: Fish and Shellfish Ecology Scoping Workshop - Written feedback (Argyll and Bute Council)	Potential impacts from INNS should be scoped in for further assessment.	The potential for the introduction and spread of INNS was scoped in for further assessment for all phases and has been assessed within this EIAR (**Section 9.11.1.6**).
6.	NatureScot	01 May 2024: Fish and Shellfish Ecology Scoping Workshop	NatureScot advised that cod may need to be considered as stationary receptors if they are known to spawn in the area.	As described in Section 1.4.3 of **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report** there is no overlap of cod spawning grounds with the WDA. The nearest cod (*Gadus morhua*) spawning grounds described in Ellis et al. (2012) are located in the North Channel between Northern Ireland and Scotland. Therefore, an overlap of the UWN impact range (**Appendix 10.1 UWN Modelling Report** and the WDA is unlikely.

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
				However, cod are considered as stationary receptors in **Section 9.11.1.3.1.1**.
7.	NatureScot	23 May 2024: Fish and Shellfish Ecology Scoping Workshop - Written feedback	Regarding the proposed approach to NCMPA Screening, it is advised that vessel collision and vessel disturbance, as with protected marine mammal features under the same designated site, is considered.	Vessel collision and vessel disturbance impacts on the basking shark feature of the Sea of the Hebrides NCMPA has been screened in – see Appendix H of the **Scoping Report** and the **Report to Inform NCMPA Assessment.**
			Additional data sources that will be useful for fish and shellfish include: • Langton et al. 2021 • González-Irusta, and Wright (2016a); • González-Irusta, and Wright (2016b); • González-Irusta, and Wright (2017); and • ScotMER (2024).	These additional data sources have been included in **Section 9.4** and have informed the EIAR as appropriate.
			NatureScot recommend inclusion of data from the Hebridean Whale and Dolphin Trust (HWDT) as well as the Shark Trust.	The Applicant requested data from HWDT (**Appendix 10.3 Analysis of Hebridean Whale & Dolphin Trust Visual and Passive Acoustic Survey Data**) which has been included and considered within Section 1.4.4 of **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report.** Basking shark sightings information provided to the Basking Shark Project via the Shark Trust is similarly considered in Section 1.4.4 of **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report** with reference to Pikesley, et al. (2024).
			NatureScot confirmed it is content with the impact titles for basking shark however noted that if floating technology is brought back into the project envelope, then secondary entanglement (dynamic cables and mooring lines) and	Floating technology is not included within this WDA application.

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
			Electromagnetic Fields (EMF) from dynamic cables would require to be scoped in.	
			Mitigation of impacts to basking shark (and other marine megafauna) is likely to be similar to those for marine mammals, so it is advised basking sharks (and other marine megafauna) are included for any proposed mitigation for marine mammals.	Relevant mitigations for marine mammals have also been applied for basking shark. See **Section 9.9**.
8.	Argyll and Bute Council and NatureScot	13 May 2024: Fish and Shellfish Ecology Scoping Workshop - Written feedback (Argyll and Bute Council) 26 July 2024: Fish and Shellfish Ecology Scoping Workshop - Written feedback (NatureScot)	In relation to whether NatureScot and Argyll and Bute Council have a preferred approach to defining the Regional Study Area, both consultees advised that they don't have a preferred approach. NatureScot highlighted that the study area should cover all the potential impacts from the proposal.	As described in **Section 9.6**, the Regional Study Area is bounded by ICES rectangles 45E2, 45E4, 39E2 and 39E4 which is a precautionary approach and will capture potential natal salmon rivers in northwest Scotland. This has since been updated to include ICES rectangles 41E1 and 40E1 following the results shown in **Appendix 10.1 UWN Modelling Report**, which identified an 88 km Zone of Influence (ZoI) based on Popper et al, (2014) UWN impact thresholds.
9.	NatureScot	04 June 2024: the Marine Directorate - Licensing Operations Team (MD-LOT) / NatureScot Quarterly Update Meeting	NatureScot advised that EPS and basking shark should be considered at EIA stage together with likely mitigation options. This is necessary to provide sufficient confidence, should the project receive s36 consent, that the likely worst-case scenario (impact) is able to be addressed through a subsequent derogation under EPS licensing. Leaving this entirely to the post-consent stage has led to substantial difficulties and delays.	Basking shark is protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). A basking shark licence application will be submitted to MD-LOT post consent at which point the project design envelope (PDE) will have been further refined through detailed design and procurement activities and further detail will be available on the techniques selected for construction. Mitigation measures relevant to basking shark are included in **Section 9.9** and will be reflected in any basking shark licence application. In addition, a full assessment of the scoped in potential impacts on basking shark, based on the worst-case scenario, is provided within this EIAR (**Section 9.10.4**).

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
				See equivalent comment in Table 10.2 (ID 31) of **Chapter 10 Marine Mammals and Leatherback Turtle** for the Applicant's response regarding EPS.
Scoping Opinion				
10.	Argyll and Bute Council	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Argyll and Bute Council confirmed that they are in agreement with the proposed approach to the EIA.	Noted.
11.	MD-LOT	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	The Scottish Ministers confirmed they are broadly content on the approach to the assessment as detailed in Section 9.12, however advise the Developer to fully consider the comments from NatureScot regarding PMFs and changes in prey availability. The Scottish Ministers direct the Developer to the Predators and Prey Around Renewable Energy Developments project in this regard. Additionally, the Scottish Ministers draw attention to the NatureScot representation regarding UWN modelling for consideration.	The Applicant acknowledges the Scottish Ministers' confirmation that they are broadly content with the assessment approach. A detailed response to this comment is provided in ID 34 and 63 of this table.
12.	Argyll and Bute Council	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Argyll and Bute Council agreed that the data presented appears to be sufficient to describe the baseline environment and did not recommend any further datasets or information sources.	Noted.
13.	Argyll District Salmon Fishery Board	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Argyll District Salmon Fishery Board (ADSFB) have a statutory responsibility to protect and improve salmon and sea trout fisheries and is advised by Argyll Fishery Trusts who provide a research and monitoring role for all freshwater fish in the Board's area. It is important that we can be assured that all potential negative impacts have been assessed in full, and mitigations put in place. We believe that where uncertainty remains, the developer should be required to contribute to research which will help fill these evidence gaps, as a condition of their operational consent.	Details on the mitigation and monitoring measures for fish and shellfish are provided in **Sections 9.9** and **9.15** respectively. No Project-specific monitoring is proposed. The Applicant acknowledges the need for strategic, coordinated research to address current knowledge gaps regarding diadromous fish and supports the principle that developers should work together to fund strategic monitoring efforts.

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
14.	FMS	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	District Salmon Fishery Boards have a statutory duty to protect and improve salmon and sea trout fisheries. In assessing marine renewable energy developments (wind, wave or tidal), it is important that DSFBs and Fisheries Trusts, can be assured that all potential negative impacts have been assessed in full, and mitigations put in place. Where uncertainty remains, the developer should be required to contribute to research which will help fill these evidence gaps, as a condition of their operational consent. In addition, and in the light of the nature crisis, we believe that all developers should contribute to projects designed to conserve and restore important habitat at a catchment scale.	The Applicant is committed to working with stakeholders and welcomes further engagement with FMS and other relevant bodies to explore opportunities for strategic research and monitoring.
15.	Argyll District Salmon Fishery Board	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	It should be emphasised that we have no wish to prevent or delay any proposed development unnecessarily and we remain keen to work constructively along with our representatives (Fisheries Management Scotland), Marine Scotland and the developers to identify appropriate monitoring programmes which will allow us to be able to assess the acknowledged risks of this development in a more appropriate manner. There is a clear need to undertake research on the movement, abundance, swimming depth, feeding behaviour and impact pathways relevant to diadromous fish. Such research would clearly feed into the potential mitigation measures that might be deemed appropriate, and the conditions under which such mitigation should be enacted. In our view, the Developers should fund monitoring, to demonstrate more certainty that the development does not impact on the salmon populations or the fisheries in the Argyll DSFB area. Argyll DSFB would welcome an opportunity to constructively engage with any such process through our representative body.	
16.	FMS	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	It should be emphasised that we have no wish to prevent or delay any proposed development unnecessarily and we remain keen to work constructively with the developers and Marine Scotland to identify appropriate monitoring programmes which will allow us to be able to assess the acknowledged risks of this	

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
			development, and other proposed developments in a more appropriate manner. There is a clear and urgent need to fund, plan and start strategic research on the movement, abundance, swimming depth, feeding behaviour and impact pathways relevant to diadromous fish. Such research would clearly feed into the potential mitigation measures that might be deemed appropriate, and the conditions under which such mitigation should be enacted. Developers should be required to work together to fund strategic monitoring, in order to allow more certainty for all involved. The scale of proposed offshore developments and other technical approaches to marine renewables development represents a step-change in the exposure of marine animals of high cultural and economic significance to attendant risks. As highlighted above, understanding of many of these risks is insufficient to support proposals for mitigation even at this late stage when substantial developments are being submitted for licensing. The cumulative impact of this proposal alongside those developments already submitted or likely to follow in the near future is potentially even greater. We believe that more needs to be done to ensure that the best scientific talent is made available to find practicable ways to address the unresolved uncertainties. Fisheries Management Scotland would welcome an opportunity to constructively engage with any such process.	
17.	MD-LOT	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	With regards to the baseline information described in Section 9.5 of the Scoping Report, the Scottish Ministers are broadly content with the proposed data sources proposed, but highlight the additional data sources recommended by NatureScot and advise that these are included in the EIA Report.	Noted. The sources provided have been reviewed and used within this EIAR where appropriate.
18.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	The existing data sources proposed to be used to inform the baseline environment are presented in Table 9.3 and the site-specific survey data is presented in Table 9.4. It is noted that site-specific benthic survey data will be used to inform the baseline, including Particle Size Analysis to identify herring	

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
			spawning and sandeel habitat suitability. In addition, we note that the Environmental DNA survey results will provide context to the baseline. Therefore, we are content that the combination of existing data and site-specific surveys should provide adequate information to characterise the baseline environment.	
19.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	We would also recommend an additional data source relevant to the spatial and temporal movement of migratory fish within the WDA: • Lilly, J. et al. (2024). Migration patterns and navigation cues of Atlantic salmon post-smolts migrating from 12 rivers through the coastal zones around the Irish Sea. Journal of Fish Biology, 104(1), 265–283. https://doi.org/10.1111/jfb.15591 14 The following data sources are also recommended for basking shark: • Austin, R.A, et al. (2019). Predicting habitat suitability for basking sharks (Cetorhinus maximus) in UK waters using ensemble ecological niche modelling. Journal of Sea Research, Volume 153, 101767, ISSN 1385-1101. • Thorburn, James, et al. (2024) Assessing the Potential of Acoustic Telemetry to Underpin the Regional Management of Basking Sharks (Cetorhinus Maximus). Animal Biotelemetry, vol. 12, no. 1, 12 July 2024, https://doi.org/10.1186/s40317-024-00370-5. • Government of Ireland (2024a) Aerial Surveys of Cetaceans and Seabirds in Irish waters: Occurrence, distribution and abundance in 2021-2023. • Government of Ireland (2024b) The seasonal distribution and abundance of seabirds, cetaceans and other megafauna off the south and southwest Irish coast. • Paxton, C.G.M., et al. (2014a). Statistical approaches to aid the identification of Marine Protected Areas for minke whale, Risso's dolphin, white-beaked dolphin and basking shark. Scottish Natural Heritage Commissioned Report No. 594. • Paxton, C.G.M., et al. (2014b). Review of available statistical approaches to help identify Marine Protected Areas for cetaceans and basking shark. Scottish Natural Heritage Commissioned Report No. 573. • Scottish Marine Animal Stranding Scheme (SMASS)	

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
20.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Section 9.7 sets out the baseline environment, including the fish and shellfish species typically expected in proximity to the WDA. This includes marine fish (including basking shark), diadromous fish and shellfish. Maps of spawning / nursery grounds are included for commercial fish species. The survey data provides good coverage of the WDA, particularly with the additional data from previous surveys (2021), giving more confidence in the baseline characterisation.	Noted.
21.	SFF	09 January 2025: Fish and Shellfish Ecology Scoping Opinion	Do you have any other matters or information sources that you wish to be presented in the EIAR? Yes. Cable footprint and Seabed Spawning Grounds Disturbance. SFF furthermore note from section 9.7.1.3 ‘Spawning and Nursery Grounds’ (p179) that the Scoping Boundary overlaps with the spawning and nursery grounds of some commercially important demersal and pelagic fish species (including, cod, haddock, whiting, herring and sandeel). Therefore, we propose any survey activities and other seabed disturbances should be undertaken outwith spawning and nursery periods of the above-mentioned fish species to avoid juvenile fish mortality.	The overlap between the WDA boundary and spawning/nursey grounds is recognised (Section 1.4.3 of **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report)** and has been considered within the assessment. Impacts have been assessed according to the magnitude of impact and the sensitivity of specific spawning and nursery grounds (**Section 9.10.4**). Mitigation measures are described in **Section 9.9**.
22.	SFF	09 January 2025: Fish and Shellfish Ecology Scoping Opinion	We are of the view that any activities on herring spawning habitat are prohibited based on the ‘ICES Advice on fishing opportunities, catch, and effort Greater North Sea ecoregion’ published 31 May 2024. Therefore, SFF propose the above-mentioned ICES advice to be taken into account and acted upon at determination stage. The link to ICES advice on herring in divisions 6.a.South of 56°N and West of 7°W and 7.b-c is provided as follows: Herring in 6aS and 7a-c[1]	The Applicant notes that the 2024 ICES Advice cited for divisions 6.a South of 56°00’N and West of 07°00’W and 7.b-c (Northwest and West of Ireland) advises for non-fishing activities that ‘no activities on spawning habitats should be allowed unless the effects of these activities have been assessed and shown not to be detrimental.’ The impacts of the WDA on herring spawning grounds are considered

[1] https://ices-library.figshare.com/articles/report/Herring_i_Clupea_harengus_i_in_division_6_a_South_of_56_00_N_and_West_of_07_00_W_and_7_b-c_Northwest_and_West_of_Ireland_/25019294?backTo=%2Fcollections%2FICES_Advice_2024%2F6976944&file=50102895

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
				throughout **Section 9.10.4**, and no significant adverse effects are predicted.
23.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Information in relation to basking sharks, recorded through site-specific DAS, is included in Section 9.7.2.2. Given the number of sightings from other data sources in the area, we agree that basking shark should be scoped into the EIA for further assessment.	Basking shark is assessed for the relevant impacts in **Section 9.10.4**.
24.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	The vessel collision risk assessment for basking shark will be qualitative in consideration of the DAS data, sightings records and the worst-case number of vessel passages and routes anticipated for the WDA over the construction phase – we are content with this approach.	Noted – see **Section 9.11.1.5**.
25.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	For basking shark, we advise that any mitigation for marine mammals should also be applied to basking sharks. Furthermore, if Uncrewed Surface Vehicles (USVs) or Autonomous Underwater Vehicles (AUVs) are to be used then we recommend further consultation to agree on appropriate mitigation for basking sharks (and also marine mammals).	Agreed. Any mitigation for marine mammals will also be applied for basking shark. In the case that USVs or AUVs are to be used, further consultation will be conducted to agree appropriate mitigation.
26.	NatureScot and MD-LOT	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	It is stated in Section 9.10 that the approach to assessment of potential cumulative impacts is set out in Chapter 4 (Approach to Scoping and EIA), which appears appropriate. As highlighted in our benthic advice, one aspect that we advise should be considered cumulatively is EMF - both within the array and with the export cable and other cables. Whilst there are fewer proposed wind farms on the west coast of Scotland there are more electricity network cables. There has been a tendency for wind farm projects to dismiss impacts from EMF from a cumulative perspective. We are concerned that the spatial and temporal scale is not being sufficiently considered cumulatively across the network of cables, including those outwith the proposed development. Therefore, we advise that EMF impacts should be considered in a cumulative assessment whether	Noted. EMF is considered cumulatively for the whole-Project as well as with other plans and projects based on a qualitative assessment, drawing on available literature, and acknowledging uncertainties (**Section 9.12.3.7**).

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
			requested in this WDA or the OfTDA scoping is a moot point as we anticipate there will be one EIA Report to cover all aspects at the application stage. MD-LOT highlight this advice from NatureScot.	
27.	MD-LOT	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	In terms of the approach to the cumulative impact assessment, as detailed in Section 9.12 of the Scoping Report, the Scottish Ministers advise that the cumulative effects assessment (CEA) for fish and shellfish ecology should consider all proposal alone impacts deemed negligible. Additionally, the Scottish Ministers advise that the impacts of EMF are also considered in the cumulative assessment in line with advice from NatureScot.	Noted. Where the potential significant effect for the WDA-alone is assessed as negligible, or is highly localised, these are not generally considered within the CEA as there is not considered to be a potential for cumulative effects with activities. In some cases, negligible effects have been taken forward based on expert judgement. A further related response to this comment is provided in ID 26 of this table.
28.	NatureScot and MD-LOT	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	As already highlighted in our advice, it is noted in Section 9.10 that "impacts assessed as negligible will not be taken forward to CEA and it is possible that some will be screened out on the basis that they are highly localised or the risk of effects occurring is reduced, given management measures will be in place for the Project and other plans and projects." We advise that proposal alone impacts could be deemed negligible, but when combined with others, the overall magnitude could be greater and therefore result in a cumulative effect. As such, further consideration should be given to negligible proposal alone impacts in the CEA. MD-LOT highlight this advice from NatureScot.	
29.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	It is also noted in Chapter 4 that the Applicant will seek agreement with MD LOT on the list of projects and/or plans to be included in the CEA, which we support.	The Applicant has sought agreement with MD-LOT on the list of projects and/or plans to be included in the CEA.
30.	FMS	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	We note, and support, the recent position that the Marine Directorate have taken - "MSS do not consider it appropriate for an EIA/HRA to conclude there is no or negligible impact just because no evidence exists of the impact. MSS advise that impacts to diadromous fish must be adequately investigated,	Within **Section 9.10.4,** the assessment includes diadromous fish as a receptor and therefore assesses direct and indirect impacts of the WDA infrastructure.

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
			rather than relying on a lack of evidence to claim there is no impact".	Impacts on diadromous fish behaviour and migratory success (incl. barrier effects) are covered in the impacts assessed (**Section 9.11.1**), including: • Temporary physical disturbance / habitat loss; • Increased suspended sediment concentrations (SSCs) and sediment redeposition; • UWN and vibration; • INNS; • Changes in fishing activity; • Permanent habitat loss; • EMF; and • Introduction of hard substrate.
31.	MD-LOT	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	In line with the advice within the NatureScot representation, the Scottish Ministers advise that migratory fish should currently be assessed only through the EIA process and not through the HRA process. However, the Developer should engage with the Scottish Ministers and NatureScot in regard to any change in how diadromous fish should be assessed through EIA and HRA as a result of ongoing research in this area.	In line with MD-LOT and NatureScot advice, fish and shellfish species are be assessed through the EIA only and are not considered within the HRA.
32.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	We note that a HRA Screening Report has also been submitted alongside the Scoping Report, which will consider SACs designated for fish species. However, we raise that diadromous fish species should be assessed through the EIA only and not through HRA. Further advice on the screening of NCMPAs and SACs is provided below.	
33.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	An HRA Screening Report has been submitted with the EIA Scoping Report, which is welcomed. Section 5 discusses the screening process in relation to sites designated for diadromous fish and notes that, as per NatureScot advice at the Scoping Workshop, potential impacts on diadromous fish will be assessed as part of the EIA only. We advise that for diadromous fish species there is limited knowledge of distribution and behaviour of these species in the marine environment and thus it is not	

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
			possible to carry out an assessment of impacts to diadromous fish to the level required under HRA. Therefore, at this time we advise that diadromous fish species should be assessed through EIA only and not through HRA.	
34.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Potential inter-related effects are discussed generally within Section 4.4.2.6 of the Scoping Report. We advise that the EIA Report should clearly set out impacts to key prey species (such as sandeel, herring, mackerel (*Scomber scombrus*) and sprat) and their habitats arising from the proposal alone and cumulatively. The PrePARED (Predators and Prey Around Renewable Energy Developments) project3 may be helpful in the understanding of predator-prey relationships in and around offshore wind farms.	Noted. Impacts have been assessed and clearly set out at a proposal alone and cumulative level (see **Section 9.11.1** and **Section 9.12.3**). The PrePARED project has also been reviewed in the understanding of predator-prey relationships in and around offshore windfarms.
35.	Argyll and Bute Council	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Do you agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of the WDA on commercial fisheries receptors? Yes, agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of the WDA on commercial fisheries receptors.	Noted.
36.	MD-LOT	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	The Scottish Ministers have reviewed the mitigation measures detailed in Table 9.8 of the Scoping Report and advise that, where impact pathways have been identified, the full range of mitigation measures and published guidance must be included in the EIA Report along with further information on proposed marine mammal monitoring. This view is in line with the NatureScot representation. In addition, as the area of the Proposed Development lies within spawning and nursery areas, the Scottish Ministers directs the Developer to the SFF representation in relation to the timing of construction activities and surveys and advise that this is fully considered within the EIA Report. Finally, the Scottish Ministers draw attention to the representation from FMS with regards to mitigation and monitoring strategies for diadromous fish for consideration.	Details on the mitigation and monitoring measures for fish and shellfish ecology are provided in **Sections 9.9** and **9.15.** No Project-specific monitoring is proposed. The Applicant acknowledges the need for strategic, coordinated research to address current knowledge gaps regarding diadromous fish and supports the principle that developers should work together to fund strategic monitoring efforts. The Applicant is committed to working with stakeholders and welcomes further engagement with stakeholders to explore opportunities for strategic research and monitoring.

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
37.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Embedded mitigation is presented in Table 9.8 and whilst the majority of the mitigation presented isn't directly related to fish and shellfish, implementation of these measures could indirectly reduce the potential impacts on fish and shellfish. As noted in our advice for other receptors – the embedded mitigation proposed largely includes adherence to post-consent plans / programmes that will mitigate impacts for which no detail has yet been provided. In addition, should significant effects be identified during the EIA, the embedded mitigation measures may not be sufficient to mitigate impacts.	
38.	Argyll and Bute Council	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Do you agree that all potential impacts have been identified for Fish and Shellfish ecology? Yes, agree that all potential impacts have been identified for Fish and Shellfish ecology.	Noted.
39.	Argyll and Bute Council	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Do you agree with the potential impacts scoped in and out? In general, yes. With regards to the Potential Impact of Permanent Habitat Loss in Table 9.9 Potential impacts scoped in or scoped out for fish (including basking shark) and shellfish ecology, as long as it is acknowledged that permanent habitat loss begins at the construction phase and continues through to decommissioning.	See **Section 9.11.1.8**.
40.	MD-LOT	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	The impact pathways proposed to be scoped in and out of the EIA are summarised in Table 9.9 of the Scoping Report. The Scottish Ministers are broadly content, subject to the following comments. The Scottish Ministers highlight the representation made by NatureScot regarding diadromous fish which may pass through the Proposed Development and request that all Priority Marine Features ("PMFs") are scoped in for further assessment. This view is supported by FMS.	Noted. Within the assessment, the Applicant recognises the status of both Atlantic salmon and sea trout (*Salmo trutta*) as PMFs for their marine life stage and where possible the assessment considers effects on their national status as PMFs. See Sections 1.4.2.1 and 1.4.2.2 of **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**.

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
			In addition, the Scottish Ministers highlight the representation from FMS in regard to PMFs for consideration.	
41.	MD-LOT and NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Section 9.9 identifies potential impacts from the WDA during the construction, O&M, and decommissioning phases. We are generally content with the list of potential impacts to be scoped in and out of assessment, subject to the following comments. Our understanding from the information provided in Table 9.9 is that the potential impact of fish aggregation around the WTGs and other hard structures is included for assessment within the 'introduction of hard substrate' impact. We agree that this potential impact needs to be scoped in for further assessment and will need to be considered with other receptors in mind, e.g. marine mammals and ornithology. The Scottish Ministers highlight the comments made in the representation by NatureScot regarding fish aggregation around WTGs and other hard structures and advise that these must be scoped in for assessment in the EIA Report.	The potential impact of fish aggregation around the WTGs and other hard structures is included with the 'introduction of hard substrate' impact – **Section 9.11.1.10**.
42.	MD-LOT and NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	For the potential impacts during decommissioning in Paragraph 440, we agree that these could be similar to construction impacts. However, until we better understand the extent to which structures will be decommissioned and how, it is too early to make the assumption that the impact will likely be lower. The Scottish Ministers also request that the comments from NatureScot on potential impacts during the decommissioning phase of the Proposed Development are fully considered by the Developer.	Noted. The Applicant recognises that there is limited information available surrounding the impact of decommissioning and has considered this within the assessment where relevant. See **Section 9.11.1**.
43.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Our interest in Fish and Shellfish species relates to those species that are PMFs as well as key prey species (such as herring, sandeels etc.) noting that many of these are also PMFs. A list of marine Fish and Shellfish scoped in for further assessment is provided in Paragraph 414, which includes all the species recorded within the WDA - we are content with this.	Noted.

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
44.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	It is noted in Section 9.7.3 that the WDA does not overlap with any designated site for fish or shellfish species. However, the Sea of Hebrides NCMPA and the Loch Sunart to the Sound of Jura NCMPA could potentially be impacted by the proposal. Therefore, we agree that these designated sites should be scoped in for further assessment.	Noted. See Section 1.4.5 in **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report** for more detail on the designated sites included within the assessment. The **Report to Inform NCMPA Assessment** should also be referred to.
45.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	An NCMPA Screening Report (Appendix H) has been provided alongside the Scoping Report. Section 3.2 of the Screening Report considers sites designated for fish species and concludes that basking shark of the Sea of Hebrides NCMPA and flapper skate of the Loch Sunart to the Sound of Jura NCMPA should be screened in for further assessment – we agree with these conclusions.	
46.	SFF	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	SFF also note from sub-section 8.7.1 'Subtidal Ecology' (p137, Benthic Ecology) that the Local Benthic Ecology Study Area seabed is suitable for herring spawning. Therefore, the SFF are concerned about the Development impacts on all commercial value fish species in the area, especially on the herring which are also particularly sensitive to noise impacts on hearing through the swim bladder.	The overlap between the WDA boundary and spawning/nursey grounds is recognised and has been considered within the assessment. Impacts have been assessed according to the magnitude of impact and the sensitivity of specific spawning and nursery grounds, see **Section 9.11.1**. The impact of UWN has been fully considered and assessed within **Section 9.11.1.3**. **Chapter 12 Commercial Fisheries** also considers impacts on commercial fishery receptors.
47.	Argyll District Salmon Fishery Board	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	In common with other parts of the country, wild salmon populations in Argyll and the Isles, are in crisis, and face a range of pressures, some of which are under human control. The Scottish Government have published a wild salmon strategy and implementation plan, which sets out the actions to be taken over a five year period to 2028. The implementation plan includes several actions under the heading of "understanding and mitigating pressures in the marine and coastal environment". We	Noted. See **Table 9.1** for reference to the wild salmon strategy and the implementation plan. The plan has been fully considered by the applicant and referenced within the assessment where relevant.

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
			note that the scoping report makes no reference to the Implementation Plan, and only quotes the Strategy itself.	
48.	FMS	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Across Scotland, wild salmon populations are in crisis, and face a range of pressures, some of which are under human control. The Scottish Government have published a wild salmon strategy and implementation plan, which sets out the actions to be taken over a five year period to 2028. The implementation plan includes a number of actions under the heading of “understanding and mitigating pressures in the marine and coastal environment”. We note that the scoping report makes no reference to the Implementation Plan, and only quotes the Strategy itself.	
49.	Argyll District Salmon Fishery Board	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Scottish salmon rivers are categorised by the Scottish Government under The Conservation of Salmon (Scotland) Regulations 2016, according to the likelihood of them meeting their conservation limits. The most recent river gradings have been published for 2024. Nearly all the salmon populations in the rivers of Argyll and the Isles are graded as Category 3, meaning there is a less than 60% probability of meeting their conservation limit. Therefore any additional pressure, including from marine renewables, cannot be considered sustainable.	Noted. All relevant rivers have been fully considered in the consenting and assessment process based on the information available at the time of the assessment. For more detail please see Section 1.4.2.1 and Section 1.4.2.2 of **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report.** For PMF's, where possible, the assessment considers effects on their national status.
50.	Argyll District Salmon Fishery Board	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	In recognition that the marine phases of both Atlantic salmon and sea trout are included on the list of PMF - the habitats and species of greatest conservation importance in inshore waters – we consider that all populations of migratory salmonid fish in Argyll & the Isles should be fully considered in the consenting and assessment process. We note that the scoping report does not recognise that the marine phases of Atlantic salmon and sea trout are Priority Marine Features.	See the Applicant’s response at ID 36 of this table.
51.	FMS	09 January 2025: Fish and Shellfish Ecology Scoping	FMS is the representative body for Scotland's District Salmon Fishery Boards, the River Tweed Commission and charitable Rivers and Fisheries Trusts. Our members work to conserve	

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
		Opinion – Written Feedback	Scotland's valuable and iconic wild salmon and freshwater fish and fisheries and the aquatic environment on which they depend. Offshore renewable energy has an important role to play if the Scottish Government are to meet their commitment for Scotland to reach net-zero emissions of all greenhouse gases by 2045. However, there remain a number of outstanding questions and concerns about the potential negative effects on diadromous fish, including Atlantic salmon and sea trout.	
52.	FMS	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Where salmon populations are below their conservation limits, any additional pressure, including from marine renewables, cannot be considered sustainable. Scottish salmon rivers are categorised by the Scottish Government under The Conservation of Salmon (Scotland) Regulations 2016, according to the likelihood of them meeting their conservation limits. The most recent river gradings have been published for 2024. There are now 112 rivers across Scotland graded as Category 3, meaning there is a less than 60% probability of meeting their conservation limit. It is now well-recognised that populations of Atlantic salmon have rapidly deteriorated across their native range. In the latest species reassessment by the IUCN Red List of Threatened Species, released in December 2023, Atlantic salmon have been reclassified from 'Least Concern' to 'Endangered' in Great Britain (as a result of a 30-50% decline in British populations since 2006 and 50-80% projected between 2010-2025), and from 'Least Concern' to 'Near Threatened' in terms of global populations (as a result of global populations declines of 23% since 2006). Page 162 of the scoping report incorrectly states that GB populations are 'Near Threatened'.	On 12 March 2024 in an FMS-MachairWind Update Meeting, FMS highlighted that Atlantic salmon are considered near threatened by the IUCN. The Applicant notes that in the latest species reassessment by the IUCN Red List of Threatened Species, released in December 2023, Atlantic salmon have been reclassified from 'Least Concern' to 'Endangered' in Great Britain. This is considered within the assessment.
53.	FMS	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Whilst there is often a focus on rivers designated at Special Areas of Conservation (SACs), it is important to recognise that the drivers behind declines in wild salmon and sea trout, and other species of migratory fish, affect all rivers to a greater or lesser extent. In recognition that the marine phases of both	Agreed. All relevant rivers have been fully considered based on the information available at the time of the assessment. For more detail please see Section 1.4.2.1 and Section 1.4.2.2 of **Appendix 9.1**

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
			Atlantic salmon and sea trout are included on the list of PMF - the habitats and species of greatest conservation importance in inshore waters – we consider that all relevant rivers should be fully considered in the consenting and assessment process. We note that the scoping report does not recognise that the marine phases of Atlantic salmon and sea trout are Priority Marine Features.	**Fish (including Basking Shark) and Shellfish Baseline Technical Report**. For PMF's, where possible the assessment considers effects on their national status.
54.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	We advise that in relation to all Fish and Shellfish PMF species, the assessment should quantify, where possible, the likely impacts and should assess whether the proposal could lead to a significant impact on the national status of the PMF.	
55.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	It is noted in Section 9.7.1.2 that diadromous fish may pass through the WDA and provides a list of species to be included for assessment, all of which are PMFs. Although, not explicitly stated – we advise that all these species should be scoped in for further assessment	Noted. See Section 1.4.2 of **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**, which includes a list of diadromous fish species included within the assessment.
56.	MD-LOT and NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	The Scottish Ministers are broadly content with the two proposed study areas described in Section 9.6, but highlight the representation made by NatureScot regarding maximum tidal excursion for consideration below: Two study areas have been defined for Fish and Shellfish ecology – the International Council for the Exploration of the Sea (ICES) rectangles 40E3 and 41E3 that overlap with the WDA and the Regional Study Area, bounded by ICES rectangles 45E2, 45E4, 39E2 and 39E4. The latter provides a wider context for the fish species and populations, used to inform impact assessments over long distances (e.g. UWN). In our advice issued following the Scoping Workshop, we indicated that we are content with the study areas proposed. The maximum tidal excursion should also be considered to take account of impacts from suspended sediments and ensure that the local study area covers the full extent of this potential impact.	Agreed. The maximum tidal excursion has been considered and is included within the Local Study Area as seen in **Figure 9.1.** As described in **Section 9.6**, the Regional Study Area is bounded by ICES rectangles 45E2, 45E4, 39E2 and 39E4 which is a precautionary approach and will capture potential natal salmon rivers in northwest Scotland. This has since been updated to include ICES rectangles 41E1 and 40E1 following the results shown in **Appendix 10.1 UWN Modelling Report**, which identified an 88 km ZoI based on Popper et al., 2014.

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
57.	FMS	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	There are 17 Special Areas of Conservation for which Atlantic salmon are either a primary reason for designation or a qualifying feature. For sea lamprey, there are six SAC sites and for river lamprey, there are six SAC sites. For freshwater pearl mussel, there are 19 SAC sites. Table 9.7 in the scoping report describes the designated sites relevant to Fish and Shellfish ecology and the WDA. However, we are slightly confused by the sites identified in this table. Why are the River Moriston SAC and River Oykel SAC identified, but other SACs in the Moray Firth and North coast of the Scottish Mainland are omitted. We are also unclear as to why the Endrick Water SAC is included, but the River Bladnoch SAC is omitted.	Designated sites for which fish and shellfish receptors are a qualifying feature, that directly overlap with, or outflow into the Regional Study Area were initially scoped in for assessment. This method unintentionally scoped in some rivers that outflow at the east coast. This EIAR has not considered rivers that outflow at the east coast, so the River Moriston SAC and River Oykel SAC have been removed. Further clarification is provided on the how rivers are selected in Section 1.4.5 of **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**. The River Bladnoch does not overlap with, nor does it directly outflow into the Regional Study Area, so is beyond the scope of the assessment.
58.	Argyll District Salmon Fishery Board	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Under Scottish Marine Energy Research (ScotMER), the Diadromous Fish Receptor Group has identified evidence gaps related to the health, distribution, and impacts on Diadromous fish (salmon, sea trout, etc.). Scottish Government has published an ‘evidence map’ which identifies and scores these evidence gaps according to a specific prioritisation process. It is important that each of these evidence gaps is considered in full by the applicant, and developers should contribute to filling these evidence gaps as a specific condition of consent.	The Applicant acknowledges the need for strategic, coordinated research to address current knowledge gaps regarding diadromous fish and supports the principle that developers should work together to fund strategic monitoring efforts, where there is uncertainty over the potential for significant impacts. The Applicant is committed to working with stakeholders and welcomes further engagement with ADSFB and other relevant bodies to explore opportunities for strategic research and monitoring.
59.	Argyll District Salmon Fishery Board and FMS	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	To properly assess Environmental Statements for developments, information on the use of the development area by diadromous fish should be provided. If such information is lacking then a suitable monitoring strategy should be devised, either for the site in question or through contributing to strategic projects undertaken through ScotMER. Any monitoring strategies must include pre-construction monitoring in order that baseline	

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
			information on movement, abundance, swimming depth, feeding behaviour etc. can be collected.	
60.	Argyll District Salmon Fishery Board and FMS	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	Offshore renewable developments have the potential to directly and indirectly impact diadromous fish. We would therefore expect developers to assess and, where necessary, mitigate the potential impacts of deployed devices on such fish during the deployment, operation and decommissioning phases. These potential impacts have been highlighted through ScotMER, and include: • Avoidance (including exclusion from particular rivers and subsequent impacts on local populations); • Disorientation effects that could potentially affect behaviour, susceptibility to predation or by-catch; and • Impaired ability to locate normal feeding grounds or river of origin; and delayed migration Argyll DSFB and FMS request that, in addition to the evidence gaps identified by ScotMER, the EIA considers the effects of predator aggregation (e.g. large gadoids/ grey seals) around the proposed development on migrating salmonids at both the smolt and adult stages and, additionally, physical barrier effects on salmon during construction and operation (e.g. noise, shadow flicker). In this regard, it should be noted that NatureScot has formally conceded that shadow flicker from moving turbine blades (and the direct visual effects of moving blades) may adversely affect salmonids in freshwater habitat. Since the same physical principles apply in the marine environment, surface-orientated fish such as salmonids are likely to be exposed to equivalent adverse effects.	See the Applicant's response at ID 27 of this table. The potential impacts scoped in for assessment have been agreed with MD-LOT and NatureScot. Shadow flicker and predator aggregation impacts have not been scoped in for assessment due to absence of evidence that offshore WTG blade flicker influences marine species, alongside the lack of any identified mechanism by which turbine-related shading or movement would alter predator behaviour in the marine environment. Predator aggregation has been considered as part of Impact 10: Introduction of Hard Substrate (**Section 9.11.1.10**).
61.	MD-LOT	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	The Scottish Ministers are in agreement that transboundary impacts should be scoped into the EIA for Fish and Shellfish, as discussed in Section 9.11. This view is supported by NatureScot.	Noted. Noise modelling for the WDA has been conducted as part of the EIA. The worst-case ZoI for UWN impacts is 88km. The WDA is approximately 32 km from the Republic of Ireland's territorial sea limit

I.D.	Consultee	Date/Engagement Activity	Stakeholder Comment	Applicant Response
62.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	We agree that the potential for transboundary impacts should be scoped in for Fish and Shellfish receptors until UWN modelling has been undertaken.	and therefore the UWN impact range will overlap with other jurisdictions and transboundary impacts are considered within the assessment (**Section 9.13**). Noted.
63.	NatureScot	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	We welcome the inclusion of UWN modelling for fish species using Popper et al., (2014) thresholds. As indicated in Paragraph 455, we note that particle motion is to be considered qualitatively within the EIA Report. We are currently content with this approach, noting this may change when further research on particle motion is available.	Noted.
64.	SFF	09 January 2025: Fish and Shellfish Ecology Scoping Opinion – Written Feedback	We propose the 'Disturbance from noise and vibration' to be scoped in as we have concern over the noise effects on juvenile Fish and Shellfish in the array area.	Noted. UWN and Vibration has been scoped in and for assessment (**Section 9.11.1.3**).
Post-Scoping Opinion				
65.	NatureScot	13 November 2025: Seabed ETG	Stakeholders agreed with the use of a 90 km buffer for cumulative assessment and with the proposal to assess EMF impacts qualitatively but reminds the Applicant of the inclusion of the Loch Sunart to the Sound of Jura NCMPA designated for flapper skate, a species which will likely encounter the WDA.	Noted. See the **Report to Inform NCMPA Assessment** for further detail on the assessment of flapper skate within the Loch Sunart to the Sound of Jura NCMPA.
66.	NatureScot	13 November 2025: Seabed ETG	Stakeholders supported reaching out to the West Coast Tracking Project and suggested looking into presentations at ScotMER Symposium conference which will give some more information on the potential impacts of offshore wind on diadromous fish.	Noted. See Section 1.4.2.1 of **Appendix 9.1 Fish and Shellfish Baseline Technical Report** for more detail.

9.4 EXISTING DATA SOURCES

16. **Table 9.3** sets out the information and data sources that have been used to inform this chapter.

