



# Bellrock Offshore Wind Farm

## Wind Farm Development Area

Environmental Impact Assessment Report - Volume II

Chapter 8: Fish and Shellfish Ecology

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## Glossary of Terminology

Term	Definition
Applicant	Bellrock Offshore Wind Farm Limited, the legal entity submitting Section 36 Consent and Marine Licence applications for the Bellrock Wind Farm Development Area.
Bellrock Offshore Wind Farm (or the Bellrock Project)	<p>An offshore wind farm capable of exporting up to 1.8 GW of renewable energy to the National Electricity Transmission System.</p> <p>The Wind Farm Development Area is located 120 km east of Stonehaven, and will connect to the National Electricity Transmission System at the proposed SSEN Transmission Hurlie substation, west of Stonehaven in Aberdeenshire. The Bellrock Offshore Wind Farm comprises of the following Development Areas:</p> <ul style="list-style-type: none"> <li>▪ Wind Farm Development Area;</li> <li>▪ Offshore Transmission Development Area; and</li> <li>▪ Onshore Transmission Development Area.</li> </ul>
Bollard Pull	Maximum static pulling force a vessel can generate when stationary, at zero forward speed and with its engines at full power.
Cable protection	Protective measure to minimise the effects of scour and hazards along the inter-array cables, and protecting these cables at infrastructure crossing points.
Commencement of construction	<p>Commencement of construction to install the Wind Farm Infrastructure as authorised by the Wind Farm Development Area Section 36 consent and Marine Licence (excluding site preparation works), being the earlier of:</p> <ul style="list-style-type: none"> <li>▪ Intrusive pre-installation surveys;</li> <li>▪ Placement on or installation in the seabed of anchors and associated scour protection, and mooring lines;</li> <li>▪ Trench excavation for inter-array cables; or</li> <li>▪ Trenching for, or laying of inter-array cables on or in the seabed.</li> </ul>
Construction works	<p>Works to install the Wind Farm Infrastructure as authorised by the Wind Farm Development Area Section 36 Consent/Marine Licence, such as:</p> <ul style="list-style-type: none"> <li>▪ Site preparation works undertaken after commencement of construction;</li> <li>▪ Pre-installation surveys (intrusive and/or non-intrusive);</li> <li>▪ Placement on or installation in the seabed of anchors and associated scour protection, and mooring lines, and associated scour protection;</li> <li>▪ Towing or transportation of the floating offshore unit to the Wind Farm Development Area from a port or wet storage facility;</li> <li>▪ Floating offshore unit installation and commissioning, including hooking-up to the pre-installed mooring system;</li> <li>▪ Trench excavation for inter-array cables;</li> <li>▪ Laying of inter-array cables in or on the seabed and, associated cable protection;</li> <li>▪ Installation of subsea cable hubs, including placing of associated foundation;</li> <li>▪ Final commissioning following cable connections and snagging; and</li> <li>▪ Post installation surveys.</li> </ul>

Term	Definition
Development Area	<p>For consenting purposes, the area for which separate consents and/or Marine Licences will be sought by the Applicant, comprising:</p> <ul style="list-style-type: none"> <li>▪ Wind Farm Development Area;</li> <li>▪ Offshore Transmission Development Area; and</li> <li>▪ Onshore Transmission Development Area.</li> </ul>
Dynamic inter-array cable	The section of inter-array cable between the floating substructure and the seabed, which is designed to accommodate the dynamic movement of the floating substructure.
eDNA	Environmental DNA that is collected from the environment, such as in seawater, rather than directly from an individual organism.
Floating offshore unit	The combined wind turbine generator and floating substructure.
Floating substructure	A floating structure which provides buoyancy and, in conjunction with the station keeping system, supports a superstructure (e.g. wind turbine generator or offshore substation), and maintaining its position within the structure's excursion limit.
Integration Port	A port at which wind turbine generators are integrated with floating substructures.
Inter-array cable	Armoured cable containing electrical and fibre optic cores, which link the wind turbine generators to each other and to the subsea cable hubs and/or the offshore substations and include dynamic inter-array cable and static inter-array cable sections.
Interconnector cable	Armoured cable containing electrical and fibre optic cores which link two or more offshore substations.
Landfall	The area from Mean Low Water Springs to a transition bay(s), where the offshore export cables come ashore and the transition bays are located.
Offshore export cable	Armoured cable containing electrical and fibre optic cores between the offshore substation(s) and the transition bay(s).
Offshore substation	An offshore platform which houses electrical equipment such as transformers, switchgear, and protection and control systems, enabling the wind farm's renewable electricity to be received via inter-array cables and exported via the offshore export cables.
Offshore Transmission Development Area	The boundary within which the Offshore Transmission Infrastructure will be constructed, operated and maintained, and decommissioned (and includes the whole of the Wind Farm Development Area).
Offshore Transmission Infrastructure	Infrastructure located within the Offshore Transmission Development Area including fixed bottom and/or floating offshore substations, offshore reactive compensation station(s) and associated scour protection; interconnector cables and associated cable protection; and offshore export cables and associated cable protection (including activities associated with the Offshore Transmission Infrastructure construction, operation and maintenance, and decommissioning).
Onshore Transmission Development Area	The boundary within which the Onshore Transmission Infrastructure will be constructed, operated and maintained, and decommissioned.

Term	Definition
Onshore Transmission Infrastructure	Infrastructure located within the Onshore Transmission Development Area including transition joint bay(s); onshore export cables; onshore substation; temporary construction compounds; temporary working areas; environmental mitigation areas; drainage/irrigation infrastructure; access works; and any other associated infrastructure (including activities associated with the Onshore Transmission Infrastructure construction, operation and maintenance, and decommissioning).
Operational life	The expected operational life of the Wind Farm Infrastructure from the Commercial Operation Date to the first floating offshore unit being decommissioned.
Project design envelope	Includes all relevant technical, spatial and temporal elements of the Wind Farm Infrastructure, and the proposed methodology to be employed for construction, operations and maintenance, and decommissioning.
Ramp-up	Ramp-up follows on from the soft-start piling procedure. It comprises a specified minimum period of piling, starting at the highest low-energy blow level achieved in the soft start and gradually increasing in hammer energy. The maximum hammer energy required (operational power for that specific pile) must not be reached within the ramp-up period.
Safety Zone	An area of water around or adjacent to a floating offshore unit 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 floating offshore unit or vessel in that vicinity, and individuals on the floating offshore unit and vessel, in line with Section 95 of the Energy Act 2004.
ScotWind	A Crown Estate Scotland leasing round for offshore wind projects in which the process enabled developers to apply for seabed rights to plan and build wind farms in Scottish waters.
Scour protection	Protective material positioned around anchors to avoid sediment being eroded as a result of the flow of water.
Site preparation works	<p>Preparatory activities undertaken within the Wind Farm Development Area prior to the commencement of construction of the Wind Farm Infrastructure, which may comprise (and which may require separate consents):</p> <ul style="list-style-type: none"> <li>▪ Geophysical surveys, geotechnical surveys, and non-archaeological/archaeological diver/ remotely operated vehicle surveys;</li> <li>▪ Seabed preparation including sand wave levelling, slope levelling for gravity based anchors (if selected), boulder clearance, and pre-lay grapnel runs;</li> <li>▪ Unexploded ordnance survey and/or clearance;</li> <li>▪ Debris clearance; and</li> <li>▪ Out of service cable/pipeline removal.</li> </ul>
Soft start	The procedure used to commence piling at a low hammer energy. The soft start procedure consists of low-energy blows which are followed by the ramp-up procedure.
SSEN Transmission Hurlie substation	The onshore substation to be developed by SSEN Transmission, which will receive renewable electricity from the Bellrock Project onshore substation and allow supply of renewable electricity from the wind farm to the National Electricity Transmission System.

Term	Definition
Station keeping system	The system (including mooring lines and anchors) used to hold a floating offshore unit within its excursion limit and maintain the intended orientation of the floating offshore unit.
Subsea cable hub	A subsea device, with a gravel pad fixed bottom structure, which allows the connection of multiple inter-array cables.
Towing	Transportation of a floating offshore unit or floating substructure between a port, and/or wet storage facility and/or the Wind Farm Development Area.
Wet storage	The temporary storage/anchorage of floating substructures and/or floating offshore units prior to their transportation to the Wind Farm Development Area.
Wind Farm Development Area	The boundary within which the Wind Farm Infrastructure will be constructed, operated and maintained, and decommissioned.
Wind Farm Infrastructure	Infrastructure located within the Wind Farm Development Area including wind turbine generators; floating substructures, station keeping systems and associated scour protection; inter-array cables and associated cable protection; subsea cable hubs; and ancillary infrastructure including buoys (including activities associated with the Wind Farm Infrastructure construction, operation and maintenance, and decommissioning).
Wind turbine generator	A wind turbine generator converts wind energy into electrical energy. The main components include rotor assembly (composed of three blades and a hub); nacelle (containing the generator, shaft and gearbox, power electronic converter and transformer); and a tower (containing lifting equipment and switchgear).

## Glossary of Abbreviations

Term	Definition
AC	Alternating current
ADD	Acoustic deterrent device
B field	Magnetic field
CBRA	Cable burial risk assessment
CEA	Cumulative effects assessment
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CIEEM	Chartered Institute for Ecology and Environmental Management
CMS	Construction Method Statement
DC	Direct current
DEA	Drag embedment anchor
DNA	Deoxyribonucleic acid
DP	Decommissioning Programme
DSLPL	Development Specification and Layout Plan
E field	Electric field
eDNA	Environmental DNA
E <sub>i</sub>	Induced electric field
EIA	Environmental impact assessment
EMF	Electromagnetic field
EMODnet	European Marine Observation and Data Network
EMP	Environmental Management Plan
EPS	European Protected Species
EU	European Union
FOUs	Floating Offshore Units
FSS	Floating Substructure
FU	Functional unit
GBA	Gravity-based anchor
GBP	Great British Pounds

<b>Term</b>	<b>Definition</b>
GES	Good Environmental Status
HRA	Habitats Regulations Appraisal
IAC	Inter-array cable
IA-CaP	Inter-array Cable Plan
ICES	International Council for the Exploration of the Sea
IHLS	International Herring Larval Survey
INNS	Invasive Non-Native species
INNSMP	Invasive Non-native Species Mitigation Plan
INTOG	Innovation and Targeted Oil and Gas
JNCC	Joint Nature Conservation Committee
MarLIN	Marine Life Information Network
MARPOL	International Convention for the Prevention of Pollution from Ships
MD-LOT	Marine Directorate – Licensing and Operations Team
MD-SEDD	Marine Directorate – Science, Evidence Data and Digital
MMMP	Marine Mammal Mitigation Protocol
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
NBN	National Biodiversity Network
ncMPA	Nature Conservation Marine Protected Area
NSP	Navigational Safety Plan
O&M	Operation and maintenance
OfSS	Offshore Substation
OfTDA	Offshore Transmission Development Area
OMP	Operation and Maintenance Plan
OnTDA	Onshore Transmission Development Area
OWF	Offshore Wind Farm
PDE	Project Design Envelope
PMF	Priority Marine Feature

Term	Definition
PNMP	Piling Noise Mitigation Plan
PSA	Particle Size Analysis
PTS	Permanent threshold shift
SAC	Special Area of Conservation
ScotMER	Scottish Marine Energy Research
SEL <sub>cum</sub>	Cumulative sound exposure level
SFF	Scottish Fishermen's Federation
SKS	Station keeping system
SMP	Sectoral Marine Plan
Section 36	s.36
SPL <sub>peak</sub>	Peak sound pressure level
TTS	Temporary threshold shift
UK	United Kingdom
UXO	Unexploded ordnance
VMNSP	Vessel Management and Navigational Safety Plan
VMP	Vessel Management Plan
WCS	Worst-case scenario
WFD	Water Framework Directive
WFDA	Wind farm development area
WTG	Wind turbine generator
ZoI	Zone of influence

## Glossary of Units

Term	Definition
dB	Decibel
Hz	Hertz
KHz	Kilohertz
km	Kilometre
km <sup>2</sup>	Square kilometre
KV	Kilovolt
mV	Millivolt
μPa <sup>2</sup> s	Micropascal squared seconds
μV/cm	Microvolts per centimetre

# 8 Fish and Shellfish Ecology

## 8.1 Introduction

1. This Chapter of the Bellrock Wind Farm Development Area (WFDA) Environmental Impact Assessment (EIA) Report presents an assessment of potential effects on fish and shellfish ecology from the construction, operation and maintenance (O&M), and decommissioning phases of the Bellrock Wind Farm Infrastructure.
2. The Bellrock Wind Farm Infrastructure comprises wind turbine generators (WTGs); floating substructures (FSSs), station keeping systems (SKSs) and associated scour protection; inter-array cables (IACs) and associated cable protection; and subsea cable hubs. Further detail on the Bellrock Wind Farm Infrastructure is provided in **Chapter 4: Project Description (Volume II)**.
3. This Chapter of the Bellrock WFDA EIA Report has been prepared to provide the Marine Directorate - Licensing and Operations Team (MD-LOT) (on behalf of the Scottish Ministers) and stakeholders with sufficient information to determine the potential effect(s) of the Bellrock Wind Farm Infrastructure on fish and shellfish ecology receptors.
4. This Chapter should be read in conjunction with the following chapters of the Bellrock WFDA EIA Report:
  - **Chapter 6: Marine Geology, Oceanography and Physical Processes (Volume II)**;
  - **Chapter 7: Benthic Ecology (Volume II)**;
  - **Chapter 9: Marine Mammals (Volume II)**;
  - **Chapter 10: Offshore Ornithology (Volume II)**; and
  - **Chapter 11: Commercial Fisheries (Volume II)**.
5. The fish and shellfish ecology assessment is likely to have key inter-relationships with the above chapters, which will be considered appropriately throughout this Bellrock WFDA EIA Report.
6. Additional information to support the fish and shellfish ecology assessment includes:
  - **Appendix 9.2: Underwater Noise Modelling Report (Volume IV)**;
  - **Appendix 9.3: Unexploded Ordnance Assessment (Volume IV)**; and
  - **Appendix 8.1: Electromagnetic Fields Assessment Report (Volume IV)**.
7. This Chapter was prepared by Haskoning.

## 8.2 Legislation, Policy and Guidance

8. **Table 8.1** describes the legislation, policy, and guidance which have been considered in the preparation of this Chapter. The overarching policy and legislation relevant to the Bellrock WFDA is described in **Chapter 2: Policy and Legislative Context (Volume II)**.
9. Any Legislation referred to in this EIA Report is as subsequently amended and as currently in force as at the date of this EIA Report.

**Table 8.1: Summary of Relevant Legislation, Policy and Guidance for Fish and Shellfish Ecology**

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
<b>Legislation</b>	
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 <i>Cetorhinus maximus</i> 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).
Wildlife and Natural Environment (Scotland) Act 2011	Basking sharks are protected in Scotland from intentional or reckless disturbance or harassment under the Wildlife and Countryside Act 1981 and the Wildlife and Natural Environment (Scotland) Act 2011. If there is 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 Conservation (Natural Habitats, &c.) Regulations 1994 (Habitats Regulations) and the Conservation of Offshore Marine Habitats and Species Regulations 2017 (Offshore Habitats Regulations)	Under these regulations, fish species listed in Annex II of the European Union (EU) Habitats Directive which are native to the United Kingdom (UK) should be conserved through the designation of Special Area of Conservation (SACs). Several SACs are designated for the conservation of Atlantic salmon <i>Salmo salar</i> on the northeast coast of Scotland. This species is also included under Schedule 3 of the Conservation (Natural Habitats, &c.) Regulations 1994, which identifies animals that may not be taken or killed using certain methods.
Directive 2000/60/EC of the European Parliament and of the Council known as the Water Framework Directive (WFD)	EC Directive 2000/60/EC known as the WFD is the framework for an integrated approach to protection, improvement and sustainable use of water bodies in Europe, and necessitates member states to ensure that they meet 'good status' for ecological and chemical quality elements. This includes coastal waters up to 1 nm offshore, and river and transitional water bodies have a fish quality element that is assessed to determine their status. The WFD has been transposed into law in Scotland by the Water Environment and Water Services (Scotland) Act 2003, which mean that the requirements of the WFD need to be considered at all stages of the planning and development process for infrastructure, such as offshore wind farms (OWF). The regulations cover rivers, lochs, transitional waters (estuaries), coastal waters, groundwater, and groundwater dependant wetlands.