Table 9.3 Summary of key datasets and information sources

Dataset	Description	Citation
Scottish salmon and sea trout fishery statistics 2024	Summary of the salmon and sea trout fishery catch statistics updated for the 2024 season.	Scottish Government, 2025b
UK sea fisheries annual statistics	Illustrates species of commercial importance in terms of landings weight and value by vessels in relation to ICES rectangles. Current available reports from 2013 to 2023.	Marine Management Organisation (MMO), 2025
Diadromous Fish ScotMER Receptor Group	The Diadromous Fish Scottish Marine Energy Research (ScotMER) Receptor Group is concerned with evidence gaps related to the health, distribution, and impacts on Diadromous fish (salmon, sea trout, etc.).	ScotMER, 2025
National Biodiversity Network (NBN) Atlas species assemblage data	The NBN Atlas is a species occurrence data portal, combining 995 datasets from 165 data partners at the time of writing.	NBN, 2025
West Coast Tracking Project	The West Coast Tracking Project aims to advance understanding of the marine and near-coastal migratory distribution of wild Atlantic salmon around the west coast of Scotland.	Atlantic Salmon Trust, 2025
Hebridean Whale and Dolphin Trust Whale Watch citizen sightings data	Citizen science resource with basking shark sightings data. Data has been gathered from 2018-2024 (**Appendix 10.3 Analysis of Hebridean Whale & Dolphin Trust Visual and Passive Acoustic Survey Data**) provides an insight into basking shark sightings in Scottish west coast waters.	Hebridean Whale and Dolphin Trust (HWDT), 2025
International Herring Larvae Survey	The International Council for the Exploration of the Sea (ICES) programme of international herring larval surveys in the North Sea, undertaken from 2014 to 2024, provides annual quantitative estimates of herring larval abundance in Scottish waters.	ICES, 2024
Aerial Surveys of Cetaceans in Irish waters	Aerial Surveys of Cetaceans and Seabirds in Irish waters: Occurrence, distribution and abundance in 2021-2023.	Government of Ireland, 2024a
Seasonal distribution of megafauna off the coast of Ireland	The seasonal distribution and abundance of seabirds, cetaceans and other megafauna off the south and southwest Irish coast.	Government of Ireland, 2024b
Atlantic salmon post-smolts migration patterns	Migration patterns and navigation cues of Atlantic salmon post-smolts migrating from 12 rivers through the coastal zones around the Irish Sea.	Lilly et al., 2024
Tracking and Movement Patterns of basking shark	Assessing the Potential of Acoustic Telemetry to Underpin the Regional Management of Basking Sharks.	Thorburn et al., 2024
Analysis of Basking Shark Watch Database 1987 to 2020	Collates and analyses Basking Shark Watch public sightings data (which has operated since 1987) to enhance accessibility and utility of the dataset. Furthermore, the report investigates the spatial and temporal patterns within the Sea of the Hebrides Marine Protected Area (MPA) in Scotland and broader geographical areas.	Pikesley, 2024

Dataset	Description	Citation
Nephrops functional units and suitable grounds in Scottish and adjacent waters	Mapped extents of stocks or ICES 'functional units' based on the discrete patches of mud which Nephrops (*Nephrops norvegicus*) inhabit. In addition, the suitable Nephrops ground within the ICES functional units around Scottish waters is also shown and is based on British Geological Survey (BGS) information and Vessel Monitoring System data (to map inferred fishing distribution of the Nephrops fleet).	Scottish Government, 2022b
Developing Essential Fish Habitat maps for Fish and Shellfish species in Scotland Report	Modelled extent of essential fish habitat in Scottish waters for 16 species in offshore waters. The lower data availability in inshore waters i.e. where the WDA is located (due to higher survey fragmentation, lower method standardisation and coverage gaps) prevented the application of Essential Fish Habitat modelling in this region. However, habitat proxies for species/life stages that may have their essential fish habitat inshore were identified and mapped based on data layers for pre-defined habitat types (European Nature Information System (EUNIS) habitat classification).	Franco et al., 2022
A verified distribution model for the lesser sandeel	Species distribution models were developed to predict the occurrence and density of sandeels in parts of the North Sea and Celtic Seas regions. Hurdle model evaluation with independent data demonstrated that it had significant discrimination ability across the study region. The distribution model helps refine past inferences about sandeel availability to predators and indicates to marine planners, potential areas where anthropogenic impacts should be considered.	Langton et al., 2021
Basking shark habitat suitability	Predicting habitat suitability for basking sharks in UK waters using ensemble ecological niche modelling.	Austin et al., 2019
Marine Information Network Fish and Shellfish sensitivity reports	Marine Information Network (MarLIN)'s The Marine Evidence-Based Sensitivity Assessments (MarESA) sensitivity assessments examine the biology or ecology of a fish or shellfish species, compile the evidence of the effect of a given pressure on the species, assess the likely sensitivity of the species to the pressure against standard scales, documenting the evidence used.	Tyler-Walters et al., 2018
Spawning grounds of whiting	Examines the importance of environmental influences on spawning distribution of whiting *(Merlangius merlangus)* using generalised additive models.	González-Irusta, and Wright, 2017
Basking shark satellite tagging project	A joint project between NatureScot and the University of Exeter has provided insights into basking sharks' horizontal and vertical use of the waters on Scotland's west coast. Basking shark satellite tagging project providing insights into basking shark movement, distribution and behaviour using satellite telemetry.	Witt et al., 2016
Spawning grounds of haddock	Examines the importance of physical constraints on the spawning distribution of northern shelf haddock *(Melanogrammus aeglefinus)* using a two-stage generalised additive model applied to bottom trawl survey data from the North Sea and west of Scotland.	González-Irusta, and Wright, 2016b
Nephrops – TV-assessed burrow density	Stock assessments make use of size composition data from catches, combined with information on stock abundance obtained from underwater television surveys. At each station, a custom-built sledge is towed along the seabed and all Nephrops burrow	Scottish Government, 2015b

Dataset	Description	Citation
	complexes are counted and used to derive density estimates, as shown in this data layer. Surveys were undertaken from 2007 to 2014.	
Species distribution models and supporting environmental data used to identify potential MPAs.	Statistical approaches to aid the identification of Marine Protected Areas for minke whale *(Balaenoptera acutorostrata)*, Risso's dolphin *(Grampus griseus)*, white-beaked dolphin *(Lagenorhynchus albirostris)* and basking shark.	Paxton et al., 2014a
Review of statistical methods for identifying Marine Protected Areas for cetaceans and basking sharks.	Review of available statistical approaches to help identify Marine Protected Areas (MPAs) for cetaceans and basking shark.	Paxton et al., 2014b
Updates to Fisheries Sensitivity Maps in British Waters	Updated modelling for probability of larvae presence for various fish species in British waters. Use and interpretation is recommended alongside the Coull et al. (1998) maps.	Aires et al., 2014
Mapping the spawning and nursery grounds of selected fish for spatial planning	Mapped extents of spawning and nursery grounds of various fish species, using the original maps produced by Coull et al. (1998), updated with newer data on larvae, juvenile, and egg abundance.	Ellis et al., 2012
Argyll Array Offshore Windfarm Boat-Based Surveys	Twenty-seven months of boat-based marine mammal and basking shark survey data taken for the now withdrawn Argyll Array Offshore Windfarm.	Booth et al., 2013
Islay Offshore Windfarm Boat-Based Surveys	Fourteen months of boat-based marine mammal and basking shark survey data undertaken for the now withdrawn Islay Offshore Windfarm.	AMEC, 2013
DATRAS Scottish West Coast Groundfish Survey	The dataset includes age- and length-based catch per unit effort data for commercial fish species collected during the Scottish West Coast Bottom Trawl Survey. This survey has been conducted annually since 2011, replacing the historical DATRAS SWC-IBTS dataset.	ICES, 2013
Fisheries sensitivity maps in British Waters	Mapped extents of the spawning and nursery grounds of various commercially important fish species and the relative intensity and duration of spawning.	Coull et al., 1998
HWDT visual survey data (2018-2024)	Seasonal distribution data for basking shark presence on the Scottish west coast, based on systematic vessel-based visual and passive acoustic surveys.	Hebridean Whale & Dolphin Trust, 2025 (**Appendix 10.3 Analysis of Hebridean Whale & Dolphin Trust Visual and Passive Acoustic Survey Data**).

9.5 SITE-SPECIFIC SURVEY DATA

17. In addition to the existing data sources identified in (**Section 1.4**), the Project has undertaken site-specific surveys to inform the EIA (**Table 9.4**).

Table 9.4 Site-specific survey data

Dataset	Year(s)	Description
Third-party Digital Aerial Survey	2020 to 2021	Digital Aerial Surveys (DAS) undertaken by APEM on behalf of a third-party developer across a portion of the OAA, including a 6 km buffer. Monthly surveys were actioned over 16 months from October 2020 to January 2022 inclusive. This survey covered the WDA.
Project's Digital Aerial Survey	2021 to 2023	DAS undertaken by APEM for the Project across the full OAA, including a 4 km buffer (analysed) and 6 km buffer, extending to 10 km during the survey. Monthly surveys were actioned over 30 months from April 2021 to September 2023 inclusive.
Third-party benthic survey	2021	Benthic survey undertaken by Briggs Marine which overlaps with the OAA. The survey work comprised of the following: • 60 benthic sediment grab samples for contaminants, faunal, biomass and particle size distribution analysis; and • 20 transects of Drop-Down Video (DDV). This data has been acquired by the Applicant to supplement the Project's site investigation survey data which together has been used to characterise the WDA. See Appendix B of the **Scoping Report**.
Project's site investigation	2023	Site Investigation survey undertaken across the OAA by Fugro on behalf of the Project. The survey works comprised: • Geophysical survey o Side Scan Sonar o Multibeam Echosounder o Sub Bottom Profiler o Magnetometer • 57 benthic sediment grabs for contaminants, faunal, biomass and particle size distribution analysis; • 59 transects of DDV with seabed photographs; and • 29 water samples for environmental DNA (eDNA) analysis.* See Appendix C, Appendix D and Appendix E of the **Scoping Report.**
Project's geophysical survey	2025	A geophysical survey covering a portion of the WDA was undertaken in 2025 and included: • Side Scan Sonar; • Multibeam Echosounder; • Sub Bottom Profiler; and • Magnetometer.
* Note that eDNA has not been considered for baseline characterisation because there currently is no guidance on its use within EIA. See Appendix E of the **Scoping Report**.		

9.6 FISH AND SHELLFISH STUDY AREA

18. This section describes the fish and shellfish Study Areas and how they have been defined. The purpose of a Study Area is to set the geographical boundary within which the existing environment is described (**Section 9.8**) and the EIA has been conducted.

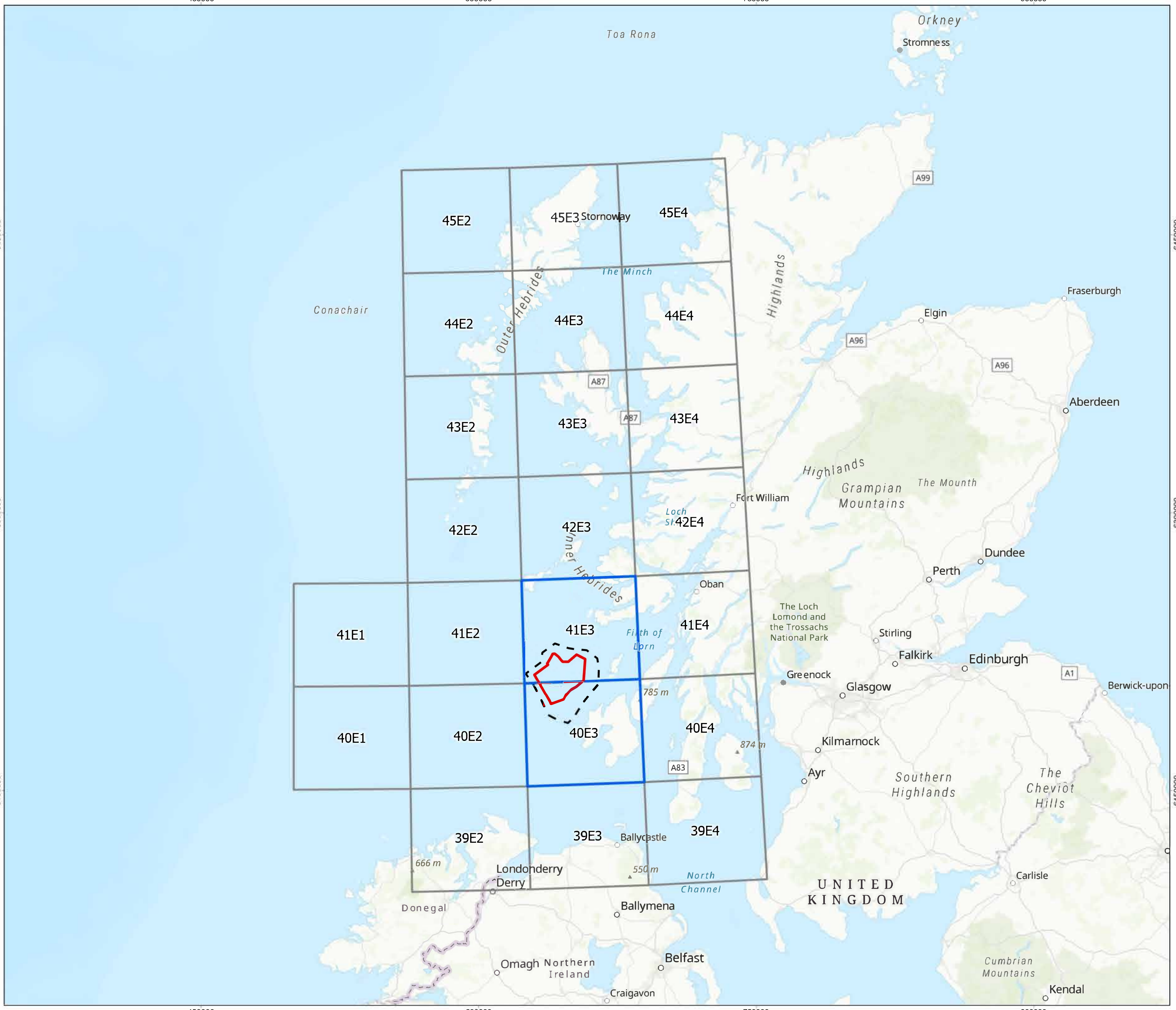
19. Fish and shellfish populations are spatially and temporally variable and therefore, a Local Study Area and a Regional Study Area have been defined for the purposes of the fish and shellfish ecology characterisation.

20. The International Council for the Exploration of the Sea (ICES) developed a gridded notation system covering the north-east Atlantic. The statistical rectangles are approximately 30 by 30 nautical miles and are used for simplified analysis and visualisation of spatial data. The WDA is located within the ICES Division 6a (West of Scotland), within UK Exclusive Economic Zone waters.

21. Two Study Areas have been defined based on ICES statistical rectangles:

- The fish and shellfish Local Study Area, defined as ICES rectangles 40E3 and 41E3 in which the WDA is located. This has been used to determine the assemblage, i.e. which species are to be considered as receptors for the EIA. The maximum tidal excursion has also been considered to take account of impacts from suspended sediments and is contained within the Local Study Area; and
- The fish and shellfish Regional Study Area, bounded by ICES rectangles 45E2, 45E4, 39E2 and 39E4. This has been used specifically to inform and assess impacts affecting fish and shellfish receptors over long distances (e.g., UWN and capturing natal salmon rivers in northwest Scotland and basking shark hotspots throughout the Hebrides). Following UWN modelling, the Regional Study area has been extended by adding ICES rectangle 41E1 and 40E1 to ensure the worst-case UWN impact range is accounted for.

22. The fish and shellfish Study Areas are displayed in **Figure 9.1**.



Windfarm Development Area

Regional Study Area

Local Study Area

Maximum Tidal Exclusion Zone

N

0 25 50 Kilometres

2	09/03/2026	FC	GC	MI	PM
REV	REV DATE	GIS CREATOR	GIS REVIEWER	TECHNICAL CHECKER	TECHNICAL APPROVER

DRAWING NUMBER	MCW-DWF-ENV-MAP-RHS-000146		
DATUM	ETRS89	PROJECTION	UTM Zone 29N
SCALE	1:2,000,000	PAGE SIZE	A3
PROJECT TITLE	MachairWind		

Figure 9.1: Fish (including Basking Shark) and Shellfish Study Areas

NOT TO BE USED FOR NAVIGATION

Haskoning
Enhancing Society Together

ScottishPower
Renewables

Name: Fig_9-1_MCW-DWF-ENV-MAP-RHS-000146_FishShellfishStudyArea

9.7 REALISTIC WORST-CASE SCENARIOS

23. The final design of the WDA will be confirmed by detailed engineering studies post-consent. To undertake a robust and precautionary impact assessment, the realistic worst-case design scenarios (i.e., those that would cause the greatest impact) are defined from the Project Design Envelope (PDE); ensuring that all other design scenarios would have equal or less impact. Please see **Chapter 5 EIA Methodology** for further details on the design envelope approach.

24. The realistic worst-case scenarios for the fish and shellfish assessment are summarised in **Table 9.5** below. These are based on the project design as described in **Chapter 3 Project Description**.

Table 9.5 Realistic worst-case scenarios for impacts on fish and shellfish

Impact	Realistic Worst-Case Scenario	Rationale
Construction		
Impact 1: Temporary physical disturbance / habitat loss	**Seabed preparation disturbance area prior to foundation installation (WTGs and OSPs) = 1,590,956 m^2** Worst-case WTG foundation type for total area = suction bucket jacket Worst-case OSP foundation type for total area = gravity based structure (GBS) Maximum number of WTGs = 144 Maximum number of OSPs = 2 Maximum area of seabed preparation per WTG = 10,677.78 m^2 Maximum area of seabed preparation for total WTG foundations = 1,537,600.32 m^2 Maximum area of seabed preparation per OSP = 26,678 m^2 Maximum area of seabed preparation for total OSP foundations = 53,356 m^2 Maximum footprint area of preparation for all foundations = 1,590,956 m^2 **Offshore cables temporary disturbance = 15,140,000 m^2** Maximum seabed route length of IAC trenches = 521 km Maximum length of OSP link cable trenches = 136 km Maximum length of offshore export cable route trenches (within the WDA) = 100 km Maximum total length of all offshore cable trenches = 757 km Maximum width of seabed affected during cable installation (including spoil heaps) = 20 m Maximum total footprint of temporary seabed disturbance from installation of all offshore cables within the WDA = 15,140,000 m^2 **Construction vessel footprints = 630,720 m^2** Jack-up vessel footprint – WTG and OSP installation: 3,600 m^2 footprint per WTG (x 144) and OSP installation (x 2) = 525,600 m^2	For seabed preparation disturbance for WTGs, the largest area is associated with the higher number of smaller turbines. Suction bucket jacket WTG foundations have a maximum bucket diameter of 15 m with four suction buckets per foundation and hence represent the worst-case scenario for temporary physical disturbance / habitat loss. For IACs, the maximum length is 572 km based on worst-case WTG / OSP layouts used for other assessments (e.g. **Chapter 13 Shipping and Navigation**). However, the maximum seabed route length is 521 km which is the total length of cable that will interact with the seabed and which is therefore relevant to fish and shellfish ecology. The 572 km length accounts for the length of the cable between the seabed and WTG / OSP. For OSP link cables and export cable(s), as a worst-case scenario, it is assumed that the total length is also the seabed route length. For sandwave levelling, based on the indicative layouts, it is assumed that sandwave levelling would only be required for IACs. If, following detailed design post-consent, there is a requirement for sandwave levelling for OSP link or export cable(s) within the WDA, the IAC levelling budget is anticipated to be sufficiently conservative to cover any additional requirement for other cable types.

Impact	Realistic Worst-Case Scenario	Rationale
	Anchoring footprint – WTG and OSP installation: 360 m^2 footprint per WTG (x 144) and OSP (x 2) installation x 2 for maximum number of operations per foundation installation = 105,120 m^2 **Sandwave levelling = 8,023,400 m^2** Total area disturbed during sandwave levelling / dredging (m^2) for IACs = 8,023,400 m^2 **Total temporary seabed disturbance/loss footprint from seabed preparation for WTG/OSP foundations, offshore cable installation and sandwave levelling = 25,385,076 m^2**	Seabed disturbance from boulder clearance during foundation installation would be encompassed by that assumed for seabed preparation for WTG and OSP foundation installation and therefore is not counted separately. It should be noted that since boulders that are not able to be micro-sited around during cable installation would be relocated to an adjacent area of seabed within 20 m, the temporary seabed disturbance footprint would be encompassed by the assumed 20 m wide temporary disturbance footprint from cable installation (see **Chapter 3 Project Description**). Similarly, boulders required to be relocated for WTG or OSP foundations would be placed within the maximum temporary seabed disturbance footprints of foundations.
Impact 2: Increased SSCs and sediment redeposition	**Seabed preparation disturbance volume prior to foundation and scour protection installation (WTGs and OSPs) = 5,961,073.28 m^3** • Worst-case WTG foundation type = suction bucket jacket • Worst-case OSP foundation type = gravity based structure (GBS) • Maximum number of WTGs = 144 • Maximum number of OSPs = 2 • Maximum WTG suction bucket foundation diameter = 15 m • Maximum OSP GBS foundation dimensions = 125 m x 120 m (length and width respectively) • Maximum proportion of foundations with scour protection = 100% • Maximum volume of dredging per WTG foundation = 39,870.37 m^3 • Maximum volume of dredging per OSP foundation = 109,870 m^3 • Maximum volume of dredging for all WTGs = 5,741,333.28 m^3 • Maximum volume of dredging for all OSPs = 219,740 m^3 • Maximum volume of dredging for all foundations = 5,961,073.28 m^3	Disturbance of seabed sediment resulting in changes to SSCs in the water column could occur due to the following construction activities: **Seabed preparation prior to foundation and scour protection installation** Seabed preparation works, including sandwave clearance/levelling, could be required prior to installation of foundations and associated scour protection. The realistic worst-case scenario is the foundations that have the greatest seabed footprint which are suction bucket foundations for WTGs and gravity-base structure foundations for OSPs.

Impact	Realistic Worst-Case Scenario	Rationale
	WTG foundation installation (with drilling) total volume of disturbance = 501,728.16 m^3 • Worst-case foundation type with drilling for total volume = monopile • Worst-case drilling volumes are associated with the larger number of smaller WTGs • Maximum number of foundations = 144 • Maximum foundation diameter associated with the smallest WTG = 13 m • Maximum drill penetration depth: 45 m • Maximum volume of drill arisings per WTG (for the smallest WTG) = 10,452.67 m^3 • Total volume of sediment disturbed due to foundation arisings assuming up to a third of foundation locations require drilling (48 of 144) = 501,728.16 m^3 **OSP foundation installation (with drilling) total volume of disturbance = 49,480 m^3** • Worst-case foundation type with drilling for total volume = pin-pile • Maximum number of piles per OSP = 16 (2 OSPs = 32 pin-piles total) • Maximum pin-pile diameter = 4.5 m • Maximum volume of drill arisings per pile = 1,546.25 m^3 • Total volume of sediment disturbed due to foundation arisings assuming all foundation locations require drilling = 49,480 m^3 **Sandwave levelling / dredging disturbance volume prior to IAC installation = 4,011,700 m^3**. **IAC installation total volume of displaced sediment = 6,694,850 m^3** • Worst-case IAC sediment displacement volume calculated assuming a cable plough creating a 'v'-shaped trench • Maximum length of IACs = 572,000 m • Maximum seabed route length of IACs = 521,000 m • Maximum disturbance width = 20 m • Maximum disturbance depth = 3 m	**Foundation installation** The installation of foundations will likely result in the release of disturbed sediments. The greatest sediment release is anticipated to be from the installation of monopile foundations for WTGs and pin-pile foundations for OSPs, if drilling is required. Drilling would result in the release of seabed and subseabed sediments, which will be deposited adjacent to each drilled foundation location, if required. **Seabed preparation prior to cable installation** Seabed preparation works, including sandwave clearance/levelling, could be required prior to installation of IACs. Based on preliminary layouts of OSPs (see **Appendix 7.1 Marine Physical Environment Numerical Modelling**), seabed preparation for export cable and OSP link cables is not anticipated. If, following detailed design post-consent, there is a requirement for sandwave levelling for OSP link or export cable(s) within the WDA, the IAC levelling budget is anticipated to be sufficiently conservative to cover any additional requirement for other cable types. **Cable installation** Offshore cable sediment displacement volume has been calculated assuming a cable plough creating a 'v'-shaped trench at 35 degree stability however cable installation may require a combination of jetting and or ploughing installation techniques. Maximum seabed route length of IACs does not account for additional IAC length for the length between seabed and WTGs / OSPs however this

Impact	Realistic Worst-Case Scenario	Rationale
	• Volume of sediment displaced per metre of IAC installation = 12.85 m^3 • Total volume of sediment disturbed due to IAC installation = 6,694,850 m^3 **OSP link cable installation total volume of displaced sediment = 1,747,600 m^3** • Worst-case OSP link cable sediment displacement volume calculated assuming a cable plough creating a 'v'-shaped trench • Maximum length of OSP link trenches = 136,000 m • Maximum disturbance width = 20 m • Maximum disturbance depth = 3 m • Volume of sediment displaced per metre of cable installation = 12.85 m^3 • Total volume of sediment disturbed due to OSP link cable installation = 1,747,600 m^3 **Offshore export cable (within the WDA) installation total volume of displaced sediment = 1,285,000 m^3** • Worst-case offshore export cable sediment displacement volume calculated assuming a cable plough creating a 'v'-shaped trench • Maximum length of offshore export cable trench within the WDA = 100,000 m • Maximum disturbance width = 20 m • Maximum disturbance depth = 3 m • Volume of sediment displaced per metre of cable installation = 12.85 m^3 • Total volume of sediment disturbed due to offshore export cable (within the WDA) installation = 1,285,000 m^3 **Worst-case scenario for total temporary increases in SSCs = 20,251,431 m^3**	additional length would not manifest an increase in sediment arisings.
Impact 3: UWN and vibration	Piling period 2030 Q2 to 2034 Q4 Monopiles • Maximum number of monopiles: 144 • Maximum pile diameter: 15 m	The spatial worst-case scenario is based on the longest duration of pin-piling at the maximum hammer energy i.e. based on sequential installation of six pin-piles in a 24 hour period.

Impact	Realistic Worst-Case Scenario	Rationale
	• Maximum hammer energy: 6,600 kJ • Maximum number of monopiles installed per day: one • Maximum piling duration per monopile = 320 minutes • Maximum piling duration for maximum monopiles = 768 hours which = 32 days <u>Pin-piles</u> • Maximum number of pin-piles for WTGs: 576 • Maximum number of pin-piles for OSPs: 32 (16 per OSP) • Total number of pin-piles: 608 • Maximum pile diameter: 4.5 m • Maximum hammer energy: 4,400 kJ • Maximum number of pin-piles installed per day: six • Maximum piling duration per pin-pile = 195 minutes • Maximum piling duration for maximum pin-piles = 1976 hours which = 82.3 days	Full hammer energy is unlikely to be required on all piles, but is assessed for all piles as a worst-case scenario.
Impact 4: Disturbance and displacement of basking shark	Pre-construction vessel trips (round trips to and from port) (total): 140 Vessel trips across entire construction period (round trips to and from port) (total): 5699 Max. no. of all types of vessels operating on site simultaneously during construction: 117 Introduction of areas of hard substrate as per O&M Impact 8 Permanent Habitat Loss	The potential for disturbance and displacement of basking shark is assessed in **Section 9.11.1.4**.
Impact 5: Vessel collision for basking shark		The potential for collision risk for basking shark is assessed in **Section 9.11.1.5**.
Impact 6: INNS		The potential for INNS is assessed in **Section 9.11.1.6.**
Impact 7: Changes in fishing activity	The worst-case scenarios are set out in **Chapter 12 Commercial Fisheries**.	The potential for construction of WDA infrastructure to change the distribution of fishing pressure is detailed in **Chapter 12 Commercial Fisheries.**
O&M		
Impact 1: Temporary physical disturbance / habitat loss	**Maintenance: seabed footprint disturbed per year on average = 36,217 m²**	Temporary physical disturbance / habitat loss could occur due to the following O&M activities:

Impact	Realistic Worst-Case Scenario	Rationale
	<u>Cable Repair / Replacement</u> • Assuming a maximum 5 m jetting disturbance width for all repair / replacement and reburial events. • IAC repair / replacement: Assuming 10 repair / replacement events over 35-year operational life with 10,000 m of cable replaced per event = total IAC repair / replacement footprint of 500,000 m² • OSP Link Cables repair / replacement: Assuming 4 repair / replacement events over 35-year operational life with 1,000 m of cable replaced per event = total OSP Link Cables repair / replacement footprint of 20,000 m² • Offshore export cable(s) (within the WDA) repair / replacement: Assuming 2 repair / replacement events over 35-year operational life with 2,000 m of cable replaced per event = total offshore export cable(s) (within the WDA) repair / replacement footprint of 20,000 m² <u>Cable Reburial</u> • Assuming a maximum 5% of the length of each cable could require reburial over the 35-year operational life. • Assuming a maximum 5 m jetting disturbance width for all repair / replacement and reburial events; • IAC reburial: Assuming 28,600 m of cable reburied over 35-year operational life = total IAC reburial footprint of 143,000 m² • OSP link cables reburial: Assuming 6,800 m of cable trench reburied = total OSP link cables reburial footprint of 34,000 m² • Offshore export cable(s) (within the WDA) reburial: Assuming 5,000 m of cable trench reburied over 35-year operational life = total offshore export cable(s) (within the WDA) reburial footprint of 25,000 m² <u>Jack-up Vessel Footprints</u> • Anticipated number of jack-up events over 35-year operational life = 292. • Jack-up vessel footprint = 1,800 m^2. • One jack-up event per maintenance activity. • Total footprint = 525,600 m^2 <u>Totals</u> • Cable repair or replacement = 540,000 m²	**Cable repair/replacement and reburial** Temporary physical disturbance would result from cable repair, replacement and reburial activities. The total disturbance footprint and volume over the 35-year operational period is based on yearly averages and thus assumes, for example, that there may be no cable repair in one year and then longer lengths of cable repair/replacement and/or reburial in other years. The worst-case assumes a maximum 5 m jetting disturbance width and 3 m disturbance depth for all repair / replacement and reburial events, and a maximum 5% of the length of each cable could require reburial over the Project’s operational life. Further detail on maximum temporary O&M footprints in the WDA are provided in **Chapter 3 Project Description**.

Impact	Realistic Worst-Case Scenario	Rationale
	• Cable remedial reburial = 202,000 m² • Jack-up vessel footprint = 525,600 m^2 • Overall, assuming a maximum of 1,267,600 m² of cable repaired/replaced and reburied and jack-up vessel footprints over the 35-year operational life • Maximum disturbed per year on average = 36,217 m²	
Impact 2: Increased SSCs and sediment redeposition	**Cable repair and reburial total volume of sediment disturbed per year = 63,600 m^3** • **IAC repair / replacement:** Assuming 10 repair / replacement events over the project lifetime with 10,000 m of cable replaced per event = total IAC repair / replacement footprint of 500,000 m^2 • **OSP Link Cables repair / replacement:** Assuming 4 repair / replacement events over the project lifetime with 1,000 m of cable replaced per event = total OSP Link Cables repair / replacement footprint of 20,000 m^2 • **Offshore export cables (within the WDA) repair / replacement:** Assuming 2 repair / replacement events over the project lifetime with up to 2,000 m of cable replaced per event = total offshore export cables (within the WDA) repair / replacement footprint of 20,000 m^2 • **IAC reburial:** Assuming 28,600 m of cable reburied over the project lifetime = total IAC reburial footprint of 143,000 m^2 • **OSP link cables reburial:** Assuming 6,800 m of cable trench reburied over the project lifetime = total OSP link cables reburial footprint of 34,000 m^2 • **Offshore export cables (within the WDA) reburial:** Assuming 5,000 m of cable trench reburied over the project lifetime = total offshore export cables (within the WDA) reburial footprint of 25,000 m^2 • Maximum disturbance depth of cable repair and reburial = 3 m (assumed to be the equal to maximum cable burial depth) • Area of sediment disturbed due to all cable repair or replacement events = 540,000 m^2 • Area of sediment disturbed due to all cable remedial reburial events = 202,000 m^2 • Total area of sediment disturbed due to cable repair and reburial during operational life of 35 years = 742,000 m^2 • Total volume of sediment disturbed due to cable repair and reburial during operational life of 35 years = 2,226,000 m^3 (742,000 m^2 x 3 m)	Disturbance of seabed sediment resulting in changes to SSCs in the water column could occur due to the following O&M activities: **Cable repair and reburial** Temporary increases in SSCs would result from cable repair, replacement and reburial activities. The total disturbance footprint and volume over the 35-year operational period is based on yearly averages and thus assumes, for example, that there may be no cable repair in one year and then longer lengths of cable repair/replacement and/or reburial in other years. The worst-case assumes a maximum 5 m jetting disturbance width and 3 m disturbance depth for all repair / replacement and reburial events, and a maximum 5% of the length of each cable could require reburial over the Project's operational life. Further detail on maximum temporary O&M footprints in the WDA are provided in Table 1.5 of **Chapter 3 Project Description**.

Impact	Realistic Worst-Case Scenario	Rationale
	• Total volume of sediment disturbed per year due to cable repair / replacement and reburial = 63,600 m^3 (2,226,000 m^3 / 35 years)	
Impact 3: UWN and vibration	O&M activities may include cable laying, suction dredging, backhoe dredging, drilling, rock placement and trenching. O&M activities will continue during the lifetime of the Project, up to 35 years.	Results from the UWN modelling report (see **Appendix 10.1 UWN Modelling Report**) have predicted auditory impact ranges for fish and shellfish, an assessment using these impact ranges is presented in **Section 9.11.1.3**.
Impact 4: Disturbance and displacement of basking shark	Annual no. of vessel round trips required for routine operational and planned maintenance activities: 423 Introduction of areas of hard substrate as per Impact 8 Permanent Habitat Loss	The potential for disturbance and displacement of basking shark is assessed in **Section 9.11.1.4**.
Impact 5: Vessel collision for basking shark		The potential for collision risk for basking shark is assessed in **Section 9.11.1.5**.
Impact 6: INNS		The potential INNS is assessed in **Section 9.11.1.6.**
Impact 7: Changes in fishing activity	The worst-case scenarios are set out in **Chapter 12 Commercial Fisheries**.	The potential for construction of WDA infrastructure to change the distribution of fishing pressure is detailed in **Chapter 12 Commercial Fisheries.**
Impact 8: Permanent habitat loss	**Total worst-case area subject to colonisation of hard substrate / permanent habitat loss = 6,788,230.51 m^2** Maximum footprint of suction bucket jacket WTG foundations including scour protection = 5,496,530.51 m^2 (38,170.35 m^2 x 144 WTGs) Maximum footprint area for two OSP GBS foundations including scour protection = 270,000 m^2 Maximum cable trench lengths: • IAC = 521 km (based on seabed route length) • OSP link trenches = 136 km • Offshore export cable trench lengths in the WDA = 100 km Offshore cable protection width for all offshore cables where cables are unable to be buried due to ground conditions or for IACs on approach to WTGs = 13 m	As a worst-case scenario, it is assumed that all foundations would require scour protection. For OSP link cables and offshore export cable(s), up to two of these would be bundled in the same trench and therefore instead of the total length of these (272 km and 200 km respectively) being used to calculate the maximum cable protection requirement, it is the maximum trench length. Calculations of the length of each cable type for which cable protection is required due to ground conditions being unsuitable for cable burial are based on: • 10% of 521 km of IACs • 10% of 136 km of OSP link cable trenches

Impact	Realistic Worst-Case Scenario	Rationale
	Maximum IAC protection area (ground conditions) = 677,300 m^2 Maximum IAC protection (unburied cable on approach to WTG) = 93,600 m^2 Maximum IAC protection (combined ground conditions and unburied cable on approach to WTG) = 770,900 m^2 Maximum offshore export cable protection area within the WDA due to ground conditions = 65,000 m^2 Maximum OSP link cable protection area (unburied cable) = 176,800 m^2 Maximum OSP link cable protection area (crossings): • Maximum width of cable protection at crossings = 18 m • Maximum length of cable protection at crossings = 250 m per crossing • Maximum number of OSP link cable crossings required = 2 • Maximum area of OSP link cable crossing protection = 9,000 m^2 Maximum area cable protection material (all sources) for OSP Link cables = 185,800 m^2 Total area of cable protection within WDA for all offshore cables = 1,021,700 m^2	• 5% of 100 km of offshore export cable trenches For IAC, additional allowance for cable protection along 50 m of cable at each WTG is provided where IACs are unable to be buried on approach to WTGs (maximum width of protection is the same as for ground conditions i.e. 13 m). Based on publicly available data there are no third-party cables or pipelines and therefore the only crossings assumed to be required are for OSP link cables crossing IACs.
Impact 9: Electro-magnetic fields	Maximum length of IAC = 572km Maximum length of OSP link cables = 272 km Maximum length of offshore export cable within the WDA: 200 km Max voltage: • IAC = 132 kV • OSP link = 275 kV • Offshore export cable(s) = 525 kV Cable burial minimum target DoL: • IAC = 0.3 m • OSP link and offshore export cable = 1m	The worst-case for EMF is associated with the maximum length of cables. The minimum target cable burial DoL and external cable protection is also important as EMF rapidly attenuates with distance from the cable. DoLs of 0.3 m may be used for IACs in challenging ground conditions such as shallow outcropping rock, due to the inherent protection it provides the cable at a shallower DoL.

Impact	Realistic Worst-Case Scenario	Rationale
Impact 10: Introduction of hard substrate	As above for O&M Impact 8 Permanent Habitat Loss	
Decommissioning		
Impact 1: Temporary physical disturbance / habitat loss	The worst-case scenario of decommissioning would be similar to those of the above outlined construction impacts of this table.	The impacts of decommissioning are primarily linked to the removal of infrastructure from the seabed, such as offshore cables and scour and cable protection. These activities may cause temporary disturbance to the seabed and surrounding marine environment. However, it is anticipated that the overall environmental impacts associated with decommissioning will be equal to, or potentially less than, those experienced during the construction phase. This is due to the fact that much of the infrastructure will have already settled into place, and the removal process will likely be more controlled and less intrusive. Additionally, any disturbance will be short-term and localised, with efforts made to minimise harm to marine habitats and ecosystems.
Impact 2: Increased SSCs and sediment redeposition		
Impact 3: UWN and vibration		
Impact 4: Disturbance and displacement of basking shark		
Impact 5: Vessel collision for basking shark		
Impact 6: INNS		
Impact 7: Changes in fishing activity		

9.8 EXISTING ENVIRONMENT

9.8.1 Existing Baseline

25. The following sections provide a summary of the fish and shellfish ecology baseline environment. **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report** includes full details of the analysis undertaken to develop the fish and shellfish ecology baseline characterisation, including results of site-specific surveys. This sets the context for the identification of mitigation measures (**Section 9.9**) and assessment of significance (**Section 9.10.4**) which then feeds into the consideration of cumulative effects (**Section 9.12**) and potential transboundary impacts (**Section 9.13**).

26. The baseline characterisation within the fish and shellfish Local Study Area identifies a diverse assemblage of pelagic, demersal, and shellfish species. Commercial fisheries data indicate that shellfish dominate landings in the Local Study Area, with key species including Nephrops, king scallop (*Pecten maximus*), velvet crab (*Necora puber*), brown crab (*Cancer pagurus*), European lobster (*Homarus gammarus*), and common whelk (*Buccinum undatum*). Demersal fish such as haddock, cod, monkfish (*Lophius piscatorius*), plaice (*Pleuronectes platessa*), and skate species are present, alongside pelagic species including herring, sprat, sandeel, whiting, and blue whiting (*Micromesistius poutassou*). Ocean quahog (*Arctica islandica*), an OSPAR-listed and PMF species, was also recorded during site-specific surveys. These findings are supported by national datasets and site-specific surveys detailed in **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**.

27. Diadromous species, notably Atlantic salmon and sea trout, are ecologically and economically significant and migrate through the Regional Study Area during key life stages. Atlantic salmon is listed under Annex II of the EU Habitats Directive, designated as a PMF in Scotland, and considered a Priority Species under the UK Biodiversity Framework. Despite its cultural and ecological importance, populations have declined markedly over the past 25 years, driven by pressures across freshwater and marine environments, including habitat degradation, migration barriers, climate change, and increased marine mortality. Recent telemetry studies indicate post-smolt migration routes through the Irish Sea toward the Norwegian Sea, with survival strongly influenced by oceanographic conditions. Sea trout exhibits more localised marine movements, emphasizing the need for high-quality coastal habitats. These species, along with basking shark, which is listed as Endangered on the IUCN Red List and protected under OSPAR, are considered further in this chapter. Further detail on species ecology, conservation designations, and spawning/nursery grounds is provided in **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**.

28. While the baseline draws on extensive datasets and surveys, uncertainties remain regarding marine survival bottlenecks for Atlantic salmon, fine-scale distribution of sea trout, and basking shark vertical habitat use. Limitations in abundance data for sandeel and other prey species, coupled with variability in fisheries statistics, are evident within the baseline datasets (see **Section 9.4** for data sources and **Section 9.8.3** for data limitations and assumptions).

9.8.2 Predicted Future Baseline

29. **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report** includes full details of predicted future baseline of fish and shellfish ecology.

30. In summary, climate change is expected to drive significant changes in fish and shellfish populations along the west coast, particularly in terms of species distribution, recruitment, and food web interactions. However, accurately predicting these changes is challenging due to the complex interplay of environmental and anthropogenic factors. While substrate type, a key factor in habitat suitability for demersal and benthic species, is unlikely to change substantially, broader ecological communities are likely to undergo gradual but noticeable shifts in the coming decades.

9.8.3 Data Limitations and Assumptions

31. The data sources used in this chapter are detailed in Table 1.1 of **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**. The desktop study utilised the most current publicly available information, obtained from existing literature, stakeholder consultation, habitat identification, and site-specific survey results. This information was used to determine the likely fish and shellfish species, communities, and associated habitats within the Local Study Area.

32. Site-specific surveys, including grab sampling and epibenthic trawls, were carried out to characterise the benthic subtidal ecology within the WDA. These surveys were not designed to specifically target fish and shellfish species, so some may not have been recorded. Nevertheless, commercial fisheries information has been incorporated into the baseline characterisation, which itself was informed by consultation with the fishing industry, as presented in **Chapter 12 Commercial Fisheries**. As such, this additional information will have helped to fill any gaps missed through site-specific surveys. These surveys provided opportunistic additional fish and shellfish data which have been incorporated into the assessment. Given the detailed desktop study completed, covering a long time series and a wide variety of information sources (e.g. including scientific literature, grey literature, commercial fisheries information) and the conservative approach adopted, it is unlikely that any key species were excluded from the assessment, given the baseline presented here is based on a robust dataset (**Section 9.4**).