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Nature Conservation (Scotland) Act 2004	Makes amendments to the Wildlife and Countryside Act (1981), strengthening the legal protection for threatened species to include 'reckless' acts.
Eel EU Regulation (EU 1100/2007)	<p>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 area; and shares responsibility for the Solway-Tweed river basin district area with England.</p> <p>The aim of this Eel Management Plan is to describe the nature of the European eel <i>Anguilla anguilla</i> population and fishery in the river basin districts; 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.</p>
<b>Policy</b>	
Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention) 1992	<p>Provides a legal framework to protect and conserve marine ecosystems through the prevention and elimination of pollution from offshore sources.</p> <p>The OSPAR Commission maintains a list of threatened or declining fish and shellfish species to guide prioritisation of conservation efforts.</p>
Council Directive 2008/56/EC of the European Parliament and of the Council known as the Marine Strategy Framework Directive and Commission Directive (EU) 2017/845 of 17 May 2017 amending Directive 2008/56/EC of the European Parliament and of the Council as regards the indicative lists of elements to be taken into account for the preparation of marine strategies (Text with EEA relevance.)	<p>The National Marine Plan also reiterates the Scottish Government's commitment to strategic objectives, including Good Environmental Status (GES) indicators that must be met, as originally defined in Council Directive 2008/56/EC (Marine Strategy Framework Directive). Within the GES indicators, of relevance to the Bellrock WFDA, and fish and shellfish species, are:</p> <ul style="list-style-type: none"> <li>▪ Biological diversity is maintained and recovered where appropriate. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic, and climatic conditions (GES 1);</li> <li>▪ All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity (GES 4); and</li> <li>▪ Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment (GES 11).</li> </ul>
The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention; 1979)	It promotes national policies for the conservation of wild flora, wild fauna and natural habitats. The obligations of the Convention are transposed into UK law by means of the Wildlife and Countryside Act (1981), and the Nature Conservation (Scotland) Act (2004).
Scotland's National Marine Plan (Scottish Government, 2015)	GEN9 Natural Heritage states that any development or use of the marine environment must comply with legal protections for designated areas and species, avoid significant impacts on Priority Marine Features (PMFs), and contribute to the protection and, where appropriate, enhancement of marine health. Regulators must ensure that any activity does not pose a significant risk to the conservation objectives of a Marine Protected Area (MPA) before granting consent. If an ongoing activity is found to pose such a risk, appropriate management interventions will be implemented using statutory mechanisms to reduce potential harm.

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
	<p>GEN5 Climate Change requires marine planners and decision-makers to take actions that best support climate change mitigation and adaptation.</p> <p>WILD FISH one highlights the importance of considering the impact of marine development on diadromous fish species (such as Atlantic salmon) during the planning and decision-making process. In cases where evidence of impacts is inconclusive, mitigation should be applied where possible. Additionally, monitoring data from developments should be used to inform future decision-making regarding these species.</p> <p>The SNMP is currently being updated, transitioning to the Scottish National Marine Plan 2. Consultation on the SNMP ran from 5th November 2024 to 7th February 2025 and a consultation analysis report has been produced by the Scottish Government (2025).</p>
<p>Sectoral Marine Plan (SMP) for Offshore Wind Energy (Scottish Government 2020); draft updated Sectoral Marine Plan 2025 published for consultation on 30 May 2025. Consultation closed 22 August 2025.) The updated SMP is now expected to be published in Summer 2026.</p>	<p>The 2020 SMP outlines measures to minimise the adverse effects of commercial-scale offshore wind development on other marine users, economic sectors, and the environment. It recognises the potential for regional cumulative impacts, particularly on bird populations, benthic habitats, cetaceans, navigational safety, seascape/landscape, and commercial fisheries.</p> <p>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 Innovation and Targeted Oil and Gas (INTOG). It proposes refined mitigation strategies and updated policy direction to address emerging pressures and opportunities.</p> <p>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.</p>
<b>Guidance</b>	
<p>Joint Nature Conservation Committee (JNCC), Marine Monitoring Handbook (JNCC, 2001)</p>	<p>These guidelines have been produced to promote good practice in marine monitoring.</p>
<p>Ware, S.J. &amp; Kenny, A.J. (2011) Guidelines for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites, 2nd ed. Marine Aggregate Levy Sustainability Fund</p>	<p>This guidance has been produced to accompany any dredging application and designed to promote a comprehensive and consistent approach to the assessment of the benthic environment (i.e. sediments and associated benthic fauna).</p>
<p>Centre for Environment Fisheries and Aquaculture Science (Cefas), Guidelines for Data Acquisition to Support Marine Environmental Assessments for Offshore Renewable Energy Projects (Cefas, 2012)</p>	<p>These guidelines assist in the design, review and implementation of environmental data collection and analytical activities associated with all stages of offshore renewable energy developments.</p>

Relevant Legislation, Policy or Guidance	Relevance to the Assessment
Guidance and publications from Scottish Natural Heritage (now NatureScot) and Marine Scotland (now Marine Directorate) on PMFs and Nature Conservation Marine Protected Area (ncMPA) search features (Tyler-Waters et al. 2016)	Provides guidance on the PMF and ncMPA features.
Chartered Institute for Ecology and Environmental Management (CIEEM), Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018)	Provides practical advice for all professionals involved with ecological evaluation and assessment for proposed developments in terrestrial, freshwater, marine and coastal environments.
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.

## 8.3 Consultation

10. Consultation undertaken to date for the Bellrock Wind Farm Infrastructure relevant to fish and shellfish ecology has been in line with the general process described in **Chapter 5: EIA Methodology (Volume II)**. Key consultation pertinent to this Chapter is provided in **Table 8.2**.

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**Table 8.2: Consultation Relevant to Fish and Shellfish Ecology**

Consultee	Date/Document	Comment	How/Where Comment is Addressed
NatureScot	30 March 2023, email	It is noted that environmental deoxyribonucleic acid (DNA) (eDNA) samples will be collected from the water column. NatureScot assume this will be for fish rather than benthic species. However, NatureScot note the intention to discuss further with stakeholders once the data is analysed and NatureScot would appreciate sight of any technical reports covering the eDNA sampling and analysis.	Yes, eDNA samples taken from the water column have been analysed for fish rather than benthic species. The data collected has been used to provide context to the baseline, as set out in <b>Section 8.7</b> .
Marine Scotland Science (Now Marine Directorate – Science Evidence Data and Digital (MD-SEDD))	12 April 2023, email	MD-SEDD were consulted on a high-level overview of the proposed scope of work for site investigation works (with particular focus on the benthic survey). MD-SEDD did not provide a response for the Bellrock Offshore Wind Farm.	MD-SEDD provided a response for the Broadshore Hub. MD-SEDD advice provided for the Broadshore Hub (Broadshore Hub Offshore Wind Farms, 2024) was considered in the refinement of the survey methodology for the Bellrock WFDA and in <b>Appendix 1.1: Bellrock WFDA Scoping Report (Volume IV)</b> , where appropriate.
MD-LOT	Bellrock WFDA Scoping Opinion, Paragraph 5.4.1	The Scottish Ministers are broadly content with the two proposed study areas described in Section 7.4.1 of the Bellrock WFDA Scoping Report, in line with the NatureScot representation, on the basis that the northern boundary of the International Council of the Exploration of the Seas (ICES) rectangles is beyond the maximum tidal excursion.	Noted. The northern boundary of the ICES rectangles is approximately 11 km from the closest point of the Bellrock WFDA. This is beyond the maximum tidal excursion ( <b>Chapter 6: Marine Geology, Oceanography and Physical Processes (Volume II)</b> ) to take account of potential impacts from suspended sediments. This is addressed in <b>Section 8.8.1.2</b> .
MD-LOT	Bellrock WFDA Scoping Opinion, Paragraph 5.4.2	With regards to the baseline information described in Section 7.4.2 of the Bellrock WFDA Scoping Report, the Scottish Ministers are broadly content with the proposed data sources proposed, but highlight the representation made by NatureScot regarding clarity relating to use of eDNA and aerial surveys. Additionally, the Scottish Ministers highlight the additional data sources recommended by NatureScot and advise that these are included in the EIA Report.	Noted. Additional data sources recommended by NatureScot are highlighted in <b>Section 8.5.2</b> .

Consultee	Date/Document	Comment	How/Where Comment is Addressed
MD-LOT	Bellrock WFDA Scoping Opinion, Paragraph 5.4.3	<p>The impact pathways proposed to be scoped in and out of the EIA are summarised in Table 7.8 of the Bellrock WFDA Scoping Report. The Scottish Ministers are broadly content, subject to the following comments. NatureScot highlight that impacts from pre-construction works may also require consideration alongside construction phase impacts and the Scottish Ministers request that this is considered in the EIA Report. The Scottish Ministers highlight the comments made in the representation by NatureScot regarding fish aggregation around WTGs and other hard structures and comments regarding noise from the movement of mooring and anchoring cables and advise that these must be scoped in for assessment in the EIA Report. 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. Additionally, the Scottish Ministers highlight the representation made by NatureScot regarding changes in prey species availability and the requirement for clear linkages between assessments and advise that this is fully considered and implemented in the EIA Report. The Scottish Ministers also highlight the representation made by the Scottish Fishermen's Federation (SFF) regarding the scoping in of "accidental release of pollutants."</p>	<p>Impacts from site preparation works are considered alongside construction phase impacts and addressed within <b>Section 8.8.1</b>.</p> <p>Fish aggregation around floating offshore units (FOUs) and other hard structures are considered within the assessment presented in <b>Section 8.8.2.8</b>.</p> <p>Additionally the assessment of underwater noise from the movement of mooring and anchoring cables was assessed within <b>Section 8.8.1.3</b> and <b>8.8.2.3</b>.</p> <p>Potential impacts during the decommissioning phase of the proposed development are fully considered by the developer, as outlined in <b>Section 8.8.3</b>.</p> <p>Changes in prey species availability and the need for clear ecological linkages are considered within the assessment in <b>Section 8.8.1</b>.</p> <p>Accidental pollution is addressed through the implementation of the <b>Marine Pollution Contingency Plan (MPCP) (Volume V)</b> and the Environmental Management Plan (EMP) (see <b>Outline EMP (Volume V)</b>). All vessels operating transiting to and from and working within the Bellrock WFDA are expected to adhere to the provisions set out in these plans. The EMP and MPCP outline the protocols to minimise the risk of pollutant release and to respond to any accidental releases. Both plans are intended to be consulted upon and agreed with relevant stakeholders and MD-LOT prior to construction, in accordance with timescales determined by MD-LOT.</p>
MD-LOT	Bellrock WFDA Scoping Opinion, Paragraph 5.4.4	<p>The Scottish Ministers are broadly content on the approach to the assessment as detailed in Section 7.7 of the Bellrock WFDA Scoping Report, however they advise the developer to fully consider the comments from NatureScot regarding PMFs and Sensitivity. Additionally, the Scottish Ministers draw attention to the NatureScot representation regarding underwater noise modelling and request that this is fully implemented in the EIA Report.</p>	<p>PMFs and sensitivities are considered within <b>Section 8.7</b> and the assessment of underwater noise is fully considered within <b>Sections 8.8.1.3</b> and <b>8.8.2.3</b>.</p>

Consultee	Date/Document	Comment	How/Where Comment is Addressed
MD-LOT	Bellrock WFDA Scoping Opinion, Paragraph 5.4.5	The Scottish Ministers note that Section 7.5.4 of the Bellrock WFDA Scoping Report covers 'Embedded Mitigation Measures' and are broadly content with the examples provided. However, the Scottish Ministers highlight the representation made by NatureScot regarding migratory fish and effects of underwater noise during construction, operation and decommissioning and advise that this is implemented in the EIA Report.	Noted. Migratory fish are assessed in <b>Section 8.7</b> . The Applicant understands the NatureScot's position remains that migratory fish should currently be assessed only through the EIA process and not through the Habitats Regulations Appraisal (HRA).
MD-LOT	Bellrock WFDA Scoping Opinion, Paragraph 5.4.6	Cumulative impacts are considered in Section 7.6.3 of the Bellrock WFDA Scoping Report. The Scottish Ministers are broadly content with the proposed approach.	Noted, cumulative impacts are addressed within <b>Section 8.9</b> .
MD-LOT	Bellrock WFDA Scoping Opinion, Paragraph 5.4.7	The Scottish Ministers advise that the impacts of electromagnetic field (EMF) are also considered in the cumulative assessment in line with advice from NatureScot.	Impacts of EMF are considered within the cumulative effects assessment in <b>Section 8.9.3.2</b> .
MD-LOT	Bellrock WFDA Scoping Opinion, Paragraph 5.4.8	The Scottish Ministers are in agreement that transboundary impacts can be scoped out of the EIA for fish and shellfish, as discussed in Section 7.6.4 of the Bellrock WFDA Scoping Report.	Noted. Transboundary impacts are scoped out.
MD-LOT	Bellrock WFDA Scoping Opinion, Paragraph 5.4.9	With regards to designated site receptors, the Scottish Ministers agree with the NatureScot representation that all SACs designated for fish and shellfish species can be scoped out due to distance from the proposed development, as well as the Southern Trench ncMPA.	The nearest SAC designated for fish or shellfish species is 117 km from the Bellrock WFDA. As no direct impact is anticipated, SACs have been scoped out and are not included in the assessment.
MD-LOT	Bellrock WFDA Scoping Opinion, Paragraph 5.4.10	Additionally, 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.	Noted. Migratory fish are assessed in <b>Section 8.7</b> . The Applicant understands that NatureScot's position remains that migratory fish should currently be assessed only through the EIA process and not through the HRA.

Consultee	Date/Document	Comment	How/Where Comment is Addressed
MD-LOT	Bellrock WFDA Scoping Opinion	The Scottish Ministers direct the Developer to the NatureScot representation on the need to understand potential impacts holistically at a wider ecosystem scale, rather than just as discrete individual receptor assessments. The Scottish Ministers therefore advise that potential impacts should be given consideration across key trophic levels, particularly in relation to the availability of prey species. Detailed advice on assessment of across trophic levels is provided in the receptor chapters in Section 5 of the Bellrock WFDA Scoping Opinion.	The assessment has been structured to reflect potential changes in prey distribution and abundance, and how these may influence higher trophic levels (see <b>Chapter 9: Marine Mammals (Volume II)</b> and <b>Chapter 10: Offshore Ornithology (Volume II)</b> ).  Cross-references between relevant receptor groups have been made throughout the EIA, and the potential for indirect effects, such as disturbance or loss of spawning and nursery habitats, on the recruitment of key prey species has been considered. These interactions are addressed within <b>Section 8.8</b> . Additionally highlighted in <b>Section 8.10.1</b> .
NatureScot	20 December 2023, email response to Bellrock WFDA Scoping Workshop held 30 October 2023	The fish and shellfish ecology study area comprises the two ICES rectangles in which WFDA sits – NatureScot are content with this assuming that the northern boundary is beyond the maximum tidal excursion to take account of potential impacts from suspended sediments.	Noted. The northern boundary of the ICES rectangles is approximately 11 km from the closest point of the Bellrock WFDA. This is beyond the maximum tidal excursion (3.5 - 5.0 km, as set out in <b>Chapter 6: Marine Geology, Oceanography and Physical Processes (Volume II)</b> ) to take account of potential impacts from suspended sediments. This is addressed in <b>Section 8.8.1.2</b> .
NatureScot	20 December 2023, email response to Bellrock WFDA Scoping Workshop held 30 October 2023	NatureScot are also content with the approach to the baseline – all relevant desktop data has been identified.	Noted. Key data and information sources are set out in <b>Section 8.5.2</b> .
NatureScot	20 December 2023, email response to Bellrock WFDA Scoping Workshop held 30 October 2023	NatureScot agree with the proposed approach for the benthic grab samples to inform habitat/spawning sediment suitability. In relation to the eDNA sampling, ideally the results would be used to help inform the EIA, however this is currently not required. Therefore, NatureScot welcome the sharing of the data for information and to the Planning Offshore Wind Strategic Environmental Impact Decisions project.	Noted. eDNA sampling is set out in <b>Appendix 7.3: Bellrock WFDA Benthic Characterisation Report (Volume IV)</b> . PSD data from benthic grab samples has been used to inform the herring <i>Clupea harengus</i> spawning and sandeel <i>Ammodytidae spp</i> spawning habitat baselines ( <b>Sections 8.7.2.1.1</b> and <b>8.7.2.1.2</b> , respectively).

Consultee	Date/Document	Comment	How/Where Comment is Addressed
NatureScot	20 December 2023, email response to Bellrock WFDA Scoping Workshop held 30 October 2023	NatureScot are content with the proposed approach to underwater noise modelling in respect of fish and shellfish. NatureScot advise that particle motion should be scoped in for assessment qualitatively.	Noted. The impact of underwater noise from the movement of mooring and anchoring cables was assessed within <b>Sections 8.8.1.3 and 8.8.2.3</b> .  Information on the approach to particle motion is provided in <b>Section 8.8.1.3</b> .
NatureScot	20 December 2023, email response to Bellrock WFDA Scoping Workshop held 30 October 2023	Impacts from both offshore export cables and floating cables should be modelled if possible. If it is not possible to model EMF impacts in relation to floating cables, an estimate should be provided along with a description of potential impacts to fish and shellfish at the estimated level.	Offshore export cables will be considered in the Bellrock Offshore Transmission Development Area (OfTDA) Scoping Report. EMF from IACs within the Bellrock WFDA have been modelled and are presented in <b>Appendix 8.1: Electromagnetic Fields Assessment Report (Volume IV)</b> .
NatureScot	20 December 2023, email response to Bellrock WFDA Scoping Workshop held 30 October 2023	Based on the project information provided to date, NatureScot are content with the proposed assessment approach for diadromous fish.	Noted. The assessment approach for diadromous fish is set out in <b>Section 8.7</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	Two study areas have been defined for fish and shellfish ecology – the ICES rectangles 42E9 and 42F0 that overlap with the WFDA and the Northern North Sea study area defined by the boundary of the northern North biogeographic region Charting Progress 2 (CP2). The latter provides a wider context for the fish species and populations, used to inform impact assessments over long distances (e.g. underwater noise).	Noted. The ICES Rectangle 42E9 and 42F0 (fish and shellfish ecology study area) and the regional fish and shellfish ecology study area are detailed in <b>Section 8.7.1</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	As per our advice issued following the Bellrock Scoping workshop (advice dated 20 December 2023), NatureScot are content with this approach assuming that the northern boundary of these ICES rectangles is beyond the maximum tidal excursion to take account of potential impacts from suspended sediments. NatureScot note that our previous advice has been acknowledged within Table 7.2 (page 167) of the Bellrock WFDA Scoping Report.	Noted. The northern boundary of the ICES rectangles is approximately 11 km from the closest point of the Bellrock WFDA. This is beyond the maximum tidal excursion (3.5 - 5.0 km, as set out in <b>Chapter 6: Marine Geology, Oceanography and Physical Processes (Volume II)</b> ) to take account of potential impacts from suspended sediments. This is addressed in <b>Section 8.8.1.2</b> .

Consultee	Date/Document	Comment	How/Where Comment is Addressed
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	Table 7.4 of the Bellrock WFDA Scoping Report provides an overview of the site-specific surveys for the Bellrock WFDA. NatureScot note that no specific fish surveys have been conducted. Benthic data will be used to inform the baseline (including particle size analysis (PSA) to identify herring spawning and sandeel habitat suitability). In addition, eDNA samples have been collected which will provide context to the baseline but will not be used to inform the EIA Report directly. The reasoning for this is unclear.	Site-specific PSA results are detailed in <b>Appendix 7.1: Benthic Ecology Baseline (Volume IV)</b> . Within this Chapter, benthic data is used to inform the baseline, including PSA to help identify herring spawning grounds and assess sandeel habitat suitability. The outcomes are further outlined in <b>Section 8.7</b> .  eDNA samples taken from the water column have been analysed for fish species. The data collected has been used to provide context to the baseline, as set out in <b>Section 8.7</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	Aerial surveys are also included in Table 7.4; however, it is unclear how these will be used. NatureScot assume aerial surveys are included in Table 7.4 of the Bellrock WFDA Scoping Report because of relevance to basking shark as well as ornithology and marine mammals. However, NatureScot are content that the desk-based study (noting our additional datasets noted for inclusion under the next scoping question) in conjunction with the benthic sediment analysis will be sufficient to inform the baseline.	No basking shark were identified during the two-year digital aerial survey campaign. Desk-based resources (including the additional datasets noted by NatureScot) are used to inform the baseline, as detailed in <b>Section 8.5.2</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	The following data sources, which can be found on National Marine Plan interactive, should also be included: <ul style="list-style-type: none"> <li>▪ José M. González-Irusta, Peter J. Wright, Spawning grounds of Atlantic cod <i>Gadus morhua</i> in the North Sea, ICES Journal of Marine Science, Volume 73, Issue 2, January/February 2016, Pages 304–315, <a href="https://doi.org/10.1093/icesjms/fsv180">https://doi.org/10.1093/icesjms/fsv180</a>;</li> <li>▪ José M. González-Irusta, Peter J. Wright, Spawning grounds of haddock <i>Melanogrammus aeglefinus</i> in the North Sea and West of Scotland, Fisheries Research, Volume 183, November 2016, Pages 180-191, <a href="https://doi.org/10.1016/j.fishres.2016.05.028">https://doi.org/10.1016/j.fishres.2016.05.028</a>; and</li> <li>▪ José M. González-Irusta, Peter J. Wright, Spawning grounds of whiting <i>Merlangius merlangus</i>, Fisheries Research, Volume 195, November 2017, Pages 141-151, <a href="https://doi.org/10.1016/j.fishres.2017.07.005">https://doi.org/10.1016/j.fishres.2017.07.005</a></li> </ul>	Noted. These sources are included in <b>Section 8.5.2</b> .

Consultee	Date/Document	Comment	How/Where Comment is Addressed
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	Table 7.6 (Section 7.4.5) of the Bellrock WFDA Scoping Report summarises the designated sites for fish and shellfish species scoped in for further assessment. There are no SACs that overlap with the Bellrock WFDA. NatureScot advise that all SACs designated for fish and shellfish species can be scoped out due to the distance from the proposed development – please see further advice under HRA screening with respect to migratory fish.	Noted. There are no SACs that overlap with the Bellrock WFDA. The nearest SAC designated for fish or shellfish species is 117 km from the proposed development. As no direct impact is anticipated, SACs have been scoped out and are not included in the assessment.
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	The Firth of Tay and Eden Estuary SAC is included within Table 7.6; however, it is unclear why this site has been included here and NatureScot note that the text included in the column titled 'Fish and Shellfish Qualifying Features' appears to be incomplete.	Noted. There are no SACs that overlap with the Bellrock WFDA and therefore not included in further assessments of this Chapter. The nearest SAC designated for fish or shellfish species is 117 km from the Bellrock WFDA. As no direct impact is anticipated, SACs have been scoped out and are not included in the assessment.
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	Section 7.5 of the Bellrock WFDA Scoping Report identifies potential impacts from the Bellrock WFDA during the construction, O&M and decommissioning phases. Potential impacts from pre-construction works may also require consideration alongside construction phase impacts.	Noted. Potential impacts during construction, O&M and decommissioning are outlined in <b>Sections 8.8.1, 8.8.2, and 8.8.3</b> , respectively. Site preparation works are considered as appropriate as part of the construction phase.
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	Section 7.5.2 of the Bellrock WFDA Scoping Report lists potential impacts arising during O&M phases that have been scoped in for further assessment. NatureScot are generally content with the potential impacts included for fish and shellfish ecology but note further considerations that should be included within our advice below.	Noted, potential impacts arising during O&M phases are set out in <b>Section 8.8.2</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	Fish aggregation around the WTGs and other hard structures should also be included for relevant fish species. This would need to be considered with other receptors in mind, e.g. marine mammals and ornithology. NatureScot note that fish aggregation is briefly covered in paragraph 530 of the Bellrock WFDA Scoping Report under "Introduction of Hard Substrate" (Section 7.6.1.2.8 of the Bellrock WFDA Scoping Report), but NatureScot wish to flag that if floating WTGs are used, the platforms may still attract fish without necessarily being considered a "hard substrate".	Fish aggregation around FSSs and other hard structures has been considered within the assessment of relevant receptor groups, including fish and shellfish ecology. This is addressed in <b>Section 8.8.2.8</b> .

Consultee	Date/Document	Comment	How/Where Comment is Addressed
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	NatureScot note that underwater noise and vibration has been considered across the construction and O&M phases. There is emerging evidence showing that the movement of mooring and anchoring cables can be noisy. Results from the Hywind and Kincardine demonstrator sites should be considered in the desk-based study.	Underwater noise and vibration have been considered across both the construction and O&M phases. The Applicant acknowledges the emerging evidence regarding noise generated by the movement of mooring and anchoring cables, particularly in relation to floating technologies.  Relevant findings from the Hywind and Kincardine demonstrator sites have been incorporated into the desk-based study and are addressed within <b>Sections 8.8.1.3</b> and <b>8.8.2.3</b> of the assessment.
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	For the potential impacts during decommissioning in Section 7.5.3 of the Bellrock WFDA Scoping Report, NatureScot agree that these would be similar to construction impacts. However, until NatureScot better understand the extent to which structures will be decommissioned, it cannot be assumed that the impact will likely be lower.	Noted. Potential impacts during construction are outlined in <b>Section 8.8.1</b> , and those associated with decommissioning based on construction impacts are assessed in <b>Section 8.8.3</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	Section 7.4.3 of the Bellrock WFDA Scoping Report recognises that many of the species included within the study area fish assemblage are important prey species for other receptors. NatureScot note that the fish and shellfish assessment will also be considered within the marine mammal and offshore ornithology chapters of the EIA Report. In addition, 'changes to prey availability' has been included as an impact pathway scoped into the marine mammal assessment (see Table 20.1) and is also included under 'indirect impacts' as scoped in for offshore ornithology (see Table 9.5).	Noted. See for further information in <b>Chapter 9: Marine Mammals (Volume II)</b> and <b>Chapter 10: Offshore Ornithology (Volume II)</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	Clear links should be made between those assessments and the fish and shellfish assessment. Most EIA Reports concentrate on receptor specific impacts; however, NatureScot increasingly need to understand impacts at the ecosystem scale. Therefore, consideration across key trophic levels will enable better understanding of the consequences (positive or negative) of any potential changes in prey distribution and abundance on marine mammal (and other top predator) interests and how this may influence population level impacts. Consideration of how this loss	The assessment has been structured to reflect potential changes in prey distribution and abundance, and how these may influence higher trophic levels (see <b>Chapter 9: Marine Mammals (Volume II)</b> and <b>Chapter 10: Offshore Ornithology (Volume II)</b> ).  Cross-references between relevant receptor groups have been made throughout the EIA, and the potential for indirect effects, such as disturbance or loss of spawning and nursery habitats, on the recruitment of key prey species has been considered.

Consultee	Date/Document	Comment	How/Where Comment is Addressed
		and or disturbance may affect the recruitment of key prey (fish) species through impacts to important spawning or nursery ground habitats should also be assessed.	These interactions are addressed within <b>Section 8.8</b> . Additionally highlighted in <b>Section 8.10.1</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	In addition, the Predators and Prey Around Renewable Energy Developments project ( <a href="https://owecprepared.org/">https://owecprepared.org/</a> ) may be helpful in the understanding of predator-prey relationships in and around offshore wind farms.	Noted. Included in <b>Section 8.5.2</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	NatureScot are content with the impacts scoped in/out as per Section 7.6 of the Bellrock WFDA Scoping Report.	Noted. See <b>Table 8.9</b> for an overview of impacts scoped in and out.
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	NatureScot are generally content with the approach to assessment for fish and shellfish ecology (as outlined in Section 7.7 of the Bellrock WFDA Scoping Report), noting our further comments below.	Noted. The assessment methodology is outline in <b>Section 8.4</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	Section 7.4.3 and Table 7.7 of the Bellrock WFDA Scoping Report refer to the presence of numerous PMFs within the fish and shellfish ecology study area. NatureScot recommend that the assessment should quantify, where possible, the likely impacts to key fish and shellfish PMFs. It should assess whether these could lead to a significant impact on the national status of the PMFs being considered ( <a href="https://www.nature.scot/doc/priority-marine-features-guidance">https://www.nature.scot/doc/priority-marine-features-guidance</a> ).	All PMFs within the fish and shellfish ecology study area are considered in <b>Section 8.7.2</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	For determining sensitivity of species, please note that all PMFs and some prey fish species are now available on the Feature Activity Sensitivity Tool ( <a href="https://feature-activity-sensitivity-tool.scot/">https://feature-activity-sensitivity-tool.scot/</a> ).	Noted. PMFs within the fish and shellfish ecology study area are considered in <b>Section 8.7.2</b> .

Consultee	Date/Document	Comment	How/Where Comment is Addressed
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	NatureScot note that a qualitative vessel collision risk assessment will be conducted for basking shark using the available sightings data for the east coast of Scotland and the worst-case number of vessel trips expected for the proposed development (as per paragraph 556 of the Bellrock WFDA Scoping Report) – NatureScot are content with this approach.	A qualitative vessel collision risk assessment has been conducted for basking shark, using available sightings data for the east coast of Scotland and the worst-case number of vessel trips expected for installation of the Bellrock Wind Farm Infrastructure. This assessment is presented in <b>Sections 8.8.1.5</b> and <b>Section 8.8.2.8</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	Paragraph 559 of the Bellrock WFDA Scoping Report briefly describes the approach to underwater noise modelling. At this stage, NatureScot would have expected to see further detail on the type of response – e.g. which species would be classed as stationary or fleeing. NatureScot would recommend that a fleeing response be used for most fish species except where mating or egg laying may override the instinct to flee e.g. for cod or herring. This is also the case for sandeel that have a very distinct habitat preference and unable to find suitable grounds further afield. Additionally, NatureScot would expect larvae (sandeel) to also be considered. Further dialogue with respect to underwater noise assessment requirements would be helpful, particularly as the Project Design Envelope (PDE) is refined.	Underwater noise modelling is addressed in <b>Section 8.8</b> across all phases of the development. The importance of distinguishing species-specific behavioural responses is acknowledged, such as stationary versus fleeing, and is incorporated into the assessment in <b>Section 8.8</b> where appropriate.
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	As per paragraph 560 of the Bellrock WFDA Scoping Report, particle motion is to be considered qualitatively within the EIA Report. NatureScot are currently content with this approach until further research on particle motion is available.	Noted. Information on the approach to particle motion is provided in <b>Section 8.8.1.3</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	Potential cumulative effects for fish and shellfish are considered in Section 7.6.3 of the Bellrock WFDA Scoping Report. It is stated that the cumulative assessment will be considered in two stages – the Bellrock WFDA with the Bellrock OfTDA and also alongside other plans and projects. NatureScot also note that the impact from underwater noise is likely to have the largest Zone of Influence (Zoi) and this will be used to determine whether other plans or projects have the potential to contribute to cumulative impacts - NatureScot are content with this approach.	Potential cumulative effects are assessed in <b>Section 8.8.1</b> with the methodology (including how the Bellrock OfTDA is considered) presented in <b>Section 8.4.2</b> .

Consultee	Date/Document	Comment	How/Where Comment is Addressed
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	Regarding EMF, NatureScot have observed a tendency for wind farm projects to reach a no likely significant effect conclusion for EMF impacts from a cumulative perspective. However, noting the proposed number of offshore wind developments in Scottish waters, NatureScot are concerned that the spatial and temporal scale is not being sufficiently considered cumulatively across the network of cables, including those outside of the proposed development. Thus, NatureScot advise that EMF impacts are considered in the cumulative assessment.	EMF impacts are assessed within the CEA, as presented in <b>Section 8.9</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	NatureScot welcome the identification of “embedded mitigation measures” described in Section 7.5.4 and summarised in Appendix 3 (Mitigation Register). The examples provided are generally appropriate, but NatureScot note that the majority of the measures do not relate to fish and shellfish directly, instead including the development and adherence to post-consent plans/programmes. For migratory fish – NatureScot advise the need for ongoing consideration of mitigation as the proposal develops. This should include but not be limited to consideration of underwater noise effects during construction, operation and decommissioning.	Embedded mitigation measures are outlined in <b>Section 8.6.3</b> . Additionally, the assessment and consideration for underwater noise effects during construction, O&M and decommissioning is addressed in <b>Section 8.8</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	NatureScot are content that transboundary impacts can be scoped out for fish and shellfish interests.	Noted. Transboundary impacts are scoped out.
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	NatureScot note that for diadromous fish species there is limited knowledge of distribution and behaviour of these species in the marine environment. For example, the precise migration routes of adult or juvenile Atlantic salmon or direction taken by migrating adult European eels is not fully known. Published information indicates that European smelt and River lamprey are primarily, though probably not exclusively, associated with estuarine environments. Shad might also prefer estuarine environments.	The limited understanding of the distribution and behaviour of diadromous fish species in the marine environment, particularly in relation to migration routes and habitat use, is acknowledged. The assessment has incorporated the best available evidence for species such as Atlantic salmon, European eel, European smelt, River lamprey, and shad, recognising the uncertainties that remain.

Consultee	Date/Document	Comment	How/Where Comment is Addressed
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	The recently updated Scottish Marine Energy Research (ScotMER) evidence map process for diadromous fish confirms these evidence gaps, particularly with respect to spatial and temporal distribution as well as uncertainty around migration routes, potential impact pathways and connectivity to protected sites. The ScotMER process is an important vehicle for helping to address these evidence gaps and uncertainties. NatureScot specifically welcome the ScotMER project Diadromous Fish in the Context of Offshore Wind – Review of Current Knowledge & Future Research, due to be published soon.	Noted. The recently published version of the ScotMER project Diadromous Fish in the Context of Offshore Wind – Review of Current Knowledge & Future Research is considered within <b>Section 8.5.2</b> .
NatureScot	Representation on the Bellrock WFDA Scoping Report (2024)	This research may change conclusions on how diadromous fish are treated in both EIA and HRA going forward. However, NatureScot advise, based on evidence currently available to us, it is not possible for us to carry out an assessment of diadromous fish to the level required under HRA. NatureScot therefore advise that diadromous fish species should be assessed through EIA only and not through HRA.	Noted. Diadromous fish are considered in this EIA Chapter.
SFF	Representation on the Bellrock WFDA Scoping Report (2024)	SFF is not content with scoping out the “Accidental release of pollutants” because if a vessel was to sink during any of the phases of the project life-span then an accidental release of pollutants would happen. Therefore, SFF would propose the ‘accidental release of pollutants’ to be scoped in.	<p>Accidental pollution will be effectively managed by implementation of the <b>MPCP (Volume V)</b> and an EMP (see <b>Outline EMP (Volume V)</b>) to be developed pre-construction, with all vessels operating on site required to adhere to the provisions within these plans.</p> <p>The EMP and MPCP will set out the protocols in place to minimise risk of pollutant release, and protocols to deal with accidental releases. The EMP and MPCP will be consulted upon and agreed with relevant stakeholders and MD-LOT prior to construction, at timescales determined by MD-LOT.</p> <p>This has therefore been scoped out of assessment.</p>

## 8.4 Assessment Methodology

### 8.4.1 Impact Assessment Methodology

11. **Chapter 5: EIA Methodology (Volume II)** provides a summary of the general impact assessment methodology applied in the Bellrock WFDA EIA Report. The assessment will use the conceptual ‘source-pathway-receptor’ model. The model identifies potential impacts resulting from the proposed activities on the environment and sensitive receptors within it.
12. The approach taken in assessing potential impacts on fish and shellfish ecology follows the methodology outlined in **Chapter 5: EIA Methodology (Volume II)**. This assessment is also conducted in accordance with best practice guidance, including the Guidelines for Ecological Impact Assessment in the UK and Ireland – Terrestrial, Freshwater, Coastal, and Marine (CIEEM, 2018). Potential impacts are identified where a clear pathway exists between the activities associated with the development and the relevant receptors, i.e. fish and shellfish.
13. Species are grouped based on shared life-history traits, which broadly influence their sensitivities to environmental pressures. The primary groups considered are diadromous fish, elasmobranchs, demersal fish, pelagic fish, cephalopods, crustaceans and molluscs each of which exhibits distinct vulnerabilities due to differences in their ecological characteristics. For example, pelagic fish are less likely to be affected by localised benthic disturbances compared to demersal fish, while elasmobranchs may be particularly sensitive to EMF. Sensitivities are determined through a thorough review of peer-reviewed scientific literature and assessments available on the Marine Life Information Network (MarLIN) database. While MarLIN provides a valuable fixed bottom structure, its limitations are acknowledged, and additional data sources are consulted where relevant.
14. For noise-related impacts, criteria are based on internationally accepted peer-reviewed research and recommendations from expert consensus. Thresholds for fish injury are derived from Popper et al. (2014).
15. Each impact scoped in (**Table 8.9**) is assessed separately for the construction, O&M and decommissioning phases of the Bellrock Wind Farm Infrastructure and described per primary groups. It is important to note that not all impacts will be relevant to all phases of the development.
16. 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.