33. For the combined assessment (**Section 9.11.2**), the Offshore ECC is defined only by a preliminary boundary, and detailed, site-specific fish and shellfish data are not yet available for the full extent of this broader inshore area. While the Regional Study Area captures much of the Offshore ECC, this does not encompass the full range of potentially sensitive habitats that may occur further inshore, including localised nursery grounds, spawning areas or shellfish concentrations that are typically more prevalent closer to the coast. At this stage, no fine-scale mapping exists to confirm whether the preliminary Offshore ECC overlaps with any such particularly sensitive features. This represents a data limitation and is acknowledged within this assessment. The combined assessment has therefore been carried out using the best available evidence at the time, drawing on regional datasets, published literature, commercial fisheries information, and expert judgement. However, further consideration of a refined Offshore ECC route will be undertaken once site investigation survey data become available. This limitation is reflected in the conclusions of the combined assessment and will be addressed in the future Offshore ECC application.

9.9 EMBEDDED MITIGATION

34. This section outlines the embedded mitigation relevant to the fish and shellfish ecology assessment (as shown in **Table 9.6** below). Where additional mitigation measures are required to mitigate potentially significant effects (in EIA terms), these are detailed in the impact assessment.

Table 9.6 Embedded mitigation measures for fish and shellfish ecology

ID	Mitigation Measure	Description	Securing Mechanism
M-3	Pollution from Ships	Compliance with the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 and adherence to the "OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic".	Section 36 and marine licence consent conditions. Secured via **Appendix 7 Marine Pollution Contingency Plan**. Will be implemented as part of the standard operating procedures of contractors.
M-4	Environmental Management Plan	Development of, and adherence to, an Environmental Management Plan (EMP) which will be in accordance with **Appendix 6 Outline EMP** submitted with the application for section 36 consent and marine licences. The EMP will include measures for preventing wastewater discharges from vessels and procedures for informing Project personnel on best practice guidance to reducing the potential for water discharges during offshore construction and O&M. In addition, the Outline EMP ensures current good practice for all activities to reduce the risk of collisions and disturbance with marine mammals and basking shark. Vessel movements, where possible, will follow set vessel routes and hence areas where marine mammals are accustomed to vessels, to reduce any increased collision risk and disturbance. All vessel movements will be kept to the minimum number that is required so that any potential collision risk and disturbance is further reduced. Additionally, vessel operators will use good practice to reduce any risk of collisions and minimise disturbance to marine mammals and basking shark, including compliance with the Scottish Marine Wildlife Watching Code[2]. Also, the Project's Environmental Clerk of Works (ECoW) will ensure vessel crew (where applicable) are informed of the locations of the protected seal haul-out sites.	Section 36 and marine licence consent conditions. Secured via **Appendix 6 Outline Environmental Management Plan**.

[2] https://www.nature.scot/sites/default/files/2017-06/Publication%202017%20-%20The%20Scottish%20Marine%20Wildlife%20Watching%20Code%20SMWWC%20-%20Part%201%20-%20April%202017%20(A2263518).pdf

ID	Mitigation Measure	Description	Securing Mechanism
M-5	Invasive Non-Native Species Mitigation Plan (INNSMP)	Development of, and adherence to, an INNSMP. This plan details mitigation measures to reduce the introduction and transfer of INNS.	Section 36 and marine licence consent conditions. Secured via **Appendix 8 Invasive Non-Native Species Mitigation Plan**.
M-6	Piling Noise Mitigation Plan	Joint Nature Conservation Committee (JNCC) (2010) guidelines for minimising the risk of injury to marine mammals from piling noise and JNCC guidance for the use of Passive Acoustic Monitoring (PAM) in UK waters for minimising the risk of injury to marine mammals from offshore activities are outlined in Section 4 of **Appendix 9 Draft Marine Mammal Mitigation Protocol (MMMP)** submitted with the application. A Piling Noise Mitigation Plan will be developed in the preconstruction phase in accordance with Section 4 of **Appendix 9 Draft MMMP**.	Section 36 and marine licence consent conditions. Secured via **Appendix 9 Draft MMMP** which sets out the requirements for a Piling Noise Mitigation Plan.
M-7	Marine Pollution Contingency Plan (MPCP)	Development of, and adherence to, a MPCP. The MPCP will provide guidance to the Project personnel, contractors and subcontractors on the actions and reporting requirements in the event of spills and collision incidents. The MPCP will also contain emergency plans and mitigation procedures for a range of potential marine pollution incidents.	Section 36 and marine licence consent conditions. Secured via **Appendix 7 Marine Pollution Contingency Plan**.
M-8	Cable Plan	Development of, and adherence to, a Cable Plan (incorporating a Cable Burial Risk Assessment (CBRA)). The Cable Plan will confirm planned cable routing, burial, and any additional external cable protection, and will set out methods for post-installation cable monitoring. Furthermore, this plan will detail environmental sensitivities and design considerations to mitigate, as far as practicable, the effects of offshore cable laying and associated protection during installation and operation of the WDA infrastructure. The amount of cable protection utilised will be minimised where practicable; protection will be used only where design burial depths are not reasonably practicable or where crossings require it.	Section 36 and marine licence consent conditions. Secured via the requirement for a Cable Plan, to be developed and submitted to the Scottish Ministers for approval before commencement of construction.
M-9	INNS	Adherence to the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM) Convention (2004) which provides global	Section 36 and marine licence consent conditions. Secured via **Appendix 8 Invasive Non-Native Species Mitigation Plan**.

ID	Mitigation Measure	Description	Securing Mechanism
		regulations to control the transfer of potentially invasive species.	
M-11	Unexploded Ordnance Clearance (UXO)	A detailed MMMP based on JNCC (2025) guidelines for minimising the risk of injury to marine mammals from UXO clearance and Defra (2025) guidance on minimising environmental impacts from UXO clearance, will be included in the Final MMMP prepared for UXO clearance during the pre-construction phase. The Final MMMP will accord with **Appendix 9 Draft MMMP** submitted with the application. This will ensure there are adequate mitigation measures to minimise the risk of any physical or permanent auditory injury to marine mammals from UXO clearance. Following the latest guidance, low order clearance will be the default method. The Draft MMMP for UXO clearance is presented in Section 3 of **Appendix 9 Draft MMMP**.	Mitigation will be secured in the UXO MMMP as part of a separate Marine Licence application submission prior to construction.
M-14	Micro-siting	Micro-siting of infrastructure, where practicable, around any identified sensitive habitats and identified anomalies of archaeological interest. Micro-siting mitigation would be agreed through consultation with MD-LOT and NatureScot on the identified sensitive benthic features (e.g. Annex I geogenic reef), and MD-LOT and historic environment advisors on anomalies of archaeological interest, which are required to be avoided. Final agreement will be through the Development Specification and Layout Plan.	Section 36 and marine licenses consent conditions. Infrastructure will be micro-sited, where practicable, to avoid identified sensitive habitats and archaeological anomalies, following site-specific surveys and design reviews in accordance with **Appendix 6 Outline Environmental Management Plan**.
M-46	Decommissioning Programme	Development and adherence to a Decommissioning Programme. This programme will identify all the items of equipment, infrastructure and materials that have been installed or drilled and describes the decommissioning solution for each whilst considering the potential environmental effects of each method alongside appropriate mitigation techniques that can be implemented.	Section 36 and marine licence consent conditions. Secured via a Decommissioning Programme, which will be developed and submitted to Scottish Ministers for approval before commencement of construction.
M-52	Removal of Gravity Based Structure (GBS) foundations for WTGs from Project design envelope	Since scoping, and following site-specific engineering development and design refinement, GBS foundations for WTGs have been removed from the design envelope which results in a large reduction in the worst-case seabed preparation requirements and seabed footprint of the WDA	Secured through Project design specifications in the generation marine licence.

ID	Mitigation Measure	Description	Securing Mechanism
		infrastructure. This reduces the magnitude of temporary physical disturbance / habitat loss, increased SSCs and permanent habitat loss impacts.	

9.10 APPROACH TO ASSESSMENT

35. As noted above, this topic chapter considers the WDA Study Area and existing environment only. A combined assessment of the construction, O&M and decommissioning of the WDA activities, Offshore ECC, and OnTDA activities (commensurate with the level of detail that is available at the time of carrying out that assessment) is also provided and the methodology for this is described in **Section 9.10.2**. This approach will ensure a holistic view is undertaken of the entire Project.

9.10.1 Windfarm Development Area-Alone

9.10.1.1 Methodology

36. **Chapter 5 EIA Methodology** provides a summary of the general impact assessment methodology applied in this WDA EIAR. The assessment uses the conceptual 'source-pathway-receptor' model. The model identifies potential impacts resulting from the proposed activities on the environment and sensitive receptors within it.

37. Species are grouped based on shared life-history traits (resulting in broadly shared sensitivities). These groups are elasmobranchs, demersal fish, and pelagic fish. The different sensitivities of these groups arise from general differences in their life history traits (e.g., pelagic fish are less likely to come into contact with localised benthic impacts compared to demersal fish, and elasmobranchs may have particular sensitivities to Electro-magnetic Fields (EMF)). Sensitivities are based on Marlin's MarESA database as a starting point (where available). Expert judgement and review of the scientific literature has also influenced determination of sensitivity for fish and shellfish receptors. For feature-pressure combinations that have been assessed by Scottish Government at the time of conducting the EIA, the Feature Activity Sensitivity Tool (FeAST) has been used to further inform receptor sensitivities.

38. Uncertainties around impact magnitudes and significance have been acknowledged where significant knowledge gaps exist in the literature. This has been informed by the Scottish Marine Energy Research group (ScotMER) research gaps for fish and shellfish.

39. Herring and sandeel habitat suitability assessments have been informed by particle size analysis data collected as part of the Project's site investigation survey. The assessment has been conducted in line with industry good practice techniques, and in consultation with stakeholders.

40. An assessment on basking shark has been undertaken with consideration of site-specific survey data and up to date literature on their likely distribution throughout the Regional Study Area and their sensitivities to potential impacts.

41. Site-specific UWN modelling has been undertaken for UWN sources from the WDA, including pile driving, seabed preparation, dredging, rock placement, UXO clearance, cable installation, vessel presence, and operational WTG noise. Further detail on noise modelling can be found in **Appendix 10.1 UWN Modelling Report**. Sound impacts for fish are based on the thresholds developed by

Popper et al. (2014). Receptors are treated either as stationary or fleeing, depending on their behaviour and the level of precaution required:

- Sandeel, spawning herring, spawning cod, and eggs are treated as stationary receptors.

42. Other species are treated as fleeing receptors at 0.5 ms^{-1}. The vessel collision risk assessment for basking shark is qualitative and based on expert judgement, in consideration of the Project and third-party DAS data, sightings records and the worst-case number of vessel passages anticipated for the WDA over the construction phase (as a worst-case).

43. The assessment considers a range of potential impacts, initially identified during the EIA Scoping process and refined as the EIA has progressed. These include:

- Temporary physical disturbance / habitat loss;
- Increased SSCs and sediment redeposition;
- UWN and vibration;
- Disturbance and displacement of basking shark;
- Vessel collision for basking shark;
- Permanent habitat loss;
- EMF;
- Introduction of hard substrate;
- INNS; and
- Changes in fishing activity.

44. Each of these impacts is assessed separately for the construction, operational and maintenance, and decommissioning phases of the Project and described per primary groups. It is important to note that not all impacts are relevant to all phases of the development.

45. The identified impacts could affect various ecological aspects of fish and shellfish populations, including:

- Effects on adults, eggs, and larvae;
- Spawning and nursery grounds;
- Feeding habitats;
- Migration routes (including emigrating smolts and returning adults);
- Designated sites and conservation status; and
- Importance in the food web.

46. For each impact, the assessment identifies receptors sensitive to that impact and implements a systematic approach to understanding the impact pathways and the level of impacts on given receptors. Definitions of sensitivity and magnitude for the purpose of the fish (including basking shark) and shellfish assessment are provided in **Table 9.7** and **Table 9.8** respectively.

Table 9.7 Definition of sensitivity for fish and shellfish receptor

Sensitivity	Definition
High	Individual* receptor (species or stock) has very limited or no capacity to avoid, adapt to, accommodate or recover from the anticipated impact.
Medium	Individual* receptor (species or stock) has limited capacity to avoid, adapt to, accommodate or recover from the anticipated impact.
Low	Individual* receptor (species or stock) has some tolerance to accommodate, adapt to or recover from the anticipated impact.

Sensitivity	Definition
Negligible	Individual* receptor (species or stock) is generally tolerant to and can accommodate or recover from the anticipated impact.

**In this case individual receptor does not refer to an individual organism but refers to the population or stock of a species.*

47. The magnitude of an impact is considered for each predicted impact on a given receptor and is defined geographically, temporally and in terms of the likelihood of occurrence. The definitions of terms relating to the magnitude of a potential impact on fish and shellfish ecology are provided in **Table 9.8**.

Table 9.8 Definition of magnitude for fish and shellfish receptor

Magnitude	Definition
High	Fundamental, permanent / irreversible changes, over the whole receptor, and / or fundamental alteration to key characteristics or features of the receptors' character or distinctiveness.
Medium	Considerable, permanent / irreversible changes, over the majority of the receptor, and / or discernible alteration to key characteristics or features of the receptors' character or distinctiveness.
Low	Discernible, temporary (throughout project duration) change, over a minority of the receptor, and / or limited but discernible alteration to key characteristics or features of the receptors' character or distinctiveness.
Negligible	Discernible, temporary (for part of the project duration) change, or barely discernible change for any length of time, over a small area of the receptor, and/or slight alteration to key characteristics or features of the receptors' character or distinctiveness.

9.10.1.2 Significance of Effect

48. The likely significance of effect for a given impact is a function of the overall sensitivity and the magnitude of the impact (see **Chapter 5 EIA Methodology** for further details). A matrix is used (**Table 9.9**) as a framework to determine the significance of an effect. Definitions of each level of significance are provided in **Table 9.10**. Impacts and effects may be either positive (beneficial) or negative (adverse).

49. In applying this methodology, professional judgement contributes to concluding significance of effects. This judgement draws on the assessor's technical expertise, knowledge of the receiving environment, and understanding of how similar developments have influenced comparable receptors. Judgement also considers the quality and confidence of the available data (**Section 9.8.3**), the level of uncertainty associated with predicted impacts, and any relevant guidance or industry standards. Professional judgement ensures that the matrix outputs are interpreted in context, allowing the assessor to account for site-specific conditions, receptor sensitivities that may cut across criteria, and the nature of the predicted changes. This approach ensures that the determination of significance is robust, transparent and proportionate.

Table 9.9 Significance of effect matrix

Sensitivity	Adverse Magnitude				Beneficial Magnitude			
	High	Medium	Low	Negligible	Negligible	Low	Medium	High
High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
Medium	Major	Moderate	Minor	Negligible	Negligible	Minor	Moderate	Major
Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

50. For the purposes of this WDA EIAR, 'major' and 'moderate' effects are deemed to be significant (in EIA terms). In addition, whilst 'minor' effects may not be significant, it is important to distinguish these from other non-significant (negligible) effects as they may contribute to significant effects cumulatively.

51. Following initial assessment, if the impact does not require additional mitigation (or none is possible) the residual effect will remain the same. If, additional mitigation is proposed there will be an assessment of the post-mitigation residual effect.

Table 9.10 Definition of significance of effect

Significance of Effect	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision-making process.
Negligible	No discernible change in receptor condition.
No Change	No effect, therefore, no change in receptor condition.

9.10.2 Combined Assessment: Windfarm Development Area, Offshore Export Cable Corridor and Onshore Development Transmission Development Area Methodology

52. This section presents how the Applicant will assess interactions between the WDA, Offshore ECC and OnTDA (i.e. considering impact interactions and additive effects to determine if any effects would be materially elevated from those assessed for the WDA-alone assessment). The approach enables potential interactions between each Development Area to be identified and assessed, ensuring a whole Project assessment is undertaken in a manner that is meaningful and proportionate. This is referred to as the combined assessment.

53. In this context, interactions are considered where there may be spatial overlap of effects and additive effects are considered where there may be incremental effects on the same receptor, including increased temporal effects.

54. Worst-case scenarios for all WDA infrastructure (which includes OSPs, OSP link cables and up to 200 km of the offshore export cable(s) which could be located within the WDA) has been incorporated into the worst-case scenario for the WDA-alone assessment (**Table 9.5** and **Section 9.11.1**).

55. To inform the combined assessment, a set of assumptions were developed which includes a preliminary boundary for the Offshore ECC and OnTDA (connect point new Girvan, South Ayrshire), anticipated project components and associated construction methods and timelines. These are set out in **Chapter 3 Project Description**, Sections 3.7 and 3.8. Offshore and onshore engineering and environmental surveys enabling Offshore ECC and OnTDA corridor refinement are anticipated to take place after the WDA EIAR has been submitted to the consenting authorities.

56. Within the upcoming Offshore ECC and OnTDA consent applications, their respective scoping and EIARs will take account of all likely effects predicted within the WDA EIA and present updated combined assessments using the latest available information covering all aspects of the Project.

57. **Section 9.11.2** includes a qualitative discussion where potential interactions and additive effects between the WDA and the Offshore ECC and OnTDA have been identified, with the aim of determining whether effects could result in those of greater significance than assessed for the WDA-alone assessment. To accompany the description, a Combined assessment summary table is provided. Only residual effects from the WDA-alone assessment are taken forward for consideration in the combined assessment.

9.10.3 Cumulative Effects Assessment Methodology

58. The CEA considers the impacts arising from the activities and infrastructure associated with the whole-Project (i.e. the WDA, Offshore ECC and OnTDA) as well as cumulatively with other relevant plans, projects and activities. The general approach to the CEA for Fish (Including Basking Shark) and Shellfish includes identifying potential cumulative effects, identifying a short list of plans and projects for consideration and evaluating the significance of cumulative effects. **Chapter 5 EIA Methodology** provides further details on the general approach to the CEA.

59. In line with the methodology set out in **Chapter 5 EIA Methodology**, the CEA is considered in two main stages with stage 1 split into two steps:

- **Stage 1a**: Screening of Potential Cumulative Impacts;
- **Stage 1b**: Screening of other plans, projects and activities; and
- **Stage 2**: CEA.

60. Stage 1a involves the screening / identification of which whole-Project impacts could have a cumulative effect with other plans, projects and activities (described as ‘impact screening’). Stage 1b is the screening of other plans, projects and activities. In accordance with guidance documents discussed in **Chapter 5 EIA Methodology**, other plans or projects that are deemed likely to go ahead or are going ahead, and for which sufficient information is available to conduct a meaningful assessment, have been taken forward for consideration in **Appendix 5.1 Cumulative Projects Long and Short Lists**. If sufficient detail is not available, it is not possible to conduct a meaningful assessment of potential cumulative effects and therefore, these developments are not considered further. For the purposes of the CEA Long-List, the criteria of other plans or projects that are proposed for consideration include those which are ‘reasonably foreseeable’ such as those:

- Which have become operational since baseline data was collected;
- Under construction;
- Permitted application(s), but not yet implemented;
- Submitted application(s) not yet determined; and

- Plans and projects with design information in the public domain, including those that requested a Scoping Opinion up to six months prior to submission of the WDA application date as follows:
  - Projects in Scottish waters;
  - Projects in English, Welsh and Northern Irish waters, or other non-UK waters if considered to be relevant, have connectivity, or the potential for a cumulative effect;
  - Offshore wind projects granted an Option Agreement or Agreement for Lease; and
  - Non-wind projects.

61. The CEA Long-List has been developed based on the above criteria, and has been screened for each potential impact-receptor pathway using the following process:

- **Conceptual overlap**: an impact-receptor pathway describes an impact which has the potential to directly or indirectly affect the receptor(s) in question;
- **Physical overlap**: ability for impacts arising from the WDA, Offshore ECC and OnTDA to overlap with those from other plans or projects on a receptor basis. An overlap of the ZoIs arising from the two (or more) projects/plans must be established for a cumulative effect to arise. There are exceptions to this for certain mobile receptors that are potentially subject to impacts from multiple plans or projects; and
- **Temporal overlap**: for a cumulative effect to arise from two or more plans or projects, a temporal overlap of impacts arising from each must be established. Some impacts are active only during certain phases of the WDA (e.g. piling noise during construction). However, the absence of a strict overlap may not necessarily mean there is no potential for cumulative effect, as receptors may become further affected by additional, non-temporally overlapping projects.

62. Stage 2 is the assessment of cumulative effects. A tiered approach is used to provide a framework for placing relative weight on the potential for each plan or project to be included in the CEA, based on the plan's or project's current stage of maturity, certainty in the design or effects and overall availability of detail on which to carry out an assessment. Projects or plans that will be assessed in Stage 2 will use the following tiers:

- Tier 1 assessment: projects which are operational (but not part of the baseline), under construction, those with consent and those projects where an application has been submitted but not yet determined;
- Tier 2 assessment: all plans/projects assessed under Tier 1, plus those projects with a Scoping Report and/or Scoping Opinion; and
- Tier 3 assessment: all plans/projects assessed under Tier 1 and Tier 2, plus those projects likely to come forward where a Crown Estate Scotland (CES) Option to Lease Agreement or equivalent has been granted (i.e., ScotWind and Innovation and Targeted Oil & Gas (INTOG) projects).

9.10.4 Transboundary Effects Assessment Methodology

63. The transboundary effect assessment considers the potential for effects to occur as a result of the WDA on fish and shellfish ecology receptors within the Exclusive Economic Zone (EEZ) of other European Economic Area (EEA) member states or other interests of EEA member states. **Chapter 5 EIA Methodology** provides further details on the approach to the transboundary effect assessment.

64. For fish and shellfish ecology receptors, the potential for transboundary effects has been identified in relation to the Republic of Ireland's territorial sea limit. The distribution of fish and shellfish species is independent of national geographical boundaries and this EIA has considered the distribution of fish stocks and populations irrespective of national jurisdictions.

65. Noise modelling for the WDA has been conducted as part of the EIA. The worst-case ZoI for UWN impacts is 88km. The WDA is approximately 32 km from the Republic of Ireland's territorial sea limit and therefore the UWN impact range will overlap with other jurisdictions.

9.11 ASSESSMENT OF SIGNIFICANCE

9.11.1 Windfarm Development Area-Alone Assessment of Significance

66. The potential effects on fish and shellfish ecology receptors that may occur during construction, O&M, and decommissioning of the WDA are assessed in the following sections. The assessment follows the methodology set out in **Section 9.10.1.1** and is based on the realistic worst-case scenarios defined in **Section 9.7**, with consideration of embedded mitigation measures identified in **Section 9.9.**

67. This assessment has been undertaken on the basis of all embedded mitigation measures outlined in **Table 9.6**. The embedded mitigation measures relevant for each impact are listed in the summary **Table 9.31**.

9.11.1.1 Impact 1: Temporary Physical Disturbance / Habitat Loss

68. The construction, O&M and decommissioning phases of the WDA may cause temporary physical disturbance and habitat loss. This is primarily linked to installing subsea infrastructure, including offshore cables, WTG and OSP foundations and use of jack-up vessels (as set out in **Table 9.5**). Before cable burial, preparatory activities, such as boulder clearance, sandwave levelling, and pre-lay grapnel runs, will be undertaken. Cables will then be buried beneath surface sediments using techniques described in **Chapter 3 Project Description**, including ploughing, jetting, mechanical/controlled flow excavation and mechanical cutting.

69. Monitoring data from over 20 UK offshore windfarms, reviewed by The Crown Estate (RPS, 2019), indicate that sandy sediments typically recover quickly after cable installation, with minimal visible disturbance persisting over time.

70. The disturbance at the WDA would occur throughout all phases of the Project, but would be temporally and spatially limited, with the majority of disturbance occurring during installation of foundations. Once activities are complete, recovery will begin immediately, allowing mobile species such as sandeel, as well as other fish and shellfish to repopulate previously disturbed areas. Whilst recovery will begin immediately, stabilisation of disturbed areas and fish and shellfish habitats may take weeks to months depending on sediment type, hydrodynamic conditions, and species' natural recolonisation rates.

9.11.1.1.1 Sensitivity

9.11.1.1.1.1 Spawning Grounds

71. The Local Study Area overlaps with potential spawning grounds for several species, including species with highly specific substrate requirements (sandeel), demersal spawners with specific substrate requirements (herring), and shellfish (Nephrops). It also intersects with areas of higher spawning intensity for less sensitive benthopelagic species (Norway pout (*Trisopterus esmarkii*)), as well as regions of uncertain intensity for other less sensitive pelagic species (sprat) and demersal species (plaice) (Coull et al., 1998; Ellis et al., 2012). The species with the most sensitive spawning grounds spawn from August to September (herring) and November to February (sandeel) (see

Table 9.6 in **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**).

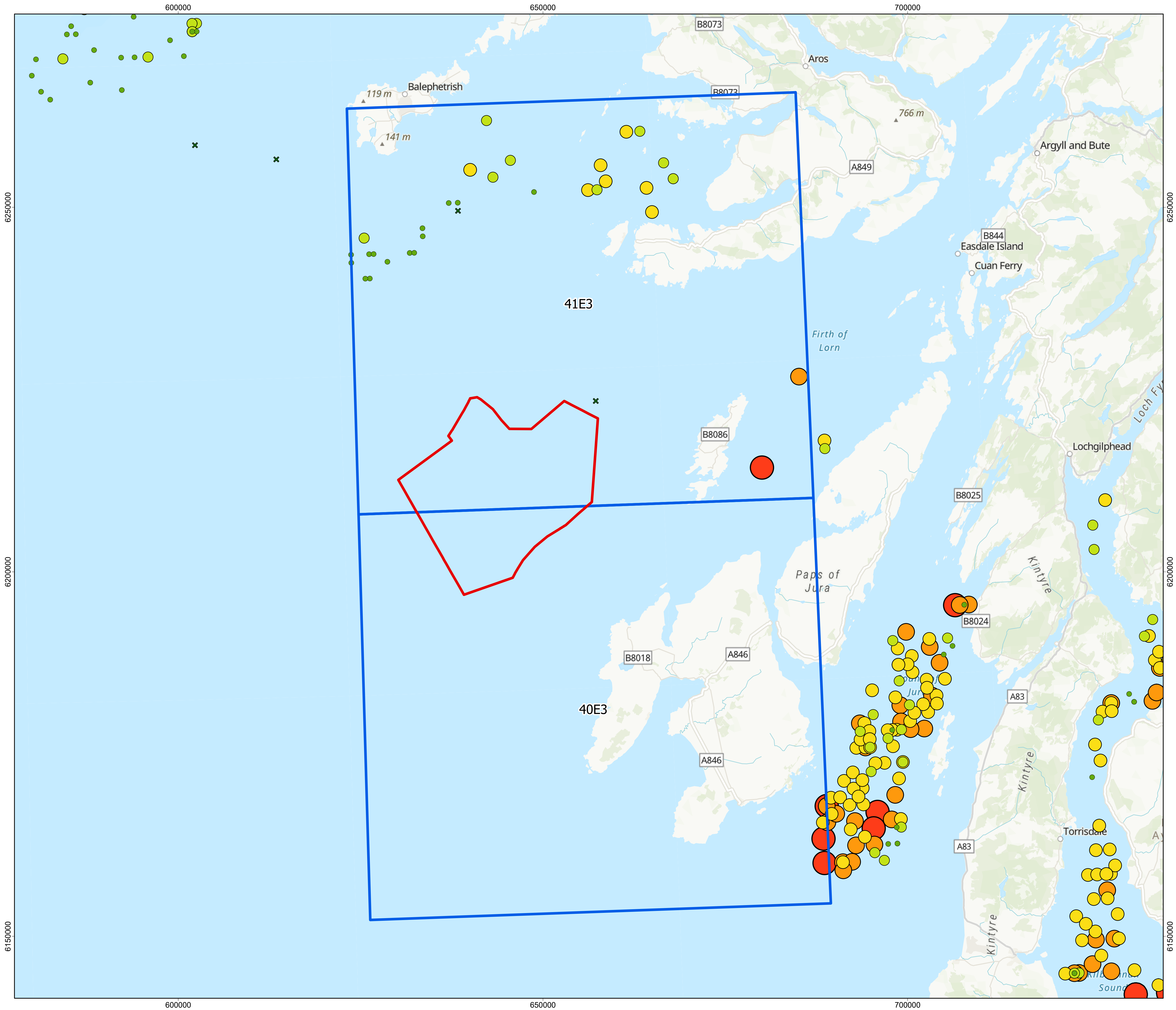
72. Sandeel require very specific sediment types for spawning, making them vulnerable to localised physical disturbance and temporary habitat loss (see Figure 1.11 in **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**). Recovery of sandeel populations is generally expected to occur relatively quickly once sediments return to their natural state following infrastructure installation. This recovery happens through the return of adult fish and larval settlement in suitable sandy substrates (Macer, 1966; Wright et al., 2000). It should be noted that based on Particle Sediment Analysis (PSA) analysis for sampling stations within the WDA, the majority of sediment is 'Sand' and 'gravelly Sand' which can be considered as 'Preferred' Sandeel habitat.

73. Herring require very specific sediment types for spawning, with suitable habitats limited to gravel, sandy gravel, and gravelly sand (Folk, 1954; see Figure 1.10 of **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**). Because spawning is restricted to these substrates, any disturbance or temporary loss of such areas can significantly impact herring reproduction. As demersal spawners, herring deposit their eggs directly on the seabed, making both the eggs and the spawning grounds highly susceptible to localised physical disturbance and habitat alteration. Analysis of herring larvae distribution using heatmapping indicates a minor overlap between the Local Study Area and historically documented spawning grounds (Coull et al., 1998).

74. Evidence from other UK offshore windfarms, such as Horns Rev (Jensen et al., 2004) and Beatrice Offshore Windfarm (BOWL, 2021), indicates that both sandeel and herring populations typically rebound rapidly after construction-related disturbance. This resilience is largely due to recolonisation from adjacent undisturbed areas and larval recruitment. However, sandeel are particularly sensitive to subsurface disturbance during their overwintering period (Wright et al., 2000). Despite this, sediment recovery in sandy and muddy environments generally occurs within one to two years (Newell et al., 1998).

75. There is also an overlap in Nephrops spawning ground and the Local Study Area based on Coull et al., 1998 (Figure 1.8 of **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report)**. However, as shown in **Figure 9.2**, the burrow densities indicate that areas of suitable habitat do not overlap with the WDA itself and have a relatively small presence within the Local Study Area when compared to the overall areas of suitable habitat and distribution of burrows. For this reason, any physical disturbance within the WDA is unlikely to have a meaningful impact on Nephrops spawning areas.

76. For other pelagic species with spawning grounds that overlap with the Local Study Area such as Norway pout and sprat, spawning is not strongly dependent on substrate type as spawning often occurs in open water, with eggs and larvae being pelagic. Pelagic, demersal, diadromous fish and elasmobranchs (including basking shark) are highly mobile and can readily avoid localised disturbance, further reducing the likelihood of significant impacts. The sensitivity of spawning grounds is therefore considered to be **low** for most fish and shellfish species spawning grounds with the exception of herring and sandeel spawning grounds which is considered to be **high**. This is due to the potential for this key life stage to be interrupted, and due to the particular sensitivity of the species to physical disturbance on the seabed. Spawning and nursery grounds are also considered sensitive by ICES (Egan, et al., 2020).



Windfarm Development Area
Local Study Area

Norway Lobster (*Nephrops norvegicus*) Burrow Density (Average of Burrows 2007 - 2016)

- 0
- 0.1 - 0.25
- 0.251 - 0.5
- 0.51 - 1.0
- 1.1 - 1.5
- 1.51 - 2.45

N

0 10 20 Kilometres

1	20/01/2026	FC	GC	MI	PM
REV	REV DATE	GIS CREATOR	GIS REVIEWER	TECHNICAL CHECKER	TECHNICAL APPROVER

DRAWING NUMBER	MCW-DWF-ENV-MAP-RHS-000147		
DATUM	ETRS89	PROJECTION	UTM Zone 29N
SCALE	1:500,000	PAGE SIZE	A3
PROJECT TITLE	MachairWind		

Figure 9.2: Nephrops Burrow Density within the Local Study Area

NOT TO BE USED FOR NAVIGATION

Haskoning
Enhancing Society Together

ScottishPower
Renewables

9.11.1.1.1.2 Nursery Grounds

77. Fish and shellfish species most vulnerable to temporary disturbance/habitat loss are those whose nursery areas coincide with the boundaries of the fish and shellfish ecology Local Study Area. These include herring, plaice, whiting, blue whiting and spurdog (*Squalus acanthias*). There is also overlap with low or unknown intensity nursery grounds for sandeel, Norway pout, mackerel, plaice, cod, saithe (*Pollachius virens*), ling (*Molva molva*), European hake (*Merluccius merluccius*), monkfish, Nephrops, common skate (*Dipturus intermedius*) and spotted ray (*Raja montagui*). See Figure 1.6 and Figure 1.7 in **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**.

78. Species that rely on the area for early life stages, such as shelter, feeding, and growth, make these nursery grounds ecologically significant. However, juvenile stocks of fish have high levels of adaptability and tolerance to transient stress and disturbance and are therefore less sensitive to physical disturbance than spawning adults. As such, they are expected to temporarily relocate during construction activities and return once disturbance ends. Many of these species exhibit broad movement patterns and are known to recolonise affected areas quickly, particularly in dynamic sediment environments where habitat recovery occurs rapidly. Sandeel larvae for example tend to disperse widely before settling in suitable sediments (Ellis et al., 2012). Based on their extensive occurrence within the wider geographic context, any potential disturbance to these areas due to construction operations is not predicted to have a significant impact on future local fish populations.

79. Shellfish species such as Nephrops, scallops, lobsters, and edible crabs are generally less mobile than many fish species, but they tend to recover quickly after localised seabed disturbance. Evidence from studies at offshore windfarms (Roach et al., 2018; RPS, 2019; Ossian, 2024) suggests that temporary construction-related closures can even provide short-term benefits to crustacean populations by reducing fishing pressure during the disturbance period.

80. The sensitivity of nursery grounds is therefore considered to be **medium** for all receptors.

9.11.1.1.1.3 Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs

81. Pelagic fish (e.g., mackerel, herring) spend most of their time in the water column, reducing their exposure to seabed disruption. Diadromous species such as Atlantic salmon (a PMF) and European eel migrate between freshwater and marine environments and, during their marine phase, primarily occupy the water column. This behaviour means they are largely unaffected by seabed disturbance or temporary habitat loss during construction activities. As such, no impact on their national conservation status or the PMF status of Atlantic Salmon is predicted.

82. Demersal fish and elasmobranchs use the seabed for feeding, shelter, and resting, making them more vulnerable to physical disturbance from activities such as cable laying, jack-up vessel legs, vessel anchors, and seabed preparation. However, these species are also generally mobile and behaviourally adaptable, allowing them to relocate during periods of disturbance and return once construction ceases. Recovery is expected to occur naturally, particularly in dynamic sediment environments where habitat restoration is rapid.

83. Basking shark is a PMF in Scotland and is also protected under the Wildlife and Countryside Act 1981, reflecting its conservation importance at a national level. As with all species in these receptor groups, basking shark have high levels of mobility and are, therefore, capable of navigating away from any temporary physical disturbance/habitat loss caused by construction activities (EMU, 2004).

84. The sensitivity of pelagic, demersal, diadromous fish and elasmobranch species is therefore considered to be **low.**

9.11.1.1.1.4 Shellfish

85. Several of the shellfish species assessed (such as king scallop and common whelk) are generally sessile, or at least slow-moving. Loss of habitats may occur in locations that these species inhabit during foundation installation, cable installation and seabed preparations, or from activities that could cause disturbance or burial of these species present in the vicinity of the works.

86. Other shellfish species that are relatively mobile (such as velvet crab, brown crab, Nephrops and European lobster) would generally be able to move away from any area of seabed disturbance. Shellfish species that are less mobile (small crabs), could be directly impacted and are likely to be most vulnerable.

87. Cephalopods such as squid and cuttlefish rely on benthic habitats for food and shelter, (Bloor, 2012). However, these species are known to have short life cycles (typically 1-2 years), high reproductive output, and rapid growth rates, which enable them to recolonise disturbed areas quickly (Boyle & Pierce, 1994). While construction activities may temporarily displace individuals, their high fecundity and mobility support rapid population recovery once seabed conditions stabilise.

88. The sensitivity of shellfish species is therefore considered to be **medium.**

9.11.1.1.1.5 Designated Sites

89. The sensitivity of designated sites to temporary physical disturbance and habitat loss will differ between sites depending on what feature the site is designated for. The nearest site to the WDA is the Sea of the Hebrides NCMPA which is designated for basking shark which have been assessed separately in **Section 9.11.1.1.1.3** and considered to be of low sensitivity. All other designated sites are outwith the Local Study Area and given the highly localised nature of the impact, disturbance is expected to be minimal.

90. The sensitivity of designated sites is therefore considered to be **low.**

9.11.1.1.2 Magnitude of Impact

9.11.1.1.2.1 Construction

91. The maximum estimated area of seabed habitat within the WDA that could be temporarily disturbed or lost during construction is 25,385,076 m², accounting for 5.67% of the WDA (see **Table 9.5**).

92. The WDA predominantly comprises sediments that provide preferred habitat for sandeel, and there is some overlap with mapped herring spawning grounds and the Local Study Area. However, the spatial extent of disturbance is relatively limited, will be intermittent, and short-term, as WDA infrastructure installation will not occur simultaneously across the entire WDA. Recovery of sediments and associated communities is expected to begin promptly once works in a given location are completed (see **Chapter 8 Benthic Ecology**). With 25,385,076 m² of seabed disturbed in the WDA during construction due to seabed preparation for foundation and offshore cable installation, the disturbance is minimal, in comparison to the size of the spawning grounds for sandeel, which cover large areas across the region beyond the Local Study Area (see Figure 1.3 in **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**) and, therefore, spawning potential of the wider populations would not be impacted. There is no potential for seabed

activities in the WDA to disturb herring, given there is no overlap between the WDA and herring spawning grounds.

93. Evidence from monitoring at other offshore windfarms, including Horns Rev in the Baltic Sea (Jensen et al., 2004; van Deurs et al., 2012) and Beatrice Offshore Wind Farm (BOWL, 2021), indicates that construction and O&M activities have not resulted in significant adverse effects on sandeel populations. Whilst some construction activities may occur during the spawning period, these activities are expected to be short term, intermittent and highly localised, thus potential effects on spawning success are predicted to be minimal. Recovery typically occurs rapidly post-construction, with sandeel abundance remaining stable or increasing over time. Given the widespread availability of similar substrate types and the extensive distribution of sandeel spawning grounds across the North Atlantic, any temporary habitat loss within the WDA is expected to be minor and reversible.

94. For sandeel, there is only a very minor overlap between the WDA and mapped potential spawning habitat (Coul et al., 1998c and see Figure 1.3 in **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**). Any disturbance would be small in spatial extent and temporary in duration, and represents only a very small proportion of the wider available spawning grounds. Preferred sandeel spawning sediments, sand, slightly gravelly sand and gravelly sand, are widely distributed locally and throughout the North Sea and North Atlantic region. For herring, there is no overlap between the WDA with areas of mapped spawning habitat, and only a slight overlap with the Local Study Area. The footprint of disturbance represents only a very small proportion of the available regional spawning grounds and suitable coarse gravel and sand substrates within the WDA are limited. Alternative spawning habitat is widely available locally and across the North Atlantic.

95. Other receptors are expected to experience similarly low levels of impact. Nursery grounds for herring, sandeel, and other less sensitive species are widely distributed both within the WDA and across the wider North Atlantic region. This availability, combined with the limited spatial extent and temporary nature of disturbance, means that any effect on nursery habitats will be limited. For pelagic species with spawning grounds that overlap with the Local Study Area such as Norway pout and sprat, the disturbance is also expected to be minimal in comparison to the size of the spawning grounds for both species, which cover large areas across the region beyond the Local Study Area.

96. For demersal species there is an area of overlap with plaice spawning grounds of undetermined intensity and the Local Study Area however overlap with the WDA itself is limited, and since construction activities are expected to disturb only about 5.67% of the WDA seabed, any impact on spawning is expected to be minimal.

97. Diadromous fish, including Atlantic salmon (a PMF) and European eel, predominantly occupy the water column during their marine phase and are therefore not directly dependent on seabed habitats affected by temporary construction-related disturbance. Elasmobranchs, including highly mobile species such as basking shark (a PMF and protected under the Wildlife and Countryside Act 1981), are capable of avoiding temporary and localised seabed disturbance. Basking sharks feed in surface waters and exhibit wide seasonal movements across the region. As construction activities will not alter pelagic habitats or disrupt feeding behaviour, there is no mechanism for population-level effects or for impacts on their protected status.

98. Shellfish species associated with the affected area are also widespread throughout adjacent habitats. While individual shellfish may be impacted through burial or direct mortality, the small footprint of disturbance will allow rapid recolonisation from surrounding populations, preventing any population-level effects.