17. The impact assessment for fish and shellfish ecology is primarily desk-based, utilising a combination of existing reference data and project-specific survey information as set out in **Section 8.5.2**.
18. A qualitative vessel collision risk assessment for basking sharks has been conducted, using expert judgment alongside the most recent sightings data from Scotland's east coast. This assessment incorporates the worst-case scenario for vessel movements during the construction, O&M and decommissioning phases of the Bellrock Wind Farm Infrastructure.
19. For herring and sandeel, habitat suitability assessments are informed by PSA data collected during the benthic survey campaign (**Appendix 7.2: Bellrock WFDA Environmental Baseline Survey 2023 Report (Volume IV)**). These assessments adhere to industry best practices and have been consulted on with stakeholders.
20. The assessment of underwater noise impacts uses thresholds developed by Popper et al. (2014), classifying receptors as either stationary or fleeing, depending on species behaviour and precautionary assumptions:
  - Stationary receptors: sandeel, spawning herring, spawning cod, and fish eggs; and
  - Fleeing receptors: all other species, with a modelled escape speed of 0.5 metres per second.
21. While these thresholds focus on sound pressure levels, it is recognised that many fish and invertebrates also detect particle motion. However, due to the lack of established impact thresholds for particle motion in an EIA context (Popper and Hawkins, 2018), this factor is considered qualitatively only in **Section 8.8**.
22. To assess EMF impacts, worst-case site-specific modelling of exposure levels from IACs has been undertaken. These findings inform the assessment of potential significance at the estimated exposure levels, both project-alone and cumulatively with other plans and projects (**Appendix 8.1: Electromagnetic Fields Assessment Report (Volume IV)**).
23. With respect to ocean quahog *Arctica islandica*, a range of impact pathways are assessed in the Benthic chapter (**Chapter 7: Benthic Ecology (Volume II)**). This Fish and Shellfish Ecology chapter specifically considers two unique impact pathways not addressed in the Benthic Ecology chapter, underwater noise and vibration and changes in fishing activity. No other impacts on ocean quahog are assessed here, to avoid duplication with the Benthic Ecology Chapter.

#### 8.4.1.1 Definitions of Sensitivity and Magnitude

24. The characterisation of the existing environment helps to determine the receptor sensitivity in order to assess the potential impacts upon it.
25. Sensitivity is defined by the ability of a receptor to adapt to change, tolerate, and/or recover from potential effects, as given in **Table 8.3**. Using expert judgement, a sensitivity value may be increased or decreased, where appropriate, according to the value of the receptor.

**Table 8.3: Definition of Sensitivity Levels for Fish and Shellfish Ecology Receptors**

Sensitivity	Definition
High	Individual receptor has very limited or no capacity to avoid, adapt to, accommodate or recover from the anticipated impact.
Medium	Individual receptor has limited capacity to avoid, adapt to, accommodate or recover from the anticipated impact.
Low	Individual receptor has some tolerance to accommodate, adapt to or recover from the anticipated impact.
Negligible	Individual receptor is generally tolerant to and can accommodate or recover from the anticipated impact.

26. The magnitude and probability of an impact occurring is established through consideration of:
- Scale or spatial extent (small scale to large scale or a few individuals to most of the population);
  - Duration (short term to long term);
  - Likelihood of impact occurring;
  - Frequency and timing, including seasonal sensitivity and ecological windows for key species or habitats (as outlined in CIEEM guidance (CIEEM, 2018)); and
  - Nature of change relative to the baseline.
27. Definitions of the magnitude levels are given in **Table 8.4**.

**Table 8.4: Definition of the Magnitude Levels for Fish and Shellfish Ecology Receptors**

Magnitude	Definition
High	Fundamental, permanent/irreversible changes, over the whole receptor, and/or fundamental alteration to key characteristics or features of the particular receptor's 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 particular receptor's 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 particular receptor's 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 particular receptor's character or distinctiveness.
No change	No measurable or discernible change from baseline conditions. The impact does not result in any alternation to the receptor.

### 8.4.1.2 Effect Significance

28. The potential significance of effect for a given impact, is a function of the overall sensitivity of the receptor and the magnitude of the impact (see **Chapter 5: EIA Methodology (Volume II)**) for further details). A matrix is used (**Table 8.5**) as a framework to determine the significance of an effect. Definitions of each level of significance are provided in **Table 8.6**. Impacts and effects may be either positive (beneficial) or negative (adverse). Impacts that are moderate or major adverse are considered to be significant in EIA terms.

**Table 8.5: Matrix for Evaluating the Significance of an Effect**

Sensitivity	Magnitude				
	High	Medium	Low	Negligible	No Change
High	Major	Major	Moderate	Minor	No effect
Medium	Major	Moderate	Minor	Negligible	No effect
Low	Moderate	Minor	Minor	Negligible	No effect
Negligible	Minor	Negligible	Negligible	Negligible	No effect

**Table 8.6: Definitions of Effect Significance**

Effect Significance	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.
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 effect	No change in receptor condition; therefore, no effect.

### 8.4.2 Cumulative Effects Assessment Methodology

29. The Cumulative Effects Assessment (CEA) considers the likely significant effects of impacts arising from the Bellrock Wind Farm Infrastructure cumulatively with other relevant plans, projects and activities. The general approach to the CEA for fish and shellfish ecology includes defining a CEA plans and projects screening area of search, identifying a short list of plans and projects for consideration, identifying potential cumulative impacts, and evaluating the significance of cumulative effects. The screening for this Chapter has been based on a four-month cut off period for other projects and plans, which represents a shorter cut-off than the six months that was proposed in the Scoping Report (**Appendix 1.1: Bellrock WFDA Scoping Report (Volume IV)**).

30. MD-LOT were consulted during the screening process as part of ongoing consultation in the pre-application phase. **Chapter 5: EIA Methodology (Volume II)** provides further details on the general approach to the CEA, including the CEA with the Bellrock Offshore Transmission Development Area (OfTDA) and Onshore Transmission Development Area (OnTDA).
31. The plans and projects selected as relevant to the CEA for fish and shellfish ecology are based upon the results of a screening exercise (see **Appendix 5.3: Cumulative Effects Assessment Long List of Projects (Volume IV)** for details). Each plan or project has been considered on a case-by-case basis for screening in or out of this assessment based upon data confidence, impact-receptor pathways and the spatial/temporal scales involved.
32. The proposed Offshore Transmission Infrastructure will be located within the Proposed Bellrock OfTDA and is assessed within the Bellrock WFDA CEA because of potential receptor impact pathways. As the OfTDA boundary overlaps with the Bellrock WFDA, the likely significant effects of the Bellrock Wind Farm Infrastructure together with the Bellrock Offshore Transmission Infrastructure within the overlapping area, so far as these can be ascertained at this stage, are assessed within the Bellrock WFDA EIA Report.
33. In line with the methodology set out in **Chapter 5: EIA Methodology (Volume II)**, three tiers have been applied to the Bellrock WFDA CEA. As the site selection process for the Bellrock OfTDA and OnTDA is ongoing (see **Chapter 4: Project Description (Volume II)** for details), activities and infrastructure associated with the Bellrock OfTDA and Bellrock OnTDA will be treated as 'other projects' for the purposes of the CEA, but have been considered within Tier 1 where relevant, due to their essential requirement for the function of the Bellrock Project.
34. The three tiers for CEA are:
- Tier 1 assessment: The Bellrock WFDA plus plans/projects which are operational, under construction, those with consent or a consent application submitted but not yet determined, plus the Bellrock OfTDA and Bellrock OnTDA;
  - Tier 2 assessment: The Bellrock WFDA plus all plans/projects assessed under Tier 1, plus projects with a Scoping Report and/or Scoping Opinion; and
  - Tier 3 assessment: The Bellrock WFDA plus all plans/projects assessed under Tier 1 and Tier 2, plus those projects likely to come forward where a Crown Estate Scotland Option to Lease Agreement or equivalent has been granted.

### 8.4.3 Transboundary Effects Assessment Methodology

35. For fish and shellfish ecology, there is no potential for impacts on transboundary receptors, and therefore, transboundary effects have been scoped out. This has been agreed with MD-LOT (see **Table 8.2**) as part of the Scoping Opinion (**Appendix 1.2: Bellrock WFDA Scoping Opinion (Volume IV)**).

## 8.5 Scope of the Assessment

### 8.5.1 Study Area

36. The distribution and abundance of fish and shellfish populations is spatially and temporally variable, therefore for the purposes of the fish and shellfish ecology baseline characterisation, two fish and shellfish ecology study areas are defined. These are shown in **Figure 8.1 (Volume III)** and described here:

- The fish and shellfish ecology study area is defined as the ICES statistical rectangles that overlap with the Bellrock WFDA (ICES rectangles 42E9 and 42F0). The existing environment for fish and shellfish ecology within this fish and shellfish ecology study area is characterised in **Section 8.7**; and
- The regional fish and shellfish ecology study area encompasses the fish and shellfish ecology study area and a surrounding area defined by the boundary of the northern North biogeographic region (CP2), as identified in the Review of Marine Nature Conservation (2004). This also encompasses waters of the Forth and Tay, northeast, and Moray Firth Scottish Marine Regions. The regional fish and shellfish ecology study area provides a wider context for the fish and shellfish species and populations and will be used specifically to inform assessments of those impacts affecting fish and shellfish receptors over long distances (e.g. underwater noise).

### 8.5.2 Data and Information Sources

37. **Table 8.7** sets out the key desk-based information and data sources that have been used to inform the fish and shellfish ecology baseline.

**Table 8.7: Key Data and Information Sources for Fish and Shellfish Ecology**

Dataset	Year(s)	Description
Spatial patterns and trends in abundance of larval sandeels in the North Sea: 1950–2005 (Lynam et al. 2013).	1950 - 2005	Continuous Plankton Recorder data on larval <i>Ammodytes marinus</i> (sandeel) abundance in the North Sea over the period 1950-2005, averaged over ICES rectangles.
A verified distribution model for the lesser sandeel <i>Ammodytes marinus</i> (Langton et al. 2021).	2021	A species distribution model (hurdle model) to predict the occurrence and density of sandeels in the North Sea.
ICES International Herring Larvae Survey	2013 - 2023	The ICES programme of international herring larval surveys in the North Sea provides annual quantitative estimates of herring larval abundance in Scottish waters.
Updating Fisheries Sensitivity Maps in British Waters (Aires et al. 2014).	2014	Modelled probability of larvae presence for various fish species.

Dataset	Year(s)	Description
Mapping the spawning and nursery grounds of selected fish for spatial planning (Ellis et al., 2012).	2012	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.
Review of migratory routes and behaviour of Atlantic salmon, sea trout and European eel in Scotland's coastal environment: implications for the development of marine renewables (Malcolm et al. 2010).	2010	A review of migratory routes and behaviour of Atlantic salmon, sea trout and European eel in Scotland's coastal environment, and the implications for marine developments.
Fisheries sensitivity maps in British Waters (Coull et al. 1998).	1998	Mapped extents of the spawning and nursery grounds of various commercially important fish species and the relative intensity and duration of spawning.
MarLIN fish and shellfish sensitivity reports. Available at: <a href="https://www.marlin.ac.uk/activity/pressures_report">https://www.marlin.ac.uk/activity/pressures_report</a> .	N/A	MarLIN's Marine Evidence-based Sensitivity Assessment 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.
Salmon and sea trout fishery statistics: 1952 to 2024 season - reported catch and effort by district and method	2025	A summary of Atlantic salmon and sea trout <i>Salmo trutta</i> catches and net catch data for the 1952 to 2024 fishing season.
National Biodiversity Network (NBN) Atlas species assemblage data	2025	The NBN Atlas is a species occurrence data portal, combining 995 datasets from 165 data partners at the time of writing.
Consenting documents for nearby projects, including Buchan, Moray West, Moray East, and Beatrice OWFs.	Various	Impact assessment and site survey reports for relevant OWF projects.
Developing Essential Fish Habitat maps for fish and shellfish species in Scotland Report (Franco et al. 2022)	2022	Modelled extent of essential fish habitat in Scottish waters for 16 species in offshore waters.
River Wick Atlantic salmon smolt tracking (McIlvenny et al. 2021)	2021	Acoustic telemetry tracking of Atlantic salmon smolts in coastal waters surrounding the mouth of the River Wick.
EMFs from subsea power cables in the natural marine environment (Gill et al. 2023)	2023	Provides field measurements of both magnetic and electric fields using the Swedish electromagnetic low-noise apparatus, covering high voltage direct current interconnectors and alternating current (AC) offshore wind cables.

Dataset	Year(s)	Description
Limited Evidence Base for Determining Impacts (Or Not) of Offshore Wind Energy Developments on Commercial Fisheries Species (Gill et al. 2024)	2024	Evidence of environmental effects of OWFs on fisheries species and then determined whether these could be interpreted as impacts using fishery-scale and organism-scale parameters for pelagic finfish, demersal and reef-associated roundfish, demersal flatfish, elasmobranchs and shellfish.
Spawning grounds of Atlantic cod <i>Gadus morhua</i> in the North Sea, ICES Journal of Marine Science (González-Irusta & Wright, 2016)	2016	Peer-reviewed study identifying and characterising Atlantic cod spawning grounds in the North Sea using spatial modelling and fisheries data.
Spawning grounds of haddock <i>Melanogrammus aeglefinus</i> in the North Sea and West of Scotland, Fisheries Research (González-Irusta & Wright, 2016)	2016	Spatial modelling of haddock spawning grounds across the North Sea and West of Scotland, supporting ecological assessments and fisheries management.
Predators and Prey Around Renewable Energy Developments (OWEC PrePARED, 2025)	2023	Research project investigating predator-prey dynamics around offshore renewable energy infrastructure, with relevance to ecological impact assessments.
Scottish Government – Diadromous Fish in the Context of Offshore Wind: Review of Current Knowledge and Future Research Needs (The Scottish Government, 2024)	2024	Government-commissioned review summarising current understanding of diadromous fish ecology and interactions with offshore wind developments.

### 8.5.3 Site-specific Surveys and Studies

38. Site-specific surveys have been undertaken to support the desk-study by providing accurate and detailed environmental information. **Table 8.8** summarises the site-specific surveys relevant to fish and shellfish ecology undertaken to date.
39. The benthic survey involved sampling a total of 113 combined drop-down camera (DCC) and grab sampling stations across the Bellrock WFDA, which has an area of 280 km<sup>2</sup>. This equates to an estimated sampling density of approximately one station per 10 km<sup>2</sup>, which informs the spatial resolution of the dataset. Each sampling station was screened using drop down camera (video and photos) to determine suitability for grab sampling. If the site was deemed unsuitable, the sampling station was repositioned in a nearby area of sediment and revisited with drop down camera prior to grab sampling. If the site was deemed suitable; it was sampled with a 0.2 m<sup>2</sup> dual Van Veen grab sampler, within 20 m of the target sampling location. Each sediment sample then underwent macrobenthic and PSD analysis. Water samples for eDNA analysis were also collected at three different depths at 10 sampling stations.
40. All elutriation, extraction, identification and enumeration of macrobenthos in the grab samples was undertaken in line with the National Marine Biological Analytical Quality Control Scheme Processing Requirement Protocol (Worsfold and Hall, 2010). Biomass was measured as blotted wet weight in grams to at least 4 decimal places for all countable taxa (i.e. at species level where possible). As a standard, the conventional conversion factors as defined by (Eleftheriou & Basford, 1989) were applied to biomass data to provide equivalent dry weight biomass (ash free dry weight). Habitats were identified and classified in accordance with the European Nature Information System 2008 habitat classification system, in considerations of JNCC guidance on assigning benthic biotopes (Parry, 2019).
41. As part of this Bellrock WFDA EIA Report, a project-specific EMF modelling study was carried out. This was undertaken to understand the potential exposure of marine species to EMFs generated by IACs. The assessment focused on worst-case scenarios, including maximum cable load and minimum burial depth, to ensure a precautionary approach. The modelling aimed to inform the potential for interaction with sensitive receptors, particularly species known or suspected to detect electric and magnetic fields. Full details of the methodology and modelling parameters are provided in **Appendix 8.1: Electromagnetic Fields Assessment Report (Volume IV)**.

**Table 8.8: Summary of Site-specific Surveys for Fish and Shellfish Ecology**

Survey	Spatial Coverage	Year(s)	Description
Benthic	Bellrock WFDA	2023	The benthic survey was conducted by TerraSond Limited (TerraSond) between 5 July 2023 and 28 July 2023. The survey consisted of grab sampling and drop-down video at 113 stations. Water samples for environmental DNA analysis were collected at three different depths at 10 sampling stations. <b>Appendix 7.2: Bellrock WFDA Environmental Baseline Survey 2023 Report (Volume IV)</b> and <b>Appendix 7.3: Bellrock WFDA Benthic Characterisation Survey 2023 Report (Volume IV)</b> .

Survey	Spatial Coverage	Year(s)	Description
EMF modelling	Bellrock WFDA	2025	Project-specific EMF modelling was undertaken to assess potential EMF emissions from IACs associated with the Bellrock Wind Farm Infrastructure. The modelling considered worst-case scenarios, including maximum cable load, burial depth, and cable configuration, to evaluate the spatial extent and intensity of EMF exposure on the seabed. The approach and results of the EMF modelling have been outlined in <b>Appendix 8.1: Electromagnetic Fields Assessment Report (Volume IV)</b> .

### 8.5.4 Assumptions and Limitations

42. The impact assessment in this Chapter is subject to certain limitations. Primarily, these stem from knowledge gaps regarding the sensitivity of specific species or species groups to particular impacts (e.g. the effects of noise on shellfish). As a result, functionally or taxonomically similar species or groups have been used for comparison where necessary. Additional uncertainties exist regarding the distribution of certain species and the extent to which they utilise the Bellrock WFDA during critical life stages such as spawning or migration.
43. Many of the impacts discussed in **Section 8.8** have been the subject of research to assess their likelihood and severity. However, in some cases (e.g. EMF), the available evidence remains inconclusive. Despite these uncertainties, the assessment has made the best possible use of existing research to evaluate the potential significance of effects arising from the Bellrock Wind Farm Infrastructure.

## 8.6 Potential Impacts

### 8.6.1 Scope

44. **Table 8.9** sets out the impacts that have been scoped in to and out of the Bellrock WFDA EIA Report, in line with the Scoping Opinion (**Appendix 1.2: Bellrock WFDA Scoping Opinion in Volume IV**).
45. Remobilisation of existing contaminated sediments was identified in **Appendix 1.1: Bellrock WFDA Scoping Report (Volume IV)** and scoped in for assessment on a precautionary basis, pending the results of site-specific sediment contamination analysis.
46. Subsequent chemical analysis of sediments within the Bellrock WFDA demonstrated that contamination concentrations were either below the limit for detection or below Cefas Action Level one (and other relevant reference thresholds). This indicates that sediments within the Bellrock WFDA are not contaminated.

47. On this basis, the remobilisation of contaminated sediments is not considered a credible impact pathway and is therefore scoped out of further assessment in this Chapter. Further details of the contaminant analysis are presented in **Appendix 7.2: Bellrock WFDA Environmental Baseline Survey 2023 Report (Volume IV)**.

**Table 8.9: Potential Impacts Scoped In and Scoped Out of the EIA for Fish and Shellfish Ecology**

Potential Impact	Construction	Operation and Maintenance	Decommissioning
	Advised within the Bellrock WFDA Scoping Opinion		
Physical disturbance and temporary habitat loss	✓	✓	✓
Permanent habitat loss	x	✓	x
Increased SSC and sediment re-deposition	✓	✓	✓
Remobilisation of contaminated sediments	x <sup>1</sup>	x <sup>1</sup>	x <sup>1</sup>
Underwater noise and vibration	✓	✓	✓
EMFs	x	✓	x
Introduction of hard structures	x	✓	x
Changes in fishing activity	✓	✓	✓
Vessel collision for basking shark	✓	✓	✓
Accidental release of pollutants	x	x	x
Introduction of marine INNS from vessel traffic	x	x	x
Secondary entanglement with SKSs	x	✓	x
Transboundary impacts	x	x	x

<sup>1</sup> No contaminated sediments were identified within the Bellrock WFDA therefore there is no pathway for effect on fish and shellfish receptors and it is scoped out. This is discussed further in **paragraphs 45 to 47**.

## 8.6.2 Realistic Worst-case Scenario

48. The final design of the Bellrock Wind Farm Infrastructure will be confirmed during detailed engineering studies post-consent. In order to undertake a robust and precautionary impact assessment, the realistic worst-case design scenario has been defined. Realistic worst-case scenarios (i.e. those that have the potential to cause the greatest impact) are derived from the PDE to ensure that all other design scenarios would have equal or less impact. Please see **Chapter 5: EIA Methodology (Volume II)** for further details on the design envelope approach.
49. The realistic worst-case scenario for the fish and shellfish ecology assessment is summarised in **Table 8.10**. These are based on the project design as described in **Chapter 4: Project Description (Volume II)**.

**Table 8.10: Realistic Worst-case Scenarios for Impacts on Fish and Shellfish Ecology**

Impact	Realistic Worst-case Scenario	Rationale
<b>Construction</b>		
C1: Physical Disturbance and Temporary Habitat Loss	<p><b>Total Area of Disturbance = 3.64 km<sup>2</sup> (3,635,158 m<sup>2</sup>)</b></p> <p><b>Seabed Preparation<sup>1</sup> = 797,032 m<sup>2</sup></b></p> <p>Maximum footprint area due to boulder clearance = 4,000 m<sup>2</sup>.</p> <p>Maximum footprint area due to sand wave levelling = 420,000 m<sup>2</sup>.</p> <p>Maximum footprint area due to slope levelling for gravity-based anchors (GBAs) only = 373,032 m<sup>2</sup>.</p> <p><b>Construction = 2,838,126 m<sup>2</sup></b></p> <p><u>Mooring Lines:</u></p> <p>Maximum footprint area due to the pre-lay of mooring lines (including clump weights) on the seabed = 532,224 m<sup>2</sup>.</p> <p><u>Anchors:</u></p> <p>Maximum seabed footprint area for all drag embedment anchors (DEAs) (including drag distance of 60 m per DEA) = 855,360 m<sup>2</sup>.</p> <p><u>IACs:</u></p> <p>Installation method with the largest seabed footprint area = ploughing.</p> <p>Maximum seabed footprint area of disturbance from ploughing = 1,447,500 m<sup>2</sup>.</p> <p><u>Subsea Cable Hubs:</u></p> <p>Maximum seabed footprint for 18 subsea cable hubs = 3,042 m<sup>2</sup>.</p> <p><u>Unexploded ordnance (UXO) Clearance:</u></p> <p>UXO clearance will be subject to a separate UXO Marine Licence. As the number, type and clearance method are currently unknown, the associated footprint cannot be quantified at this stage and is therefore excluded from the total footprint area for physical disturbance and temporary loss of seabed habitat. For context, indicative crater dimensions from UK UXO studies (Ordtek, 2018) suggest that a high-order detonation of a German LMB Ground Mine can create a</p>	<p>Temporary disturbance/seabed habitat loss relates to seabed preparation and installation of infrastructure on and in the seabed. The continuous footprint of infrastructure is assessed as impact of the O&amp;M phase.</p>

Impact	Realistic Worst-case Scenario	Rationale
	<p>crater of approximately 21.1 m diameter (~350 m<sup>2</sup>) and 3.3 m depth in similar sediments. This is provided as benchmarking information only.</p> <p>This represents a precautionary worst-case, as low-order deflagration techniques, now commonly applied in UK waters, would result in substantially smaller craters and therefore reduced physical disturbance and temporary seabed habitat loss. A detailed assessment will be provided within the UXO Marine Licence application once UXO type, location, and clearance method are confirmed.</p>	
<p>C2: Increased Suspended Sediment Concentrations and Sediment Re-deposition</p>	<p><b>Total SSC released due to construction activities (including site preparation) = 0.0014 km<sup>3</sup> (1,394,530 m<sup>3</sup>)</b></p> <p><b>Seabed Preparation = 793,032 m<sup>3</sup></b></p> <p>Maximum volume of sediment disturbed due to seabed preparation prior to anchor installation (only required for GBAs) = 373,032 m<sup>3</sup></p> <p>Maximum volume of sediment disturbed due to sand wave levelling prior to IAC installation = 420,000 m<sup>3</sup>.</p> <p><b>Construction total volume of disturbance = 601,498 m<sup>3</sup></b></p> <p><u>Anchor Installation:</u></p> <p>Worst-case anchor type in relate to sediment mobilisation = FOU driven pile (installed via Drive – Drill – Drive).</p> <p>Total volume of sediment disturbed due to pile drill arisings for up to 10% anchor locations and assuming 80% depth of drilling required.</p> <p>Anchor installation (with drilling (Drive – Drill – Drive)) total volume of drill arisings = 94,052 m<sup>3</sup>.</p> <p><u>Installation of mooring buoy anchors:</u></p> <p>Maximum number of moorings buoys = 2;</p> <p>Maximum number of anchors per mooring buoy = 3;</p> <p>Maximum footprint per mooring buoy = 147 m<sup>2</sup>;</p> <p>Maximum footprint for all mooring buoys = 294 m<sup>2</sup>;</p> <p>Maximum seabed penetration= 2 m; and</p> <p>Maximum volume of all sediment disturbance mooring buoy installation = 588 m<sup>3</sup>.</p>	<p>In the construction phase, the worst-case scenario for this impact is associated with the activities that may result in increased suspended sediment concentrations and associated deposition.</p>

Impact	Realistic Worst-case Scenario	Rationale
	<p><u>IAC installation total volume of disturbance:</u>                      Worst-case IAC installation method = Jet trenching;                      Maximum IAC to be buried = 225 km;                      Maximum jet trenching disturbance width = 3 m;                      Maximum jet trenching disturbance depth = 2.5 m;                      Assuming 30% suspension of sediment; and                      Maximum volume of sediment disturbance from IAC installation = 506,250 m<sup>3</sup>.</p> <p><u>Installation of subsea cable hubs:</u>                      Up to 18 subsea hubs, each with a footprint of 169 m<sup>2</sup> (13 m x 13 m);                      Maximum volume of subsea cable hub disturbance depth = 0.2 m;                      Maximum volume of subsea cable hub disturbance = 608.4 m<sup>3</sup>;</p>	
<p>C3: Underwater Noise and Vibration</p>	<p><b>Impact Piling of FOU:</b></p> <ul style="list-style-type: none"> <li>▪ 15 minute and 50 seconds initiation, at a rate of 6 strikes per minute at a hammer energy of 277 kJ.</li> <li>▪ 4 minute and 10 seconds, at a rate of 10 strikes per minute at a hammer energy of 443 kJ.</li> <li>▪ 19 minute and 14 seconds ramp up, at a rate of 30 strikes per minute and hammer energy of 1,112 kJ.</li> <li>▪ 10 minute and 14 seconds, at a rate of 30 strikes and hammer energy increasing of 1,670 kJ.</li> <li>▪ 124 minute and 52 seconds, at a rate of 30 strikes and hammer energy increasing of 2,649 kJ.</li> <li>▪ 5 minutes, at a rate of 30 strikes and hammer energy increasing of 3,000 kJ.</li> </ul> <p>Maximum FOU driven pile diameter = 6 m                      Maximum number of FOU driven piles (9 anchors x 132 FOU) = 1,188                      Total active piling duration = 1029.6 hours                      Maximum piling days = 1,188</p>	<p>Continuous noise source levels are detailed in <b>Appendix 9.2: Underwater Noise Modelling Report (Volume IV)</b></p>

Impact	Realistic Worst-case Scenario	Rationale
	Maximum FOU driven piles installed within 24 hours = 3 <b>Underwater noise from vessels:</b> Maximum number of vessels within the WFDA at any one time = 34 Maximum number of round trips <sup>2</sup> = 1,615 (site preparation works and construction)	
C4: Changes in Fishing Activity	The worst-case scenarios are set out in <b>Chapter 11: Commercial Fisheries (Volume II)</b>	The worst-case has been generated from most extreme design parameters considered in the PDE. The implications of fishing displacement for fish and shellfish populations are considered in this Chapter.
C5: Vessel collision for basking shark	Maximum number of FSSs = 132 Maximum number of vessels on within the WFDA at any one time = 34 Maximum number of round trips = 1,615 (site preparation works and construction)	Maximum vessel traffic and infrastructure during the construction period.
<b>Operation and maintenance</b>		
O1: Physical Disturbance and Temporary Habitat Loss	<p><b><u>Worst-case O&amp;M disturbance footprint for the Bellrock WFDA (total over the lifetime of the Bellrock Project) = 47.46 km<sup>2</sup> (47,461,080 m<sup>2</sup>)</u></b></p> <p><u>Moorings:</u>                      Maximum catenary drag seabed footprint (swept area) of all mooring lines = 46,200,000 m<sup>2</sup> (350,000 m<sup>2</sup> per FOU).</p> <p><u>IACs:</u>                      IAC repair due to failure: Maximum seabed disturbance footprint (per year) = 27,720 m<sup>2</sup> (970,200 m<sup>2</sup> over lifetime (35 yrs)); and                      Remedial IAC burial due to exposure: Maximum seabed disturbance footprint (per year) = 2,880 m<sup>2</sup> per year (100,800 m<sup>2</sup> overtime lifetime (35 years)).</p>	<p>The worst-case scenario (WCS) for this impact pathway includes all temporary physical disturbance associated with O&amp;M activities. This encompasses potential IAC repair works, remedial IAC burial, and any jack-up vessel deployments. It also includes the swept area of mooring lines.</p> <p>The swept area generated by mooring line movement represents periodic or intermittent disturbance of the seabed rather than permanent habitat loss footprint. Although abrasion can occur over the operational life of the Bellrock Wind Farm Infrastructure, the</p>

Impact	Realistic Worst-case Scenario	Rationale
	<p><u>Jack-up Vessels:</u></p> <p>Maximum jack-up vessel seabed footprint (per jack-up vessel) = 1,440 m<sup>2</sup>;</p> <p>Maximum number of jack-up positions = 3.77 per year (132 across the operational life).</p> <p>Maximum number of jack-up positions = 3.77 per year (132 across the operational life).</p> <p>Maximum jack-up vessel seabed footprint (per year) = 5,431 m<sup>2</sup>.</p> <p>Maximum jack-up vessel seabed footprint (for all jack-up positions) = 190,080 m<sup>2</sup> (1,440 m<sup>2</sup> x 132).</p> <p><u>Removal and subsequent deposit of marine growth:</u></p> <p>The removal of marine growth is not quantified within the worst-case scenario, as the volume of material that may require removal is highly uncertain and would be dependent on a range of operational and environmental factors, including the nature of the infrastructure, location within the water column, and maintenance requirements.</p> <p>MD-LOT considers the deposit of marine growth to be a licensable activity under Section 21 of the Marine (Scotland) Act 2010 and Section 66 of the Marine and Coastal Access Act 2009. Accordingly, the potential effects associated with the removal and deposit of marine growth are considered qualitatively within this assessment, and no quantitative estimate of volumes is provided at this stage.</p>	<p>seabed is not permanently occupied by infrastructure and retains the potential to recover once movement ceases. For this reason, mooring line swept area is appropriately assessed under O1 rather than O4, which is limited to the fixed infrastructure footprint only.</p>
<p>O2: Increased SSC and Sediment Re-Deposition</p>	<p><b><u>Total SSC released due to O&amp;M activities = 0.0255 km<sup>3</sup> (25,525,500 m<sup>3</sup>)</u></b></p> <p><b>IAC Repair Due to Failure</b></p> <p>Maximum sediment disturbed per year due to IAC repair = 69,300 m<sup>3</sup></p> <p>Maximum sediment disturbed across the operational life of the Bellrock Wind Farm Infrastructure = 2,425,500 m<sup>3</sup>.</p> <p><b>Catenary Mooring Lines</b></p> <p>Maximum area of seabed disturbed by catenary mooring lines (all mooring lines) = 46,200,000 m<sup>2</sup> (350,000 m<sup>2</sup> *132).</p> <p>Maximum depth of seabed disturbed by one mooring line = 0.5 m.</p> <p>Maximum volume of sediment disturbed within the swept area of the catenary mooring lines = 23,100,000 m<sup>3</sup></p>	<p>The WCS includes the potential repair of IACs and the swept area of mooring lines during the O&amp;M phase.</p>