99. With respect to designated sites, the area of disturbance within the WDA does not overlap with any designated features or qualifying interests that rely on seabed habitat within the footprint of temporary disturbance. No pathways exist for indirect effects such as changes to prey availability, water quality or sediment transport that could affect designated site integrity.

100. The magnitude of impact from seabed disturbance and habitat loss for all receptors is therefore considered to be **negligible**.

9.11.1.1.2.2 O&M

101. O&M activities within the WDA have the potential to cause temporary physical disturbance and associated habitat loss. The maximum anticipated footprint for such disturbance is 22,886 m² and is outlined in **Table 9.5**. The extent of disturbance would be lower than that for the construction phase but would occur as intermittent (short term) events throughout the operational lifetime of the Project.

102. The primary source of disturbance will be the deployment of jack-up vessels during cable reburial and repair works. These activities are expected to result in impacts similar to those observed during the construction phase, remaining highly localised within the WDA. Consequently, the spatial extent of disturbance is considered minimal and recovery of sediments and recolonisation by communities is anticipated to begin promptly following the removal of equipment.

103. Due to reduced scope for temporary physical disturbance and habitat loss during O&M compared to construction, the magnitude of impact will be lower. However, the magnitude is considered to be the same as for construction for all receptor groups (see **Section 9.11.1.1.2.1**). The magnitude of impact from seabed disturbance and habitat loss for all receptors is therefore considered to be **negligible**.

9.11.1.1.2.3 Decommissioning

104. Decommissioning impacts will be associated with the removal of cables and sections of WTG / OSP foundations which will be cut at seabed level. Because this will not involve seabed preparation and cable burial, impacts on the seabed are likely to be similar in nature but reduced in magnitude compared to construction. Whilst impact magnitudes are likely to be reduced in comparison to construction, on a precautionary basis, the magnitude of impact is assessed to be the same as for the construction phase (**Section 9.11.1.1.2.1**).

105. The magnitude of impact from seabed disturbance and habitat loss for all receptors is therefore considered to be **negligible.**

9.11.1.1.3 Significance of Effect

106. Overall, it is predicted that sensitivity of all receptors is **low** to **medium** (except **high** for sandeel and herring spawning grounds) and the magnitude of impact is **negligible**. The effect is therefore of **negligible** to **minor adverse** significance, which is **not significant** in EIA terms.

107. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

Table 9.11 Significance of effect for Impact 1: temporary physical disturbance/habitat loss

Phase	Receptor	Sensitivity	Magnitude	Significance of Effect	Additional Mitigation	Residual Effect
Construction	Spawning Grounds	Low – apart from herring and sandeel spawning grounds which have a high sensitivity	Negligible	Negligible or Minor Adverse	N/A	Not significant
	Nursery Grounds	Medium	Negligible	Negligible	N/A	Not significant
	Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs	Low	Negligible	Negligible	N/A	Not significant
	Shellfish	Medium	Negligible	Negligible	N/A	Not significant
	Designated Sites	Low	Negligible	Negligible	N/A	Not significant
O&M	Spawning Grounds	Low – apart from herring and sandeel spawning grounds which have a high sensitivity	Negligible	Negligible or Minor Adverse	N/A	Not significant
	Nursery Grounds	Medium	Negligible	Negligible	N/A	Not significant
	Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs	Low	Negligible	Negligible	N/A	Not significant
	Shellfish	Medium	Negligible	Negligible	N/A	Not significant
	Designated Sites	Low	Negligible	Negligible	N/A	Not significant
Decommissioning	Spawning Grounds	Low – apart from herring and sandeel spawning grounds which have a high sensitivity	Negligible	Negligible or Minor Adverse	N/A	Not significant
	Nursery Grounds	Medium	Negligible	Negligible	N/A	Not significant
	Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs	Low	Negligible	Negligible	N/A	Not significant
	Shellfish	Medium	Negligible	Negligible	N/A	Not significant
	Designated Sites	Low	Negligible	Negligible	N/A	Not significant

9.11.1.2 Impact 2: Increased SSCs and Sediment Redeposition

9.11.1.2.1 Sensitivity

108. Direct increased SSCs and sediment redeposition within the WDA during the construction, O&M, and decommissioning phases will occur as a result of a range of activities (as set out in **Table 9.5**) including seabed preparation and cable installation. Suspended sediment has the potential to impair respiratory, filter feeding or reproductive functions, including the disruption of migration/spawning activity. Sediment deposition, especially if it changes the characteristics of the existing seabed sediments, could affect the quality of spawning and nursery habitats.

109. Sands and silts released during seabed preparation and foundation construction activities would be temporarily deposited on the seabed but are more likely to be remobilised and redistributed through natural hydrodynamic processes than gravels and clays, which are likely to remain on the seabed for a longer period of time after settlement. As discussed in **Chapter 7 Marine Physical Environment**, the WDA is predominantly composed of sand and gravelly sand. Based on the sediment sizes present, finer suspended sediment is expected to exist as a passive plume, extending to a maximum of 11 km towards the south, with other sediments settling quickly in proximity to its release (ABPmer, 2008).

9.11.1.2.1.1 Spawning Grounds

110. Sediment re-deposition can alter the seabed's particle size distribution, which may lead to the loss of spawning habitats for species that require specific substrates, such as herring and sandeel. Additionally, increased concentrations of suspended sediment could discourage adult fish from entering their usual spawning grounds.

111. There are mapped spawning habitats for several fish and shellfish species within the Local Study Area (which includes the tidal excursion zone), which could be affected by temporary elevated SSCs and sediment deposition during construction (Figure 1.3 – Figure 1.10 of **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**) (Coull et al., 1998; Ellis et al., 2012). Species potentially impacted include sandeel, herring, Norway pout, sprat, plaice and Nephrops) (Coull et al., 1998; Ellis et al., 2012). Eggs and early larval stages do not have the same capacity to avoid increased SSCs as juvenile or adult fish, as they are either passively drifting in the water column, or present on/attached to benthic substrates.

112. For herring, potential increases in SSC and sediment deposition within suitable spawning habitats are unlikely to pose a major risk, as research indicates herring eggs can tolerate relatively high sedimentation levels (Birklund & Wijsman, 2005). Laboratory studies demonstrate that SSCs of approximately 250 mg/L can cause sediment particles to adhere to the surface of herring eggs during the early adhesion period, particularly within the first two hours post-fertilisation (Griffin et al., 2008). Prolonged smothering or sediment accumulation beyond natural dispersion thresholds could negatively affect spawning success, particularly in low-energy environments.

113. For other pelagic species with spawning grounds that overlap with the Local Study Area such as Norway pout and sprat, their spawning is not strongly dependent on substrate type as spawning often occurs in open water, with eggs and larvae being pelagic. A lower sensitivity to sediment loading for spawning, as these species do not have the same level of spatial dependency on a specific substrate is expected. Burial by fine sediment may also prevent larvae from successfully emerging following hatching; however, the literature does not provide any species-specific or universal quantitative burial-depth thresholds for these effects (Wilkens & Suedel, 2017).

114. For demersal species such as plaice, whilst their spawning is dependent on substrate type, they are generally considered to have low sensitivity to temporary localised disturbance of sediments, as these species are adaptable and can utilise a range of suitable substrates across their wider habitat.

115. Similarly whilst there is an overlap in historical Nephrops spawning grounds and the Local Study Area, the overlap between burrow density and the WDA is small and since the 'Sandy' and 'gravelly Sand' sediment type which makes up most of the WDA is not preferred habitat for Nephrops. Spatial dependency experienced by Nephrops isn't as high as it may be for species such as herring and sandeel.

116. The sensitivity of spawning grounds is therefore considered to be **medium** for most fish and shellfish species spawning grounds with the exception of herring and sandeel spawning grounds which is considered to be **high.**

9.11.1.2.1.2 Nursery Grounds

117. Nursery habitats for several species may be affected by increased SSCs and sediment redeposition during all phases of the WDA, either within the Local Study Area, or up to approximately 11 km away (equivalent to one spring tidal ellipse). Species potentially impacted include herring, sandeel, Norway pout, mackerel, plaice, cod, saithe, whiting, ling, European hake, blue whiting, monkfish, Nephrops, spurdog, common skate, and spotted ray. For most of these species, nursery ground intensity within the area is low or not well defined, with the exception of whiting, which is considered to have high-intensity nursery grounds.

118. Juvenile fish stocks are generally considered tolerant to short-term increases in SSCs due to their high adaptability and resilience to transient stress. Their mobility enables them to avoid areas with elevated sediment levels during construction. Nursery habitats for key species are widely distributed across the region, and this, combined with their behavioural flexibility, allows juveniles to temporarily relocate and return once conditions stabilise (Rees et al., 1990; Lambert et al., 2014). Species such as plaice, whiting, and sandeel have shown rapid recovery following disturbance, particularly in dynamic sediment environments where natural habitat restoration occurs quickly.

119. The sensitivity of shellfish species is therefore considered to be **medium.**

9.11.1.2.1.3 Pelagic Fish, Demersal Fish, Diadromous Fish and Elasmobranchs

120. The sensitivity of fish groups to elevated SSCs has been assessed based on their ecological traits and mobility. Diadromous species such as Atlantic salmon (a PMF), sea trout, lamprey, and European eel are adapted to naturally turbid estuarine environments and therefore exhibit low sensitivity to increased turbidity and reduced light conditions (Behrmann-Godel & Eckmann, 2003; Hansen et al., 2016; Christoffersen et al., 2018). Their high mobility and preference for the water column mean there is no risk of smothering or burial and therefore no impact on their national status or PMF status for Atlantic salmon is predicted.

121. Similarly, pelagic fish, demersal fish, and elasmobranchs are considered to have low sensitivity overall. These groups are highly mobile and can avoid areas with elevated SSCs, reducing the likelihood of sediment-related impacts. Temporary increases in SSCs could temporarily affect feeding efficiency during foraging periods (Robertson et al., 2006). Demersal species, including plaice, cod, saithe, whiting, ling, European hake, monkfish, and blue whiting, and elasmobranchs such as spurdog, common skate, and spotted ray may have a slightly higher chance of encountering sediment disturbance due to their seabed association. Nevertheless, their mobility and behavioural

adaptability allow them to relocate during construction and return once conditions stabilise, supporting natural recovery.

122. Basking shark is a PMF in Scotland and is also protected under the Wildlife and Countryside Act 1981, reflecting its conservation importance at a national level. Like other elasmobranchs, basking sharks are highly mobile and can readily avoid areas with increased SSCs, minimizing the risk of smothering or burial. However, because they feed primarily on plankton, increased SSCs may reduce their ability to detect zooplankton. Sediment plumes can also indirectly affect food availability by reducing light penetration and lowering zooplankton abundance.

123. The sensitivity of pelagic fish, demersal fish, diadromous fish and elasmobranchs is therefore considered to be **low** with the exception of basking shark, which is considered to be **medium**.

9.11.1.2.1.4 Shellfish

124. Mollusc species, including bivalves and gastropods, generally have limited mobility and cannot easily escape areas affected by elevated SSCs or sediment redeposition. Despite this, many species demonstrate tolerance to increased turbidity (Mainwaring et al., 2014). For example, the Marine Evidence-based Sensitivity Assessment (MarESA) indicates that ocean quahog, a PMF in Scotland and an OSPAR Threatened and/or Declining Species, is unlikely to be significantly impacted by higher SSCs, as it can burrow for several days to avoid sudden changes.

125. Crustaceans also have restricted mobility, but some species, such as Nephrops, demonstrate resilience to partial smothering (Johnson et al., 2013). MarESA further notes that shellfish species like brown crab exhibit low sensitivity to increased SSCs. Because any rise in sediment levels will be short-term and highly localised, impacts on individual crustaceans are expected to be minimal. There is no significant risk to the wider population, as these species are generally resilient and capable of tolerating temporary changes in environmental conditions.

126. Cephalopods present within the area are likely to be feeding or foraging, so temporary increases in SSCs could reduce feeding efficiency. However, these species are moderately mobile and can actively avoid areas with elevated sediment levels. As they are not strictly bottom-dwelling, there is no risk of smothering or burial (Villanueva, Perricone & Fiorito, 2017). Any behavioural changes or short-term reductions in feeding success are expected to be reversible and of limited duration, with no long-term impact on population structure or function.

127. The sensitivity of shellfish is therefore considered to be **medium.**

9.11.1.2.1.5 Designated Sites

128. The sensitivity of designated sites to increased SSCs and sediment redeposition will differ between sites depending on what feature the site is designated for. The Sea of the Hebrides NCMPA which is designated for basking shark has been assessed separately in **Section 9.11.1.2.1.3** and is considered to be of medium sensitivity. All other designated sites are outwith the Local Study Area and given the maximum tidal excursion area is included within the Local Study Area, disturbance is expected to be minimal. Despite this, in order to recognise the designations, a precautionary approach has been taken.

129. The sensitivity of designated sites is therefore considered to be **medium.**

9.11.1.2.2 Magnitude of Impact

9.11.1.2.2.1 Construction

130. Construction activities are expected to cause temporary increases in SSCs, which can reduce water clarity and potentially affect species that rely on visual cues for feeding, such as certain fish and cephalopods. Reduced light penetration may also limit phytoplankton productivity, while sediment deposition could smother eggs, larvae, and filter-feeding organisms. The maximum volume of suspended sediment is 20,251,431 m³ and is outlined in **Table 9.5.** Sediment deposition modelling (**Appendix 7.1 Marine Physical Environment Numerical Modelling**) shows that most activities cause seabed-level changes of less than 5 cm, a commonly used indicative ecological threshold for potential smothering of benthic eggs and sessile early life stages. Only cable ploughing exceeds this threshold, creating deposition of 0.1-0.2 m within approximately 200 m of the cable plough trench and 0.2-0.3 m within 100 m. Predicted deposition is highest at the OSPs, where multiple cable trenches converge, producing modelled values of up to 4 m. However, this is a modelling artefact resulting from the assumption that sediment continually accumulates with no redistribution between installation phases. In reality, once sediment settles, natural bedload transport will disperse it before the next cable is installed, preventing cumulative build-up. Given the highly dynamic, sand-dominated seabed, any deposited material will continue to be redistributed, and seabed levels will return towards baseline conditions once construction activities cease.

131. Fine particles may mobilise contaminants bound to sediments, introducing them into the water column and creating a risk of sublethal effects on fish and shellfish, including impaired feeding and reproduction, however due to the negligible concentrations of contaminants present in the WDA (**Chapter 7 Marine Physical Environment**), this impact was scoped out for further assessment. These impacts are also generally associated with prolonged or large-scale disturbance, which is not anticipated within the WDA.

132. Species present in the area, including demersal and pelagic fish, elasmobranchs such as skates and rays, basking sharks, and diadromous species, are adapted to naturally dynamic sediment conditions and variable turbidity, particularly in offshore environments where sediment movement is frequent. Many of these species exhibit behavioural responses such as relocating or adjusting feeding strategies when faced with short-term changes in water clarity. The predicted increases in SSCs and sediment deposition during construction are expected to be highly localised, short-lived, and within the natural variability of offshore habitats. As a result, fish and shellfish populations are likely to tolerate these changes without lasting ecological effects.

133. Nursery and spawning grounds for several species overlap with the WDA or fall within the tidal ellipse where sediments may disperse. However, the affected areas represent only a very small proportion of the extensive nursery grounds distributed around the Scottish, Irish and English coasts (Figure 1.3 – Figure 1.10 of **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**). For herring, there is no mapped overlap between the WDA and recognised spawning grounds (Ellis et al., 2012), meaning 0% of regional spawning habitat is exposed to SSC increases, while the small portion of low-intensity nursery ground in the Local Study Area represents well under 1% of the wider nursery distribution.

134. Similarly, sandeel, which have highly specific substrate requirements for spawning, may be vulnerable to SSC and sediment re-deposition during construction activities. Modelling undertaken for the Project (**Appendix 7.1 Marine Physical Environment Numerical Modelling**) indicates that predicted deposition is highly localised and composed of the same sand-dominated material already present within the WDA. Combined with the naturally dynamic bedload transport regime, this means

no change to sediment grain-size distribution within preferred sandeel habitat is expected. For sandeel, only a minor part of the Coull et al. (1998) low-intensity nursery polygon intersects the maximum tidal excursion area. This equates to a less than 2% overlap of regional nursery extent, and areas where modelled deposition exceeds 5 cm, are restricted to within approximately 200 m of cable plough trenches. Given the wide geographical range of species and temporary nature of SSC increases predicted by the modelling, any disturbance during construction is unlikely to significantly affect future local fish populations.

135. Similarly, diadromous species migrating through the area, such as Atlantic salmon and sea trout may encounter short-term sediment plumes, but these species are highly mobile and capable of avoiding areas of elevated SSCs. The likelihood of exposure is low.

136. Demersal and pelagic fish and elasmobranchs are widely distributed across the west coast of Scotland, where turbidity fluctuations from storm events are common. SSC increases from construction are unlikely to exceed natural background levels except in very localised areas for short durations and individual plumes will return to baseline within hours of construction activities (**Appendix 7.1 Marine Physical Environment Numerical Modelling**).

137. When reviewing thirty months of DAS undertaken for the Project, very low numbers of basking shark were recorded within the WDA. The digital aerial survey results therefore indicate that the WDA is not likely to be an area where a large number of basking sharks are present and it can be expected that if any feeding behaviour occurs, it is expected to be at low levels. In addition, the spatial footprint of the predicted SSC and sediment redeposition effects is highly restricted. Although the Study Area appropriately incorporates the full tidal-excursion ellipse for assessment purposes, the worst-case SSC plumes are short-lived and disperse within hours of each activity, and that measurable SSC increases only occur within a small area surrounding the point of disturbance rather than across the entire ellipse. Similarly, sediment redeposition is confined to highly localised areas surrounding cable ploughing and seabed-preparation locations (**Chapter 7 Marine Physical Environment)**. Given this limited spatial extent of effects and the high mobility and broad-scale movement patterns of basking sharks, individuals are readily able to move away from any temporary, localised increase in turbidity or seabed disturbance. As a result, even if basking sharks transit through the WDA, the scale and duration of effects are unlikely to constrain their movement or disrupt feeding opportunities at a population-relevant level. The Sea of the Hebrides NCMPA, designated for basking sharks is the only designated site that may see an increase in background levels of SSCs, however there is only a 766 m overlap of the tidal ellipse with the NCMPA, and SSC increases would be limited and temporary, effects would be short-lived meaning the impact on designated site features is not expected to be high.

138. The magnitude of impact from increased SSCs and sediment redeposition for all receptors is therefore considered to be **negligible**.

9.11.1.2.2.2 O&M

139. O&M activities within the WDA have the potential to cause an increase in SSCs and sediment redeposition. The maximum volume of suspended sediment is approximately 68,657.14 m^3 and is outlined in **Table 9.5**. The extent of disturbance would be lower than that for the construction phase but would occur as intermittent events throughout the operational lifetime of the Project.

140. The primary source of increased SSCs will be the activities which disturb the seabed, for example when conducting repairs on offshore cables, they may be brought to a surface vessel, jointed and then re-laid. These activities are predicted to generate sediment plumes comparable to those

observed during construction, but their spatial extent will remain minimal, and concentrations will dissipate fully within several hours, under prevailing hydrodynamic conditions. The extent of disturbance would be lower than that for the construction phase but would occur as intermittent events throughout the lifetime of the Project and be similar in nature.

141. Given the reduced scale and frequency of SSC increases during O&M compared to construction, the magnitude of impact is expected to be lower. However, for precautionary purposes, the same magnitude classification applied during construction has been adopted for all receptor groups (see **Section 9.11.1.2.2.1**). SSC increases are temporary, localised, and within the range of natural variability for dynamic offshore environments.

142. The magnitude of impact from increased SSCs and sediment redeposition for all receptors is therefore considered to be **negligible**.

9.11.1.2.2.3 Decommissioning

143. Decommissioning impacts will be associated with the removal of cables and sections of WTG / OSP foundations which will be cut at seabed level. Because this will not involve seabed preparation and cable burial, impacts on the seabed are likely to be similar in nature but reduced in magnitude than construction. Whilst impact magnitudes are likely to be reduced in comparison to construction, on a precautionary basis for the following decommissioning phase impacts, the magnitude of impact is assessed to be the same as for the construction phase (**Section 9.11.1.2.2.1**).

144. The magnitude of impact from increased SSCs and sediment redeposition for all receptors is therefore considered to be **negligible** (see **Section 19.11.1.2.2.1**).

9.11.1.2.3 Significance of Effect

145. Overall, it is predicted that sensitivity of the receptors is **low** or **medium** (**high** for sandeel and herring spawning grounds) and the magnitude of impact is **negligible**. The effect is therefore of **negligible** to **minor adverse** significance, which is **not significant** in EIA terms.

146. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

Table 9.12 Significance of effect for Impact 2: increased SSCs and sediment redeposition

Phase	Receptor	Sensitivity	Magnitude	Significance of Effect	Additional Mitigation	Residual Effect
Construction	Spawning Grounds	Medium - apart from herring and sandeel spawning grounds which have a high sensitivity	Negligible	Negligible – apart from herring and sandeel spawning ground which are Minor Adverse	N/A	Not significant
	Nursery Grounds	Medium	Negligible	Negligible	N/A	Not significant
	Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs	Low – apart from basking shark which have a medium sensitivity	Negligible	Negligible	N/A	Not significant
	Shellfish	Medium	Negligible	Negligible	N/A	Not significant
	Designated Sites	Medium	Negligible	Negligible	N/A	Not significant
O&M	Spawning Grounds	Medium - apart from herring and sandeel spawning grounds which have a high sensitivity	Negligible	Negligible – apart from herring and sandeel spawning ground which are Minor Adverse	N/A	Not significant
	Nursery Grounds	Medium	Negligible	Negligible	N/A	Not significant
	Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs	Low – apart from basking shark which have a medium sensitivity	Negligible	Negligible	N/A	Not significant
	Shellfish	Medium	Negligible	Negligible	N/A	Not significant
	Designated Sites	Medium	Negligible	Negligible	N/A	Not significant
Decommissioning	Spawning Grounds	Medium - apart from herring and sandeel spawning grounds which have a high sensitivity	Negligible	Negligible – apart from herring and sandeel spawning ground which are Minor Adverse	N/A	Not significant
	Nursery Grounds	Medium	Negligible	Negligible	N/A	Not significant

Phase	Receptor	Sensitivity	Magnitude	Significance of Effect	Additional Mitigation	Residual Effect
	Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs	Low - apart from basking shark which have a medium sensitivity	Negligible	Negligible	N/A	Not significant
	Shellfish	Medium	Negligible	Negligible	N/A	Not significant
	Designated Sites	Medium	Negligible	Negligible	N/A	Not significant

9.11.1.3 Impact 3: UWN and Vibration

147. Impacts from UWN and vibration have been considered within the Regional Study Area to encompass the 88 km ZoI during the construction, O&M, and decommissioning phases of the Project. Construction activities such as piling for foundations, UXO clearance, and vessel operations during offshore cable installation can generate UWN and vibration, potentially affecting fish and shellfish species. The 88 km ZoI represents the worst-case impact range associated with sequential piling of six pin-piles and is based on the most precautionary fish-behaviour threshold (temporary threshold shifts in hearing (TTS)). Impacts such as recoverable injury occur at far smaller ranges (**Appendix 10.1 UWN Modelling Report**).

148. Impacts may include physical injury, physiological stress, mortality, or behavioural changes such as avoidance and acoustic masking. Both sound pressure and particle motion are relevant mechanisms of impact. While traditional assessments have focused on sound pressure, recent research highlights that particle motion is often more ecologically significant for many fish and invertebrates, particularly species lacking gas-filled organs, such as elasmobranchs and invertebrates (Hawkins & Popper, 2016; Popper et al., 2014). Although understanding of UWN effects continues to improve, uncertainty remains due to limited empirical data for many taxa (Hawkins & Popper, 2016; Williams et al., 2015). The most widely applied thresholds for mortality, injury, and TTS in fish are provided by the Acoustical Society of America guidelines (Popper et al., 2014).

149. Detailed UWN modelling has been undertaken and is presented in **Appendix 10.1 UWN Modelling Report**. Noise modelling for impact piling at the WDA considered multiple locations and piling configurations. The worst-case scenario was identified as the installation of six sequential jacket pin piles at the West modelling location, where deeper water and site conditions result in the greatest predicted sound transmission. Using Popper et al. (2014) criteria, cumulative sound exposure levels (LE,p,24h) for stationary receptors indicate potential recoverable injury ranges extending up to 88 km under unmitigated conditions. This represents the maximum predicted range for fish species most sensitive to impulsive noise exposure. For fleeing receptors (assumed swim speed of 1.5 m/s), the predicted unmitigated range is substantially smaller, but still precautionary (**Table 9.14**).

150. All injury and behavioural disturbance thresholds applied in this assessment are based on peer-reviewed guidance from Popper et al. (2014) and Hawkins & Popper (2016).

9.11.1.3.1 Sensitivity

151. Fish use sound for communication and to interpret their environment (Popper et al., 2018). Sensitivity to noise varies widely among species, meaning the potential impacts differ across taxa. High-intensity anthropogenic noise can cause severe injury or mortality, while lower levels may lead to temporary hearing loss, physiological stress, behavioural changes, or masking of biologically important sounds (Kastelein et al., 2017).

152. Current understanding of fish hearing is limited, as most research has been conducted under controlled acoustic conditions for only a few species (Popper & Hawkins, 2019). Existing assessments primarily focus on sound pressure, despite growing evidence that particle motion, a key component of underwater sound, is more relevant for many fish and invertebrates (Popper & Hawkins, 2018). However, particle motion remains poorly understood and is rarely incorporated into impact evaluations.

153. Studies examining UWN effects on fish and shellfish highlight the lack of robust data for defining clear impact thresholds (Hawkins & Popper, 2016; Popper et al., 2014). As a result, current assessments rely on broad criteria for injury and behavioural effects based on limited evidence.

154. The most widely accepted guidance for this assessment is provided by the Acoustical Society of America (ASA) Sound Exposure Guidelines for Fishes and Sea Turtles (Popper et al., 2014). These guidelines outline criteria for injury and behavioural responses and classify fish into four functional hearing groups based on anatomical features and hearing capabilities:

- **Group 1:** Fish without swim bladders. These species detect only particle motion and have limited sensitivity across a narrow frequency range;
- **Group 2:** Fish with swim bladders that do not assist hearing. These species are primarily sensitive to particle motion, with minimal sound pressure sensitivity;
- **Group 3:** Fish with swim bladders near, but not connected to, the ear (e.g., gadoids and eels). These species respond to both particle motion and sound pressure; and
- **Group 4:** Fish with specialised anatomical structures linking the swim bladder to the ear. These species are highly sensitive to sound pressure, have a broad frequency range extending into several kilohertz, and generally exhibit greater sensitivity than Groups 1-3.

155. Research into the effects of UWN on aquatic invertebrates, including shellfish, has shown that exposure can lead to behavioural and physiological changes (e.g., de Soto et al., 2013; Wale et al., 2013; Stenton et al., 2022). However, current evidence is insufficient to define clear sensitivity thresholds or establish noise levels at which impacts occur. Measurements of operational noise from both floating and fixed turbine designs indicate that tonal components typically occur below 1 kHz and at levels significantly lower than those associated with impulsive sources such as impact piling, suggesting that operational noise poses a comparatively low risk to invertebrates.

9.11.1.3.1.1 Spawning Grounds

156. Eggs and larvae are among the most vulnerable life stages to UWN because they cannot actively avoid exposure. While drifting with currents may reduce prolonged exposure, individuals close to piling activities remain at risk of mortality. Spawning adults may also experience behavioural disruption during high-noise events. Popper et al. (2014) identify thresholds for potential mortality or severe injury in eggs and larvae as greater than 210 dB SEL_{cum} or 207 dB SPL_{peak}. For this assessment, 207 dB SPL_{peak} has been adopted as the impact threshold, consistent with MMO guidance and supported by Bolle et al. (2012), who observed no damage to larval fish at SEL_{cum} levels up to 210 dB re 1 $\mu Pa^2 \cdot s$. These thresholds are considered precautionary because they represent the onset of possible effects, not levels at which impacts are expected to occur widely across individuals or species. The thresholds also apply to peak acoustic parameters that occur only very close to the source, whereas exposure levels decline rapidly with distance, meaning that only a very small proportion of eggs or larvae would be expected to encounter sound levels approaching the threshold. Within the WDA, spawning grounds for herring and sandeel require particular consideration due to their reliance on specific sediment types and more restricted spatial distribution, and, in the case of herring, their high hearing sensitivity, which means spawning activity could be disrupted by UWN. ICES maps and regional data confirm that preferred sandeel habitat overlaps with the WDA, and important herring spawning grounds occur within the wider ZoI (Figure 1.11 - Figure 1.12 of **Appendix 9.1 Fish (including Basking shark) and Shellfish Baseline Technical Report)**, which extends up to 88 km under worst-case cumulative exposure from six sequential pin-piles.

157. Most other species distribute eggs and larvae over broad areas, reducing sensitivity and increasing potential for avoidance. However, even though herring and sandeel spawning grounds may be more spatially restricted, all spawning habitats are afforded a similar level of precaution, recognising that early life stages of all species are inherently sensitive to UWN and unable to avoid exposure. The assessment therefore treats spawning areas consistently to ensure that potential risks to early life stages are not underestimated.

158. The sensitivity of spawning grounds is therefore considered to be **medium.**

9.11.1.3.1.2 Nursery Grounds

159. Nursery habitats within the WDA support early life stages of several fish species. For Group 1 species and Group 2 species, sensitivity to UWN is generally low. These species are highly mobile and can relocate away from noise sources once soft-start piling begins, reducing their exposure. However, sandeel represent an exception due to their burrowing behaviour and reliance on specific sediment types, which limits their ability to avoid disturbance within nursery areas.

160. Species in Groups 3 and 4 also use nursery grounds and are capable of moving away during piling activities. Despite this mobility, they are more acoustically sensitive because they detect both sound pressure and particle motion and are susceptible to barotrauma, making them relatively more vulnerable than Groups 1 and 2.

161. Eggs and larvae present in nursery grounds lack functional swim bladders and auditory structures, meaning they cannot detect sound pressure but can sense particle motion. This limited sensory capacity prevents active avoidance of noise sources, leaving them exposed to potential physical impacts such as tissue damage or developmental disruption during high-intensity activities like piling.

162. The sensitivity of nursery grounds is therefore considered to be **low** for Groups 1 and 2 species with the exception of sandeel, which is considered to be **medium**. The sensitivity for Groups 3 and 4 species is also considered to be **medium**.

9.11.1.3.1.3 Diadromous Fish

163. Diadromous species such as Atlantic salmon (a PMF), sea trout, river lamprey, and sea lamprey migrate through offshore waters only briefly, limiting their exposure to construction-related noise. These species exhibit low hearing sensitivity and are classified within Group 2 for Atlantic salmon and sea trout or Group 1 for river lamprey and sea lamprey.

164. Salmonids have a narrow auditory range and poor ability to discriminate between sounds (Hawkins & Johnstone, 1978). Field studies, including piling operations at Southampton Water (Nedwell et al., 2008), reported no evidence of trauma or behavioural disturbance in sea trout, which was used as a proxy for salmon. Laboratory research supports these findings: repeated tones and sweeps up to 2 kHz and intermittent low-frequency sounds similar to piling did not alter swimming behaviour in trout (Jesus et al., 2019), and high-intensity low-frequency sound had no effect on smolt migration (Knudsen et al., 2005). While very low-frequency infrasound (10 Hz) can deter smolt movement at extreme levels, piling energy occurs primarily above 20 Hz (Gill et al., 2012), making such effects unlikely. Despite their low acoustic sensitivity, diadromous species are recognised as PMFs and hold high conservation value and whilst there is no predicted impact on their national status or PMF status of Atlantic salmon a precautionary approach has been taken.

165. Lamprey and European eel, which lack swim bladders, fall into Group 1 and are considered to have very low sensitivity to UWN.

166. The sensitivity of diadromous fish is therefore considered to be **low.**

9.11.1.3.1.4 Pelagic Fish, Demersal Fish, and Elasmobranchs

167. As explained in **Section 9.11.1.3.1.2**, species in Group 1 and Group 2 are generally considered to have low sensitivity to UWN. Most species within these groups are highly mobile and are likely to vacate the area once soft-start piling begins.

168. Elasmobranchs, such as the thornback ray, lack a swim bladder or any other air-filled cavity, and are therefore classified within Group 1. Consequently, they are unable to detect sound pressure and instead respond only to particle motion (Casper et al., 2012). They are therefore considered as a group, to have low sound sensitivity. The basking shark, which lacks a swim bladder, also falls within this group. Basking shark is a PMF in Scotland and is also protected under the Wildlife and Countryside Act 1981, reflecting its conservation importance at a national level. However, similar to other elasmobranchs, basking sharks are highly mobile and can therefore move away from the affected area once soft-start piling begins. Basking sharks are listed as 'Endangered' on the IUCN Red List and are recognised by OSPAR as a threatened or declining species, following extensive historical exploitation in the northeast Atlantic (Witt et al., 2012). Despite their conservation status, as an elasmobranch with limited acoustic sensitivity, their sensitivity is in line with other elasmobranch species.

169. Within the WDA, the most acoustically sensitive species are herring, sprat, and cod. Herring and sprat (Group 4) are classified as hearing specialists, while cod (Group 3) exhibits moderate sensitivity.

170. Other demersal and pelagic species, such as haddock, whiting, and sandeel, are hearing generalists and therefore display lower sensitivity. That being said due to its burrowing behaviour and reliance on substrate, the sandeel may have limited ability to leave the affected area compared to other fish species. Outside of key spawning periods (which are covered in **Section 9.11.1.3.1.1**), in general, adult individuals within these receptor groups have the ability to move away from potentially damaging sound sources, and are expected to recover from any temporary behavioural responses quickly (Popper & Hawkins, 2012).

171. The sensitivity of pelagic fish, demersal fish, and elasmobranchs is therefore considered to be **low,** apart from sandeel, herring and sprat which is considered to be of **medium** sensitivity.

9.11.1.3.1.5 Shellfish

172. Research on lobsters indicates that exposure to high impulsive noise levels (greater than 220 dB) does not lead to increased mortality, loss of appendages, or impaired ability to regain normal posture. However, some avoidance behaviour has been observed (Payne et al., 2007).

173. Cephalopods have shown sensitivity to intense underwater sound in laboratory studies, where exposure to very high sound pressure levels has resulted in statocyst damage (e.g., André et al., 2011). However, the sound pressure levels predicted for piling activities during the Project are substantially lower than the levels associated with such effects in experimental studies, and therefore statocyst trauma is not expected under project conditions. Cephalopods are also highly mobile and are expected to move away from increasing noise levels once soft-start procedures begin (Fewtrell & McCauley, 2012).

174. The sensitivity of shellfish is therefore considered to be **low**.

9.11.1.3.1.6 Designated Sites

175. Several designated sites for fish and shellfish fall within the predicted ranges associated with potential mortality or injury from UWN and vibration. The modelled range for TTS extends approximately 88 km from the source.

176. The closest designated site is the Sea of the Hebrides NCMPA, located 4.3 km from the WDA. This site is designated for basking shark, which has been assessed separately in **Section 9.11.1.3.1.4** and classified as having **low** sensitivity.

177. Other sites within the 88km ZoI are listed in **Table 9.13.**

Table 9.13 Designated sites for fish and shellfish ecology features within the UWN 88km ZoI

Designated Site	Protected fish and shellfish ecology feature(s)	Closest approximate distance from the WDA (km)
Sea of the Hebrides NCMPA	Basking shark	4.3
Loch Sunart to the Sound of Jura NCMPA	Flapper skate	44.9
Loch Sween NCMPA	Native oyster *(Ostrea edulis)*	47.9
Upper Loch Fyne and Loch Goil NCMPA	Flame shell beds Horse mussel beds Ocean quahog aggregations	68.2
Loch Sunart NCMPA	Flame shell *(Limaria hians)* beds Northern feather star aggregations (*Leptometra celtica*) on mixed substrata Serpulid aggregations	69.7
Small Isles NCMPA	Fan mussel *(Atrina fragilis)* aggregations	79.8
Loch Creran NCMPA	Flame shell beds	80.2
Loch Creran SAC	Horse mussel *(Modiolus modiolus)* beds	80.3

178. At distances over several kilometres, behavioural responses are expected to be minimal, with behavioural or injury level effects only occurring within <50 m for fleeing receptors and up to 15 km for stationary receptors (**Appendix 10.1 UWN Modelling Report**). Mobile species such as basking shark and flapper skate may exhibit avoidance behaviour closer to the source. Sessile features (e.g., flame shell beds, horse mussel reefs, fan mussel aggregations) are not directly sensitive to noise; any potential indirect effects from vibration would be confined to areas near construction activity and will not extend to these sites. Nevertheless, a precautionary approach has been adopted to acknowledge these designations.

179. The sensitivity of designated sites is therefore considered to be **medium.**

9.11.1.3.2 Magnitude of Impact

9.11.1.3.2.1 Construction

180. Model results presented in **Appendix 10.1 UWN Modelling Report** indicate that, under the worst-case piling scenario involving the installation of six sequential jacket pin-piles, peak pressure thresholds for potential injury occur within a few hundred metres of the pile. If fish are assumed to remain stationary, cumulative sound exposure levels could extend over several kilometres. When realistic fleeing behaviour is considered, predicted injury zones reduce to tens or hundreds of metres, and TTS zones shrink to a few kilometres for the most sensitive Group 4 species. All piling will incorporate soft-start and ramp-up procedures, allowing fish time to move away before peak energy strikes occur. The likelihood of injury is therefore low, and any effects are expected to be short-term and reversible.

181. To support the assessment of fish and shellfish receptors, detailed UWN modelling was undertaken for impact piling at the WDA, considering multiple locations and piling configurations. The worst-case scenario was identified as the installation of six sequential jacket pin-piles at the west modelling

location, where deeper water and site conditions result in the greatest predicted sound transmission. Using Popper et al. (2014) criteria, cumulative sound exposure levels (LE,p,24h) for stationary receptors indicate potential recoverable injury ranges extending up to 88 km under unmitigated conditions, representing the maximum predicted range for fish species most sensitive to impulsive noise exposure.

182. For fleeing receptors (assumed swim speed of 1.5 m/s), predicted ranges are substantially smaller but remain precautionary. Predicted ranges for both stationary and fleeing receptors due to pile driving noise are summarised in **Table 9.14.**

Table 9.14 Summary of the cumulative sound exposure level (SEL_{cum}) impact ranges for fish due to unmitigated pin-pile driving noise, using the Popper et al. (2014), assuming both fleeing and stationary receptors

Popper et al. (2014) Unweighted $L_{E,p,24h}$ - SELcum		**Jacket pin-pile foundation (six sequential piles)**			
		Area	**Maximum range**	**Minimum range**	**Mean range**
Fleeing (1.5 m/s)	219 dB	< 0.01 km²	< 50 m	< 50 m	< 50 m
	216 dB	< 0.01 km²	< 50 m	< 50 m	< 50 m
	210 dB	< 0.01 km²	< 50 m	< 50 m	< 50 m
	207 dB	< 0.01 km²	< 50 m	< 50 m	< 50 m
	203 dB	< 0.01 km²	< 50 m	< 50 m	< 50 m
	186 dB	2,700 km²	50 km	14 km	28 km
Stationary (0 m/s)	219 dB	6.2 km²	1.4 km	1.4 km	1.4 km
	216 dB	15 km²	2.2 km	2.2 km	2.2 km
	210 dB	92 km²	5.6 km	5.3 km	5.4 km
	207 dB	210 km²	8.6 km	7.8 km	8.2 km
	203 dB	570 km²	15 km	13 km	14 km
	186 dB	9,800 km²	88 km	36 km	57 km

183. Model results presented in **Appendix 10.1 UWN Modelling Report** indicate that, under the worst-case piling scenario of installing six sequential jacket pin-piles at the West modelling location (maximum hammer energy 4,400 kJ), peak-pressure injury thresholds occur within several hundred metres of the pile. If fish are assumed to remain stationary, cumulative sound exposure levels (LE,p,24h) could extend to several kilometres. When realistic fleeing behaviour (1.5 m/s) is considered, injury thresholds are not reached, and ranges for TTS for the most sensitive Group 4 species reduce significantly. All piling will incorporate soft-start and ramp-up procedures (see **Appendix 9 Draft MMMP**), allowing fish to move away before peak energy strikes occur. The likelihood of injury is therefore low, and any effects are expected to be short-term and reversible.

184. To support the assessment of fish and shellfish receptors, predicted injury ranges for the installation of six sequential jacket pin-piles from the worst-case modelling location have been provided. Metrics include cumulative sound exposure level (LE,p,24h) for both stationary and fleeing receptors (see Tables 4.28 - 4.29 and Figures 4.2 - 4.3 in **Appendix 10.1 UWN Modelling Report**), as well as peak sound pressure level (Lp,pk) impact ranges derived from a single hammer strike at maximum energy. The West modelling location produced the greatest predicted injury ranges and is therefore the primary focus of the assessment. It is important to note that, in practice, maximum hammer energy will rarely be sustained throughout piling.

185. Behavioural responses to UWN depend on hearing sensitivity, noise characteristics, and ecological context. According to Popper et al. (2014), impulsive noise sources such as piling may elicit high behavioural response risk within tens of metres, moderate risk within hundreds of metres, and low risk within thousands of metres of the source.

186. Potential herring spawning grounds within the Regional Study Area are shown in **Figure 9.4**, which illustrates the modelled probability of 0-group herring overlaid with the worst-case scenario UWN contours. The figure demonstrates that the majority of important herring spawning habitat, including the highest-probability spawning areas, is located outside the predicted ranges for TTS, recoverable injury, and mortality.

187. Higher probabilities of 0-group herring larvae presence do not directly delineate the extent of spawning grounds; however, increased larval density does suggest that spawning activity is more likely to be occurring nearby.

188. Mortality and recoverable injury effect ranges do not overlap with known herring spawning grounds (**Figure 9.4**).

189. Whilst most modelling locations demonstrated a lack of significant overlap with the highest-probability spawning areas, the pile driving modelling location located at the northeast corner of the WDA suggests that there could be an overlap of the TTS impact range in a worst-case scenario of 6 sequentially installed pin-piles within 24 hours and assuming stationary herring receptors. Therefore, short-term behavioural or auditory disturbance cannot be ruled out for individuals occurring within this portion of the spawning grounds, were worst-case piling noise to occur in the most north-easterly portion of the WDA. The majority of the high-intensity spawning habitat remains outside the TTS contour from the northeast modelling location, meaning that the majority of potential spawning habitat within the Regional Study Area is expected beyond the range of effect. Given the reversible nature of TTS, combined with the fact that the overlap is spatially restricted and does not coincide with the core spawning hotspots, the level of disturbance predicted during the spawning season is not expected to result in any significant changes to spawning activities, or population-level effects.

190. Although there is overlap between the modelled 186 dB SEL_{cum} (TTS) contour and areas of moderate modelled probability of 0-group herring larvae presence, it should be noted that there is no overlap with the historical herring spawning grounds described by Coull et al.1998. This dataset is based on documented, empirically observed spawning locations used repeatedly over time, and these historically validated spawning grounds fall outside the areas intersected by the TTS contour shown in **Figure 9.3**.

191. It should also be noted that the nearest high-probability aggregations of 0-group larvae are located over 40 km from the modelled piling locations. Over these distances, piling sound is known to lose its impulsive characteristics due to geometric spreading, frequency-dependent absorption, reflections and scattering, resulting in a wide range of arrival times of the sound at the receptor. In other words, over tens of kilometres, piling sound becomes more comparable to continuous sound rather than impulsive sound, and impulsive sound effect thresholds lose their relevance. Any piling sound transmitted to the higher-intensity spawning grounds is therefore unlikely to retain the impulsive characteristics capable of eliciting strong startle responses or meaningful behavioural disruption. Consequently, the potential for piling noise to cause meaningful behavioural disturbance to herring spawning is expected to be low (Popper et al., 2014).

192. For sandeel spawning grounds, **Figure 9.4** illustrates that moderate to higher-probability sandeel habitat occurs both within and surrounding the WDA; however, the majority of the higher-suitability areas lie outside the predicted ranges for mortality, potential mortal injury, recoverable injury, and TTS. A relatively small (in comparison to the extent of sandeel habitat) area of interaction occurs

where the 186 dB SEL_{cum} contour, representing TTS effects, intersects with patches of more probable sandeel habitat. This limited overlap suggests that a small proportion of the local sandeel population may experience short-term, reversible, non-injurious TTS in hearing disturbance during piling, but that such effects would be spatially restricted.

193. Crucially, the 203 dB and 216 dB SEL_{cum} contours, associated with mortality and potential mortal injury, and recoverable injury, do not overlap with any areas of high sandeel habitat probability, and the majority of sandeel habitat in the Regional Study Area lies beyond all UWN impact ranges. As a result, although localised and temporary disturbance may occur, the affected area is small in relation to the wider availability of suitable sandeel habitat, and the effect is both reversible and spatially restricted.

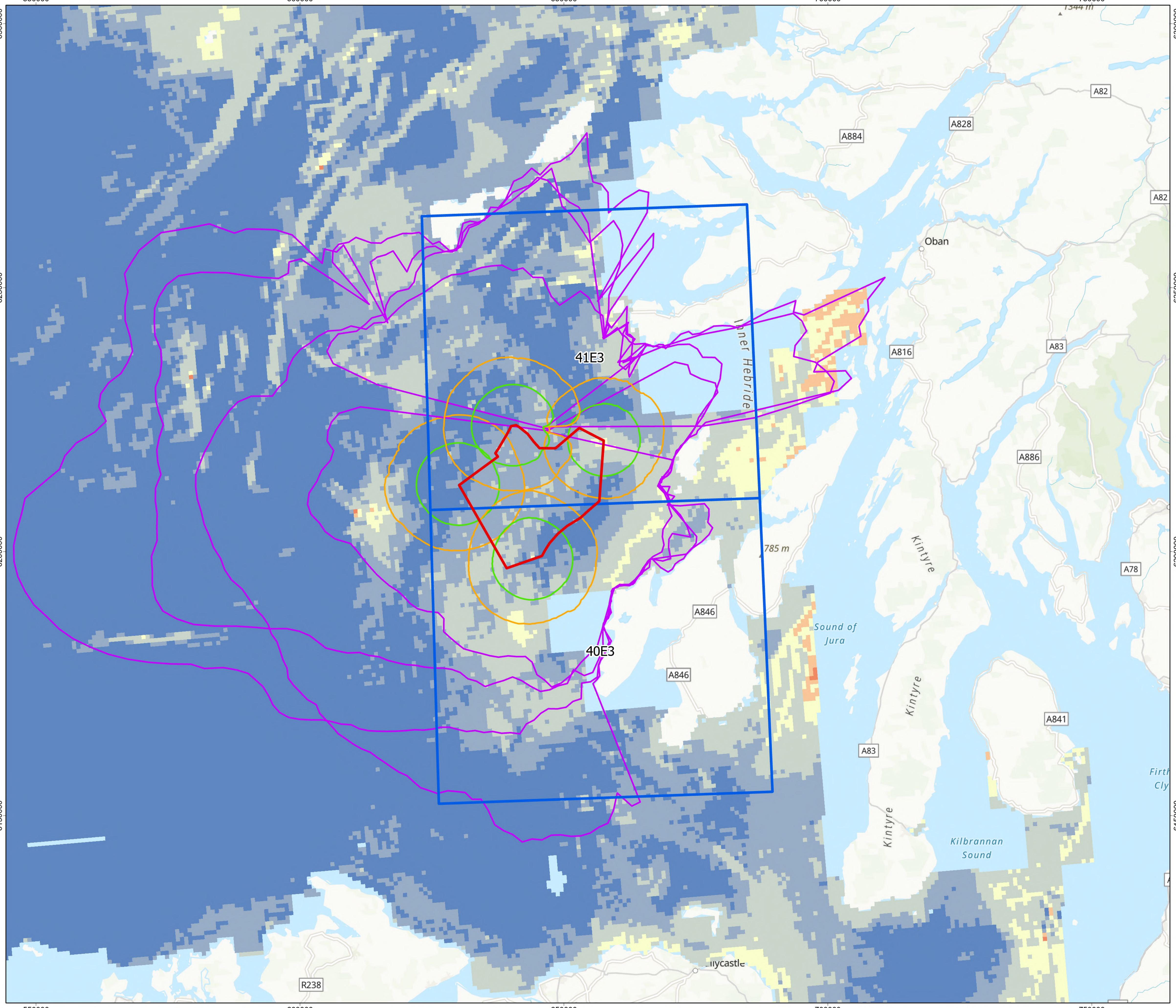
194. Given the limited extent of habitat overlap, the temporary nature of TTS, and the wider availability of suitable sandeel habitat across the region, the predicted UWN impacts during the spawning and burrowing season are not expected to lead to population-level effects. The combination of spatial separation, limited exposure, and the resilience associated with reversible auditory changes supports the conclusion that sandeel populations will not be adversely affected at a meaningful scale.

195. Modelled sound levels indicate that fish within tens of kilometres of active piling may exhibit startle or avoidance behaviour. For sensitive species such as herring, sprat, and cod, these responses are expected to be temporary and reversible. Monitoring from comparable Scottish offshore projects (e.g., Beatrice OWF 2021) showed no measurable long-term impacts on sandeel or cod distribution post-construction as at distances of tens of kilometres, piling noise will lose its impulsive characteristics, further reducing the potential for behavioural responses, so any impact ranges greater than 10 km for impulsive noise can be considered conservative.

196. UXO clearance activities also have the potential to cause short-duration, high-level impulsive noise. Modelling of UXO detonations, reported in **Appendix 10.1 UWN Modelling Report**, considered charge weights up to 750 kg TNT equivalent including donor charge. Applying the explosion criteria set out by Popper et al. (2014), potential mortal-injury ranges are predicted to be less than 1 km for the largest charge, with recoverable-injury and behavioural responses extending a few kilometres at most. The Project will adopt low-order clearance methods wherever practicable, substantially reducing source levels and impact ranges,(see **Appendix 9 Draft MMMP**). It should be noted that UXO noise impact ranges are presented here for information only, and the consent to clear UXO will be applied for via a separate Marine Licensing process post-consent.

197. Continuous, lower-level noise will also arise from vessel movements, drilling, trenching, rock placement, and offshore cable installation. Modelled source levels (Table 5.2 of **Appendix 10.1 UWN Modelling Report**) are substantially below continuous-noise thresholds for TTS (158 dB re 1 μPa over 12 hours) and recoverable injury (170 dB re 1 μPa over 48 hours) as defined by Popper et al. (2014). Predicted received levels at realistic exposure durations are therefore well below injury or TTS criteria, and effects are limited to minor, transient behavioural reactions within tens of metres of active equipment.

198. The magnitude of impact from UWN and vibration is therefore considered to be **low** for all receptors.



Windfarm Development Area

Local Study Area

Probability Presense of 0-Group Herring

- 0 - 0.05
- 0.051 - 0.1
- 0.11 - 0.2
- 0.21 - 0.3
- 0.31 - 0.4
- 0.41 - 0.5
- 0.51 - 0.53

Multiple Pulse Unmitigated SELcum dB Contour

- 186 dB
- 203 dB
- 207 dB

N

0 10 20 Kilometres

2	09/03/2026	AB	GC	MI	PM
REV	REV DATE	GIS CREATOR	GIS REVIEWER	TECHNICAL CHECKER	TECHNICAL APPROVER

DRAWING NUMBER	MCW-DWF-ENV-MAP-RHS-000148		
DATUM	ETRS89	PROJECTION	UTM Zone 29N
SCALE	1:700,000	PAGE SIZE	A3
PROJECT TITLE	MachairWind		

Figure 9.3: Modelled probability of D-group herring presence with overlaid unmitigated SELcum noise contours

NOT TO BE USED FOR NAVIGATION

Haskoning Enhancing Society Together

ScottishPower Renewables

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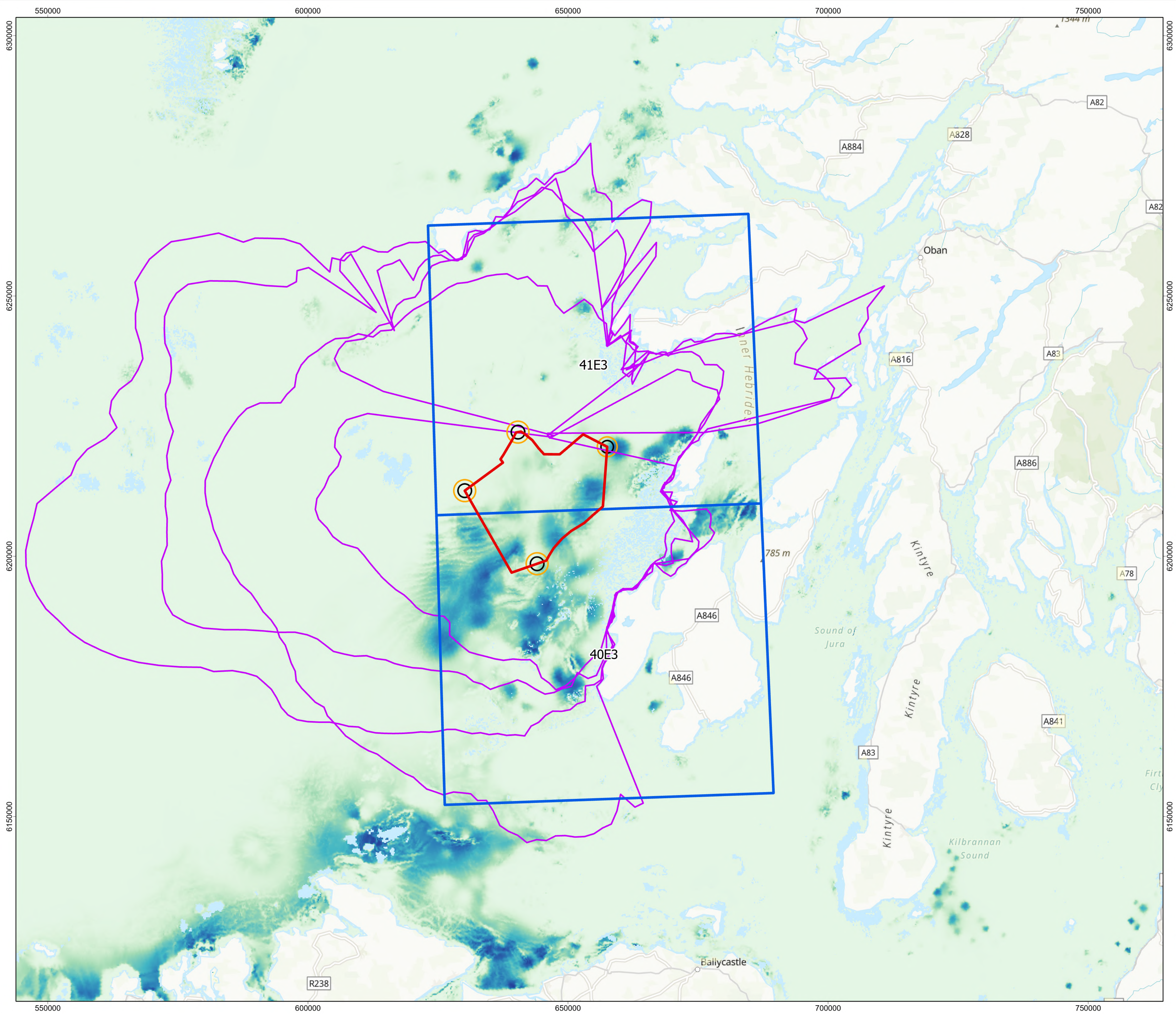

Windfarm Development Area

Local Study Area

Multiple Pulse Unmitigated SELcum dB Contour

186 dB

216 dB

219 dB

Lesser Sandeel (Ammodytes marinus) - Celtic Seas - Probability of presence of buried sandeel

0 (Less Probable)

0.25

0.5

0.75

1 (More Probable)

0 10 20 Kilometres

2	09/03/2026	AB	GC	MI	PM
REV	REV DATE	GIS CREATOR	GIS REVIEWER	TECHNICAL CHECKER	TECHNICAL APPROVER

DRAWING NUMBER MCW-DWF-ENV-MAP-RHS-000149

DATUM	ETRS89	PROJECTION	UTM Zone 29N
SCALE	1:700,000	PAGE SIZE	A3

PROJECT TITLE MachairWind

Figure 9.4: Modelled probability of lesser sandeel presence with overlaid unmitigated SELcum noise contours

NOT TO BE USED FOR NAVIGATION

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Name: Fig_9-4_MCW-DWF-ENV-MAP-RHS-000149_SandeelPresence

9.11.1.3.2.2 O&M

199. Operational noise from the WTGs is predicted to be low intensity and dominated by low-frequency tonal components (<1 kHz). Modelled source levels for operational WTGs (Table 5.2 of **Appendix 10.1 UWN Modelling Report**) are substantially below continuous-noise thresholds for TTS (158 dB re 1 μPa over 12 hours) and recoverable injury (170 dB re 1 μPa over 48 hours) as defined by Popper et al. (2014). Predicted received levels at realistic exposure durations are well below injury or TTS criteria, and any effects are expected to be limited to minor, transient behavioural reactions within a few metres of individual WTGs.

200. O&M vessels will contribute short-term, intermittent noise typical of standard marine traffic. Such events will be temporary, localised, and reversible, and will not materially influence the overall operational noise field.

201. The magnitude of impact from UWN and vibration is therefore considered to be **negligible**.

9.11.1.3.2.3 Decommissioning

202. The final approach to decommissioning has not yet been determined, as it is acknowledged that regulations and industry standards evolve over time. To ensure compliance with the most up-to-date requirements, the detailed methodology and programme will be confirmed closer to the end of the Project's operational life. Decommissioning activities will require a separate consent process and will be supported by an appropriate environmental impact assessment before any works begin.

203. The impacts expected during decommissioning are anticipated to be similar to, or lower than, those identified for the construction phase.

204. The magnitude of impact from UWN and vibration is therefore considered to be **low**.

9.11.1.3.3 Significance of Effect

205. Overall, it is predicted that spawning grounds are assessed as **medium** sensitivity, nursery grounds are **low** for Groups 1 and 2 and **medium** for Groups 3 and 4. Fish species including elasmobranchs, demersal fish, pelagic fish, and diadromous fish are **low**, except sandeel which is **medium**. Shellfish are **low sensitivity**, and a precautionary approach is applied to designated sites which has been assessed as **medium** sensitivity.

206. The magnitude of impact is **low** for construction and **negligible** for O&M and decommissioning phases. The effect is therefore of **negligible** or **minor adverse** significance, which is **not significant** in EIA terms.

207. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

Table 9.15 Significance of effect for Impact 3: UWN and vibration

Phase	Receptor	Sensitivity	Magnitude	Significance of Effect	Additional Mitigation	Residual Effect
Construction	Spawning Grounds	Medium	Low	Minor Adverse	N/A	Not significant
	Nursery Grounds	Low for Groups 1 and 2 Medium for Groups 3 and 4 and sandeel	Low	Minor Adverse	N/A	Not significant
	Pelagic Fish, Demersal Fish, Elasmobranchs	Low for Groups 1,2 and 3 Medium for Groups 4 and sandeel	Low	Minor Adverse	N/A	Not significant
	Diadromous Fish,	Low	Low	Minor Adverse	N/A	Not significant
	Shellfish	Low	Low	Minor Adverse	N/A	Not significant
	Designated Sites	Low	Low	Minor Adverse	N/A	Not significant
O&M	Spawning Grounds	Medium	Negligible	Negligible	N/A	Not significant
	Nursery Grounds	Low for Groups 1 and 2 Medium for Groups 3 and 4 and sandeel	Negligible	Negligible	N/A	Not significant
	Pelagic Fish, Demersal Fish, Elasmobranchs	Medium	Negligible	Negligible	N/A	Not significant
	Diadromous Fish	Low	Negligible	Negligible	N/A	Not significant
	Shellfish	Low	Negligible	Negligible	N/A	Not significant
	Designated Sites	Low	Negligible	Negligible	N/A	Not significant
Decommissioning	Spawning Grounds	Medium	Low	Minor Adverse	N/A	Not significant
	Nursery Grounds	Low for Groups 1 and 2 Medium for Groups 3 and 4 and sandeel	Low	Minor Adverse	N/A	Not significant
	Pelagic Fish, Demersal Fish, Elasmobranchs	Medium	Low	Minor Adverse	N/A	Not significant

Phase	Receptor	Sensitivity	Magnitude	Significance of Effect	Additional Mitigation	Residual Effect
	Diadromous Fish	Low	Low	Minor Adverse	N/A	Not significant
	Shellfish	Low	Low	Minor Adverse	N/A	Not significant
	Designated Sites	Low	Low	Minor Adverse	N/A	Not significant

9.11.1.4 Impact 4: Disturbance and Displacement of Basking Shark

9.11.1.4.1 Sensitivity

208. Increased vessel activity within the WDA during construction, O&M, and decommissioning phases has the potential to disturb and displace basking shark through overlapping with basking shark surface-feeding areas. Basking shark is a PMF in Scotland and is also protected under the Wildlife and Countryside Act 1981, reflecting its conservation importance at a national level. Basking sharks spend prolonged periods feeding at the surface and exhibit limited awareness of approaching vessels, often failing to move away (Chapple et al., 2024; McInturf et al., 2024). This behaviour indicates a low sensitivity to displacement and disturbance from vessel presence. Behavioural data suggest that where disturbance does occur, it is short-lived, with basking sharks resuming normal swimming and feeding behaviour shortly after a vessel has passed (Chapple et al., 2024). Their highly mobile nature and broad-scale habitat use allow individuals to move locally around temporary sources of disturbance without experiencing prolonged effects.

209. Additionally, eDNA surveys from multiple Dutch offshore windfarms (e.g., Hollandse Kust Zuid and Borssele), conducted by the Wageningen University & Research have confirmed the presence of regular activity by basking sharks in and around project infrastructure, with no clear evidence of avoidance or displacement due to the windfarms themselves (Hermans et al., 2025).

210. The sensitivity of basking shark is therefore considered to be **low.**

9.11.1.4.2 Magnitude of Impact

9.11.1.4.2.1 Construction

211. As stated in **Table 9.5**, the maximum number of construction vessels operating within the WDA is 117, with an average of three vessels transiting daily between the WDA and port, resulting in approximately 5,699 round trips during the construction period. This level of vessel activity represents a significant increase in marine traffic within the Local Study Area.

212. While embedded mitigation measures for vessel operations (**Table 9.6** - aligned with marine mammal protocols) will reduce risk, the potential for disturbance and displacement of basking sharks remains. Basking sharks are known to spend extended periods feeding at the surface and exhibit limited awareness of vessels. Increased vessel presence can lead to avoidance behaviour, displacement from preferred feeding grounds, and interruption of normal foraging activity.

213. Within UK waters, there is a marked seasonality in basking shark sightings, with peak sightings between May and September (Pikesley et al., 2024). The vast majority of surface sightings occur in western Scotland (including the Sea of the Hebrides Marine Protected Area (MPA)), the Isle of Man and southwest England. Pikesley et al., 2024, researched basking shark density estimates for the UK based on public sightings data from 2014-2020. A density estimate of 0-0.01 basking shark / km^2 is estimated for the area which overlaps the WDA.

214. Thirty months of digital aerial surveys (DAS) recorded very low numbers of basking sharks within the WDA, with sightings limited to April (two in 2021, one in 2022, and four in 2023) and a single record in November 2021. Additional third-party surveys over 16 months recorded seven individuals in May 2021. These results indicate that the WDA is not a key area for basking sharks, and any feeding or courtship activity is likely to occur at low levels. Higher concentrations of basking sharks are found further north in the Sea of the Hebrides NCMPA, with only small numbers expected to transit through

the WDA en-route to preferred habitats. The magnitude of impact due to disturbance and displacement of basking shark is considered to be **negligible**.

9.11.1.4.2.2 O&M

215. As stated in **Table 9.5,** the annual no. of vessel round trips required for routine operational and planned maintenance activities is 423.

216. The interaction with the Project is expected to be lower than during the construction phase, given the distribution of basking sharks and assuming embedded mitigation for vessel operations which will be consistent with marine mammal mitigation, and the decreased levels of vessel activity.

217. The magnitude of impact due to disturbance and displacement of basking shark is therefore considered to be **negligible**.

9.11.1.4.2.3 Decommissioning

218. The final approach to decommissioning has not yet been determined, as it is acknowledged that regulations and industry standards evolve over time. To ensure compliance with the most up-to-date requirements, the detailed methodology and programme will be confirmed closer to the end of the Project's operational life. Decommissioning activities will require a separate consent process and will be supported by an appropriate environmental impact assessment before any works begin.

219. The impacts expected during decommissioning are anticipated to be similar to, or lower than, those identified for the construction phase.

220. The magnitude of impact due to disturbance and displacement of basking shark is therefore considered to be **negligible**.

9.11.1.4.3 Significance of Effect

221. Overall, it is predicted that sensitivity of the receptors is **low** and the magnitude of impact is **negligible**. The effect is therefore of **negligible** significance, which is **not significant** in EIA terms.

222. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

Table 9.16 Significance of effect for Impact 4: disturbance and displacement of basking shark

Phase	Receptor	Sensitivity	Magnitude	Significance of Effect	Additional Mitigation	Residual Effect
Construction	Basking Shark	Low	Negligible	Negligible	N/A	Not significant
O&M	Basking Shark	Low	Negligible	Negligible	N/A	Not significant
Decommissioning	Basking Shark	Low	Negligible	Negligible	N/A	Not significant

9.11.1.5 Impact 5: Vessel Collision for Basking Shark

9.11.1.5.1 Sensitivity

223. Increased vessel traffic within the WDA during construction, O&M, and eventual decommissioning introduces a potential risk of vessel strikes to basking sharks.

224. Basking shark is a PMF in Scotland and is also protected under the Wildlife and Countryside Act 1981, reflecting its conservation importance at a national level. Basking sharks spend extended periods at or near the surface while filter-feeding and have limited ability to detect or avoid approaching vessels, making them particularly susceptible to collision (Chapple et al., 2024; McInturf et al., 2024).

225. Sightings of basking sharks have been recorded within the Local Study Area, and the Sea of the Hebrides NCMPA, located approximately 4.3 km north of the WDA, which is recognised as an important habitat for this species (NatureScot, 2024). Given their surface-feeding behaviour, slow swimming speed, and endangered status, basking sharks exhibit high sensitivity to vessel collision risk. These biological traits, combined with their low reproductive rate, increase vulnerability to population-level impacts if collisions occur.

226. The sensitivity of basking shark is therefore considered to be **high.**

9.11.1.5.2 Magnitude of Impact

9.11.1.5.2.1 Construction

227. As stated in **Table 9.5,** the maximum number of construction vessels is 117 in the WDA. There would be an average of three vessels that could be transiting from the WDA to port per day based on a five year offshore construction period. With a total of 5,699 round trips during the construction period, representing a substantial increase in vessel traffic and a potential rise in collision risk for basking sharks. However, vessels working within the WDA typically operate at low speeds or remain stationary reducing the potential for collisions during active working periods.

228. Basking sharks often feed at the surface for extended periods and have limited ability to detect approaching vessels, making them susceptible to accidental strikes. Increased vessel movements could therefore heighten the likelihood of injury or mortality during surface activity.

229. Sightings of basking sharks in UK waters are strongly seasonal, peaking between May and September (Pikesley et al., 2024). Most observations occur in western Scotland, the Isle of Man, and southwest England. For the WDA, density estimates based on 2014-2020 public sightings data are extremely low (0-0.01 sharks/km^2), suggesting minimal presence.

230. Thirty months of DAS recorded only a handful of basking sharks within the WDA, two in April 2021, one in April 2022, four in April 2023, and a single sighting in November 2021. Additional third-party surveys noted seven individuals in May 2021. Recent HWDT visual survey data (2018-2024) (**Appendix 10.3 Analysis of Hebridean Whale & Dolphin Trust Visual and Passive Acoustic Survey Data**) indicates that basking shark presence in Scottish west coast waters remains highly seasonal, with sightings concentrated between May and September and peaking in July and August. While the Sea of the Hebrides continues to be a key aggregation area, detections within a 30 km buffer zone around the WDA were rare, with only one positive observation recorded in 2023, however given that basking sharks do not need to surface for respiration, visual detection is likely negatively biased, and their actual presence may be greater than recorded. These findings confirm that the

WDA is not a significant habitat for basking sharks, with most activity concentrated further north in the Sea of the Hebrides NCMPA.

231. Considering the robust embedded mitigation in place to reduce the risk of collisions for marine mammals and basking shark including adherence by Project vessels to the Scottish Marine Wildlife Watching Code (see **Section 9.9** and **Appendix 6 Outline EMP**), the very low occurrence and limited surface activity, the magnitude of impact for vessel collision is therefore considered to be **negligible**.

9.11.1.5.2.2 O&M

232. As stated in **Table 9.5**, the anticipated maximum annual number of vessel round trips required for operational and planned maintenance activities is 423.

233. The interaction with the Project is expected to be lower than during the construction phase, given the distribution of basking sharks and assuming embedded mitigation for vessel operations which will be consistent with marine mammal mitigation, and the decreased levels of activity.

234. The magnitude of impact from vessel collision is therefore considered to be **negligible**.

9.11.1.5.2.3 Decommissioning

235. The final approach to decommissioning has not yet been determined, as it is acknowledged that regulations and industry standards evolve over time. To ensure compliance with the most up-to-date requirements, the detailed methodology and programme will be confirmed closer to the end of the Project’s operational life. Decommissioning activities will require a separate consent process and will be supported by an appropriate environmental impact assessment before any works begin.

236. The impacts expected during decommissioning are anticipated to be similar to, or lower than, those identified for the construction phase.

237. The magnitude of vessel collision for basking shark is therefore considered to be **negligible**.

9.11.1.5.3 Significance of Effect

238. Overall, it is predicted that sensitivity of the receptors is **high** and the magnitude of impact is **negligible**. The effect is therefore of **minor adverse** significance, which is **not significant** in EIA terms.

239. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

Table 9.17 Significance of effect for Impact 5: vessel collision for basking shark

Phase	Receptor	Sensitivity	Magnitude	Significance of Effect	Additional Mitigation	Residual Effect
Construction	Basking Shark	High	Negligible	Minor Adverse	N/A	Not significant
O&M	Basking Shark	High	Negligible	Minor Adverse	N/A	Not significant
Decommissioning	Basking Shark	High	Negligible	Minor Adverse	N/A	Not significant

9.11.1.6 Impact 6: INNS

9.11.1.6.1 Sensitivity

240. Increased vessel activity and introduction of hard substrate within the WDA during construction, O&M, and decommissioning phases has the potential to introduce and spread INNS. As outlined in **Table 9.5**, up to 5,699 vessel round trips may occur during construction (excluding pre-construction), and during O&M, the estimated maximum annual number of vessel round trips required is 423. This level of activity represents a significant increase in maritime traffic, which can facilitate the transfer of INNS via hull fouling, ballast water, and equipment.

241. The MarESA framework is used to evaluate the sensitivity of marine habitats and species to specific pressures.

242. For the pressure 'Introduction or spread of INNS', the benchmark is **'**the introduction of one or more INNS**'.** This means that sensitivity is evaluated based on the potential ecological consequences if at least one invasive species is introduced and becomes established.

9.11.1.6.1.1 Spawning Grounds

243. Spawning grounds are critical habitats for the reproduction of many fish species, these areas often provide stable substrates and specific environmental conditions required for egg deposition and larval development. The introduction or spread of INNS can significantly alter these conditions by changing habitat structure, competing for space, or introducing predation pressures (Roy et al., 2020; Marine Scotland, 2023a). INNS already recorded in parts of western Scotland, such as carpet sea squirt (*Didemnum vexillum*) can colonise hard substrates and smother benthic habitats, reducing the availability of suitable spawning surfaces for species like herring and sandeel. These changes can disrupt spawning success and recruitment, particularly for species with highly specific habitat requirements (Coull et al., 1998). In contrast, slipper limpet (*Crepidula fornicata*) is not currently widespread on the Scottish west coast, and the risk of colonisation is therefore potential rather than established, arising primarily from recognised pathways such as hull fouling and aquaculture movements. Even so, both species have the capacity to alter spawning substrates where they occur (Coull et al., 1998) and therefore represent a context-dependent but plausible pressure on spawning habitats.

244. Given the ecological importance of spawning grounds and their vulnerability to habitat modification, sensitivity to INNS introduction is generally considered to be high for species with specialised spawning requirements (e.g., herring, sandeel) and medium for species with broader habitat tolerances. This aligns with the MarESA benchmark for INNS, which assumes the introduction of one or more invasive species capable of establishing and spreading.

245. The sensitivity of spawning grounds is therefore considered to be **medium** for the majority of species, with the exception of herring and sandeel, where the sensitivity is considered to be **high.**

9.11.1.6.1.2 Nursery Grounds

246. Nursery grounds provide essential habitats for juvenile fish, offering shelter and abundant food resources that support early life stages. These areas are often located in shallow coastal zones or specific benthic habitats, making them vulnerable to ecological changes caused by INNS. The introduction or spread of INNS can alter habitat structure, reduce prey availability, and increase competition or predation pressure (Roy et al., 2020; Marine Scotland, 2023a).

247. Nursery grounds for herring and sandeel both have specific habitat requirements. Herring juveniles often utilize coastal areas with suitable substrates, while sandeels depend on clean, well-oxygenated sandy sediments (Coull et al., 1998; Marine Scotland, 2023a). The introduction or spread of INNS can significantly alter these habitats. INNS such as carpet sea squirt, which is already present in several west coast Scottish locations can smother benthic habitats, while slipper limpet, which is not currently widespread in western Scottish waters, could potentially change sediment composition, reducing the suitability of nursery grounds for these species. Such habitat modifications can limit shelter and feeding opportunities, disrupt juvenile development, and ultimately affect recruitment success (Roy et al., 2020).

248. Given the ecological importance of nursery grounds for population recruitment and their susceptibility to habitat alteration, sensitivity to INNS introduction is considered generally Medium to High, depending on species-specific habitat requirements.

249. The sensitivity of nursery grounds is therefore considered to be **medium** for the majority of species, with the exception of herring and sandeel, where the sensitivity is considered to be **high.**

9.11.1.6.1.3 Pelagic Fish, Demersal Fish, Diadromous Fish and Elasmobranchs

250. Diadromous, pelagic, demersal fish and elasmobranchs occupy a range of habitats and are generally mobile. While these species are less dependent on fixed benthic habitats compared to spawning or nursery grounds, INNS can still indirectly affect them through ecosystem-level changes (Roy et al., 2020), although no impact on their national status is predicted.

251. INNS such as Pacific oyster (*Magallana gigas*), which are already established across parts of western Scotland and Japanese kelp (*Undaria pinnatifida*) which are not but pose a potential threat, can significantly alter ecosystems. For example, Pacific oyster form dense reefs that change benthic habitat structure, reducing prey availability for demersal fish and Japanese kelp can outcompete native kelp, alter food webs and reduce habitat complexity for juvenile fish and elasmobranch prey species. These changes can lead to indirect impacts such as reduced feeding opportunities, altered migration pathways, and shifts in prey abundance.

252. Basking shark is a PMF in Scotland and is also protected under the Wildlife and Countryside Act 1981, reflecting its conservation importance at a national level. Basking sharks are slow-moving filter feeders that rely on plankton-rich waters for feeding. While they are highly mobile and not directly dependent on benthic habitats, INNS can indirectly affect basking sharks by altering plankton communities and overall ecosystem productivity (Marine Scotland, 2023a; Roy et al., 2020).

253. INNS such as carpet sea squirt which are already established in parts of western Scotland and other species such as Japanese kelp, and comb jelly (*Mnemiopsis leidyi*) pose potential, rather than established threats in Scottish waters. Carpet sea squirt can smother benthic habitats, reduce biodiversity and alter nutrient cycling, which may influence plankton availability. Japanese kelp competes with native kelp species, potentially changing coastal productivity and food web dynamics. Comb jelly, a gelatinous zooplankton species preys on fish eggs and larvae and competes with native plankton consumers, potentially reducing plankton abundance and impacting basking shark feeding efficiency. These changes can lead to reduced prey availability and force basking sharks to alter their feeding patterns or migrate to alternative areas, increasing energetic costs and displacement risk.

254. Overall, sensitivity to INNS introduction for these groups is generally considered low to medium, as they are less reliant on specific substrates but can be affected by ecosystem-level changes. This assessment aligns with the MarESA benchmark for INNS, which assumes the introduction of one or more invasive species capable of establishing and spreading.

255. The sensitivity of diadromous, pelagic, demersal fish and elasmobranchs is therefore considered to be **medium.**

9.11.1.6.1.4 Shellfish

256. Shellfish species such as scallops, mussels, and native oysters are ecologically and commercially important. They rely on stable benthic habitats and clean substrates for settlement and growth. The introduction or spread of INNS can significantly impact these habitats and shellfish populations through competition, habitat alteration, and disease transmission (Roy et al., 2020; Marine Scotland, 2023a).

257. INNS such as Pacific oyster which is already established along the west coast of Scotland, Chinese mitten crab (*Eriocheir sinensis*) and slipper limpet (*Crepidula fornicate*) both of which are widely established across the UK, pose notable risks. Pacific oysters can form dense reefs, outcompete native oysters and alter benthic habitat structure, Chinese mitten crab burrows into sediment, destabilizing substrates and increasing turbidity, which can affect filter-feeding shellfish and American slipper limpet smothers seabed habitats and changes sediment composition, reducing settlement opportunities for scallops and mussels.

258. These changes can lead to reduced growth rates, increased mortality, and displacement of native shellfish populations. Given the ecological and economic importance of shellfish and their reliance on specific benthic conditions, sensitivity to INNS introduction is generally considered high. This aligns with the MarESA benchmark for INNS, which assumes the introduction of one or more invasive species capable of establishing and spreading.

259. The sensitivity of shellfish is therefore considered to be **high.**

9.11.1.6.1.5 Designated Sites

260. Several designated sites within the wider region support protected fish and shellfish features, including horse mussel beds, flame shell beds, native oyster, freshwater pearl mussel, and species such as Atlantic salmon and basking shark. These habitats and species are highly sensitive to ecological changes caused by INNS, which can alter habitat structure, reduce biodiversity, and disrupt ecosystem functioning (Marine Scotland, 2023b; Roy et al., 2020).

261. INNS such as carpet sea squirt, slipper limpet, and Pacific oyster pose significant risks to these designated features. Carpet sea squirt can smother horse mussel and flame shell beds, reducing structural complexity and associated biodiversity. Slipper limpet alters sediment composition, impacting benthic habitats critical for shellfish and associated species. Pacific oyster forms dense reefs that outcompete native oysters and modify habitat conditions.

262. These changes can compromise the conservation objectives of SACs and NCMPAs, particularly those designated for sensitive benthic habitats and species such as native oyster and horse mussel beds. Given the ecological importance and legal protection of these sites, sensitivity to INNS introduction is generally considered high. This aligns with the MarESA benchmark for INNS, which assumes the introduction of one or more invasive species capable of establishing and spreading

263. The sensitivity of designated sites is therefore considered to be **high.**

9.11.1.6.2 Magnitude of Impact

9.11.1.6.2.1 Construction

264. As outlined in **Table 9.5**, up to 5,699 vessel trips may occur during construction, with 140 pre-construction round vessel trips. The introduction or spread of INNS as a result of increased vessel activity and subsea infrastructure installation has been assessed for the WDA. Vessels associated with construction present a potential pathway for INNS transfer via hull fouling, ballast water discharge, and equipment movement. However, the risk of INNS introduction is considered low given the implementation of embedded biosecurity measures and compliance with relevant marine guidance.

265. The WDA does not contain habitats that inherently promote INNS establishment, such as extensive hard substrate areas, and the spatial footprint of infrastructure is limited compared to the wider marine environment. The introduction of hard substrate has been assessed in **Section 9.11.1.10**. The introduction of hard substrate, which is more likely to promote INNS establishment within the WDA is expected to occur primarily through the installation of foundations and scour protection during construction. The total area of hard substrate introduced is estimated at approximately 1.52% of the WDA. This footprint is highly localised when considered against the overall WDA and the wider Regional Study Area.

266. While INNS such as carpet sea squirt, slipper limpet, and Pacific oyster have the potential to colonise artificial structures and alter benthic habitats, the likelihood of these species establishing and spreading from Project activities is low. This is due to the intermittent nature of vessel movements, the application of antifouling coatings, and management protocols. Given the widespread availability of similar habitats across the region and the localised nature for any potential colonisation, any ecological effect would be minor.

267. However, when the embedded biosecurity measures set out in **Appendix 8 INNSMP** are applied, the overall magnitude of impact is assessed as negligible for all receptors, including spawning and nursery grounds for herring and sandeel, shellfish, diadromous species, demersal and pelagic fish species, elasmobranchs, basking shark and designated sites. This is because the plan targets the three points at which INNS risks typically escalate i.e. introduction, establishment and spread, and applies a robust set of controls at each stage.

268. Prevention measures include pre-mobilisation vessel inspections, up-to-date antifouling systems, ballast water management, and mandatory equipment cleaning before mobilisation. Early detection is supported through routine surveillance at critical control points, vessel and equipment inspections, and staff training to identify and report potential INNS. Monitoring and rapid-response procedures ensure that any suspected INNS is quickly contained, assessed and escalated following the contingency protocols outlined in the INNSMP. Taken together, these measures substantially reduce both the likelihood of introduction and the probability that any single propagule could establish, persist or spread, meaning that a detectable ecological effect at the scale of sensitive receptors is highly unlikely.