Impact	Realistic Worst-case Scenario	Rationale
<p>O3: Underwater noise and vibration</p>	<p><b>Underwater noise from operational FOUs:</b> FOUs parameters (diameter, number etc) as outlined above for construction. Operational life of windfarm: 35 years</p> <p><b>Underwater noise from maintenance activities (cable repair, replacement and reburial and cable protection works):</b> Worst-case cable failure rate per year = 1.8 Worst-case length of cable reburial = 21,000 m</p> <p><b>Underwater noise from vessels:</b> Maximum number of vessels within the WFDA at any one time = 21 Maximum number of round trips per vessel = 211</p>	<p>Continuous noise source levels are detailed in <b>Appendix 9.2: Underwater Noise Modelling Report (Volume IV)</b></p>
<p>O4: Changes in fishing activity</p>	<p>The worst-case scenarios are set out in <b>Chapter 11 Commercial Fisheries (Volume II)</b></p>	<p>The worst-case has been generated from most extreme design parameters considered in the PDE. The implications of fishing displacement for fish and shellfish populations are considered in this Chapter.</p>
<p>O5: Vessel collision for basking shark</p>	<p>Maximum number of WTGs = 132 Maximum number of vessels within the WFDA at any one time = 21 Maximum number of round trips = 211</p>	<p>Maximum vessel traffic and infrastructure during the O&amp;M period.</p>
<p>O6: EMFs</p>	<p><b><u>Presence of IACs:</u></b> Maximum length of 300 km of 132 kV (maximum) high voltage alternating current IACs, with up to 225 km buried (with up to 26.2 km potentially requiring cable protection) and up to 92.4 km of dynamic IAC sections<sup>3</sup>. Target burial depth of 0.5 to 2.5 m (subject to cable burial risk assessment (CBRA)).</p> <p><b><u>Cable Protection:</u></b> Maximum amount of IAC requiring external cable protection = 26.2 km.</p>	<p>The maximum length of cables would result in the greatest potential for EMF-related effects. Details of the EMF assessment is outlined in <b>Appendix 8.1: Electromagnetic Fields Assessment Report (Volume IV)</b>.</p>

Impact	Realistic Worst-case Scenario	Rationale
	<p><b><u>Cable Crossings:</u></b> Maximum number of cable crossings = 3; and Maximum length of cable crossings = 157.2 m.</p> <p><b><u>Subsea Cable Hubs:</u></b> Maximum number of subsea cable hubs = 18.</p> <p><b><u>Additional considerations:</u></b> The O&amp;M phase will be up to 35 years.</p>	
<p>O7: Permanent Habitat Loss</p>	<p><b><u>Total Area of permanent habitat loss = 2.93 km<sup>2</sup> (2,926,659 m<sup>2</sup>)</u></b></p> <p><b>Anchors:</b> Maximum footprint for the suction pile anchoring system (worst-case) = 377,784 m<sup>2</sup>.</p> <p><b>Permanent mooring buoys:</b> Maximum footprint for two permanent mooring buoys = 294 m<sup>2</sup>.</p> <p><b>Subsea cable hubs:</b> Maximum seabed footprint for 18 subsea cable hubs = 3,042 m<sup>2</sup>.</p> <p><b>Cable Protection:</b></p> <p><b>IACs</b> Maximum amount of IAC requiring external cable protection = 26.2 km of the unburied IACs. Maximum area of cable protection for IACs at 4.8 m width = 125,760 m<sup>2</sup>.</p> <p><b>Cable Crossings</b> Maximum seabed footprint for three cable crossings = 981 m<sup>2</sup>.</p> <p><b>Scour Protection:</b></p> <p><b>Anchors</b> Maximum seabed footprint for anchor scour protection (all anchors) = 2,418,768 m<sup>2</sup>.</p>	<p>The WCS for this impact pathway covers the permanent loss of seabed habitat resulting from the physical footprint of fixed infrastructure that occupies the seabed for the lifetime of the Bellrock Wind Farm Infrastructure.</p> <p>It does not include mooring line swept area or other disturbance effects, as these do not result in permanent occupation of the seabed and are assessed under O1.</p>

Impact	Realistic Worst-case Scenario	Rationale
	<p><b>Metocean Buoys:</b></p> <p>Maximum number of metocean buoys = 2.</p> <p>Maximum seabed footprint per buoy = 15 m<sup>2</sup>.</p> <p>Maximum footprint for all metocean buoys = 30 m<sup>2</sup>.</p> <p><b>Additional considerations:</b></p> <p>Minimum FOU separation distance = approximately 1,150 m (centre to centre); and</p> <p>Operational lifetime = 35 years.</p>	
<p>O8: Introduction of Hard Structures</p>	<p><b><u>Hard Substrate:</u></b></p> <p>See WCS for impact pathway O4 (2.93 km<sup>2</sup>) in relation to the footprint of infrastructure installed on the seabed which could be colonised by benthic species during the O&amp;M phase. In addition, the FSSs, dynamic IACs, and mooring lines represent hard substrate introduced into the water column. Given the complexity of calculating a footprint of hard substrate associated with mooring lines, dynamic IACs and steel tubulars associated with a FSS and the uncertainty around final FSS design it is not possible to calculate an area available for colonisation of organisms. In addition, marine growth may periodically be removed from the subsea infrastructure, as it could inhibit buoyancy.</p> <p><b><u>Additional considerations:</u></b></p> <p>Operational lifetime = 35 years</p>	
<p>O9: Secondary entanglement with SKSs</p>	<p><b><u>Mooring lines:</u></b></p> <ul style="list-style-type: none"> <li>▪ Maximum number of mooring lines = 1,188 for 132 FOUs (up to 9 mooring lines per FOU);</li> <li>▪ Maximum mooring touchdown distance from FOU = 1,300 m;</li> <li>▪ Maximum length of each mooring line within the water column during normal operation = 920 m;</li> <li>▪ Maximum length of each mooring line on the seabed during normal operation = 770 m; and</li> <li>▪ Mooring line material: Chain, nylon, polyester, high modulus polyethylene.</li> </ul>	<p>The maximum length of mooring line and dynamic IACs in the water column is assessed as the worst case.</p>

Impact	Realistic Worst-case Scenario	Rationale
	<p><b><u>IACs:</u></b></p> <ul style="list-style-type: none"> <li>▪ Maximum external cable diameter = 270 mm;</li> <li>▪ Maximum length of dynamic cable in the water column (free hanging, lazy s wave, steep wave) per IAC connection to each FSS = 350 m; and</li> <li>▪ Total maximum length of dynamic cable in the water column for all FSS (1 – 2 connection points per FSS) = 92.4 km.</li> </ul>	
<b>Decommissioning</b>		
D1: Physical disturbance and temporary habitat loss	<p><b><u>Decommissioning Overview:</u></b></p> <p>It is expected that the Bellrock Wind Farm Infrastructure will be fully removed at the end of its operational life. Exceptions to this would be where removal would create unacceptable risks to personnel or to the marine environment, be technically unfeasible or involve extreme costs (Scottish Government, 2022).</p> <p>The sequence of decommissioning is likely to be the reverse of the construction sequence, taking around seven years, with similar types and numbers of vessels and equipment expected to be involved. The removal and dismantling of the FOU's will largely be a reversal of the installation process. Generally, the FOU's will be towed from the Bellrock WFDA to a suitable port for decommissioning. Mooring lines and anchors will be recovered and removed from the WFDA. For FOU driven pile anchors, these are expected to be either fully removed or cut off below seabed level with a proportion remaining in-situ (due to anticipated excessive cost in their complete removal) following good practice and consideration of environmental conditions and sensitivities.</p> <p>Subsea cable hubs are expected to be fully removed from the seabed.</p> <p>The dynamic sections of the IACs within the water column will be cut at the connector with the static IAC and fully removed. The approach for decommissioning the static IACs on the seabed is yet to be determined, however, this will be reviewed throughout the lifetime of the Bellrock WFDA and good practice guidance at time of decommissioning will be followed.</p> <p>Subject to the material used and environmental sensitivities, it may be preferable to leave scour protection in-situ to preserve the marine habitat that may have developed over the life of the Bellrock WFDA. The approach for decommissioning cable protection will be similar to scour protection. Relevant stakeholders and regulators will be consulted to establish the best approach. Good practice guidance at time of decommissioning will be followed.</p>	<p>Decommissioning impacts are related to removal of infrastructure on or within the seabed and/or suspended within the water column. It is anticipated that decommissioning WCS would be equal to or lesser than the WCS presented for construction.</p>
D2: Increased Suspended Sediment Concentrations and Sediment Re-deposition		
D3: Underwater noise and vibration		
D4: Changes in fishing activity		
D5: Vessel collision for basking shark		

Impact	Realistic Worst-case Scenario	Rationale
<p>Notes:</p> <p><sup>1</sup> Site preparation works will commence up to one year before commencement of construction (year 0), at which point they may continue albeit as construction works (rather than site preparation works) these activities have been considered in the assessments of this Chapter, for completeness.</p> <p><sup>2</sup> One round trip comprises two movements (i.e. one to and one from the Bellrock WFDA).</p> <p><sup>3</sup> The maximum IAC length is 300 km; however, the maximum values presented for buried IAC (225 km, including up to 26.2 km with cable protection) and dynamic IAC (92.4 km) represent individual worst-case parameters and would not occur simultaneously. Accordingly, these values do not sum to the total IAC length.</p>		

### 8.6.3 Embedded Mitigation Measures

50. This section outlines the embedded mitigation relevant to the fish and shellfish ecology assessment (as shown in **Table 8.11** below). Where additional mitigation measures are proposed, these are detailed in the impact assessment (**Section 8.8**).

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**Table 8.11: Embedded Mitigation Measures Relevant to Fish and Shellfish Ecology**

Measure ID	Embedded Mitigation Measure(s)	Mitigation Type	Means of Implementation
WFDA-1	Minimum spacing of 1,150 m between FOU's (centre to centre) to reduce possibility of secondary entanglement.	Primary	Secured in the Section 36 (s.36) Consent and Marine Licence via a condition requiring a Development Specification and Layout Plan (DSLPL) to be developed and submitted to the Scottish Ministers for approval prior to commencement of construction.
WFDA-2	Minimum spacing of 1,150 m between FOU's (centre to centre) to avoid increasing the magnitude of impacts in localised areas, such as increased suspended sediment concentrations.	Primary	Secured in the s.36 Consent and Marine Licence via a condition requiring a DSLPL to be developed and submitted to the Scottish Ministers for approval prior to commencement of construction.
WFDA-4	Where seabed preparation is required (e.g. seabed levelling), methods and equipment that have been designed to minimise the potential for sediment suspension and dispersal will be adopted as far as is reasonably practicable.	Primary	Secured in the s.36 Consent and Marine Licence via a condition requiring a Construction Method Statement (CMS) to be developed and submitted to the Scottish Ministers for approval prior to commencement of construction.
WFDA-5	Static sections of the IACs will be installed with a target burial depth of 0.5 to 2.5 m (if burial is required and where ground conditions allow), to avoid the need for external cable protection. External cable protection will only be used where adequate burial cannot be achieved and will be minimised so far as reasonably practicable, thereby limiting permanent benthic habitat disturbance and habitat loss. The requirement for, and extent of, any cable protection will be determined through a post-consent CBRA.	Primary	Secured in the s.36 Consent and Marine Licence, via a condition requiring an Inter-array Cable Plan (IA-CaP) to be developed and submitted to the Scottish Ministers for approval before commencement of construction.
WFDA-6	Scour protection (e.g. concrete mattresses, rock placement, grout bags, artificial frond mats), will prevent scour during the operational life of the Bellrock Wind Farm Infrastructure, therefore inherently reducing risk of scour-induced temporary benthic habitat loss and disturbance and increased suspended sediment concentrations.	Primary	Secured in the s.36 Consent and Marine Licence via a condition requiring a DSLPL to be developed and submitted to the Scottish Ministers for approval before commencement of construction.

Measure ID	Embedded Mitigation Measure(s)	Mitigation Type	Means of Implementation
WFDA-7	Where alternating current cable is used, armoured 3-phase single core (trefoil arrangement) high voltage submarine cables will be used, to minimise both electric and magnetic fields. Static sections of the IACs will be buried or protected, with a target burial depth of 0.5 to 2.5 m (if burial is required and where ground conditions allow), to reduce the impact of electromagnetic fields and thermal emissions, and to minimise disturbance. Cable trench width may also vary to accommodate greater burial depths (subject to the conclusions of a CBRA), further minimising disturbance to habitats and species.	Primary	Secured in the s.36 Consent and Marine Licence, via a condition requiring an IA-CaP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.
WFDA-8	IAC burial techniques could involve ploughing, trenching or jetting reducing the magnitude of disturbance/temporary habitat loss for benthic receptors compared to other alternative techniques.	Primary	Secured in the s.36 Consent and Marine Licence, via a condition requiring an IA-CaP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.
WFDA-10	Material displaced during cable burial activities will be backfilled, where necessary, to promote recovery of benthic habitats.	Primary	Secured in the s.36 Consent and Marine Licence, via a condition requiring an IA-CaP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.
WFDA-11	Subsea infrastructure will be subject to routine monitoring to ensure marine growth remains within design tolerance. Localised cleaning will be undertaken when marine growth is likely to exceed or reach design tolerance. This approach limits the development and stability of extensive fouling communities and reduces the potential for INNS colonisation.	Primary	Secured in the s.36 Consent and Marine Licence, via a condition requiring an Invasive Non-native Species Mitigation Plan (INNSMP) to be developed and submitted to the Scottish Ministers for approval before commencement of construction.  The deposit of marine growth is considered a licensable activity by MD-LOT. Therefore, the Applicant will apply for a marine growth deposit Marine Licence prior to any marine growth removal works taking place.
WFDA-12	The PNMP will be submitted to MD-LOT for approval prior to the commencement of piling, outlining mitigation and management measures that will be implemented during pile installation.	Tertiary	Secured in the s.36 Consent and Marine Licence via a condition requiring a PNMP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.
WFDA-14	Development of and adherence to an IA-CaP. The IA-CaP will set out detailed IAC installation methods and techniques (based on final project design). The IA-CaP will confirm planned IAC routing, burial (if any), and any additional protection if required, and will set out methods for post-installation IAC monitoring.	Tertiary	Secured in the s.36 Consent and Marine Licence, via a condition requiring an IA-CaP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.

Measure ID	Embedded Mitigation Measure(s)	Mitigation Type	Means of Implementation
WFDA-15	A detailed CBRA will be prepared where IACs are proposed to be buried to determine the target burial depth. The burial depths may vary and will be dependent on risk and ground conditions. The CBRA will also highlight instances where adequate burial cannot be achieved, and alternative protection is needed.	Primary	Secured in the s.36 Consent and Marine Licence, via a condition requiring an IA-CaP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.
WFDA-18	<p>A Vessel Management and Navigational Safety Plan (VMNSP) will be developed and implemented for the construction and O&amp;M phases of the Bellrock Wind Farm Infrastructure. The VMNSP will set out the types and anticipated numbers of vessels to be deployed, together with indicative transit corridors between the Bellrock WFDA and the relevant construction ports.</p> <p>The VMNSP will be aligned with the Scottish Marine Wildlife Watching Code (Scottish Natural Heritage, 2017a) and the associated Guide to Best Practice for Watching Marine Wildlife (Scottish Natural Heritage, 2017b). As such, vessel operations will incorporate recognised good practice measures to reduce the risk of disturbance to, and collision with, marine mammals, seabirds, and other marine megafauna.</p> <p>Where practicable, vessel movements will follow defined transit corridors, thereby concentrating activity within established navigation corridors and reducing the spatial extent of potential disturbance and collision risk. The number of vessel movements will be limited to those necessary for safe and efficient delivery of the works.</p>	Tertiary	<p>Secured in the s.36 Consent and Marine Licence via a condition requiring a Vessel Management Plan (VMP) and Navigational Safety Plan (NSP) to be developed and submitted to the Scottish Ministers for approval before commencement of construction.</p> <p>An <b>Outline VMNSP (Volume V)</b> is submitted alongside the s.36 consent application and Marine Licence application for the Bellrock Wind Farm Infrastructure.</p>
WFDA-19	Development of and adherence to a MPCP outlining the approach for managing and reducing risk of pollution and procedures to protect personnel and to be followed in the event of a pollution incident.	Tertiary	<p>Secured in the s.36 Consent and Marine Licence, via a condition requiring a MPCP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.</p> <p>A <b>MPCP (Volume V)</b> is submitted alongside the s.36 consent application and Marine Licence application for the Bellrock Wind Farm Infrastructure.</p>
WFDA-20	During the construction and O&M of the Wind Farm Infrastructure, periodic geophysical surveys would be required to ensure the IACs remain buried and if they do become exposed, remedial works will be undertaken.	Primary	Secured in the s.36 Consent and Marine Licence, via a condition requiring an IA-CaP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.

Measure ID	Embedded Mitigation Measure(s)	Mitigation Type	Means of Implementation
WFDA-21	<p>An EMP will be prepared and implemented to set out the procedures to avoid, reduce, and manage potential environmental effects arising across the construction and O&amp;M of the Bellrock Wind Farm Infrastructure, in accordance with relevant international and national legislation and guidance.</p>	Tertiary	<p>Secured in the s.36 Consent and Marine Licence via a condition requiring an EMP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.</p> <p>An <b>Outline EMP (Volume V)</b> is submitted alongside the s.36 consent application and Marine Licence application for the Bellrock Wind Farm Infrastructure.</p>
WFDA-23	<p>Implementation of soft start and ramp-up measures for piling (which would reduce underwater noise effects), to be set out in the Piling Noise Mitigation Plan (PNMP) and part of the Marine Mammal Mitigation Protocol (MMMP) for piling activities.</p> <p>Each piling event would commence with a soft start at a lower hammer energy followed, by a gradual ramp-up for at least 20 minutes to the maximum hammer energy required. The soft start and ramp-up allows mobile species to move away from the area before the maximum hammer energy with the greatest noise impact area is reached.</p>	Primary	<p>Secured in the s.36 Consent and Marine Licence via a condition requiring an PNMP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.</p> <p>An <b>Outline MMMP (Volume V)</b> is submitted alongside the s.36 consent application and Marine Licence application for the Bellrock Wind Farm Infrastructure.</p>
WFDA-24	<p>Development of, and adherence to, a MMMP.</p> <p>The MMMP for piling will be developed prior to commencement of construction and based upon best available information, methodologies, industry best practice, latest scientific understanding, current guidance and detailed project design.</p> <p>The MMMP for piling will be developed in consultation with MD-LOT and NatureScot, and will detail the proposed mitigation measures to reduce the risk of any physical or permanent auditory injury/change in hearing sensitivity (Permanent Threshold Shift (PTS)) to marine mammals and impacts of disturbance during all piling operations.</p> <p>This will include details of designed-in mitigation, for the soft-start and ramp-up, as well as details of the mitigation zone and any additional mitigation measures required in order to minimise potential impacts of any physical injury or PTS, for example, the activation of acoustic deterrent devices (ADD) for a maximum of 30 minutes<sup>1</sup> prior to the soft-start.</p>	Tertiary	<p>Secured in the s.36 Consent and Marine Licence via a condition requiring an PNMP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.</p> <p>An <b>Outline MMMP (Volume V)</b> is submitted alongside the s.36 consent application and Marine Licence application for the Bellrock Wind Farm Infrastructure.</p>

Measure ID	Embedded Mitigation Measure(s)	Mitigation Type	Means of Implementation
WFDA-25	<p>Development of, and adherence to, a PNMP. The PNMP will be developed in consultation with MD-LOT and NatureScot and prepared in accordance with the Marine Directorate guidance on mitigation and monitoring plans (Marine Directorate, 2025), which sets out prescriptive requirements for what the PNMP should cover.</p>	Tertiary	<p>Secured in the s.36 Consent and Marine Licence via a condition requiring a PNMP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.</p> <p>An <b>Outline MMMP (Volume V)</b> is submitted alongside the s.36 consent application and Marine Licence application for the Bellrock Wind Farm Infrastructure.</p>
WFDA-26	<p>A detailed MMMP will be prepared for UXO clearance. The MMMP for UXO clearance will ensure there are adequate mitigation measures to minimise the risk of any physical or permanent auditory injury to marine mammals as a result of UXO clearance.</p> <p>The most suitable mitigation measures, based upon best available information and methodologies at that time will be utilised. The MMMP for UXO clearance will be prepared in consultation with MD-LOT and NatureScot.</p> <p>The MMMP for UXO clearance will include details of all the required mitigation measures to minimise the potential risk of PTS as a result of underwater noise during UXO clearance. This would consider the options, suitability and effectiveness of mitigation measures such as, but not limited to:</p> <ul style="list-style-type: none"> <li>▪ Avoidance of UXO if practicable;</li> <li>▪ Use of low-order clearance techniques, such as deflagration;</li> <li>▪ The potential use of noise abatement if any high-order detonation is required (taking into consideration the environmental limitations);</li> <li>▪ Monitoring requirements for marine mammal observers;</li> <li>▪ Requirements for ADDs; and</li> <li>▪ Other UXO clearance techniques, or relocation of UXO. If more than one high-order detonation is required, other measures such as the use of scare charges; or multiple detonations, if UXO are located in close proximity, will also be considered.</li> </ul>	Tertiary	<p>The Applicant will seek consent for UXO clearance activities via a separate Marine Licence application process.</p> <p>Secured in the UXO MMMP as part of a Marine Licence prior to construction.</p> <p>An <b>Outline MMMP (Volume V)</b> is submitted alongside the s.36 consent application and Marine Licence application for the Bellrock Wind Farm Infrastructure.</p>

Measure ID	Embedded Mitigation Measure(s)	Mitigation Type	Means of Implementation
WFDA-27	If required, mitigation for geophysical surveys will follow the Joint Nature Conservation Committee (2017) 'Guidelines for Minimising the Risk of Injury to Marine Mammals from Geophysical Surveys.	Tertiary	Secured through the European Protected Species (EPS) Risk Assessment and EPS Licence.
WFDA-28	Development of UXO Threat and Risk Assessment. All UXO detonations will be subject to a risk assessment undertaken in accordance with relevant guidance such as publication C754 Assessment and Management of UXO Risk in the Marine Environment (Construction Industry Research and Information Association, 2015).	Tertiary	A UXO Threat and Risk Assessment has been developed to support an indicative assessment of UXO clearance in the Bellrock WFDA EIA Report and will inform separate Marine Licence application(s) for UXO clearance.
WFDA-33	Preparation of an INNSMP to include provisions for INNS management. The INNSMP would implement biosecurity measures in line with international and national regulations and guidance, namely: <ul style="list-style-type: none"> <li>▪ International Convention for the Prevention of Pollution from Ships (MARPOL), which sets out requirements, including appropriate vessel maintenance;</li> <li>▪ The International Convention for the Control and Management of Ships' Ballast Water and Sediments, which provides an international framework for the control of transfer of potentially INNS from ballast water; and</li> <li>▪ Consideration of guidance from the International Maritime Organisation (IMO, 2023) on the control and management of ships' biofouling to minimise the transfer of invasive aquatic species.</li> </ul>	Tertiary	Secured in the s.36 Consent and Marine Licence via a condition requiring an INNSMP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.  The <b>INNSMP (Volume V)</b> is submitted alongside the s.36 consent application and Marine Licence application for the Bellrock Wind Farm Infrastructure.
WFDA-34	Adherence to the following international and national regulations and guidance, namely: <ul style="list-style-type: none"> <li>▪ International Convention for the Prevention of Pollution from Ships (MARPOL), which sets out requirements, including appropriate vessel maintenance;</li> <li>▪ The International Convention for the Control and Management of Ships' Ballast Water and Sediments, which provides an international framework for the control of transfer of potentially invasive species from ballast water; and</li> </ul>	Tertiary	Secured in the s.36 Consent and Marine Licence via a condition requiring a VMNSP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.  An <b>Outline VMNSP (Volume V)</b> is submitted alongside the s.36 consent application and Marine Licence application for the Bellrock Wind Farm Infrastructure.

Measure ID	Embedded Mitigation Measure(s)	Mitigation Type	Means of Implementation
	<ul style="list-style-type: none"> <li>Consideration of guidance from the International Maritime Organisation (IMO, 2023) on the control and management of ships' biofouling to minimise the transfer of invasive aquatic species.</li> </ul>		
WFDA-41	<p>Any dropped objects during works associated with the Bellrock WFDA will be reported in line with MD-LOT's guidance on the 'accidental deposit of an object at sea' (Marine Directorate, 2024) and objects will be recovered where they pose a hazard to other marine users and where recovery is practicable.</p>	Tertiary	<p>Secured in the s.36 Consent and Marine Licence via a condition an EMP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.</p> <p>An <b>Outline EMP (Volume V)</b> is submitted alongside the s.36 consent application and Marine Licence Application for the Bellrock Wind Farm Infrastructure.</p>
WFDA-47	<p>Development of, and adherence to, a Decommissioning Programme (DP).</p> <p>The DP will set out the framework for the safe, orderly, and environmentally acceptable decommissioning and removal of the Bellrock Wind Farm Infrastructure, in the interests of safety and environmental protection.</p> <p>Climate change risk measures will be included in the DP to be developed prior to the commencement of construction and will include a review of site-specific weather and metocean conditions, recent extreme weather events and up-to-date climate change projection data will be undertaken to ensure risk assessments, H&amp;S protocols and guidelines on safe working practices are suitable for future climate conditions at the time of decommissioning works. The DP will be refreshed prior to decommissioning activities commencing.</p> <p>The DP will mitigate the risk of climate change impacts on decommissioning site personnel, plant and equipment and other assets and the risk of delays to the decommissioning programme due to extreme weather events, which are becoming more frequent and intense due to climate change.</p>	Tertiary	<p>Secured in the s.36 Consent and Marine Licence, via a condition requiring a DP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.</p>
WFDA-50	<p>No more than two non-rotating FOU's will be towed together at once and will not exceed a velocity of 10 knots.</p>	Primary	<p>Secured in the s.36 Consent and Marine Licence via a condition requiring a VMP and NSP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.</p> <p>An <b>Outline VMNSP (Volume V)</b> is submitted alongside the s.36 consent application and Marine Licence application for the Bellrock Wind Farm Infrastructure.</p>

Measure ID	Embedded Mitigation Measure(s)	Mitigation Type	Means of Implementation
WFDA-59	<p>Seabed contacting infrastructure will be micro-sited, where practicable, to avoid sensitive seabed habitats, low or limited mobility benthic species, such as Annex I habitats and Priority Marine Features. Micro-siting will be informed by surveys prior to the commencement of construction which will identify the location and extent of habitats and species.</p>	Primary	<p>Secured in the s.36 Consent and Marine Licence via a condition requiring a CMS and DSLP to be developed and submitted to the Scottish Ministers for approval before commencement of construction.</p>
WFDA-60	<p>Development of, and adherence to, a CMS.</p> <p>The CMS will describe the methods for construction for all consented Wind Farm Infrastructure and set out the measures to be implemented to avoid or reduce adverse effects on the environment and legitimate users of the sea during the construction phase. This will include a clear definition of roles and responsibilities and reference to relevant H&amp;S protocols.</p> <p>In relation to climate change, the CMS will incorporate measures to ensure construction activities are resilient to current and projected extreme weather and metocean conditions. This will include, as appropriate:</p> <ul style="list-style-type: none"> <li>▪ Monitoring of site-specific weather and metocean conditions, including use of recognised forecasting and severe weather alert services;</li> <li>▪ Programming and phasing of construction activities with regard to seasonality and short- to medium-term forecasts;</li> <li>▪ Definition of safe working limits for vessel, lifting, and installation operations and procedures for suspension of works where thresholds are exceeded;</li> <li>▪ Measures to secure plant, equipment, and materials during adverse weather; and</li> <li>▪ Risk assessments and safety procedures that account for site-specific extreme weather risks.</li> </ul> <p>Through these measures, the CMS will mitigate risks to construction personnel, plant, and equipment, and reduce the potential for programme disruptions arising from extreme weather events.</p>	Tertiary	<p>Secured in the s.36 Consent and Marine Licence via a condition requiring a CMS to be developed and submitted to the Scottish Ministers for approval before commencement of construction.</p>

Measure ID	Embedded Mitigation Measure(s)	Mitigation Type	Means of Implementation
WFDA-61	<p>Regular and periodic inspections and maintenance of all components of the Wind Farm Infrastructure will be undertaken over their operational lifetime to identify and remediate any damage and deterioration and maintain good working conditions. These will be included in the Operation and Maintenance Plan (OMP).</p> <p>Monitoring of site-specific weather and metocean conditions, recent extreme weather events and up-to-date climate change projection data will be undertaken to provide a dynamic risk assessment of climate change impacts and inform operation and maintenance planning.</p> <p>The OMP will mitigate the risks of climate change impacts on the conditions and performance of the Wind Farm Infrastructure and ensures that it is adaptable to future climate conditions and remains resilient over its operational life. The O&amp;M strategy will be adaptive, with the frequency of maintenance, repair and replacement activities being adjusted based on need (i.e. increasing planned O&amp;M visits for components with higher deterioration rates than anticipated).</p>	Tertiary	Secured in the s.36 Consent and Marine Licence via a condition requiring an OMP to be developed and submitted to the Scottish Ministers for approval prior to the commissioning of the first WTG.
WFDA-62	<p>Regular and periodic inspections and maintenance of the Wind Farm Infrastructure will be undertaken over its operational life to identify and remediate any damage and deterioration and maintain good working conditions (including any debris entangled with the Wind Farm Infrastructure).</p> <p>This will include but not be limited to:</p> <ul style="list-style-type: none"> <li>▪ Surveys of subsea infrastructure.</li> </ul>	Primary	Secured in the s.36 Consent and Marine Licence via a condition requiring an OMP to be developed and submitted to the Scottish Ministers for approval prior to the commissioning of the first WTG.
<p>Notes:</p> <p><sup>1</sup> Anything additional to 30-minutes ADD activation is considered secondary mitigation and therefore not a designed in measure.</p>			

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## 8.7 Existing Environment

### 8.7.1 Fish Assemblage

51. The fish and shellfish ecology study area includes demersal, pelagic, diadromous, and elasmobranch fish species, including commercial and non-commercial species:
- Demersal species include cod, haddock, whiting, plaice *Pleuronectes platessa*, lemon sole *Microstomus kitt*, common dab *Limanda limanda*, witch *Glyptocephalus cynoglossus*, grey gurnard *Eutriglia gurnadus*, and sandeel;
  - Pelagic species include herring, mackerel *Scomber scombus* and sprat *Sprattus sprattus*; and
  - Elasmobranch species, such as spotted ray *Raja montagui*, thornback ray *Raja clavata*, tope shark *Galeorhinus galeus*, small-spotted catshark *Scyliorhinus canicula*, spurdog *Squalus acanthias*, thorny skate *Amblyraja radiata* and cuckoo ray *Leucoraja naevus*, among others, have been observed in the fish and shellfish ecology study area (Coull, et al. 1998; Daan et al. 2005; Baxter et al. 2011; Ellis et al. 2012). Many of these species are of conservation importance either nationally or internationally; conservation designations are listed in **Table 8.12**.
52. In addition, many of these species form important prey resources for marine mammals and seabirds. For this reason, the findings of the fish and shellfish assessment will be considered by in **Chapter 9: Marine Mammals (Volume II)** and **Chapter 10: Offshore Ornithology (Volume II)**.
53. Basking sharks are listed as 'Endangered' on the International Union for Conservation of Nature Red List. There is a marked seasonality in basking shark sightings in UK waters, with almost all surface sightings occurring on the English and Scottish west coast over summer months. The NBN atlas collates basking shark sightings datasets, and in the period of 1987- 2025 no<sup>1</sup> basking sharks have been recorded within 75 km of the Bellrock WFDA (NBN, 2025).
54. The mean annual landings of key fish species landed by commercial vessels over the period 2019-2023 within the fish and shellfish ecology study area are listed in **Table 8.12** (Marine Management Organisation, 2024). These figures give an indication of the species present in the fish and shellfish ecology study area.

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<sup>1</sup> Non-commercial records have been excluded. Access: <https://registry.nbnatlas.org/public/show/dr1488>

**Table 8.12: Mean Annual Quantity (Tonnes) and Mean Annual Value (Great British Pounds (GBP)) of Species Landed from ICES Rectangle 42E9 and 42F0 (Fish and Shellfish Ecology Study Area) for All Species where Landings were Greater Than or Equal to 3 Tonnes Over the Period 2019-2023**

ICES Rectangle	Species	Scientific	Quantity (Tonnes)	Value (GBP)
42E9	Haddock	<i>Melanogrammus aeglefinus</i>	67	42,711
42E9	Plaice	<i>Pleuronectes platessa</i>	6	543
42E9	Common dab	<i>Limanda limanda</i>	5	4,126
42E9	King scallops	<i>Pecten maximus</i>	9	16,685
42E9	Whiting	<i>Merlangius merlangus</i>	5	1,333
42E9	Herring	<i>Clupea harengus</i>	68	26,544
42E9	Nephrops (Norway Lobster)	<i>Nephrops norvegicus</i>	10	113,230
42F0	Haddock	<i>Melanogrammus aeglefinus</i>	97	37,040
42F0	Whiting	<i>Merlangius merlangus</i>	47	37,768
42F0	Monk and anglers	<i>Lophiidae</i>	31	141,026
42F0	Plaice	<i>Pleuronectes platessa</i>	10	4,335
42F0	Grey gurnard	<i>Eutrigla gurnardus</i>	8	2,061
42F0	Witch	<i>Glyptocephalus cynoglossus</i>	7	7,785
42F0	Lemon sole	<i>Microstomus kitt</i>	5	9,209
42F0	Cod	<i>Gadus morhua</i>	34	11,998
42F0	Nephrops (Norway Lobster)	<i>Nephrops norvegicus</i>	32	1,092,484
42F0	Squid	<i>Ommastrephidae/ Loliginidae</i>	4	16,865

## 8.7.2 Receptor Groups

### 8.7.2.1 Spawning and Nursery Grounds

55. The spawning and nursery habitats present within the fish and shellfish ecology study area are summarised in **Table 8.13**, based on the maps included in Ellis et al. (2012) and Coull et al. (1998). Nursery and spawning habitats were categorised by Ellis et al. (2012) as either high or low intensity dependent on the level of spawning activity or abundance of juveniles recorded. Spawning grounds identified by Coull et al. (1998) are classified as low, high or undetermined, again based on the level of spawning activity. Intensity of nursery grounds were not specified by Coull et al. (1998). Spawning and nursery habitats for a variety of fish species do not overlap with the fish and shellfish ecology study area.
56. Spawning and nursery habitats for various fish species are found in the North Sea. Species that are common to spawning and nursery grounds within the North Sea are herring, mackerel, sprat, blue whiting *Micromesistius poutassou*, haddock, European hake *Merluccius merluccius*, saithe *Pollachius virens*, anglerfish *Lophius piscatorius*, plaice, ling *Molva molva*, lemon sole, cod, whiting, sandeel, norway pout *Trisopterus esmarkii*, spurdog, basking shark, tope shark, common skate *Dipturus batis*, spotted ray and ocean quahog (Coull et al. 1998; Ellis et al. 2012). Sandeel and herring spawn on the seabed in specific habitat types (such as coarse sand, maerl, and shell) that contain minimal fine sediment and have well-oxygenated water. Their demersal eggs remain on the seabed until hatching and therefore are potentially more sensitive to localised impacts upon the seabed. In contrast, the eggs of cod, whiting, and plaice are pelagic, meaning they float and are dispersed through the water column. These eggs are carried by ocean currents and are therefore less sensitive to localised impacts.
57. Predicted spawning and nursery grounds for a variety of fish species overlap the fish and shellfish ecology study area. Spawning and nursery areas for relevant fish and shellfish species in the fish and shellfish ecology study area are shown in **Figure 8.2** to **Figure 8.8 (Volume III)**.