269. The magnitude of impact from INNS for all receptors is therefore considered to be **negligible**.

9.11.1.6.2.2 O&M

270. As stated in **Table 9.5**, the estimated maximum annual number of vessel round trips required for O&M activities is 423. The potential for INNS introduction and spread during this phase is expected to be lower than during construction, given the reduced level of vessel activity. The risk over the full

operational lifetime also remains low because O&M vessels are subject to continued implementation of the embedded biosecurity measures set out in **Appendix 8 INNSMP**. These include regular maintenance of antifouling systems in line with merchant shipping regulations, routine hull and niche-area inspections, adherence to vessel-specific Biofouling Management Plans, ballast water management compliant with IMO requirements, and mandatory cleaning and inspection of tools and equipment before mobilisation. Ongoing surveillance, reporting procedures, and periodic compliance checks ensure early detection and rapid response capability throughout the O&M period. As these preventive, detection and monitoring actions are maintained consistently across the operational lifecycle, the likelihood of INNS introduction, establishment or spread remains very low despite the multi-year duration of O&M activity. The magnitude of impact from INNS is therefore considered to be **negligible**.

9.11.1.6.2.3 Decommissioning

271. The final approach to decommissioning has not yet been determined, as it is acknowledged that regulations and industry standards evolve over time. To ensure compliance with the most up-to-date requirements, the detailed methodology and programme will be confirmed closer to the end of the Project’s operational life. Decommissioning activities will require a separate consent process and will be supported by an appropriate EIA before any works begin.

272. The impacts expected during decommissioning are anticipated to be similar to, or lower than, those identified for the construction phase.

273. The magnitude of impact from INNS is therefore considered to be **negligible**.

9.11.1.6.3 Significance of Effect

274. Overall, it is predicted that the sensitivity of spawning grounds is **medium** for most species, with herring and sandeel considered to be **high**. Nursery grounds are also assessed as **medium** sensitivity for the majority of species, with herring and sandeel again considered **high**. Basking Shark are assessed as **medium** sensitivity. Diadromous, pelagic, demersal fish and elasmobranchs are considered to have **medium** sensitivity. Shellfish and designated sites are considered **high**.

275. The magnitude of impact from INNS is considered **negligible**, assuming embedded biosecurity measures described in **Appendix 8 INNSMP** are implemented. For high-sensitivity receptors such as herring, sandeel, shellfish, and designated sites, the potential for any propagule to be introduced, establish, persist or spread is therefore extremely limited. As the biosecurity system prevents the conditions required for measurable ecological change at the receptor scale, even high-sensitivity receptors experience a negligible magnitude of impact.

276. The effect is therefore of **negligible** to **minor adverse significance**, which is **not significant** in EIA terms.

277. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

Table 9.18 Significance of effect for Impact 6: INNS

Phase	Receptor	Sensitivity	Magnitude	Significance of Effect	Additional Mitigation	Residual Effect
Construction	Spawning Grounds	Medium – apart from herring and sandeel spawning grounds which have a high sensitivity	Negligible	Negligible or Minor Adverse	N/A	Not significant
	Nursery Grounds	Medium – apart from herring and sandeel spawning grounds which have a high sensitivity	Negligible	Negligible or Minor Adverse	N/A	Not significant
	Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs	Medium	Negligible	Negligible	N/A	Not significant
	Shellfish	High	Negligible	Minor Adverse	N/A	Not significant
	Designated Sites	High	Negligible	Minor Adverse	N/A	Not significant
O&M	Spawning Grounds	Medium – apart from herring and sandeel spawning grounds which have a high sensitivity	Negligible	Negligible or Minor Adverse	N/A	Not significant
	Nursery Grounds	Medium – apart from herring and sandeel spawning grounds which have a high sensitivity	Negligible	Negligible or Minor Adverse	N/A	Not significant

Phase	Receptor	Sensitivity	Magnitude	Significance of Effect	Additional Mitigation	Residual Effect
	Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs	Low	Negligible	Minor Adverse	N/A	Not significant
	Shellfish	High	Negligible	Minor Adverse	N/A	Not significant
	Designated Sites	High	Negligible	Minor Adverse	N/A	Not significant
Decommissioning	Spawning Grounds	Medium – apart from herring and sandeel spawning grounds which have a high sensitivity	Negligible	Negligible or Minor Adverse	N/A	Not significant
	Nursery Grounds	Medium – apart from herring and sandeel spawning grounds which have a high sensitivity	Negligible	Negligible or Minor Adverse	N/A	Not significant
	Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs	Low	Negligible	Minor Adverse	N/A	Not significant
	Shellfish	High	Negligible	Minor Adverse	N/A	Not significant
	Designated Sites	High	Negligible	Minor Adverse	N/A	Not significant

9.11.1.7 Impact 7: Changes in Fishing Activity

278. Changes in fishing activity refer to any alteration in the pattern, intensity or distribution of fishing operations that may occur as a result of the WDA infrastructure (see **Chapter 12 Commercial Fisheries**). During construction, activities such as foundation installation, anchor deployment, offshore cable laying and the presence of installation vessels will require temporary safety zones around active work areas. These measures will restrict access to parts of the seabed and may lead to short-term displacement of fishing effort, modification of routes and occasional disruption to gear deployment.

279. As part of the embedded mitigation measures, safety zones of up to 500 m will be applied around construction activities, including piling and cable installation, to protect personnel and other sea users (**Chapter 13 Shipping and Navigation**). These zones will move incrementally as works progress across the WDA, meaning any exclusion will be localised and temporary. Relative to the wider fishing grounds available in the region, the proportion of seabed affected at any one time is very small.

280. **Appendix 12.1 Commercial Fisheries Technical Report** confirms that the main fisheries operating within and around the WDA comprise inshore potting for brown crab, lobster and velvet crab, together with occasional Nephrops potting. Activity within the WDA is moderate for potting fleets but negligible for mobile gears such as demersal trawls and scallop dredges, and absent for pelagic trawls. The site does not coincide with major ICES identified spawning or nursery grounds and does not intersect areas of persistently high fishing effort. Consequently, the potential for significant disruption to established fishing patterns or displacement of effort is limited, and the likelihood of population level effects on fish and shellfish is low.

281. During the O&M phase, changes in fishing activity may arise from the presence of permanent infrastructure including WTGs, IACs, OSP link cables and OSPs. These features can influence access to familiar grounds and may lead to minor redistribution of effort. As noted in **Chapter 12 Commercial Fisheries**, the main operational pathway relates to the physical presence of subsea structures and the potential for gear interaction or navigational avoidance.

282. Formal exclusion zones are not generally maintained during operation; however, some fishers may choose to avoid areas around WTGs or cable corridors due to concerns over snagging or vessel safety. This informal avoidance is most relevant to mobile gear fisheries, although these fleets are already largely absent from the WDA. Static gear fisheries, including creeling and potting, are expected to continue operating within or adjacent to the WDA, subject to regulatory guidance and operational protocols.

9.11.1.7.1 Sensitivity

9.11.1.7.1.1 Spawning Grounds

283. Mapped spawning grounds for pelagic and demersal species within the Local Study Area are generally of low or undetermined intensity, with no major hotspots intersecting the WDA boundary. Construction activities will introduce short-term, localised safety zones, while O&M phases involve only intermittent maintenance works and no permanent exclusion zones. Given the absence of high-intensity spawning areas and the ability of fishing fleets to adapt, changes in fishing activity are unlikely to influence spawning success at a population level.

284. The sensitivity of spawning grounds is therefore considered to be **low.**

9.11.1.7.1.2 Nursery Grounds

285. Nursery habitats for species such as whiting, ling, and elasmobranchs occur regionally but are recorded at low intensity within the WDA. All phases will result in only minor, localised changes in fishing patterns, primarily affecting static gear fleets, with negligible overlap from mobile gears. These changes are not expected to compromise nursery function or recruitment.

286. The sensitivity of spawning grounds is therefore considered to be **low.**

9.11.1.7.1.3 Diadromous, Pelagic, Demersal Fish and Elasmobranchs

287. Diadromous species migrate through the Regional Study Area but are not targeted by commercial fisheries within the WDA. Construction-related displacement of potting effort and operational avoidance of WTGs do not create a realistic pathway for increased fishing mortality. SACs designated for these species are located far from the WDA, and no direct interaction with fishing activity is anticipated and no impact on their national status or PMF status of Atlantic salmon is predicted.

288. Pelagic trawl activity is absent within the WDA, and mapped spawning/nursery grounds for pelagic species occur mainly outside the footprint or at low intensity. Localised construction and decommissioning zones and operational presence will not influence pelagic fishing patterns or mortality.

289. Demersal trawl and dredge activity within the WDA is negligible, and scallop dredging effort is very low. All phases will not materially alter fishing pressure on demersal species, given the absence of significant mobile-gear overlap and the ability of static gear fleets to resume activity post-construction.

290. Elasmobranch nursery grounds overlap only at low intensity, and commercial fishing within the WDA is dominated by static gear, with minimal mobile-gear presence. Short-term displacement during construction, minor operational and decommissioning adjustments are unlikely to affect population level mortality.

291. Basking shark is not a commercial target species, and changes in fishing activity during construction or O&M do not create a pathway for increased fishing mortality. DAS confirm low basking shark presence in the WDA, with seasonal aggregations occurring further north in the Sea of the Hebrides MPA. Although the species exhibits life-history characteristics typically associated with higher vulnerability, such as slow growth, late maturity and low reproductive output, its sensitivity in the context of the Project is limited by ecological and spatial factors.

292. The sensitivity of diadromous, pelagic, demersal fish and elasmobranchs is therefore considered to be **low.**

9.11.1.7.1.4 Shellfish

293. Potting is the principal activity within the WDA. Construction will introduce temporary safety zones, prompting short-term displacement to adjacent grounds, while operational phases allow static gear fleets to resume activity around infrastructure. There is a large availability of alternative grounds, and fleets within the area are considered to be adaptable (**Chapter 12 Commercial Fisheries**).

294. Scallop dredging is also minimal within the WDA, razor clam harvesting is highly regulated, and ocean quahog presence is not linked to significant fishing effort. Sequential construction and decommissioning works and intermittent maintenance will not materially alter fishing pressure on these species.

295. Cephalopod fisheries are also not identified as key activities within the WDA. Localised construction exclusions, minor operational and decommissioning adjustments will not affect population-level dynamics.

296. The sensitivity of shellfish is therefore considered to be **low.**

9.11.1.7.1.5 Designated Sites

297. The WDA does not overlap any designated sites for fish or shellfish features, and the nearest relevant designation (Sea of the Hebrides NCMPA for basking shark) lies approximately 4.3 km to the north. Localised construction and decommissioning exclusions and minor operational changes in fishing patterns provide no mechanism for increased fishing pressure on designated features.

298. The sensitivity of designated sites is therefore considered to be **low.**

9.11.1.7.2 Magnitude of Impact

9.11.1.7.2.1 Construction

299. During construction, temporary safety zones (up to 500 m) will be established around active works such as foundation installation, cable laying, and vessel activities. These zones will move sequentially across the WDA, creating short-term, localised restrictions on fishing activity. The footprint of exclusion is small relative to the wider fishing grounds available in the region, and the duration of restrictions is limited to the construction programme. Static gear fleets (potting for crab and lobster) are the most affected, with short-term displacement to adjacent grounds; however, alternative grounds exist within normal steaming ranges, and embedded mitigation (liaison protocols, phased works) will reduce disruption (see **Chapter 12 Commercial Fisheries**). Mobile gear fisheries (demersal trawl, dredge) have negligible baseline overlap with the WDA, and pelagic trawl activity is absent. Spawning and nursery grounds for pelagic and demersal species occur at low intensity within the WDA, and construction-related changes in fishing patterns are not expected to influence population-level recruitment. Similarly, diadromous fish and basking shark are not targeted by fisheries, and designated sites lie outside the WDA, with no pathway for increased fishing pressure on qualifying features.

300. The magnitude of impact from changes in fishing activity for all receptors is therefore considered to be **negligible**.

9.11.1.7.2.2 O&M

301. During O&M, fishing activity is expected to resume within and around the WDA, with only intermittent maintenance campaigns introducing small, temporary footprints of exclusion. No permanent safety zones are anticipated under normal operations, although some fishers may voluntarily avoid areas around WTGs or cable corridors due to perceived snagging risk. This informal avoidance is most relevant to mobile gears, which are already largely absent from the WDA, while static gear fleets can adapt set patterns to operate safely around infrastructure.

302. Spawning and nursery grounds remain unaffected by operational changes in fishing activity, and diadromous species continue to migrate through offshore waters without interaction with fisheries. Shellfish species such as crab and lobster, which dominate local fishing effort, are unlikely to experience increased fishing mortality as a result of operational-phase changes, given the ability of fleets to resume activity and the minor scale of any displacement. Basking shark and designated

sites are similarly unaffected, as operational changes in fishing patterns do not create a pathway for increased pressure on these features.

303. The magnitude of impact from changes in fishing activity for all receptors is therefore considered to be **negligible**.

9.11.1.7.2.3 Decommissioning

304. The final approach to decommissioning has not yet been determined, as it is acknowledged that regulations and industry standards evolve over time. To ensure compliance with the most up-to-date requirements, the detailed methodology and programme will be confirmed closer to the end of the Project's operational life. Decommissioning activities will require a separate consent process and will be supported by an appropriate environmental impact assessment before any works begin.

305. The impacts expected during decommissioning are anticipated to be similar to, or lower than, those identified for the construction phase.

306. The magnitude of changes in fishing activity for all receptors is therefore considered to be **negligible**.

9.11.1.7.3 Significance of Effect

307. Overall, it is predicted that sensitivity of the receptors is **low** and the magnitude of impact is **negligible**. The effect is therefore of **negligible** significance, which is **not significant** in EIA terms.

308. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

Table 9.19 Significance of effect for Impact 7: changes in fishing activity

Phase	Receptor	Sensitivity	Magnitude	Significance of Effect	Additional Mitigation	Residual Effect
Construction	Spawning Grounds	Low	Negligible	Negligible	N/A	Not significant
	Nursery Grounds	Low	Negligible	Negligible	N/A	Not significant
	Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs	Low	Negligible	Negligible	N/A	Not significant
	Shellfish	Low	Negligible	Negligible	N/A	Not significant
	Designated Sites	Low	Negligible	Negligible	N/A	Not significant
O&M	Spawning Grounds	Low	Negligible	Negligible	N/A	Not significant
	Nursery Grounds	Low	Negligible	Negligible	N/A	Not significant
	Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs	Low	Negligible	Negligible	N/A	Not significant
	Shellfish	Low	Negligible	Negligible	N/A	Not significant
	Designated Sites	Low	Negligible	Negligible	N/A	Not significant
Decommissioning	Spawning Grounds	Low	Negligible	Negligible	N/A	Not significant
	Nursery Grounds	Low	Negligible	Negligible	N/A	Not significant
	Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs	Low	Negligible	Negligible	N/A	Not significant
	Shellfish	Low	Negligible	Negligible	N/A	Not significant
	Designated Sites	Low	Negligible	Negligible	N/A	Not significant

9.11.1.8 Impact 8: Permanent Habitat Loss

9.11.1.8.1 Sensitivity

309. For the purposes of this assessment, impacts are assumed to be permanent. It should be noted that, this impact is assessed for the O&M phase (as this is the time period where the majority of effects would manifest), as discussed at the Scoping Workshop and agreed with respect to benthic ecology within the Scoping Opinion (January 2025), to avoid duplication of the same assessment for construction and decommissioning. It should be noted that habitat loss would also occur during the construction phase, in a staged manner, as foundations and cable protection are progressively installed and decommissioning. Whilst this has been considered, it has not been scoped in for further assessment. Direct impacts on fish and shellfish will result from the continuous physical presence of WDA infrastructure on the seabed throughout the operational period. Any pre-existing habitat within the footprint of this infrastructure will be permanently lost.

310. At this stage, it is not known which structures would remain in-situ at the time of decommissioning, and a detailed decommissioning programme would be developed and agreed with the relevant authorities post-consent. Therefore, it is currently unknown if the full extent of the habitat loss would be long-term or permanent. For assessment purposes, however, a precautionary worst-case scenario has been adopted. The worst-case assumes that areas of habitat loss associated with the WDA could persist permanently.

9.11.1.8.1.1 Spawning Grounds

311. The sensitivity of herring and sandeel spawning grounds to habitat loss is considered high, because demersal spawners are particularly dependent on suitable substrate and therefore are sensitive to the loss of this habitat. As noted in **Section 9.6**, the Regional Study Area, and the wider north Atlantic contains preferred sandy habitats for sandeel based on sediment characteristics, and these suitable sediments are widely distributed across the WDA.

312. Some habitat loss may occur in areas suitable for other fish species that spawn within the Local Study Area, however, these species are pelagic spawners and therefore less dependent on substrate.

313. The sensitivity of herring and sandeel spawning grounds is therefore considered to be **high**, and the sensitivity of other spawning grounds is considered to be **medium.**

9.11.1.8.1.2 Nursery Grounds

314. Fish nursery grounds are generally considered to be highly sensitive to permanent loss of habitat because disruption at this stage could significantly affect species development.

315. Although nursery areas for several species may overlap with the WDA (see Figure 1.6 and Figure 1.7 in **Appendix 9.1 Fish (including Basking Shark) and Shellfish Baseline Technical Report**), any habitat loss would be highly localised and is not expected to compromise the overall functioning of these broader nursery grounds.

316. The sensitivity of nursery grounds is therefore considered to be **high**.

9.11.1.8.1.3 Pelagic Fish, Demersal Fish, Diadromous Fish and Elasmobranchs

317. Diadromous species such as Atlantic salmon (a PMF), sea trout, and eel are highly mobile and migrate through the area rather than relying on fixed habitats within the WDA. Therefore, long-term seabed habitat loss is unlikely to significantly affect their populations or migratory behaviour.

318. Elasmobranchs are generalist foragers capable of relocating to suitable habitats and tolerating short-term changes in turbidity or sediment deposition as are most demersal fish species with the exception of sandeel, which require sandy sediments for burrowing and would be directly affected if such habitat is replaced with rock or hard substrate.

319. Basking shark is a PMF in Scotland and is also protected under the Wildlife and Countryside Act 1981, reflecting its conservation importance at a national level. While basking sharks may temporarily avoid areas where infrastructure is present, they are highly mobile filter feeders and can relocate to alternative habitats. However, permanent habitat loss will occur within the footprint of foundations, scour protection, and subsea cables, removing any pre-existing benthic habitat, although basking sharks do not depend on these habitats for feeding and impacts will be highly localised.

320. The sensitivity of pelagic fish, demersal fish, diadromous fish and elasmobranchs is therefore considered to be **low** with the exception of sandeel which is **high**.

9.11.1.8.1.4 Shellfish

321. Some crustaceans may be displaced by rock placement or scour protection although most species are mobile and can relocate to suitable habitats, and many (e.g., lobsters, crabs) can utilise hard substrates for shelter and foraging. However, Nephrops are dependent on burrowed muddy sediment and cannot adapt to permanent habitat loss.

322. Molluscs are generally sessile, and permanent loss of soft sediment habitats will occur within the footprint of infrastructure, with some burial of individuals and limited recolonisation of hard substrates.

323. The sensitivity of shellfish is therefore considered to be **medium**.

9.11.1.8.1.5 Designated Sites

324. The effects from permanent habitat loss are highly localised within the WDA. The Sea of the Hebrides NCMPA is the closest designated site to the WDA, however, is designated for the protection of basking shark and minke whale which are highly mobile and do not rely on seabed habitats and therefore are not impacted by changes to benthic substrate or permanent habitat loss (Scottish Government, 2019; NatureScot, 2020).

325. Loch Sween NCMPA, designated for burrowed mud and maerl beds amongst other features, is located 47.9 km from the WDA and is the closest designated site with features that could be impacted by permanent habitat loss. Since there is no hydrodynamic or ecological pathway through which the small and spatially constrained areas of habitat loss within the WDA could affect its qualifying features, no direct or indirect effects are expected on this or any further sites.

326. The sensitivity of designated sites is therefore considered to be **negligible.**

9.11.1.8.2 Magnitude of Impact

9.11.1.8.2.1 O&M

327. The estimated worst-case habitat loss within the WDA is 6,788,230.51 m², (**Table 9.5**) which accounts for 1.52% of its total area. These figures indicate that any habitat loss would be limited in scale.

328. For spawning grounds, the proportion of habitat loss within areas of higher herring spawning potential is negligible, and spawning would continue in adjacent areas unaffected by foundations and rock protection. Similarly, the loss of habitat for sandeel is minimal in the context of the extensive suitable substrate available across the Regional Study Area. Other fish species are generalists and show little sensitivity to localised changes in seabed substrate, meaning any impact would be negligible.

329. Nursery grounds for many species may overlap with the WDA; however, the loss of habitat is highly localised and is not expected to affect the functioning of these broader nursery areas.

330. Pelagic, diadromous, demersal and elasmobranch species, including basking shark, do not rely on seabed habitats and therefore have no pathway for impact from permanent habitat loss.

331. For Nephrops, Coul et al., 1998 indicates that spawning and nursery grounds overlap entirely with the WDA, however the permanent footprint represents only a very small proportion of the overall available muddy sediment habitat (approximately 1.52% of the WDA) and an even smaller fraction at the wider Regional Study Area scale. Based on the site-specific and third-party data, it has been confirmed that the sediment in the WDA is predominantly made up of Sand, Slightly gravelly sand and Gravelly sand as opposed to muddy sediment, making it unlikely to be suitable for nephrops (Appendix D of the **Scoping Report**). Similarly Nephrops grounds, identified from amalgamated VMS intensity layers, do not overlap with the WDA, but are concentrated in adjacent ICES rectangles associated with fine muddy sediments. Given this highly localised loss relative to the extensive distribution of suitable habitat, the effect on Nephrops populations is considered negligible.

332. Similarly for other shellfish species, since the permanent habitat loss accounts for 1.52% of the WDA, the level of change would have a highly localised effect and would not be detectable within local or regional crustacean populations.

333. For designated sites, as there are none that overlap with the WDA, there is no pathway for impact.

334. The magnitude of permanent habitat loss for all receptors is therefore considered to be **negligible**.

9.11.1.8.3 Significance of Effect

335. Overall, it is predicted that sensitivity of basking shark, pelagic, demersal, diadromous fish and elasmobranchs is **low** with the exception of sandeel, which is considered to be of **high** sensitivity. Spawning grounds and shellfish sensitivity is **medium** except for herring and sandeel spawning grounds which is **high**. The sensitivity of nursery grounds is **high**. The sensitivity of designated sites is **negligible**.

336. For all receptors, the magnitude of impact is **negligible**. The effect is therefore of **negligible adverse** significance, with the exception of sandeel and nursery grounds which are of **minor adverse** significance which is **not significant** in EIA terms.

337. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

Table 9.20 Significance of effect for Impact 8: permanent habitat loss

Phase	Receptor	Sensitivity	Magnitude	Significance of Effect	Additional Mitigation	Residual Effect
O&M (all phases)	Spawning Grounds	Medium – apart from herring and sandeel spawning grounds which have a high sensitivity	Negligible	Negligible or Minor Adverse	N/A	Not significant
	Nursery Grounds	High	Negligible	Minor Adverse	N/A	Not significant
	Pelagic Fish, Demersal Fish, Diadromous Fish, Elasmobranchs	Low – apart from sandeel which has a high sensitivity	Negligible	Negligible or Minor Adverse	N/A	Not significant
	Shellfish	Medium	Negligible	Negligible	N/A	Not significant
	Designated Sites	Negligible	Negligible	Negligible	N/A	Not significant

9.11.1.9 Impact 9: Electro-Magnetic Fields

9.11.1.9.1 Sensitivity

338. During the O&M phase, EMFs may be generated by offshore cables. The transmission of electricity through subsea cables produces localised EMFs that can affect the sensory systems of certain fish and shellfish, particularly electrosensitive groups such as elasmobranchs and diadromous fish, which rely on the Earth's geomagnetic field for navigation during migration (CMACS, 2003; Hutchison et al., 2020).

339. EMFs consist of two components: electric fields (measured in V/m) and magnetic fields (measured in µT or mG). Conductive sheathing is standard practice to block direct electric fields, meaning only magnetic fields and induced electric fields enter the marine environment. While burial cannot eliminate magnetic fields or induced electric fields at the sediment water interface, it does reduce field strength at the seabed because intensity decreases with distance from the cable (Gill et al., 2009; Gill et al., 2010; CSA, 2019).

340. Cable minimum Depth of Lowering (DoL) (i.e. the distance between mean seabed level and the top surface of the buried cable will be between 0.3 m and 3 m but is typically between 1.0 m and 2.0 m in seabed substrates consisting of granular material or soft clay. Where practicable, the Applicant will seek to achieve DoLs of 1.0 m to 2.0 m for all offshore cable types. DoLs of up to 3.0 m may be used for areas experiencing significant seabed mobility or due to an increased external threat, such as crossing shipping lanes. DoLs of 0.3 m may be used for IACs in challenging ground conditions such as shallow outcropping rock, due to the inherent protection it provides the cable at a shallower DoL. OSP link cables and offshore export cables would, as far as practicable, have a minimum DoL of 1 m. Otherwise, external cable protection methods would be considered such as concrete mattresses, rock placement, rock bags and nature inclusive design solutions. External cable protection methods up to 3.0 m in height will be applied to provide stability and maintain distance between receptors and EMF sources, thereby reducing potential behavioural or physiological effects.

341. The IAC system operates at up to 132 kV and consists of three single-core cables with fibre optics and an external diameter of up to 220 mm, each laid in its own trench. Burial to a depth of 1.0-3 m is preferred, though rock placement may be used where burial is impractical. Transmission of alternating current (AC) through IACs generates localised EMFs. Burial and cable protection reduce electric fields, leaving a residual magnetic field that may induce weak electric fields in seawater or swimming organisms.

342. OSP link cables operate at up to 400 kV with an external diameter of 275 mm. Up to four OSP link cables may be installed at the WDA, with two bundled per trench if required. These cables will also be buried where practicable, with external cable protection applied only where burial cannot reasonably be achieved. Like IACs, AC transmission in OSP link cables produces magnetic fields, with electric fields largely mitigated by design and shielding. OSP link cables would be buried to a minimum target DoL of 1.0 m

343. The WDA will also include up to four offshore export cable(s), which are anticipated to operate at up to 525 kV HVDC and comprise up to four single-core cables integrated with fibre optics. A maximum length of 200 km of cable will be included within the WDA. These cables will be installed in trenches, with two cables bundled per trench, if required. A DoL of 1.0-3 m is preferred to provide mechanical protection and reduce exposure risk, with a minimum target depth of 1.0 m being assessed as a worst-case scenario. Where burial is not practicable e.g. due to unsuitable ground conditions, external protection such as rock placement or concrete mattresses may be installed.

344. Some marine species detect magnetic fields through magnetite, a mineral particle that enables orientation during navigation and migration. Examples include teleost fish such as Atlantic salmon and sandeel, crustaceans like lobsters, crabs, prawns, and shrimps, and molluscs including snails, bivalves, and cephalopods. Other species are electro-receptive, notably elasmobranchs (sharks, skates, and rays). They can sense magnetic fields indirectly, by detecting electrical currents generated when water moves through a magnetic field, or directly through their own movement. This ability aids foraging, as elasmobranchs detect faint signals from prey, and may also support navigation (Molteno & Kennedy, 2009).

345. Evidence of EMF effects on fish and shellfish remains limited (Levitt et al., 2022), particularly for diadromous species, creating uncertainty about potential impacts. Where data are available or concern is greater (e.g., diadromous fish), these receptors are assessed separately.

9.11.1.9.1.1 Spawning Grounds

346. Several spawning grounds overlap with the WDA, including pelagic species such as herring, sandeel, sprat, and mackerel, demersal species including cod, haddock, plaice, and shellfish such as Nephrops which exhibit seasonal or year-round reproductive activity in defined habitats. Spawning grounds are considered sensitive because they represent critical points in the species' life cycle. Given that spawning grounds are generally distributed over large areas and not concentrated immediately adjacent to cable routes, exposure to elevated EMF levels is expected to be limited.

347. Any potential interaction with spawning habitats tends to be highly localised and temporary. While electrosensitive species such as elasmobranchs may detect magnetic fields at close range, there is no evidence from existing studies of barrier effects, disruption to spawning behaviour, or population-level impacts. However, these areas are highly sensitive because any disturbance during spawning periods can affect reproductive success and long-term population dynamics. Species such as herring, sandeel, cod, and haddock rely on specific environmental conditions, such as sediment type, temperature, and salinity, for successful spawning. Even minor changes in habitat quality or environmental cues during these life stages can have disproportionate impacts on survival rates.

348. The sensitivity of spawning grounds is therefore considered to be **high.**

9.11.1.9.1.2 Nursery Grounds

349. Nursery grounds are critical habitats that support juvenile stages of fish and shellfish, providing shelter and feeding opportunities essential for survival and growth. Species such as whiting, ling, blue whiting, and Nephrops, as well as elasmobranchs like spurdog and skate, have nursery areas that can overlap with the WDA, although most high-intensity nursery grounds occur in nearshore or shallow environments rather than in deep offshore areas. These life stages are considered sensitive because juveniles are less mobile than adults and may spend extended periods within localised habitats. Given that nursery grounds typically cover broad areas and are not concentrated immediately adjacent to cable routes, exposure to elevated EMF levels is expected to be limited.

350. While electrosensitive species such as elasmobranchs may detect magnetic fields at close range, any potential interaction would be highly localised and temporary. There is no evidence from existing studies of barrier effects, disruption to juvenile movement, or population-level impacts. These habitats are however crucial for maintaining population structure and resilience, as juveniles often exhibit limited mobility and prolonged residency within these areas. Any disruption to nursery habitats can reduce juvenile survival and recruitment, ultimately influencing stock levels and ecosystem balance.

351. The sensitivity of nursery grounds is therefore considered to be **high.**

9.11.1.9.1.3 Diadromous Fish

352. EMFs generated by subsea cables have the potential to influence the behaviour of migratory and pelagic species. These effects may include changes in swimming speed or direction, which could in turn affect the ability of fish to reach spawning, nursery, or feeding grounds. Certain species, such as the European eel, are thought to use magnetic fields for orientation, while salmonids can respond to electrical stimuli.

353. A number of studies have investigated the response of diadromous fish to EMFs. Research by Swedpower (2003) found no measurable effects on salmon and sea trout when exposed to magnetic fields twice the strength of the Earth's geomagnetic field. Similarly, work by Marine Scotland Science (Armstrong et al., 2015; 2016) and Walker (2001) reported no abnormal behaviour in Atlantic salmon exposed to EMFs from subsea cables. These experiments used both AC and direct current (DC) fields at levels stronger than those expected at seabed depth for cables buried at 1 m (Normandeau, 2011). The Bureau of Ocean Energy Management (BOEM, 2016) also concluded that energised cables do not present a barrier to the seasonal migration of fish.

354. Potential impacts on salmonids are closely linked to proximity to the EMF source. Gill and Bartlett (2010) suggest that any influence on migration would depend on water depth and the location of home rivers relative to development sites. During the later stages of marine migration, Atlantic salmon and sea trout rely primarily on olfactory cues to locate their natal rivers, and at this stage they are typically found in the mid to upper water column, further reducing exposure to seabed-level EMFs.

355. Studies on European eels have shown short-term changes in swimming speed and timing when exposed to AC subsea cables, although overall migration direction was unaffected (Öhman et al., 2007; Westerberg, 2000; Westerberg & Lagenfelt, 2008). Some deviations in swimming direction were observed within 500 m of offshore windfarm IACs, but these did not prevent eels from crossing cable systems. In one study, slower swimming speeds were recorded as eels passed over a 130 kV three-phase AC cable, yet no barrier effect was identified (Westerberg & Lagenfelt, 2008).

356. It is important to note that EMFs from AC cables fluctuate at 50 Hz, meaning they change direction 50 times per second. This rapid variation prevents them from interacting meaningfully with the Earth's geomagnetic field, which is why AC fields do not interfere with magnetic compasses. The same principle applies to species that use geomagnetic cues for long-distance navigation (Normandeau et al., 2011). However, DC fields, that would be produced by the offshore export cable(s) at the Project, are static in nature and therefore have a greater potential to interact with the Earth's geomagnetic field and with magneto-sensitive species.

357. Based on the available evidence, any EMF-related effects on diadromous fish are expected to be limited to short-term behavioural responses. These are unlikely to create barriers to migration or cause long-term impacts on foraging or navigation.

358. The sensitivity of diadromous fish is therefore considered to be **low.**

9.11.1.9.1.4 Pelagic and Demersal Fish

359. Pelagic fish generally exhibit low sensitivity to EMF and have a reduced likelihood of encountering elevated EMF levels because they occupy the water column rather than the seabed. Demersal species, which live on or near the seafloor and in close proximity to subsea cables, are more likely to encounter EMF. However, the demersal fish species identified within the Local Study Area lack

electromagnetic receptors capable of detecting EMF at 50 Hz and are therefore not regarded as sensitive to this stimulus.

360. Similarly, although DC cables generate a static magnetic field that can be detectable by some magneto-sensitive species, the pelagic species identified for the Local Study Area, such as herring, sandeel, Norway pout, sprat, and mackerel, are not known to possess specialised electro- or magneto-receptive structures and do not rely on geomagnetic cues for navigation or behaviour.

361. The sensitivity of pelagic and demersal fish is therefore considered to be **low.**

9.11.1.9.1.5 Elasmobranchs

362. Elasmobranchs are both electrosensitive and magneto sensitive, equipped with specialised sensory organs known as the ampullae of Lorenzini, which allow them to detect EMFs. These receptors play a crucial role in locating prey, avoiding predators, and recognising competitors. EMFs generated by subsea cables may therefore influence elasmobranch behaviour, potentially prompt investigation of the source and altering foraging activity, which could reduce food intake and overall fitness (Hutchison et al., 2018).

363. The detection range of EMFs around buried cables is relatively short, typically limited to a few metres at burial depths of 0.9-1.8 m (CSA, 2019). Species that spend extended periods on or near the seabed, such as skates and rays, are the most likely to encounter EMFs from offshore cables. These species, including thornback and spotted rays, feed primarily on benthic invertebrates and fish. Prey organisms generally emit bioelectric signals below 10 Hz, which is considerably lower than the 50 Hz frequency associated with windfarm cables and outside the optimal detection range for elasmobranchs (Snyder et al., 2019). In addition, EMF strength diminishes rapidly with distance from the cable, further reducing potential exposure.

364. Modelling from a comparable project shows that a buried HVAC cable at 1 m depth, consistent with the minimum target burial depth for OSP link cables in this project, produces a magnetic field of approximately 26.5 μT at the seabed, decreasing to 1 μT at 4.4 m above the seabed (Equinor, 2022). For context, background geomagnetic field levels in the northeast Atlantic are around 50 μT (Tasker et al., 2010).

365. For basking sharks, EMFs are not expected to cause notable changes in behaviour, and there is no evidence of barrier effects from existing offshore wind developments. Basking sharks typically spend around three-quarters of their time near the surface, where zooplankton, their primary food source, is concentrated (Rudd et al., 2021). As a result, they are unlikely to come into contact with EMFs from offshore cables during their summer migrations.

366. The sensitivity of elasmobranchs is therefore considered to be **medium**.

9.11.1.9.1.6 Shellfish

367. The effects of EMF on shellfish remain poorly understood and appear to vary across species and life stages. Some crustaceans and molluscs, including spiny lobsters and sea slugs, are magneto-sensitive and have shown behavioural responses to magnetic fields (Boles & Lohmann, 2003; Hutchison et al., 2020). Brown crab, for instance, have been observed associating with EMF zones around subsea cables (Scott et al., 2018). Laboratory studies suggest that chronic exposure to strong DC EMFs during embryonic stages can lead to smaller larval size and increased deformities, although no effects were detected on development time, larval release, or swimming speed (Harsanyi et al., 2022). These findings, however, reflect exposure levels far greater than those expected from IACs, OSP link or offshore export cable(s), limiting their real-world applicability.

368. Further experiments on adult brown crab found that EMF strengths of 250 μT did not significantly affect physiology or behaviour. At higher intensities (500-1000 μT), however, disruptions were observed in circadian rhythms of L-Lactate and D-Glucose, alongside changes in total haemocyte count, suggesting possible stress responses. Crabs also spent more time in shelters under these conditions, which may indicate attraction or reduced activity (Scott et al., 2018). The study did not clarify whether AC or DC fields were used, introducing uncertainty about their relevance to offshore wind projects.

369. The sensitivity of shellfish is therefore considered to be **medium**.

9.11.1.9.1.7 Designated Sites

370. Given that EMF effects from subsea cables are highly localised, attenuating rapidly with distance from the source, the potential for interaction with designated sites is minimal. Modelling from comparable projects indicates that magnetic field strength falls to approximately 1 μT within 3.9 m above the seabed for cables buried at 3.5 m depth, which is significantly below the background geomagnetic field of ~50 μT in the northeast Atlantic (Tasker et al., 2010; Equinor, 2022).

371. The nearest designated site (Sea of the Hebrides NCMPA) lies approximately 4.3 km away, far beyond the spatial extent of detectable EMF influence, which is typically limited to a few metres around the cable (CSA, 2019).

372. The sensitivity of designated sites is therefore considered to be **low.**

9.11.1.9.2 Magnitude of Impact

9.11.1.9.2.1 O&M

373. No specific EMF modelling has been undertaken for the Project; however, comparable scenarios from the Sheringham Shoal Offshore Windfarm Extension/Dudgeon Offshore Windfarm Extension (SEP/DEP) and Green Volt EMF assessments have been used to inform this assessment. These studies demonstrate that EMF emissions from subsea power cables are highly localised and reduce rapidly with distance due to the use of single 3-core AC cable designs.

374. The IACs will operate at up to 132 kV AC and consist of three single-core cables with integrated fibre optics, each laid in its own trench. The indicative external diameter is approximately 220 mm, and target DoL of 1.0-3 m is preferred, although a minimum target depth of 0.3 m may be accepted in areas of shallow bedrock. Where burial is impractical, external protection such as rock placement may be applied. Transmission of AC through IACs generates localised magnetic fields, while electric fields are largely mitigated by cable armour and metallic sheathing. SEP/DEP modelling for similar HVAC systems shows magnetic fields attenuate rapidly, falling below 1 μT within 4-5 m of the seabed (Trip, 2022). These findings are consistent with Green Volt results, which reported maximum seabed magnetic fields of 35 μT for 66 kV circuits, also reducing to below 1 μT at 5 m (Green Volt EMF Assessment, 2022). Given the lower voltage and current rating of IACs compared to export cable(s), EMF emissions will be highly localised and well below thresholds of ecological concern.

375. OSP link cables will operate at up to 400 kV AC, with an indicative external diameter of 275 mm. Up to four link cables may be installed, with two bundled per trench where required. Target DoL of 1.0-3 m is preferred, with external protection applied only where burial cannot reasonably be achieved. Like IACs, AC transmission in OSP link cables produces magnetic fields, but electric fields are effectively contained within the cable sheath. SEP/DEP modelling for comparable HVAC export circuits (220 kV) demonstrated magnetic fields of 26 μT at the seabed, reducing to **<**1 μT within 5.4 m

vertically (Equinor, 2022). Green Volt modelling for 275 kV circuits reported similar attenuation, with fields halving within 0.8 m and falling below 1 μT at 5 m (Flotation Energy, 2022). These results indicate that OSP link cable EMF emissions will remain highly localised and diminish rapidly with distance, aided by burial and compact phase arrangements.

376. The offshore export cable(s) are anticipated to operate at up to 525 kV HVDC, comprising up to four single-core cables integrated with fibre optics. Within the WDA, these cables will be installed in trenches, with two cables bundled per trench where required. A minimum target DoL of 1.0 m is preferred to provide mechanical protection and reduce exposure risk, although deeper burial (up to 3 m) may be applied in areas of high seabed mobility or increased external threat. HVDC cables produce static magnetic fields rather than alternating fields, meaning they do not interact with the Earth’s geomagnetic field in the same way as AC fields. The use of armoured cables and burial further mitigates EMF exposure, ensuring compliance with marine guidance and minimising potential ecological effects.

377. Cable protection through burial is the preferred method of providing protection to cables from damage. Although a minimum target burial depth of 0.3 m for IACs could be accepted in very specific geological conditions (e.g., shallow bedrock), this is not the norm and would only be likely to occur along very short sections of the IAC where natural seabed protection is present. If adequate burial cannot be achieved, external protection methods (e.g., concrete mattresses, rock berms, rock bags, or nature-inclusive designs) would be considered for all offshore cable types.

378. While some electrosensitive species may exhibit short-term behavioural responses within a few metres of cables, there is no evidence of barrier effects, migration disruption, or population-level impacts.

379. The magnitude of EMF for all receptors is therefore considered to be **negligible**.

9.11.1.9.3 Significance of Effect

380. Overall, it is predicted that sensitivity of spawning and nursery grounds is **high**. Elasmobranchs, shellfish and basking shark is **medium,** while sensitivity of diadromous, pelagic, demersal fish and designated sites is **low** and the magnitude of impact is **negligible**. The effect is therefore of **negligible** to **minor adverse** significance, which is **not significant** in EIA terms.

381. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

Table 9.21 Significance of effect for Impact 9: electro-magnetic fields

Phase	Receptor	Sensitivity	Magnitude	Significance of Effect	Additional Mitigation	Residual Effect
O&M	Spawning Grounds	High	Negligible	Minor Adverse	N/A	Not significant
	Nursery Grounds	High	Negligible	Minor Adverse	N/A	Not significant
	Pelagic Fish, Demersal Fish	Low	Negligible	Negligible	N/A	Not significant
	Diadromous Fish	Low	Negligible	Negligible	N/A	Not significant
	Elasmobranchs	Medium	Negligible	Negligible	N/A	Not significant
	Shellfish	Medium	Negligible	Negligible	N/A	Not significant
	Designated Sites	Low	Negligible	Negligible	N/A	Not significant

9.11.1.10 Impact 10: Introduction of Hard Substrate

382. Artificial structures placed within the WDA, such as foundations and scour protection, can provide new surfaces for benthic invertebrates to colonise. In areas that are largely composed of soft sediment, the addition of hard substrate alters the types of habitat available, enabling species that would not normally thrive there to establish. This can lead to a localised increase in biodiversity, with the structures functioning like artificial reefs and potentially serving as fish aggregation points (Birchenough & Degraer, 2020; Coolen et al., 2020).

383. The growth of these communities may subsequently attract predators, including seabirds and marine mammals, which could shift local predator-prey relationships. While the greatest effects are expected during the O&M phase, the gradual introduction of hard substrate begins during construction as foundations and rock protection are installed. Colonisation is likely to occur slowly at first, with more noticeable ecological changes developing during O&M. If any infrastructure remains after decommissioning, these effects could persist.

384. At this stage, it is not known which structures would remain in-situ at the time of decommissioning, and a detailed decommissioning programme would be developed and agreed with the relevant authorities post-consent. Therefore, it is currently unknown if the full extent of the habitat loss would be long-term or permanent. For assessment purposes, however, a precautionary worst-case scenario has been adopted. This assumes that certain elements of the infrastructure would remain in place following decommissioning, specifically the scour protection and external cable protection, the below-seabed portions of driven piles (which would be cut at the natural level of the seabed and left in situ). Under this assumption, some areas of permanent habitat loss associated with these structures could therefore persist in the long term.

385. Although such changes might be seen as beneficial for certain species, they represent a departure from natural baseline conditions. For this reason, a precautionary approach is taken, assuming that the impacts could be adverse, however the Project is looking into the application of Nature Inclusive Design (NID) and enhancement measures, to maximise any potential ecological benefits (see the **Nature Positive Plan**).

9.11.1.10.1 Sensitivity

9.11.1.10.1.1 Spawning Grounds

386. The sensitivity of spawning habitats to changes in substrate is generally high due to the critical nature of this life stage. Hard substrate introduced into the environment would not provide suitable conditions for sandeel spawning. Site-specific particle size analysis indicates that the existing sediment composition within the WDA is preferred sandeel spawning habitat and there is an overlap between the WDA and sandeel spawning sites (Coull et al., 1998, Ellis et al., 2012). Although these habitats are ecologically significant, they are fairly widespread within the Regional Study Area and are resilient to minor changes.

387. In contrast, other spawning species considered in this assessment such as herring, are pelagic spawners and therefore release eggs into the water column rather than onto the seabed. As such, they have low sensitivity to seabed substrate changes, and no meaningful effect on their spawning success is anticipated from the limited areas of permanent habitat loss.

388. The sensitivity of spawning grounds is therefore considered to be **low** with the exception of sandeel which is **medium.**

9.11.1.10.1.2 Nursery Grounds

389. Fish nursery grounds are also generally considered sensitive to changes in substrate because of the critical role this stage plays in the species' life cycle. The introduction of hard substrate as part of the WDA would minimally impact existing nursery areas, as these habitats occur over spatial scales far larger than the limited extent of the introduced material and associated impacts are expected to be very localised. The limited and highly localised seabed footprint of foundations and rock protection would not alter the distribution, quality or ecological function of these nursery habitats. However, the inherent sensitivity of nursery grounds remains medium, reflecting the ecological importance of this life stage.

390. The sensitivity of nursery grounds is therefore considered to be **medium.**

9.11.1.10.1.3 Pelagic Fish, Diadromous Fish and Elasmobranchs

391. Research has shown that mobile fish groups such as elasmobranchs including basking shark, pelagic fish, and diadromous species exhibit low sensitivity to the introduction of hard substrates, as their ecology is not closely tied to seabed habitat (Degraer et al., 2020).

392. The presence of discrete pockets of hard substrate is not considered to negatively impact these groups and the sensitivity of pelagic, diadromous fish and elasmobranchs is therefore considered to be **low.**

9.11.1.10.1.4 Demersal fish

393. Hard substrate introduced by the Project could provide suitable habitat for several demersal species such as cod, whiting, and ling, which favour or utilise rocky substrate. These species may benefit from increased refuge availability, foraging opportunities, and localised habitat heterogeneity created by artificial hard substrate. Atlantic cod show higher relative abundance in areas with greater seabed complexity and mixed substrates, while whiting and other gadoids demonstrate species-specific preferences linked to substrate extent and local habitat configuration (Elliott et al., 2017). As such, the introduction of hard substrate may provide a positive ecological pathway for these species, even if such benefits are ultimately assessed as negligible within the EIA. The introduction of hard substrate represents a departure from the natural soft-sediment baseline and may adversely affect species that specialise in soft-sediment habitats. Consistent with the precautionary principle, this change is therefore assessed conservatively as an ecological alteration with both potentially beneficial and adverse aspects, depending on species' habitat preferences and ecological interactions.

394. The sensitivity of demersal fish to this change is considered low, as these species are generally adaptable and capable of utilising a variety of benthic environments. Consequently, any associated effects are unlikely to influence local or regional populations of these species. Nonetheless, recognising the possibility of localised habitat enhancement, the Project will look to apply NID and other enhancement measures where appropriate to maximise any potential ecological benefits (see the **Nature Positive Plan**) while maintaining a balanced and precautionary assessment.

395. The sensitivity of demersal fish is therefore considered to be **low.**

9.11.1.10.1.5 Shellfish

396. The introduction of hard substrate could provide suitable habitat for various crustaceans, including European lobster, brown crab, and velvet crab, which favour rocky substrates. Additionally, certain encrusting molluscs, such as blue mussels, may benefit from the increased habitat availability.

397. However, species that rely on soft sediment, such as burrowing bivalves and crustaceans like Nephrops, would lose appropriate habitat within the footprint of the introduced substrate. These species cannot utilise hard ground and are therefore more sensitive to any permanent change in seabed type, particularly where the footprint overlaps directly with areas of suitable muddy sediment. The tendency of hard substrate to aggregate fish may also lead to increased predation on these species.

398. Therefore, sensitivities vary across shellfish species. Most shellfish species such as hard-substrate, associated crustaceans and encrusting molluscs are considered to have **low** sensitivity due to their ability to utilise or benefit from the new habitat. Soft sediment dependent species such as burrowing bivalves and Nephrops exhibit **high** sensitivity because they rely on the habitat that would be lost.

9.11.1.10.1.6 Designated Sites

399. The effects from the introduction of hard substrate are highly localised and the nearest designated site, the Sea of the Hebrides NCMPA, which is designated for the protection of basking shark, is approximately 4.3 km from the WDA. Basking shark have been assessed as part of **Section 9.11.1.10.1.3** and are considered to have low sensitivity to the introduction of hard substrate. Given this distance and the designation of the site, there is no realistic pathway through which changes in substrate within the WDA could influence the ecological features or conservation objectives of the designated sites. As the designated site is fully spatially separated from the area of effect and its qualifying features would not be exposed to any direct or indirect pressures arising from the Project.

400. The sensitivity of designated sites is therefore considered to be **negligible**.

9.11.1.10.2 Magnitude of Impact

9.11.1.10.2.1 O&M

401. The introduction of hard substrate within the WDA is expected to occur primarily through the installation of foundations and scour protection during construction, with the most noticeable ecological changes developing during the O&M phase. The total area of hard substrate introduced is estimated at 6,788,230.51 m², representing approximately 1.52% of the WDA. This footprint is highly localised when considered against the overall WDA and the wider Regional Study Area.

402. Given the limited spatial extent of the introduced material, the resulting changes in habitat availability are expected to be minor and confined to the immediate vicinity of the structures. While these changes may lead to localised increases in biodiversity and attract certain species, they do not represent a significant alteration at a regional scale as outlined in **Section 9.11.1.6.2.1**.

403. The magnitude of impact for the introduction of hard substrate for all receptors is therefore considered to be **negligible**.

9.11.1.10.3 Significance of Effect

404. Overall, it is predicted that sensitivity of elasmobranch, demersal fish, pelagic fish, and diadromous fish, shellfish and spawning grounds is **low**, with the exception of sandeel spawning grounds which are **medium**, and soft sediment dependent shellfish species such as burrowing bivalves and Nephrops which are **high.** The sensitivity of, nursery grounds, and designated sites is **negligible** and the overall magnitude of impact is **negligible**. The effect is therefore of **negligible to minor adverse** significance, this therefore is **not significant** in EIA terms.

405. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

Table 9.22 Significance of effect for Impact 10: introduction of hard substrate

Phase	Receptor	Sensitivity	Magnitude	Significance of Effect	Additional Mitigation	Residual Effect
O&M	Spawning Grounds	Low – except for sandeel which is considered Medium	Negligible	Negligible	N/A	Not significant
	Nursery Grounds	Medium	Negligible	Negligible	N/A	Not significant
	Pelagic Fish, Diadromous Fish, Elasmobranchs	Low	Negligible	Negligible	N/A	Not significant
	Demersal Fish	Low	Negligible	Negligible	N/A	Not significant
	Shellfish	Low – except for soft sediment dependent species such as burrowing bivalves and Nephrops which is considered High	Negligible	Negligible/Minor Adverse	N/A	Not significant
	Designated Sites	Negligible	Negligible	Negligible	N/A	Not significant

9.11.2 Combined Assessment: Windfarm Development Area, Offshore Export Cable Corridor and Onshore Development Transmission Development Area

9.11.2.1 Impact 1: Temporary Physical Disturbance / Habitat Loss

406. Cable installation activities within the Offshore ECC, such as ploughing, jetting, mass/controlled flow excavation and mechanical cutting, would temporarily increase the overall footprint of seabed disturbance when combined with the WDA. Despite this, the combined area of disturbance will remain very small in comparison to the extensive sandy and gravelly sediment habitats across the region. Evidence from similar environments indicates that benthic communities typically recover quickly following installation (RPS, 2019; Newell et al., 1998).

407. Disturbance within the OnTDA will be limited to terrestrial and intertidal environments. In the event that cable trenching in the intertidal area was the landfall method employed, additional temporary physical disturbance / habitat loss would occur however as the landfall area is greater than 150 km from the WDA, no additive or interactional effects are anticipated.

408. Overall, while the Offshore ECC adds to the total area of temporary physical disturbance / habitat loss, the interactional and additive effects are limited by spatial separation, short duration, and rapid recovery of benthic habitats. Consequently, the combined assessment of effects on receptors remains **negligible** and **not significant** in EIA terms, consistent with the WDA-alone assessment (**Section 9.11.1**).

9.11.2.2 Impact 2: Increased SSCs and Sediment Redeposition

409. Seabed preparation and cable installation activities within the Offshore ECC, such as ploughing, or jetting, would increase the overall footprint of sediment disturbance when combined with the WDA. This would result in additional SSCs and sediment redeposition. However, these effects are expected to remain highly localised and short-lived, with concentrations dispersing rapidly under prevailing hydrodynamic conditions (ABPmer, 2008; **Chapter 7 Marine Physical Environment**).

410. The OnTDA will not materially increase marine sediment disturbance that would lead to an increase in SSCs as all works would be onshore or in the intertidal area.

411. Overall, although the Offshore ECC contributes to the total volume of suspended sediment, the combined effects are constrained by spatial separation, short duration, and natural sediment dynamics. Given the resilience of most fish and shellfish receptors to turbidity fluctuations and the broad distribution of spawning and nursery grounds, the combined magnitude of impact is considered **negligible** and **not significant** in EIA terms, consistent with the WDA-alone assessment.

9.11.2.3 Impact 3: UWN and Vibration

412. There would be no piling within the Offshore ECC and so no combined UWN effects with respect to piling activities. UXO clearance within the Offshore ECC would increase the overall footprint of UWN emissions when combined with the WDA however given the short-term and impulsive nature of UXO clearance activities and that low-order clearance will be the method employed, an increase in the predicted impact from the combined clearance activities in the Offshore ECC is not predicted. Any noise generated by cable installation activities (e.g., rock placement, mechanical cutting, jetting) is substantially lower than that associated with foundation installation. As a result, any additive effect on UWN levels will be minimal and highly localised (**Appendix 10.1 UWN Modelling Report**).

413. The OnTDA will not introduce additional UWN sources beyond HDD or cable trenching works at landfall, which produce negligible acoustic energy compared to offshore piling and are also constrained by spatial separation. Therefore, the combination of WDA and OnTDA will not result in any meaningful increase in UWN during construction.

414. Overall, while the Offshore ECC may contribute some noise from UXO clearance, minor vessel noise and limited vibration during cable installation, these effects are small relative to the dominant source i.e. impact piling within the WDA. Consequently, the combined assessment of UWN and vibration impacts on fish and shellfish receptors remains **negligible/minor adverse** and **not significant** in EIA terms, consistent with the WDA-alone assessment.

9.11.2.4 Impact 4: Disturbance and Displacement of Basking Shark

415. The maximum number of vessels assumed for WDA infrastructure activities includes those required for offshore export cable installation and therefore there would be no overall increase in vessel traffic when combined with the WDA. It is likely that each type of offshore cable will be installed at separate times and therefore there is unlikely to be any interactional disturbance or displacement effects. Additionally, offshore cable laying vessels are likely to move at slow speeds as the cable is being installed and therefore the risk of disturbance and displacement would be minimised throughout the Offshore ECC. Basking shark sightings within the WDA are very low, and the Offshore ECC is not likely to be an important area for the species (Pikesley et al., 2024). As a result, any additive effect on disturbance or displacement is expected to be minimal and highly localised (NatureScot, 2024; Pikesley et al., 2024).

416. The OnTDA will not introduce additional vessel activity in marine habitats as all works would be onshore or in the intertidal area. Vessel activity at the landfall would be associated with the Offshore ECC.

417. Overall, while the Offshore ECC will increase the temporal and geographical spread of vessel movements during installation, these contributions are small relative to construction vessel traffic within the WDA. Consequently, the combined assessment of disturbance and displacement impacts on basking sharks remains **negligible** and **not significant** in EIA terms, consistent with the WDA-alone assessment.

9.11.2.5 Impact 5: Vessel Collision for Basking Shark

418. As above, the maximum number of vessels assumed for WDA infrastructure activities includes those required for offshore export cable installation and therefore there would be no overall increase in vessel traffic when combined with the WDA. Basking shark density within the WDA is extremely low (0–0.01 sharks/km^2; Pikesley et al., 2024), and 30 months of DAS observations indicate that the WDA is not likely a key habitat for this species and the Offshore ECC is not likely to be an important area for the species (Pikesley et al., 2024). Consequently, any additive effect on collision risk is expected to be minimal and highly localised (NatureScot, 2024).

419. The OnTDA will not introduce additional vessel activity in marine habitats as all works would be onshore or in the intertidal area.

420. Overall, while the Offshore ECC will increase the temporal and geographical spread of vessel movements during installation, these contributions are small relative to construction vessel traffic and have already been accounted for within the WDA assessment. Embedded mitigation measures for vessel operations will apply across all Development Areas. As a result, the combined assessment of

vessel collision risk for basking sharks remains **minor adverse** and **not significant** in EIA terms, consistent with the WDA-alone assessment.

9.11.2.6 Impact 6: INNS

421. As above, the maximum number of vessels assumed for WDA infrastructure activities includes those required for offshore export cable installation and therefore there would be no overall increase in vessel traffic when combined with the WDA. There is therefore unlikely to be an elevated the risk of INNS transfer through mechanisms such as hull fouling, ballast water discharge, or equipment movement when compared to the WDA alone. Regardless, embedded biosecurity measures and adherence to marine guidance will apply across all Development Areas, keeping this risk low.

422. The OnTDA will not introduce additional marine pathways for INNS beyond HDD or cable trenching works at landfall. While HDD equipment could theoretically act as a vector, strict biosecurity protocols as embedded mitigation will effectively mitigate this risk.

423. Overall, while the Offshore ECC will increase the temporal and geographical spread of vessel movements during installation, and theoretically, the risk of INNS spread, these contributions are small relative to construction vessel traffic within the WDA. The WDA does not contain habitats that inherently promote INNS establishment, and the spatial footprint of infrastructure is limited compared to the wider marine environment. In addition, the Project will adhere to the commitments and procedures set out in **Appendix 8 INNSMP**, which provides a structured framework for preventing, detecting, and managing INNS risks throughout the lifecycle of the development. Consequently, the combined assessment of INNS-related impacts remains **negligible/minor adverse** and **not significant** in EIA terms, consistent with the WDA-alone assessment.

9.11.2.7 Impact 7: Changes in Fishing Activity

424. Implementation of safety exclusion zones along the Offshore ECC during cable installation would temporarily increase the overall footprint of restricted access for fishing vessels compared to the WDA-alone scenario. This could lead to short-term displacement of fishing effort to adjacent grounds; however, the effect is expected to be minor and reversible.

425. The OnTDA will not introduce additional restrictions on marine fishing activity as all works would be onshore or in the intertidal area.

426. Overall, while the Offshore ECC adds a small additional area of temporary exclusion during cable installation, these contributions are negligible relative to the overall distribution of fishing grounds in the region. Embedded mitigation measures for vessel operations will apply across all areas. Consequently, the combined assessment of changes in fishing activity remains **negligible** and **not significant** in EIA terms, consistent with the WDA-alone assessment.

9.11.2.8 Impact 8: Permanent Habitat Loss

427. Installation of additional cable protection or infrastructure within the Offshore ECC during operation would slightly increase the overall footprint of permanent habitat loss compared to the WDA-alone scenario. However, the spatial extent of habitat loss within the ECC will remain very small relative to the total seabed area and will primarily affect sandy substrates, which are widely distributed across the Regional Study Area.

428. The OnTDA will not introduce permanent habitat loss in marine environments as all works would be onshore or in the intertidal area. Therefore, the combination of WDA and OnTDA will not result in any meaningful increase in seabed habitat loss during operation.

429. Overall, while the Offshore ECC adds a minor additional footprint of cable protection and associated structures, these contributions are negligible compared to foundations and scour protection within the WDA. Consequently, the combined assessment of permanent habitat loss remains **negligible/minor adverse** and **not significant** in EIA terms, consistent with the WDA-alone assessment.

9.11.2.9 Impact 9: Electro-Magnetic Fields

430. In a combined assessment, the export cable extending beyond the WDA into the Offshore ECC would increase the overall footprint of EMF sources compared to the WDA-alone scenario. However, EMF emissions from subsea AC or HVDC cables are highly localised and attenuate rapidly with distance. SEP/DEP and Green Volt modelling indicates magnetic fields fall below 1 μT within 4-5 m of the seabed. Furthermore, the export cable will be buried to a target DoL of at least 1 m providing further EMF attenuation. Where burial is not practicable, cable protection will be applied to provide stability and maintain distance between receptors and EMF sources, thereby reducing potential behavioural or physiological effects.

431. The OnTDA will not introduce additional subsea EMF sources unless cable trenching through the intertidal area is employed as the landfall technique. However, as cables would be buried through the intertidal, rapid attenuation of EMF would occur and the combination of the WDA and OnTDA will not result in any meaningful increase in EMF exposure for marine receptors.

432. Overall, while the Offshore ECC adds additional cable length through the export route, these contributions are highly localised and attenuate rapidly with distance. Consequently, the combined assessment of EMF-related impacts remains **negligible/minor adverse** and **not significant** in EIA terms, consistent with the WDA-alone conclusion.

9.11.2.10 Impact 10: Introduction of Hard Substrate

433. Installation of additional scour protection or cable protection within the Offshore ECC would slightly increase the overall footprint of hard substrate compared to the WDA-alone scenario. This could create new surfaces for colonisation by benthic invertebrates, altering habitat composition and potentially generating artificial reef effects (Birchenough & Degraer, 2020; Coolen et al., 2020). However, the spatial extent of hard substrate introduction within the Offshore ECC will remain very small relative to the wider region, and any ecological changes will be highly localised.

434. The OnTDA will not introduce hard substrate into marine environments as all works would be onshore or in the intertidal area where the addition of permanent infrastructure (other than the cables themselves) is not anticipated. Therefore, the combination of WDA and OnTDA will not result in any meaningful increase in habitat alteration during operation.

435. Overall, while the Offshore ECC adds a minor additional footprint of external cable protection, colonisation processes and associated ecological shifts will occur gradually and remain localised. Consequently, the combined assessment of hard substrate introduction remains **negligible** and **not significant** in EIA terms, consistent with the WDA-alone assessment.

9.11.2.11 Combined Assessment Summary

Table 9.23 Fish and shellfish ecology combined assessment summary

Receptor/Topic	WDA Residual Effect	Offshore ECC Appraisal of Effects	OnTDA Appraisal of Effects	Combined assessment
C, O&M, D* Impact 1: Temporary Physical Disturbance	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible)	No significant residual effects likely, a greater area of seabed will be disturbed but the total will remain small when compared to wider regional area.
C, O&M, D* Impact 2: Increased SSCs and Sediment Redeposition	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible to Minor Adverse).	N/A – no pathway to receptors.	No significant residual effects, a greater volume of sediment will be disturbed but it is highly unlikely to generate a combined effect as plumes will disperse rapidly after disturbance limiting the potential for overlapping plumes.
C, O&M, D* Impact 3: UWN and Vibration	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible)	No significant residual effects likely, additional UWN and vibration will be produced but the overall impact will not be more significant than the WDA alone residual effect.
C, O&M, D* Impact 4: Disturbance and Displacement of Basking Shark	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible to Minor Adverse).	N/A – no pathway to receptors.	No significant residual effects likely, despite some additive effects in the vicinity of the WDA.
C, O&M, D* Impact 5: Vessel Collision for Basking Shark	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible to Minor Adverse).	N/A – no pathway to receptors.	No significant residual effects likely, despite some additive effects in the vicinity of the WDA.
C, O&M, D* Impact 6: INNS	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible to Minor Adverse).	N/A – no pathway to receptors.	No significant residual effects likely, despite an increase in subsea infrastructure therefore some additive effects in the vicinity of the WDA.
C, O&M, D* Impact 7: Changes in Fishing Activity	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible to Minor Adverse).	N/A – no pathway to receptors.	No significant residual effects likely, despite some additive effects in the vicinity of the WDA.

Receptor/Topic	WDA Residual Effect	Offshore ECC Appraisal of Effects	OnTDA Appraisal of Effects	Combined assessment
O&M* Impact 8: Permanent Habitat Los	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible)	No significant residual effects likely, despite some additive effects in the vicinity of the WDA.
O&M* Impact 9: EMF	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible)	No significant residual effects likely, despite some additive effects in the vicinity of the WDA.
O&M* Impact 10: Introduction of Hard Substrates	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible to Minor Adverse).	Not Significant (Negligible)	No significant residual effects likely, despite an increase in subsea infrastructure therefore some additive effects in the vicinity of the WDA.
* C = Construction, O&M = Operation and Maintenance, D = Decommissioning				

9.12 CUMULATIVE EFFECTS

9.12.1 Screening of Potential Cumulative Impacts

436. The first step in the CEA is the screening / identification of which whole-Project impacts could have a cumulative effect with other plans, projects and activities (described as 'impact screening'). This information is set out in **Table 9.24**, together with a consideration of the confidence in the data that is available to inform a detailed assessment and the associated rationale.

Table 9.24 Potential cumulative impacts (impact screening)

Impact	Potential for Cumulative Impact	Data Confidence	Rationale
Construction			
Impact 1: Temporary Physical Disturbance / Habitat Loss	Yes	High	The loss of habitat and associated disturbance will be highly localised and short-term in nature, however there will be spatial and temporal overlap with other plans and projects. Although the duration and footprint of disturbance are limited, the overlap of activities may increase the overall impact from temporary physical disturbance/loss. Consequently, the potential for physical disturbance and temporary habitat loss affecting fish and shellfish has been included in the cumulative effects assessment (CEA).
Impact 2: Increased SSCs and Sediment Redeposition	Yes	High	The increase in SSCs and subsequent sediment re-deposition are expected to be highly localised and short-lived. Although elevated SCCs may disperse over the distance of a single tidal ellipse (approximately 11km). There will be spatial and temporal overlap with other plans/projects with the potential to increase the overall impact from increased SSCs and sediment redeposition. Consequently, the potential for increased SSCs and sediment redeposition has been included in the CEA.
Impact 3: UWN and Vibration	Yes	High	Disturbance from UWN refers to a short-term behavioural change caused by noise exposure and typically resolves within hours to days after the source ceases. These effects generally extend over wider ranges and areas than those predicted for recoverable injury. The ZoI may overlap with other projects if sequential pile driving occurs. Disturbance from UWN and vibration has been included in the CEA to account for possible cumulative impacts.
Impact 4: Disturbance and Displacement of Basking Shark	No	Medium	With robust mitigation measures in place, the risk to basking sharks is low, and the likelihood of WDA infrastructure contributing to cumulative effects is minimised. For both the WDA-alone assessment and the combined assessment, the significance of effects on basking sharks was concluded to be negligible, reflecting the very limited interaction expected between this species and project activities. This conclusion is further supported by the highly

Impact	Potential for Cumulative Impact	Data Confidence	Rationale
			mobile nature of basking sharks, which enables individuals to move freely through the wider marine environment and avoid localised, short-term pressures. As a result, no meaningful cumulative effect pathway is anticipated. The potential for disturbance and displacement of basking sharks has been excluded from the CEA.
Impact 5: Vessel Collision for Basking Shark	No	Medium	Although the WDA-alone assessment concluded a minor adverse significance, the magnitude of impact was assessed as negligible across all phases, reflecting the very low density of basking sharks within the WDA, limited surface-feeding activity, and the implementation of robust vessel-management mitigation. Basking sharks are also a highly mobile species, capable of moving rapidly through large areas of the marine environment, which substantially reduces the likelihood of repeated or prolonged exposure to vessel traffic from multiple developments. Given the negligible magnitude, low likelihood of spatial or temporal overlap, and the species' mobility, there is no realistic pathway for cumulative vessel-collision effects. The potential for vessel collision with basking shark has been excluded from the CEA.
Impact 6: INNS	Yes	High	There is the potential for a cumulative increase in vessels within the ZoI that would allow INNS to move or spread between developments. The potential for cumulative effects from the transfer of INNS has been included within the CEA.
Impact 7: Changes in Fishing Activity	Yes	High	Temporary changes in fishing activity are expected during construction, with a localised reduction in access and minor displacement occurring only within the WDA. While the Offshore ECC will introduce a small additional area of short-term restricted access during cable installation, this contribution is very limited in scale relative to the wider regional fishing grounds. The potential for cumulative effects from changes in fishing activity has been included within the CEA
O&M			
Impact 1: Temporary Physical Disturbance / Habitat Loss	Yes	High	The loss of habitat and associated disturbance will be highly localised and short-term in nature, however there will be spatial and temporal overlap with other plans and projects. Although the duration and footprint of disturbance are limited, the overlap of activities may increase the overall impact from temporary physical disturbance/loss.

Impact	Potential for Cumulative Impact	Data Confidence	Rationale
			Consequently, the potential for physical disturbance and temporary habitat loss affecting fish and shellfish has been included in the cumulative effects assessment (CEA).
Impact 2: Increased SSCs and Sediment Redeposition	Yes	High	The increase in SSCs and subsequent sediment re-deposition are expected to be highly localised and short-lived. Although elevated SSCs may disperse over the distance of a single tidal ellipse (approximately 11km). There will be spatial and temporal overlap with other plans/projects with the potential to increase the overall impact from increased SSCs and sediment redeposition. Consequently, the potential for increased SSCs and sediment redeposition has been included in the CEA.
Impact 3: UWN and Vibration	Yes	High	Disturbance from UWN refers to a short-term behavioural change caused by noise exposure and is typically resolved within hours to days after the source ceases. These effects generally extend over wider ranges and areas than those predicted for recoverable injury. The ZoI during O&M is expected to be less, so overlap with projects is not expected. Disturbance from UWN and vibration during O&M has been included in the CEA.
Impact 4: Disturbance and Displacement of Basking Shark	No	Medium	With robust mitigation measures in place, the risk to basking sharks is low, and the likelihood of WDA infrastructure contributing to cumulative effects is minimised. For both the WDA-alone assessment and the combined assessment, the significance of effects on basking sharks was concluded to be negligible, reflecting the very limited interaction expected between this species and project activities. This conclusion is further supported by the highly mobile nature of basking sharks, which enables individuals to move freely through the wider marine environment and avoid localised, short-term pressures. As a result, no meaningful cumulative effect pathway is anticipated. The potential for disturbance and displacement of basking sharks has been excluded from the CEA.
Impact 5: Vessel Collision for Basking Shark	No	Medium	Although the WDA-alone assessment concluded a minor adverse significance, the magnitude of impact was assessed as negligible across all phases, reflecting the very low density of basking sharks within the WDA, limited surface-feeding activity, and the implementation of robust vessel-management mitigation. Basking sharks are also a highly mobile species, capable of moving rapidly through large areas of the marine environment, which substantially reduces the likelihood of repeated or prolonged exposure to vessel traffic from multiple developments. Given the negligible magnitude, low

Impact	Potential for Cumulative Impact	Data Confidence	Rationale
			likelihood of spatial or temporal overlap, and the species' mobility, there is no realistic pathway for cumulative vessel-collision effects. The potential for vessel collision with basking shark has been excluded from the CEA.
Impact 6: INNS	Yes	High	There is the potential for a cumulative increase in vessels within the ZoI that would allow INNS to move or spread between developments. The potential for cumulative effects from the transfer of INNS has been included within the CEA.
Impact 7: Changes in Fishing Activity	Yes	High	During O&M, any reduction in fishing activity is expected to be very limited and highly localised within the WDA, with only small areas temporarily avoided during routine maintenance works. While the Offshore ECC may introduce occasional, short-term maintenance activity, its contribution to overall spatial or temporal restrictions is negligible in the context of the extensive fishing grounds available across the region. The potential for cumulative effects from changes in fishing activity has been included within the CEA.
Impact 8: Permanent Habitat Loss	Yes	High	There is potential for cumulative long-term habitat loss and disturbance resulting from the presence WDA infrastructure and the associated Offshore ECC Infrastructure. Therefore, permanent habitat loss affecting fish and shellfish has been included in the CEA for the O&M phases to account for possible cumulative impacts.
Impact 9: EMF	Yes	Medium	There is potential for repeated behavioural effects from EMF on migratory species if individuals pass through multiple operational offshore windfarms. Such repeated exposure could cumulatively influence migratory behaviour. Therefore, the potential for EMF impacts on fish and shellfish has been included in the CEA for the O&M phases to account for possible cumulative impacts.
Impact 10: Introduction of Hard Substrate	No	High	The introduction of hard substrate is predicted to result in negligible effects on fish and shellfish, as colonisation of new structures is expected to be neutral or beneficial for hard-substrate species and does not adversely affect the wider resource. Given the very small spatial footprint of introduced substrate and the absence of any negative ecological pathway, there is no realistic mechanism by which these negligible effects could combine with other third-party projects to create a significant cumulative impact.

Impact	Potential for Cumulative Impact	Data Confidence	Rationale
			As a result, this potential impact on fish and shellfish has been excluded from the CEA.
Decommissioning			
As above for Construction			

9.12.2 Screening of Other Plans, Projects and Activities

437. The second screening step in the CEA is the identification of the other plans, projects and activities that may result in cumulative impacts for inclusion in the CEA (described as ‘project screening’). This information is set out in **Table 9.25**, together with consideration of the relevant details of each, including current status (e.g. under construction), planned construction period, closest distance to the Project, status of available data and rationale for including or excluding from the assessment.

438. The project screening has been informed by the development of a CEA Long-List (**Appendix 5.1**) which forms an exhaustive list of plans, projects and activities in a very large Study Area relevant to the Project. The list has been appraised, based on the confidence in being able to undertake an assessment from the information and data available, enabling individual plans, projects and activities to be screened in or out. As described in **Section 9.10.3**, this has been undertaken using a tiered approach to provide a framework for placing relative weight on the potential for each plan or project to be included in the CEA for this topic.

439. An appropriate ZoI to identify overlapping projects/activities has been determined based on the worst-case UWN modelling results which is 88 km, as described in **Table 9.5.**

Table 9.25 Planned projects within 88 km of the Project

Project / Plan	Status	Closest Distance from the WDA (km)	Closest Distance from the Offshore ECC (km)	Description of Project / Plan	Construction Period	Operational Period	Data Confidence	Overlap with the WDA	Included in the CEA	Rationale
Tier 1 projects / plans (projects which are operational (but not part of the baseline), under construction, those with consent and submitted but not yet determined)										
Dubh Artach Lighthouse Refurbishment	Operational	1.5	28	Refurbishment	2027-2032	5 years	High	Yes, temporal overlap	Yes	Potential overlap with the Project's Construction and O&M activities
Flex Marine Power	Operational	26	37	Tidal	2024	5 years	High	Yes, temporal overlap	Yes	Potential overlap with the Project's O&M activities
Tier 2 projects / plans (all plans/projects assessed under Tier 1, plus those projects with a Scoping Report and/or Scoping Opinion)										
LirIC interconnector	Development	125	Overlap	Electricity Interconnector	2032	Unknown	High	Yes, temporal overlap	Yes	Potential overlap with the Project's construction and O&M activities
Tier 3 projects / plans (all plans/projects assessed under Tier 1 and Tier 2, plus those projects likely to come forward where a CES Option to Lease Agreement or equivalent has been granted (i.e., ScotWind and INTOG projects)										
Malin Sea Wind	Early Planning	48	14	Offshore Windfarm	2030-2031	25+ years	High	Yes, temporal overlap	Yes	Potential overlap with the Project's construction and O&M activities
Oran na Mara	Pre-Application	24	38	Tidal	Unknown	Unknown	High	Yes, temporal overlap	Yes	Potential overlap with the Project's Construction and O&M activities
Western Link 2	Early Planning	104	Overlap	Electricity Transmission Cable	Unknown	Unknown	High	Yes, temporal overlap	Yes	Potential overlap with the Project's construction and O&M activities

9.12.3 Cumulative Effects Assessment

9.12.3.1 Cumulative Impact 1: Temporary Physical Disturbance/Habitat Loss

9.12.3.1.1 Sensitivity

440. Receptor sensitivity to temporary physical disturbance/habitat loss varies by receptor group, ranging from **low-medium** with the exception of sandeel and herring spawning grounds, which are **high**, and align with the sensitivities outlined in **Section 9.11.1.1.1**.

9.12.3.1.2 Magnitude of Impact

9.12.3.1.2.1 Construction

441. The cumulative assessment considers the Project infrastructure alongside other developments listed in **Table 9.24**. Several Tier 1 and Tier 2 projects coincide spatially or temporally with the Project footprint, creating the potential for overlapping areas of temporary seabed disturbance.

442. Disturbance from the Project will be highly localised, intermittent and short-term, with a maximum estimated footprint of 25,385,076 m² associated with the WDA infrastructure (5.67% of the WDA) (**Section 9.11.1.1.2.1**). Although some temporal overlap may occur, the affected areas represent a very small proportion of available habitat, and recovery of sediments is expected to begin rapidly once activities cease.

443. For Tier 2, the LirIC interconnector is the only development within the fish and shellfish ZoI. Seabed disturbance associated with this activity is expected to be similar to that associated with the Project's offshore export cable. It is unlikely that there would be a temporal overlap of activities in the areas where the cable installation works would cross although if this were to occur, temporary physical disturbance / habitat loss areas would be restricted the crossing location and be highly localised. Given the wide availability of similar habitats throughout the region, cumulative effects on fish and shellfish receptors are not anticipated. Further detail will be provided in the Offshore ECC consent application.

444. For Tier 3, regional-scale development may increase the overall density of offshore construction activity. However, these works are generally implemented in a phased or sequential manner. As a result, cumulative disturbance at any single location would remain limited, and benthic habitats and associated species are expected to recover quickly once activities cease.

445. The magnitude of impact for temporary physical disturbance and habitat loss for all receptors is therefore considered to be **negligible**.

9.12.3.1.2.2 O&M

446. For Tier 1, only limited O&M activities are expected to occur concurrently with the Project. Disturbance from jack-up vessels or cable repair works at neighbouring projects will be infrequent and small in spatial extent. Any temporal overlap with the Project would therefore result in only minor, highly localised seabed disturbance, with rapid recovery anticipated once works are completed. As such, cumulative effects on fish and shellfish habitats are not expected.

447. For Tier 2, activities are not anticipated to undertake O&M works that would create appreciable seabed disturbance. Any overlap in timing with the Project would be very limited, and given the wide

availability of similar habitat throughout the region, cumulative disturbance or loss of fish and shellfish habitat is unlikely.

448. For Tier 3, long-term operational activities across the wider region may involve occasional O&M activities. However, these activities are generally low in frequency, spatially discrete, and typically occur at different times across individual sites. As a result, the likelihood of multiple maintenance events causing cumulative seabed disturbance at a single location is low, and benthic habitats and associated species are expected to recover quickly once activities cease.

449. The magnitude of impact for temporary physical disturbance and habitat loss for all receptors is therefore considered to be **negligible**.

9.12.3.1.2.3 Decommissioning

450. At the time the Project enters decommissioning, most Tier 1 and Tier 2 developments are expected to be either fully operational or already decommissioned. As a result, only limited and low-intensity seabed disturbance would be occurring at these sites, with no major seabed preparation or cable installation works anticipated. The likelihood of significant temporal overlap between the Project's decommissioning activities and other substantial seabed-disturbing works is therefore very low. Any interaction with ongoing operational activities or minor decommissioning works at nearby developments would be highly localised and not expected to contribute to cumulative habitat loss due to the small scale and short duration of disturbance.

451. For Tier 3, in a full regional build-out scenario, some offshore projects may enter decommissioning within a similar broad timeframe. However, decommissioning programmes are typically phased over several years, meaning that large-scale seabed disturbance occurring simultaneously at multiple sites is unlikely. Furthermore, decommissioning does not require the types of seabed-preparation activities used during construction, so disturbance footprints at individual sites would be considerably reduced. Given the patchy and temporary nature of disturbance, cumulative effects on fish and shellfish are not expected.

452. The magnitude of impact for temporary physical disturbance and habitat loss for all receptors is therefore considered to be **negligible**.

9.12.3.1.3 Significance of Effect

453. Overall it is predicted that sensitivity for all receptors is **low-medium** with the exception of sandeel and herring spawning grounds, which are **high**. The magnitude of impact is **negligible** for all phases. The cumulative effect is therefore of **negligible** or **minor adverse** significance, which is **not significant** in EIA terms.

454. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

9.12.3.2 Cumulative Impact 2: Increased SSCs and Sediment Redeposition

9.12.3.2.1 Sensitivity

455. Receptor sensitivity to increased SSCs and sediment redeposition varies by receptor group, ranging from **low-medium** with the exception of sandeel and herring spawning grounds, which are **high**, and align with the sensitivities outlined in **Section 9.11.1.2.1**.

9.12.3.2.2 Magnitude of Impact

9.12.3.2.2.1 Construction

456. Several Tier 1 and Tier 2 projects overlap spatially or temporally with the Project's construction window, with potential for combined increases in suspended sediment. Increases in SSCs from the Project will be highly localised and short-lived, with sediment plumes predicted to disperse within hours under prevailing hydrodynamic conditions (**Section 9.11.1.2.2.1**), with measurable increases limited to the immediate surrounding footprint of the construction activities. Although some overlap may occur with nearby Tier 1 projects, any combined plumes would still occupy only a very small proportion of available water column habitat, and natural tidal dispersion would rapidly decrease SSC concentrations.

457. For Tier 2, only one development falls within the fish and shellfish ZoI. No piling is anticipated, and activities involve offshore cables being buried or placed on the seabed. Increased SSCs associated with its construction activities are expected to be limited in extent. If temporal overlap occurs, plumes would be small and short-duration, and within natural turbidity variability. Consequently, cumulative increases in SSCs are not anticipated to produce adverse ecological effects. However, further information will be provided in the Offshore ECC consent application.

458. For Tier 3 projects, regional-scale offshore development may marginally increase level of SSC across the wider area. However, construction programmes are generally phased, and increased SSCs decline rapidly with distance from the disturbance source. As a result, the potential for multiple SSC plumes to accumulate at any single location is low, and dynamic conditions of the WDA and Offshore ECC will further facilitate tidal dispersion.

459. The magnitude of impact for increased SSCs and sediment redeposition for all receptors is therefore considered to be **negligible**.

9.12.3.2.2.2 O&M

460. For Tier 1, O&M activities may occasionally disturb seabed sediments during cable repair or maintenance activities, generating small, short-lived plumes similar to those predicted for the Project. Any temporal overlap between these activities would be infrequent, and SSC increases would remain highly localised.

461. For Tier 2, O&M activities are not expected to produce significant increases in SSCs within the ZoI. Increases in SSCs are anticipated to be very small in scale, and any overlap with Project O&M activities would not meaningfully elevate turbidity conditions above natural variability.

462. For Tier 3, O&M activities across the region are expected to occur intermittently and often at different times across individual sites. The limited spatial extent and short duration of SSC releases means that cumulative turbidity effects are unlikely to arise. Given the patchy and temporary nature of increased SSCs and sediment redeposition, cumulative effects on fish and shellfish are not expected.

463. The magnitude of impact for increased SSCs and sediment redeposition for all receptors is therefore considered to be **negligible**.

9.12.3.2.2.3 Decommissioning

464. At the time the Project enters decommissioning, most Tier 1 and Tier 2 activities will involve limited activities which result in increased SSCs, or sites will already be decommissioned. The likelihood of

meaningful temporal overlap with major sediment-disturbing activities is therefore very low. Any interactions with minor SSC releases from neighbouring sites would be short-lived and not significant.

465. For Tier 3, in a full regional build-out scenario, some offshore projects may enter decommissioning within a similar broad timeframe. However, decommissioning programmes are typically staggered across multiple years, reducing the potential for simultaneous SSC increases. As decommissioning does not involve seabed-preparation activities such as ploughing or excavation, the scale of SSC release at each site is expected to be smaller, further limiting cumulative effects.

466. The magnitude of impact for increased SSCs and sediment redeposition for all receptors is therefore considered to be **negligible**.

9.12.3.2.3 Significance of Effect

467. Overall it is predicted that sensitivity for all receptors is **low-medium** with the exception of sandeel and herring spawning grounds, which are **high**. The magnitude of impact is **negligible** for all phases. The cumulative effect is therefore of **negligible** or **minor adverse** significance, which is **not significant** in EIA terms.

468. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

9.12.3.3 Cumulative Impact 3: UWN and Vibration

9.12.3.3.1 Sensitivity

469. Receptor sensitivity to UWN and vibration varies by receptor group, ranging from **low-medium**, and aligns with the sensitivities outlined in **Section 9.11.1.3.1**.

9.12.3.3.2 Magnitude of Impact

9.12.3.3.2.1 Construction

470. For Tier 1, one tidal development has been identified. However, according to the submitted Marine Licence application, no loud, low to mid frequency (10 Hz to 10 kHz) impulsive noise will be produced, with no piling anticipated. Consequently, the potential for cumulative UWN impacts from concurrent piling does not arise. The construction phase also has the potential to overlap with the Dubh Artach Lighthouse refurbishment, however, for the Project, piling will be short-term and intermittent, and fish species are highly mobile, allowing them to avoid peak noise levels. Furthermore, no temporal overlap in high-energy impulsive noise sources (e.g. impact piling) within the wider region are expected.

471. For Tier 2, the LirIC interconnector is the only development within the fish and shellfish ZoI. No piling is anticipated, and offshore cables will be buried or placed on the seabed which would result in minimal additional noise emissions above background levels into the marine environment. Consequently, the project is not expected to generate the high-energy impulsive noise which would increase potential for cumulative UWN impacts.

472. Regarding Tier 3 projects, regional-scale development, including INTOG projects would increase the overall density of offshore construction activity across the wider region. However, construction programmes are expected to be largely sequential, and piling remains a temporary activity. As a result, cumulative exposure at any single location would be limited, and fish and shellfish receptors are expected to recover quickly once noise-generating activities cease.

473. The magnitude of impact for UWN and vibration for all receptors is therefore considered to be **low**.

9.12.3.3.2.2 O&M

474. During the O&M phase, UWN generated by the Project will be limited to low-intensity, non-impulsive sources associated with routine vessel activity and periodic maintenance tasks and are not considered to pose a risk of injury or behavioural disruption to fish and shellfish receptors due to their low sound levels and rapid attenuation with distance.

475. For Tier 1 and Tier 2, the operational projects generate similar low-level operational noise. As such, any cumulative contribution from overlapping operational sound fields will be minimal, with no potential for additive or synergistic effects. Fish and shellfish receptors are accustomed to such background noise levels across much of the region.

476. Regarding Tier 3, a greater number of operational projects may be present regionally in the long term, operational noise from these developments would remain low-intensity, non-impulsive, and diffuse. As a result, cumulative operational noise levels are not expected to exceed natural variability in the wider environment or elicit adverse responses in fish or shellfish species.

477. The magnitude of impact for UWN and vibration during O&M for all receptors is therefore considered to be **negligible**.

9.12.3.3.2.3 Decommissioning

478. At the time the Project enters decommissioning, most Tier 1 and Tier 2 projects will already be operational or fully decommissioned, generating only low-level, non-impulsive UWN. Consequently, there is a very low likelihood that the Project's decommissioning activities will overlap temporally with any major noise-generating activities at other Tier 1 or Tier 2 sites. Any interaction with operational noise fields from adjacent developments would have no meaningful cumulative effect due to rapid sound attenuation with distance and the inherently low intensity of operational noise.

479. Regarding Tier 3, in a full regional build-out scenario, several offshore projects could enter decommissioning within the same broad timeframe as the Project. However, decommissioning programmes are typically implemented sequentially, with removal works phased over multiple years. This phasing significantly reduces the likelihood of overlapping high-intensity UWN emissions across different sites. Moreover, impact piling would not be required during decommissioning activities so UWN emissions from individual projects would be much reduced compared to construction.

480. The magnitude of impact for UWN and vibration for all receptors is therefore considered to be **negligible.**

9.12.3.3.3 Significance of Effect

481. Overall it is predicted that sensitivity for all receptors is **low-medium**. The magnitude of impact is **low** for construction and **negligible** for O&M and Decommissioning phases. The cumulative effect is therefore of **negligible** or **minor adverse** significance, which is **not significant** in EIA terms.

482. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

9.12.3.4 Cumulative Impact 4: INNS

9.12.3.4.1 Sensitivity

483. Receptor sensitivity to permanent habitat loss varies by receptor group, ranging from **medium-high**, and aligns with the sensitivities outlined in **Section 9.11.1.6.1**.

9.12.3.4.2 Magnitude of Impact

9.12.3.4.2.1 Construction

484. During construction, up to 5,699 vessel round trips are predicted. These vessels provide vectors for the potential introduction of INNS into the habitats within the fish and shellfish Local Study Area. In addition, the installation of artificial hard substrate on the seabed and in the water column in the construction phase could provide new habitat for INNS to colonise throughout the lifetime of the Project, resulting in a potential 'stepping-stone' to the spread of INNS in the wider area.

485. There will be up to up to 117 vessels potentially carrying out construction activities within the WDA at any one time. Additional vessels supporting the refurbishment of the Lighthouse is expected to be small in number, significantly less than the number of vessels used during the construction phase of the Project.

486. All vessels must adhere to the International Convention for the Control and Management of Ships' BWM Convention (2004) which provides global regulations to control the transfer of potentially invasive species. In addition, the Project would implement an INNSMP (**Appendix 8 INNSMP**) as an embedded mitigation measure which aims to manage and reduce the potential risk of introduction and spread of INNS as far as reasonably practicable.

487. Therefore, the magnitude is considered to be **negligible**.

9.12.3.4.2.2 O&M

488. As discussed above, the installation of artificial hard substrate to the WDA has the potential to provide a steppingstone for the colonisation of INNS. However, as the surrounding region has natural hard substrate, such as rock outcrops and boulders, the construction of the Project, alone will not significantly increase the risk of INNS, as 'stepping-stones' have existed in the fish and shellfish Local Study Area for a prolonged period of time.

489. The cumulative risk is also associated with the movement of vessels in and out of the region. However, the introduction of INNS through vessels will be mitigated through adherence with the BWM Convention 2004 guidelines and an INNSMP.

490. Therefore, the magnitude is considered to be **negligible**.

9.12.3.4.2.3 Decommissioning

491. As with the construction and O&M phases of the Project, the risk of spreading of INNS from vessels would be mitigated through the BWM Convention 2004 guidelines and an INNSMP.

492. Therefore, the magnitude is considered to be **negligible**.

9.12.3.4.3 Significance of Effect

493. Overall, it is predicted that sensitivity for all receptors is **medium** or **high** (**Table 9.18**). The magnitude of impact is **negligible** for all phases. The cumulative significance of effect is therefore **minor adverse**, which is **not significant** in EIA terms.

9.12.3.5 Cumulative Impact 5: Changes in Fishing Activity

9.12.3.5.1 Sensitivity

494. Receptor sensitivity to permanent habitat loss varies by receptor group, ranging from **low**, and aligns with the sensitivities outlined in **Section 9.11.1.7.1**.

9.12.3.5.2 Magnitude of Impact

9.12.3.5.2.1 Construction

495. During construction, temporary exclusion of fishing activity within parts of the WDA and immediate surrounds will intermittently displace static and mobile gears into adjacent grounds. At the scale of the regional fisheries system, this represents a short-term redistribution of effort rather than a material increase in total fishing mortality, because displaced fleets draw on nearby grounds already used within their normal operational range. Accordingly, any pressure on commercial fish and shellfish resources is expected to be localised and transient relative to natural spatio-temporal variability in stocks.

496. When considered cumulatively with other past, present and reasonably foreseeable marine activities, the conceptual and temporal overlap in fishing-effort displacement is limited and managed by embedded measures (e.g. fisheries liaison, advance NtMs, cable burial/monitoring) that seek to minimise fishing-development interactions. In this context, additive change in fishing activity affecting fish and shellfish resources is predicted to remain small in scale and duration.

497. The Project's Fisheries Mitigation, Monitoring and Communication Plan (FMMCP) and associated practices (e.g. Offshore Fisheries Liaison Officer (FLO), coordination of works, minimising external cable protection) are expected to reduce the potential for concentrated, abrupt displacement and associated local pressure on fish and shellfish resources during peak construction phases.

498. Therefore, the magnitude is considered to be **negligible**.

9.12.3.5.2.2 O&M

499. In operation, fishing access is expected to partially resume across much of the WDA and Offshore ECC, with activity patterns adapting around fixed structures. Consequently, long-term, project-related displacement pressures are limited, and any incremental change in fishing effort distribution relative to baseline conditions is expected to be minor and geographically constrained.

500. Considering other relevant plans and projects in the region, sustained cumulative increases in fishing pressure on the same stock units are not anticipated, because all Tier developments, except potentially Malin Sea Wind which is a floating project of approximately 32 km^2, allow at least partial resumption of fishing opportunities. Opportunities remain to diffuse effort across accessible grounds, and embedded liaison/communication measures continue through O&M, avoiding prolonged clustering of displaced fleets and subsequent pressure on fish and shellfish resources.

501. Therefore, the magnitude is considered to be **negligible**.

9.12.3.5.2.3 Decommissioning

502. Decommissioning activities will be temporary and spatially limited, and the pattern of short-term fishing displacement is expected to be analogous to construction, with similar embedded mitigation and liaison arrangements in place. In combination with other projects, any overlap in timing is expected to be brief and managed, such that additional pressure on fish and shellfish resources remains transient and minor.

503. Therefore, the magnitude is considered to be **negligible**.

9.12.3.5.3 Significance of Effect

504. Overall, it is predicted that sensitivity for all receptors is **low** (**Table 9.19**). The magnitude of impact is **negligible** for all phases. The cumulative significance of effect is therefore **negligible**, which is **not significant** in EIA terms.

9.12.3.6 Cumulative Impact 6: Permanent Habitat Loss

9.12.3.6.1 Sensitivity

505. Receptor sensitivity to permanent habitat loss varies by receptor group, ranging from **low-high**, and aligns with the sensitivities outlined in **Section 9.11.1.8.1**.

9.12.3.6.2 Magnitude of Impact

9.12.3.6.2.1 O&M

506. Permanent habitat loss during the O&M phase of the WDA arises from the long-term presence of WTG infrastructure that would remain in place throughout the project lifetime and potentially beyond. The worst-case assumes that areas of habitat loss associated with these structures could persist permanently.

507. These features represent a permanent physical alteration of the seabed environment. The cumulative assessment considers the additive contribution of the Project (including Offshore ECC infrastructure) in combination with other operational and proposed offshore developments identified in **Table 9.24**, focusing on the potential for regional-scale habitat modification that could influence fish and shellfish ecology.

508. The estimated worst-case permanent habitat loss footprint within the WDA is approximately 6,788,230.51 m², accounting for less than 1.6% of its total area. When combined with other Tier 1 and Tier 2 developments on the west coast of Scotland, the cumulative area of permanent seabed change represents a negligible proportion of the regional seabed. The footprint of Offshore ECC infrastructure is unknown at this time but would be significantly less than that associated with the WDA and so there is limited potential for significant cumulative permanent habitat loss effects associated with this. Each development introduces small, discrete footprints widely separated across the region, and given the limited number of projects, this is not anticipated to be significant.

509. Regarding Tier 3 developments, even under a full regional build-out scenario along the west coast of Scotland, the combined footprint of all projects would represent only a very small proportion of the extensive seabed area. While localised replacement of soft sediment with hard substrata may alter species composition at the microhabitat level, this change is generally limited to the enhancement of reef-like communities rather than loss of ecological function.

510. The magnitude of impact for permanent habitat loss, for all receptors is therefore considered to be **negligible.**

9.12.3.6.3 Significance of Effect

511. Overall, it is predicted that sensitivity for all receptors is **low-high**. The magnitude of impact is **negligible** for O&M. The cumulative effect is therefore of **negligible** or **minor adverse** significance, which is **not significant** in EIA terms.

512. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

9.12.3.7 Cumulative Impact 7: EMF

9.12.3.7.1 Sensitivity

513. Receptor sensitivity to permanent habitat loss varies by receptor group, ranging from **low-high**, and aligns with the sensitivities outlined in **Section 9.11.1.9.1**.

9.12.3.7.2 Magnitude of Impact

9.12.3.7.2.1 O&M

514. During O&M, EMFs will be generated by the IACs, OSP link cables and offshore export cable(s) associated with the WDA. This cumulative assessment considers whether combined or repeated exposure to EMFs from multiple developments could influence fish and shellfish receptors, either through attraction, avoidance, or disruption of navigation and migration. Consistent with the combined assessment, EMF emissions from all Project cables are highly localised, rapidly attenuate with distance, and are further reduced by cable burial depths of at least 0.3 m (for IACs only and this would only occur at very discrete sections) or 1 m for OSP link cables or offshore export cables (or by cable protection where burial is not practicable).

515. Given the highly localised nature of EMF emissions and rapid attenuation with distance, exposure zones around Project cables will be small and transient. Cables from nearby operational or consented projects are separated by large distances and are generally buried to similar or greater depths, meaning EMF fields from other projects will not combine with those from the Project. The remaining potential cumulative pathway is repeated exposure as animals move long distances and potentially pass subsea cables from multiple projects, for example during diadromous fish migrations. Based on results for comparable studies, these brief encounters are not expected to accumulate to cause effects of greater significance over the course of longer-distance travel.

516. Considering receptor sensitivity, limited exposure extent, and rapid attenuation of EMF strength with distance, the cumulative effect from Tier 1 is assessed as negligible. There is no evidence that exposure to EMFs at these levels would impair orientation, feeding, or migration behaviour at a population scale.

517. For Tier 2, the LirIC interconnector is the only additional project within the fish and shellfish ZoI. The interconnector will comprise of two 320 kV HVDC subsea cables which will be buried underground or placed on the seabed, resulting in highly localised EMF emissions that attenuate rapidly with distance. Cable burial substantially limits the spatial extent of detectable EMFs. Fields from the LirIC cables may spatially overlap with the offshore export cables however, given cables are generally buried to similar or greater depths (likely for an interconnector cable) and, at cable crossing locations,

a layer of protection is added on top of the cable being crossed and then another layer on top of the cable that has crossed it, EMF fields are not expected to accumulate to cause effects of greater significance than assessed for Project alone effects.

518. For Tier 3 developments, cumulative EMF exposure would increase proportionally with the number of cables. However, these effects would remain highly localised (within approximately 5 m of each cable) and would not spatially connect across the region. Migratory species traversing multiple cable routes would experience brief, intermittent exposure events well below behavioural threshold levels.

519. The magnitude of impact for EMF, for all receptors is therefore considered to be **negligible.**

9.12.3.7.3 Significance of Effect

520. Overall, it is predicted that sensitivity for all receptors is **low-high**. The magnitude of impact is **negligible** for O&M. The cumulative effect is therefore of **negligible** or **minor adverse** significance, which is **not significant** in EIA terms.

521. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

9.13 TRANSBOUNDARY EFFECTS

522. The distribution of fish and shellfish species is independent of national boundaries. The assessment for the Project has therefore been undertaken based on species distributions and population ranges rather than jurisdictional limits.

523. Based on the maximum extent of SSC plumes predicted for the project of 11km, transboundary effects from sediment suspension will not occur (see Section 7.12.1.1 in **Chapter 7 Marine Physical Environment**).

524. There is potential for UWN generated during piling in the construction phase to propagate into Irish territorial waters. Impact ranges for fish receptors, as determined by dedicated UWN modelling (**Appendix 10.1 UWN Modelling Report**), are discussed in **Section 9.11.1.3**. Worst-case modelling indicates that the greatest predicted range for TTS is approximately 88 km. This ZoI extends into Irish waters under worst-case assumptions. However, TTS impacts are expected to be short-term and intermittent, with recovery of fish and shellfish populations following completion of piling activities.

525. Overall, the sensitivity of fish and shellfish to piling noise is assessed as low to medium, with a magnitude of low, resulting in an effect significance of minor adverse. The distribution of fish and shellfish species is independent of national geographical boundaries and this EIA has considered the distribution of fish stocks and populations irrespective of national jurisdictions so therefore transboundary effects of UWN and vibration are considered **minor adverse** and **not significant** in EIA terms.

9.14 INTER-RELATED AND INTERACTING IMPACTS

9.14.1 Inter-Relationships

526. **Table 9.26** below provides a summary of the key inter-relationships between fish and shellfish ecology and other technical chapters and indicates where those issues have been addressed in the relevant chapters.

Table 9.26 Fish and shellfish ecology inter-relationships

Topic and description	Related chapter(s)	Where addressed in this chapter	Rationale
Construction and Decommissioning			
Temporary Physical Disturbance / Habitat Loss	Chapter 7 Marine Physical Environment; Chapter 8 Benthic Ecology; Chapter 10 Marine Mammals and Leatherback Turtle; and Chapter 12 Commercial Fisheries.	**Section 9.11.1.1.2.1**	Seabed disturbance during construction and decommissioning, of the WDA infrastructure may temporarily displace fish and reduce the availability of benthic prey species through sediment deposition. These interactions are relevant to marine physical processes (sediment mobilisation), benthic habitats (substrate alteration), marine mammals (due to trophic links), and commercial fisheries.
Increased SSC and sediment redeposition	Chapter 7 Marine Physical Environment; and Chapter 8 Benthic Ecology.	**Section 9.11.1.2.2.1**	Elevated SSCs can lead to smothering of benthic organisms and may temporarily affect water quality. The effects outlined in this chapter demonstrate how suspended sediment influences benthic habitats and associated marine species, which is an important consideration when assessing potential impacts on wider marine ecosystems.
UWN and Vibration	Chapter 8 Benthic Ecology; and Chapter 10 Marine Mammals and Leatherback Turtle.	**Section 9.11.1.3.2.1**	UWN and vibration generated during construction and decommissioning of the WDA infrastructure has the potential to disturb marine mammals and benthic organisms. This section evaluates the biological implications of noise exposure, including displacement and behavioural changes in sensitive marine species, which is critical for assessing ecological risks within the project area.
Disturbance and Displacement of Basking Shark	Chapter 13 Shipping and Navigation	**Section 9.11.1.4.2.1**	Although basking shark is considered within the fish and shellfish assessment, increased vessel traffic during construction could elevate the risk of disturbance/displacement of this species.
Vessel Collision for Basking Shark	Chapter 13 Shipping and Navigation.	**Section 9.11.1.5.2.1**	Although basking shark is considered within the fish and shellfish assessment, increased vessel traffic during construction could elevate the risk of collision for this species.
INNS	Chapter 8 Benthic Ecology; and Chapter 12 Commercial Fisheries.	**Section 9.11.1.6.2.1**	INNS can alter seabed habitats by introducing new species that compete with or displace native benthic organisms. This affects community structure, nutrient cycling, and habitat integrity, which are key considerations in benthic impact

Topic and description	Related chapter(s)	Where addressed in this chapter	Rationale
			assessment. They may also impact fish and shellfish stocks targeted by fisheries through predation, competition, or disease transmission. Changes in species composition can influence catch rates and economic viability, making this a critical issue for fisheries management.
Changes in Fishing Activity	Chapter 12 Commercial Fisheries.	**Section 9.11.1.7.2.1**	Construction and decommissioning activities may temporarily restrict access to fishing grounds, displacing fishing effort to other areas and potentially altering local fishing pressure on fish populations. These interactions are closely linked to the commercial fisheries assessment and may influence population-level pressures
O&M			
Temporary Physical Disturbance	Chapter 7 Marine Physical Environment; Chapter 8 Benthic Ecology; Chapter 10 Marine Mammals and Leatherback Turtle; and Chapter 12 Commercial Fisheries.	**Section 9.11.1.1.2.2**	Seabed disturbance during O&M of the WDA infrastructure may temporarily displace fish and reduce the availability of benthic prey species through sediment deposition. These interactions are relevant to marine physical environment (sediment mobilisation), benthic habitats (substrate alteration), marine mammals (due to trophic links), and commercial fisheries.
Increased SSC and sediment redeposition	Chapter 7 Marine Physical Environment; and Chapter 8 Benthic Ecology.	**Section 9.11.1.2.2.2**	Elevated SSCs can lead to smothering of benthic organisms and may temporarily affect water quality. The effects outlined in this chapter demonstrate how suspended sediment influences benthic habitats and associated marine species, which is an important consideration when assessing potential impacts on wider marine ecosystems.
UWN and Vibration	Chapter 8 Benthic Ecology; and Chapter 10 Marine Mammals and Leatherback Turtle.	**Section 9.11.1.3.2.2**	UWN and vibration generated during O&M of the WDA infrastructure has the potential to disturb marine mammals and benthic organisms. This section evaluates the biological implications of noise exposure, including displacement and behavioural changes in sensitive marine species, which is critical for assessing ecological risks within the project area

Topic and description	Related chapter(s)	Where addressed in this chapter	Rationale
Disturbance and Displacement of Basking Shark	Chapter 13 Shipping and Navigation	**Section 9.11.1.4.2.2**	Although basking shark is considered within the fish and shellfish assessment, increased vessel traffic during O&M could elevate the risk of disturbance/displacement of this species.
Vessel Collision for Basking Shark	Chapter 13 Shipping and Navigation.	**Section 9.11.1.5.2.2**	Although basking shark is considered within the fish and shellfish assessment, increased vessel traffic during O&M could elevate the risk of collision for this species.
INNS	Chapter 8 Benthic Ecology; and Chapter 12 Commercial Fisheries.	**Section 9.11.1.6.2.2**	INNS can alter seabed habitats by introducing new species that compete with or displace native benthic organisms. This affects community structure, nutrient cycling, and habitat integrity, which are key considerations in benthic impact assessment. They may also impact fish and shellfish stocks targeted by fisheries through predation, competition, or disease transmission. Changes in species composition can influence catch rates and economic viability, making this a critical issue for fisheries management.
Changes in Fishing Activity	Chapter 12 Commercial Fisheries.	**Section 9.11.1.7.2.2**	O&M activities may temporarily restrict access to fishing grounds, displacing fishing effort to other areas and potentially altering local fishing pressure on fish populations. These interactions are closely linked to the commercial fisheries assessment and may influence population-level pressures
Permanent Habitat Loss	Chapter 8 Benthic Ecology; and Chapter 12 Commercial Fisheries.	**Section 9.11.1.8.2.1**	Permanent habitat loss resulting from infrastructure installation and long-term seabed occupation can alter benthic communities and disrupt ecological functions, with potential implications for fisheries. This section examines the long-term consequences of habitat modification, which is critical for understanding effects on benthic species and commercial fishing activity.
EMF	Chapter 8 Benthic Ecology; Chapter 10 Marine Mammals and Leatherback Turtle; and	**Section 9.11.1.9.2.1**	EMFs generated by subsea cables have the potential to influence the behaviour and navigation of marine species. This section evaluates the possible effects of EMFs on marine life and fisheries, ensuring these interactions are fully considered within the impact assessment process.

Topic and description	Related chapter(s)	Where addressed in this chapter	Rationale
	Chapter 12 Commercial Fisheries.		
Introduction of Hard Substrate	Chapter 7 Marine Physical Environment; Chapter 8 Benthic Ecology; and Chapter 12 Commercial Fisheries.	**Section 9.11.1.10.2.1**	The installation of WTGs, scour protection, and associated cable protection introduces hard substrates to the seabed, creating permanent physical changes to local habitats. These structures can provide new surfaces for colonisation, supporting reef-like communities and altering species composition, while potentially displacing organisms adapted to soft sediment environments. This section examines how such artificial habitats may influence biodiversity and ecosystem dynamics within the WDA.

9.14.2 Interactions

527. The impacts identified and assessed in this chapter have the potential to interact with each other. Areas of potential interaction between impacts are presented in **Table 9.27, Table 9.28**, and **Table 9.29**. The impacts are assessed relative to each development phase (i.e. construction, O&M or decommissioning) to see if (for example) multiple construction impacts affecting the same receptor could increase the magnitude of impact upon that receptor.

528. A subsequent lifetime assessment has been undertaken which considers the impact interactions identified and the potential for impacts to effect receptors relevant to this chapter across all development phases (**Table 9.30**).

Table 9.27 Potential interaction between impacts – construction

Potential Interactions Between Construction Impacts							
	Impact 1: Temporary Physical Disturbance	Impact 2: Increased SSCs and Sediment Redeposition	Impact 3: UWN and Vibration	Impact 4: Disturbance and Displacement of Basking Shark	Impact 5: Vessel Collision for Basking Shark	Impact 6: INNS	Impact 7: Changes on Fishing Activity
Impact 1: Temporary Physical Disturbance		Yes	Yes	Yes	No	No	Yes
Impact 2: Increased SSCs and Sediment Redeposition	Yes		No	No	No	No	Yes
Impact 3: UWN and Vibration	Yes	No		Yes	Yes	No	Yes
Impact 4: Disturbance and Displacement of Basking Shark	Yes	No	Yes		Yes	No	Yes
Impact 5: Vessel Collision for Basking Shark	No	No	Yes	Yes		No	Yes
Impact 6: INNS	No	No	No	No	No		No
Impact 7: Changes on Fishing Activity	Yes	Yes	Yes	Yes	Yes	No	

Table 9.28 Potential interactions between impacts – O&M

Potential Interactions Between O&M Impacts										
	Impact 1: Temporary Physical Disturbance	Impact 2: Increased SSCs and Sediment Redeposition	Impact 3: UWN and Vibration	Impact 4: Disturbance and Displacement of Basking Shark	Impact 5: Vessel Collision for Basking Shark	Impact 6: INNS	Impact 7: Changes on Fishing Activity	Impact 8: Permanent Habitat Loss	Impact 9: Electro-Magnetic Fields	Impact 10: Introduction of Hard Substrate
Impact 1: Temporary Physical Disturbance	N/A	Potential[3]	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Impact 2: Increased SSCs and Sediment Redeposition	Potential	N/A	No	No	No	No	Yes	Yes	Yes	Yes
Impact 3: UWN and Vibration	Yes	No	N/A	Yes	Yes	No	Yes	Yes	Yes	Yes
Impact 4: Disturbance and Displacement of Basking Shark	Yes	No	Yes	N/A	Yes	No	Yes	No	Yes	No
Impact 5: Vessel Collision for Basking Shark	No	No	Yes	Yes	N/A	No	Yes	No	No	No
Impact 6: INNS	No	No	No	No	No	N/A	No	No	No	No

[3] Potential indicates that an interaction may occur under certain O&M or decommissioning scenarios where two impact pathways could overlap in time or space, but the relationship is not consistent or strong enough to be classified as a clear interaction. It reflects a possible but uncertain linkage based on the nature of activities.

Potential Interactions Between O&M Impacts										
Impact 7: Changes on Fishing Activity	Yes	Yes	Yes	Yes	Yes	No	N/A	Yes	Yes	No
Impact 8: Permanent Habitat Loss	Yes	Yes	Yes	No	No	No	Yes	N/A	Yes	Yes
Impact 9: Electro-Magnetic Fields	Yes	Yes	Yes	Yes	No	No	Yes	Yes	N/A	Yes
Impact 10: Introduction of Hard Substrate	Yes	Yes	Yes	No	No	No	No	Yes	Yes	N/A

Table 9.29 Potential interaction between impacts – decommissioning

Potential Interactions Between Decommissioning Impacts							
	Impact 1: Temporary Physical Disturbance	Impact 2: Increased SSCs and Sediment Redeposition	Impact 3: UWN and Vibration	Impact 4: Disturbance and Displacement of Basking Shark	Impact 5: Vessel Collision for Basking Shark	Impact 6: INNS	Impact 7: Changes on Fishing Activity
Impact 1: Temporary Physical Disturbance	N/A	Potential	Yes	Yes	No	No	Yes
Impact 2: Increased SSCs and Sediment Redeposition	Potential	N/A	No	No	No	No	Yes
Impact 3: UWN and Vibration	Yes	No	N/A	Yes	Yes	No	Yes
Impact 4: Disturbance and	Yes	No	Yes	N/A	Yes	No	Yes

Potential Interactions Between Decommissioning Impacts							
Displacement of Basking Shark							
Impact 5: Vessel Collision for Basking Shark	No	No	Yes	Yes	N/A	No	Yes
Impact 6: INNS	No	No	No	No	No	N/A	No
Impact 7: Changes on Fishing Activity	Yes	Yes	Yes	Yes	Yes	No	N/A

Table 9.30 Potential interactions between impacts – phase and lifetime assessment

Potential Interactions Between Impacts					
Receptor	Construction	O&M	Decommissioning	Phase Assessment	Lifetime Assessment
Spawning Grounds Nursery Grounds Pelagic Fish Demersal Fish Diadromous Fish Elasmobranchs Shellfish Basking Shark Designated Sites	Minor adverse	Minor adverse	Minor adverse	**No greater than individually assessed impact for each phase.** Across all phases of the project, construction, O&M, and eventual decommissioning, the potential impacts on fish and shellfish are expected to remain within the levels assessed for individual stressors and are not anticipated to interact in a way that increases overall significance. During construction, activities such as piling, and seabed preparation may generate UWN, disturb habitats, and temporarily increase SSCs. These effects are predicted to be short-term, localised, and intermittent, with limited spatial overlap. Most fish and shellfish species are mobile and can avoid areas of elevated noise or turbidity, reducing the likelihood of cumulative or synergistic impacts. For spawning sandeel and herring in nearshore areas, the primary concern is sediment deposition that could lead to egg burial; however, temporary increases in SSC are unlikely to cause additional harm, as eggs and larvae are generally tolerant of short-term turbidity (see **Section 9.11.1.2.1.1**). Once noisy activities cease, the disturbance footprint and any associated changes in prey availability are expected to diminish rapidly. During O&M, UWN from wind turbine generators is highly localised, and any associated habitat or prey changes are confined to the immediate infrastructure footprint. Maintenance activities and vessel movements may introduce short-term noise or disturbance, but these events are episodic and low in intensity. Fish and shellfish are generally resilient to such fluctuations, and	**No greater than individually assessed impact.** Across the lifetime of the Project, the greatest magnitude of effect is expected during the construction phase, primarily due to the spatial footprint of UWN from piling. Once these activities are complete, any remaining impacts during construction, O&M, and decommissioning will be small-scale, localised, and short-lived. This rationale also applies to sensitive areas such as herring and sandeel spawning grounds within the Local Study Area, where temporary sediment deposition may occur but is not anticipated to result in long-term effects. There is no evidence to suggest long-term displacement or population-level impacts from operational offshore windfarms. Decommissioning impacts are expected to mirror those of construction, excluding piling, and will involve temporary habitat disturbance from the removal of IACs and scour protection, as well as short-term increases in SSCs and vessel noise. These effects will be spatially limited and diminish rapidly once activities conclude. The potential for electromagnetic fields (EMF) to create barrier effects has been addressed separately in **Section 9.11.1.9**. Overall, the combined pressures across all phases are not expected to interact in a way that increases the significance level beyond what has been assessed for individual stressors. The greatest effect will occur during construction, and once this phase is complete,

Potential Interactions Between Impacts					
				any potential interactions between noise, habitat change, and water quality effects during this phase are considered negligible. Consequently, these pressures do not result in a cumulative increase in significance. Decommissioning impacts are expected to resemble those of construction, excluding piling. Activities such as the removal of IACs and scour protection may cause temporary habitat disturbance, short-term increases in SSC, and vessel-related noise. These effects will be spatially limited and diminish quickly once decommissioning activities conclude. There is no evidence to suggest long-term displacement or population-level impacts on fish and shellfish.	all subsequent impacts will remain small-scale, localised, and episodic, with no evidence of long-term or cumulative effects on fish and shellfish populations.

9.15 POTENTIAL MONITORING REQUIREMENTS

529. No monitoring to test the predictions made within the assessment of LSE on fish and shellfish ecology is considered necessary, as the assessment has found no significant effects. The embedded mitigation measures already in place (**Section 9.9**) provides additional confidence that impacts will be negligible to minor adverse.

530. Nonetheless, the Applicant acknowledges the need for strategic, coordinated research to address current knowledge gaps regarding diadromous fish and supports the principle that developers should work together to fund strategic monitoring efforts.

531. The Applicant is committed to working with stakeholders and welcomes further engagement with FMS and other relevant bodies to explore opportunities for strategic research and monitoring.

9.16 SUMMARY

532. **Table 9.31** presents a summary of the assessment of LSE on fish and shellfish ecology during the construction, O&M and decommissioning phases of the Project.

533. The assessment has established that the WDA would result in effects of **negligible adverse** to **minor adverse** significance (is **not significant** in EIA terms) only.

Table 9.31 Summary of potential effects for fish and shellfish ecology

Potential Impact	Receptor(s)	Relevant Embedded Mitigation Measures	Sensitivity	Magnitude of Impact	Significance of Effect	Additional Mitigation	Residual Significance of Effect	Proposed Monitoring	Combined assessment	Cumulative Residual Significance of Effect
Construction										
Impact 1: Temporary Physical Disturbance	Spawning Grounds	M-4, M-8, M-14, M-52	Low-High	Negligible	Not Significant (Negligible-Minor Adverse)	N/A	Not Significant (Negligible-Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Nursery Grounds		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Pelagic Fish, Demersal Fish, Diadromous Fish and Elasmobranchs		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Shellfish		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Designated Sites		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
Impact 2: Increased SSCs and Sediment Redeposition	Spawning Grounds	M-4, M-8, M-14, M-52	Medium-High	Negligible	Not Significant (Negligible-Minor Adverse)	N/A	Not Significant (Negligible-Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Nursery Grounds		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Pelagic Fish, Demersal Fish, Diadromous Fish and Elasmobranchs		Low – Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Shellfish		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Designated Sites		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
Impact 3: UWN and Vibration	Spawning Grounds	M-6, M-10	Medium	Low	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Nursery Grounds		Low-Medium	Low	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Diadromous Fish		Low	Low	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Pelagic Fish, Demersal Fish, and Elasmobranchs		Low-Medium	Low	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)

Potential Impact	Receptor(s)	Relevant Embedded Mitigation Measures	Sensitivity	Magnitude of Impact	Significance of Effect	Additional Mitigation	Residual Significance of Effect	Proposed Monitoring	Combined assessment	Cumulative Residual Significance of Effect
	Shellfish		Low	Low	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Designated Sites		Medium	Low	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
Impact 4: Disturbance and Displacement of Basking Shark	Basking Shark	M-4, M-7	Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Minor Adverse)
Impact 5: Vessel Collision for Basking Shark	Basking Shark	M-4	High	Negligible	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Minor Adverse)
Impact 6: INNS	Spawning Grounds	M-3, M-4, M-5, M-9	Medium-High	Negligible	Not Significant (Negligible-Minor Adverse)	N/A	Not Significant (Negligible-Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Nursery Grounds		Medium-High	Negligible	Not Significant (Negligible-Minor Adverse)	N/A	Not Significant (Negligible-Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Pelagic Fish, Demersal Fish, Diadromous Fish and Elasmobranchs		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Shellfish		High	Negligible	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Minor Adverse)
	Designated Sites		High	Negligible	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Minor Adverse)
Impact 7: Changes in Fishing Activity	Spawning Grounds	M-8	Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Nursery Grounds		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Pelagic Fish, Demersal Fish, Diadromous Fish and Elasmobranchs		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Shellfish		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Designated Sites		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
O&M										
Impact 1: Temporary Physical Disturbance	Spawning Grounds	M-8, M-14	Low-High	Negligible	Not Significant (Negligible-Minor Adverse)	N/A	Not Significant (Negligible-Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Nursery Grounds		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)

Potential Impact	Receptor(s)	Relevant Embedded Mitigation Measures	Sensitivity	Magnitude of Impact	Significance of Effect	Additional Mitigation	Residual Significance of Effect	Proposed Monitoring	Combined assessment	Cumulative Residual Significance of Effect
	Pelagic Fish, Demersal Fish, Diadromous Fish and Elasmobranchs		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Shellfish		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Designated Sites		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
Impact 2: Increased SSCs and Sediment Redeposition	Spawning Grounds	M-8, M-14	Medium-High	Negligible	Not Significant (Negligible-Minor Adverse)	N/A	Not Significant (Negligible-Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Nursery Grounds		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Pelagic Fish, Demersal Fish, Diadromous Fish and Elasmobranchs		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Shellfish		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Designated Sites		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
Impact 3: UWN and Vibration	Spawning Grounds	M-10	Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Nursery Grounds		Low-Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Diadromous Fish		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Pelagic Fish, Demersal Fish, and Elasmobranchs		Low-Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Shellfish		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Designated Sites		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
Impact 4: Disturbance and Displacement of Basking Shark	Basking Shark	M-4, M-7	Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Minor Adverse)
Impact 5: Vessel Collision for Basking Shark	Basking Shark	M-4	High	Negligible	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Minor Adverse)
Impact 6: INNS	Spawning Grounds	M-3, M-4, M-5, M-9	Medium-High	Negligible	Not Significant (Negligible-Minor Adverse)	N/A	Not Significant (Negligible-Minor Adverse)	N/A	Not significant	Not Significant (Minor Adverse)

Potential Impact	Receptor(s)	Relevant Embedded Mitigation Measures	Sensitivity	Magnitude of Impact	Significance of Effect	Additional Mitigation	Residual Significance of Effect	Proposed Monitoring	Combined assessment	Cumulative Residual Significance of Effect
	Nursery Grounds		Medium-High	Negligible	Not Significant (Negligible-Minor Adverse)	N/A	Not Significant (Negligible-Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Pelagic Fish, Demersal Fish, Diadromous Fish and Elasmobranchs		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Shellfish		High	Negligible	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Designated Sites		High	Negligible	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
Impact 7: Changes in Fishing Activity	Spawning Grounds	M-8	Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Minor Adverse)
	Nursery Grounds		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Pelagic Fish, Demersal Fish, Diadromous Fish and Elasmobranchs		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Shellfish		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Designated Sites		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
Impact 8: Permanent Habitat Loss	Spawning Grounds	M-8, M-14, M-52	Medium-High	Negligible	Not Significant (Negligible-Minor Adverse)	N/A	Not Significant (Negligible-Minor Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Nursery Grounds		High	Negligible	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Pelagic Fish, Demersal Fish, Diadromous Fish and Elasmobranchs		Low-High	Negligible	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Shellfish		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Designated Sites		Negligible	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
Impact 9: Electro-Magnetic Fields	Spawning Grounds	M-8	High	Negligible	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)

Potential Impact	Receptor(s)	Relevant Embedded Mitigation Measures	Sensitivity	Magnitude of Impact	Significance of Effect	Additional Mitigation	Residual Significance of Effect	Proposed Monitoring	Combined assessment	Cumulative Residual Significance of Effect
	Nursery Grounds		High	Negligible	Not Significant (Minor Adverse)	N/A	Not Significant (Minor Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Diadromous Fish		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Pelagic Fish and Demersal Fish		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Elasmobranchs		Medium	Negligible	Not Significant (Negligible Adverse)		Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Shellfish		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
	Designated Sites		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible-Minor Adverse)
Impact 10: Introduction of Hard Substrate	Spawning Grounds	M-8, M-52	Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Nursery Grounds		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Pelagic Fish, Diadromous Fish, and Elasmobranchs		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Demersal Fish		Low	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Shellfish		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
	Designated Sites		Medium	Negligible	Not Significant (Negligible Adverse)	N/A	Not Significant (Negligible Adverse)	N/A	Not significant	Not Significant (Negligible Adverse)
Decommissioning										
Impact 1: Temporary Physical Disturbance	During decommissioning, the receptors, sensitivity, magnitude and significance of effect for all Impacts is expected to be equal to or less than the receptors, sensitivity, magnitude and significance of effect during construction.									
Impact 2: Increased SSCs and Sediment Redeposition										
Impact 3: UWN and Vibration										
Impact 4: Disturbance and Displacement of Basking Shark										

Potential Impact	Receptor(s)	Relevant Embedded Mitigation Measures	Sensitivity	Magnitude of Impact	Significance of Effect	Additional Mitigation	Residual Significance of Effect	Proposed Monitoring	Combined assessment	Cumulative Residual Significance of Effect
Impact 5: Vessel Collision for Basking Shark										
Impact 6: INNS										
Impact 7: Changes in Fishing Activity										

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