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Table 8.13: Spawning Grounds and Nursery Grounds of Fish and Shellfish Species Overlapping the Fish and Shellfish Ecology Study Area

Species	Spawning	Spawning Intensity	Nursery	Nursery Intensity
<b>Pelagic Species</b>				
Herring	Overlap	Low intensity	Overlap	Low intensity
Mackerel	Overlap	Low intensity	Overlap	Low intensity
Sprat	Overlap	- <sup>2</sup>	Overlap	-
Blue Whiting	No overlap	-	Overlap	Low intensity
<b>Demersal Species</b>				
Haddock	No overlap	-	Overlap	-
European Hake	No overlap	-	Overlap	Low intensity
Anglerfish	-	-	Overlap	Low intensity
Saithe	No overlap	-	No overlap	
Cod	Overlap	Low intensity	No overlap	High intensity
Lemon sole	Overlap	-	Overlap	-
Ling	No overlap	Low intensity	No overlap	Low intensity
Plaice	Overlap	Low intensity	Overlap	Low intensity
Whiting	Overlap	Low intensity	Overlap	High intensity

<sup>2</sup> Indicates spawning and nursery intensity not stated by Coull et al. (1998) and Ellis et al. (2012).

Species	Spawning	Spawning Intensity	Nursery	Nursery Intensity
Sandeel	Overlap	High intensity	Overlap	Low intensity
Norway Pout	Overlap	Low intensity	Overlap	-
<b>Elasmobranchs</b>				
Basking shark	Not included in datasets	Not included in datasets	Not included in datasets	Not included in datasets
Tope shark	-	-	No overlap	-
Common skate	-	-	No overlap	-
Spotted Ray	-	-	Overlap	Low intensity
Spurdog	-	-	Overlap	Low intensity
<b>Shellfish</b>				
Ocean quahog	Not included in datasets	Not included in datasets	Not included in datasets	Not included in datasets
<b>Crustaceans</b>				
Nephrops	No overlap	-	No overlap	-

### 8.7.2.1.1 *Herring*

58. Herring spawn on specific seabed substrate types, making them vulnerable to activities that disturb the seabed. In evaluating herring habitats across the fish and shellfish ecology study area, 'gravel', 'sandy gravel' from the European Marine Observation and Data Network (EMODnet) data were classified as preferred habitats, while 'gravelly sand' was categorised as marginal. **Figure 8.9 (Volume III)** presents site-specific sediment data alongside EMODnet seabed substrate information, to illustrate the distribution of potentially appropriate herring spawning habitat across the fish and shellfish ecology study area. Within the Bellrock WFDA herring spawning grounds are shown as unsuitable (**Figure 8.9 (Volume III)**). The fish and shellfish ecology study area is shown as mainly unsuitable with some categorised as marginal areas. Preferred habitats for herring are mainly around the coast between Dundee and Elgin but not within the fish and shellfish ecology study area.
59. International Herring Larval Survey (IHLS) data (2015-2024) is presented in **Figure 8.10 (Volume III)**, which demonstrates that on average, herring larvae are concentrated along the coastal waters of the Bellrock WFDA, particularly in areas between Dundee and Fraserburgh and with most recorded around Aberdeen. A herring larvae aggregation is anticipated approximately 35 - 40 km northwest of the Bellrock WFDA, aligning with the eastern edge of the herring spawning area as delineated by Coull et al. (1998). Another larvae aggregation is expected in the inshore region (within 5 km of the coastline), extending roughly 50 km from Cruden Bay to Stonehaven to the south. No spawning activity has been recorded in proximity to the Bellrock WFDA itself; however, an aggregation of herring larvae is approximately 30 - 40 km east of the Bellrock WFDA. It is important to note that while herring larvae aggregations may indicate potential spawning activity, these data should be interpreted with caution, as larval presence does not always directly correspond to spawning locations.
60. As indicated in **Figure 8.10 (Volume III)**, the spawning ground to the northwest of the Bellrock WFDA, as identified by Coull et al. (1998), consistently showed high levels of spawning activity from 2007 to 2016, with little variation. This area lies at the northern extent of the fish and shellfish ecology study area, where suitable spawning habitat overlaps with the study boundary. Meanwhile, the spawning area to the southwest of the Bellrock WFDA exhibited more variable levels of activity during the same period. Due to the lack of IHLS data for 2017 and 2018, and a shift in the reporting approach since 2019, more recent larvae data were unavailable. However, an ICES scientific report (ICES, 2022) noted that the IHLS data for 2019–2020 in the Buchan area (where autumn spawning occurs off northeast Scotland) remained consistent with previous years (Boyle and New, 2018), suggesting no significant deviations outside of typical annual fluctuations. The highest concentrations of herring larvae were found near Peterhead, with no significant extension of this concentration across the broader, undetermined-intensity spawning grounds outlined by Coull et al. (1998) (**Figure 8.9 (Volume III)**). This is further supported by the habitat suitability data from both the site-specific surveys and broadscale EMODnet seabed substrates (following classifications in Reach et al. 2013), as depicted in **Figure 8.9 (Volume III)**.

### 8.7.2.1.2 *Sandeel*

61. Sandeels are PMFs. They are highly specific in their habitat preferences, occupying areas with particular sediment types that allow them to burrow into the seabed. Sandeel show a preference for medium and coarser (0.25 to <2.0 m diameter) sandy sediments and avoid areas of fine sediment. In evaluating sandeel habitats across the fish and shellfish ecology study area, 'gravelly

sand', '(gravelly) sand', and 'sand' from the EMODnet data were classified as preferred habitats, 'sandy gravel' was categorised as marginal, and all other sediment types as unsuitable, based on criteria defined by Latta et al. (2013). Site-specific grab sample data indicates that the Bellrock WFDA is primarily composed of slightly gravelly sand, a preferred habitat for sandeel. **Figure 8.11 (Volume III)** presents the EMODnet seabed substrate information to assess habitat suitability for sandeel.

62. According to the criteria in Latta (2013), the northwestern part of the Bellrock WFDA primarily consists of marginal and preferred habitats, while the southeastern area is characterised by patches of unsuitable and marginal habitats. This suggests that the Bellrock WFDA includes a mix of suitable and marginal habitats, indicating that based on sediment type alone, the Bellrock WFDA may comprise appropriate habitat for sandeel. **Figure 8.12 (Volume III)** additionally represents model derived predictions of density and probability of presence of sandeel within the Bellrock WFDA showing that the probability of presence of buried sandeel within the fish and shellfish ecology study area is comparatively low (Derived from Langton et al. 2021). **Figure 8.13 (Volume III)** highlights the potential spawning habitat suitability for sandeel, based on heatmapping methods set out by Reach et al. (2024) which shows low confidence for habitat suitability for sandeel within the fish and shellfish ecology study area.

### 8.7.2.2 Pelagic species

63. Pelagic fish live in the open water column and are not directly associated with the seabed. Their distribution is shaped by ocean currents, bathymetric features, and food availability, and many species exhibit seasonal migration patterns between feeding and spawning grounds. Due to these factors, pelagic fish populations fluctuate significantly from year to year.
64. Based on landings data, the key pelagic species in the fish and shellfish ecology study area waters is herring.

### 8.7.2.3 Demersal species

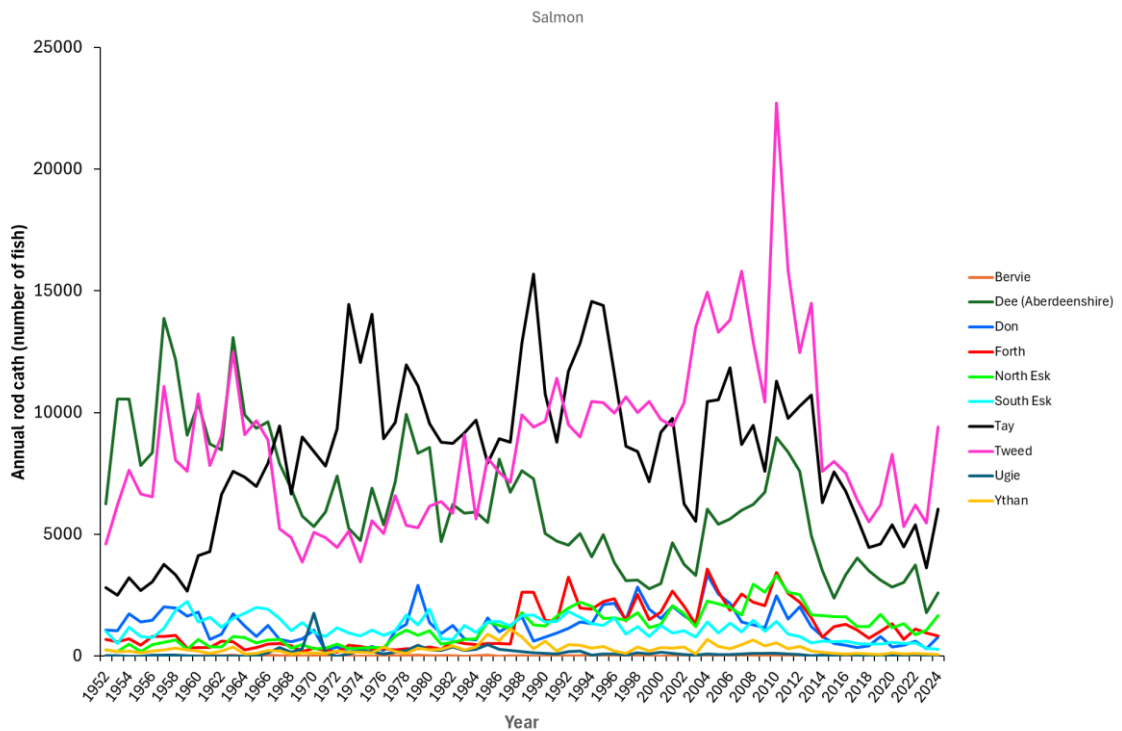
65. Demersal fish live on or near the seabed and include both flatfish, which rest on the sea floor, and benthopelagic fish, such as cod, which swim just above the seabed. These fish are predominantly bottom feeders and rely on seabed conditions for habitat and food availability. Distribution is influenced by sediment type, hydrodynamic conditions, and ecological factors such as predator-prey relationships.
66. Based on landings data, key demersal species in the fish and shellfish ecology study area include:
- Haddock;
  - European Hake;
  - Plaice;
  - Common dab;
  - Whiting;
  - Monkfish/anglerfish;
  - Grey gurnard;
  - Witch;
  - Lemon sole; and
  - Cod.

#### 8.7.2.4 Diadromous Species

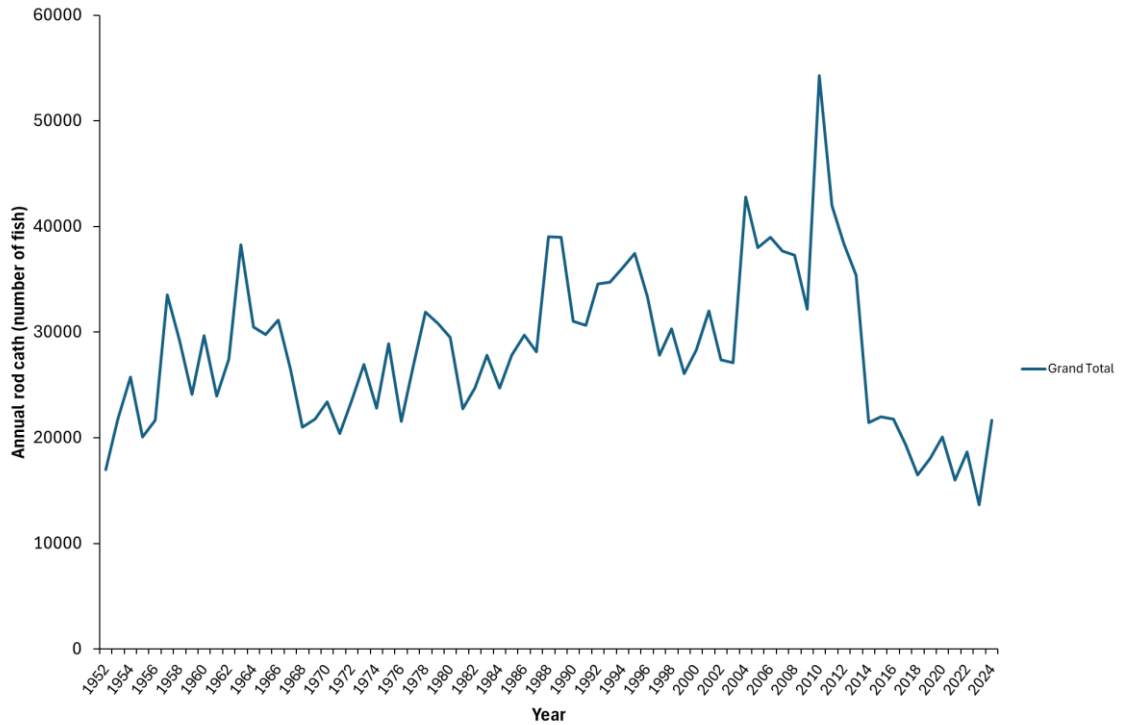
67. Fish species are considered to be diadromous if they migrate from saltwater to freshwater to spawn (anadromous migrants) or if they migrate from freshwater to saltwater to spawn (catadromous migrants). Relevant diadromous species that are likely to pass through the Bellrock WFDA during their spawning migrations, or during foraging and maturation stages of their life cycles are:
- Atlantic salmon;
  - Sea trout;
  - Sea lamprey *Petromyzon marinus*;
  - River lamprey *Lampetra fluviatilis*; and
  - European eel.
68. Atlantic salmon, sea trout, river lamprey and sea lamprey are all anadromous, and as such have predominantly marine adult life phases with spawning and nursery grounds located in freshwater rivers. The European eel is catadromous, so migrates from freshwater river systems to spawn in saltwater.
69. Spawning populations of Atlantic salmon are present in numerous rivers on the eastern coast of Scotland and England. Capture-mark-recapture studies suggest that Atlantic salmon post-smolts migrate to foraging grounds to the west of Greenland and the Faroe Islands, and as such the individuals leaving their rivers as post smolts will migrate in a general northward direction to their foraging and maturation grounds (Malcolm et al. 2010).
70. This means that some post-smolt Atlantic salmon may cross the area of the Bellrock WFDA during their migratory life phase. It should be noted that migration times can vary slightly between rivers and between different components of the Atlantic salmon population within a river. In Scotland smolting normally takes place between April and June, however a small number may reach the size required for spawning in the autumn and drop downstream at this time of year (Maitland and Campbell, 1992). In addition, in relation to adult Atlantic salmon, stocks comprise a number of distinct temporal components (spring, summer and autumn multi-sea-winter fish and grilse); which means that Atlantic salmon have the potential to enter Scotland's rivers at any time of the year (Webb et al. 2007).
71. Although comparatively little is known about the anadromous migrations of sea trout on the east coast of Scotland, existing tracking studies from the west coast of Scotland and Norway, along with mark-recapture work on the South Esk and Bervie rivers, suggest that most individuals remain relatively close to the coast, typically within 10 nautical miles of their natal river mouths. However, occasional long-distance movements exceeding 200 nautical miles have been documented, indicating that some fish are capable of travelling far offshore (Marine Scotland Science and River Dee Trust, 2019).
72. While the likelihood is low, this behaviour means that post-smolt sea trout migrating seawards from east coast rivers could potentially pass through the Bellrock WFDA, even though the majority are expected to remain nearshore.

73. Data from Marine Directorate shows that recreational rod catches of Atlantic salmon in the Rivers Don, Forth, Ythan, Ugie, South Esk and North Esk and Bervie have remained relatively consistent since the 1950's (**Plate 8.1** (Scottish Government, 2025)). Catches in the Dee have declined since 1952, whilst catches in the Tweed increased between 1952-2012, before decreasing once again to similar levels to 1952. Catches in the River Tay also increased from 1952-1990, before decreasing again between 1990-2024. Rod catches were highest in the Tweed and the Tay, which are two notable rivers for Atlantic salmon populations and Atlantic salmon fishing in Scotland. In general, there is a decreasing trend in Atlantic salmon rod catches in most rivers since 2010 (**Plate 8.2**). For trout/sea trout, recorded rod catches decreased since 1952 in the River Ythan and remained relatively stable in all other rivers (Scottish Government, 2025) (**Plate 8.3** and **Plate 8.4**).

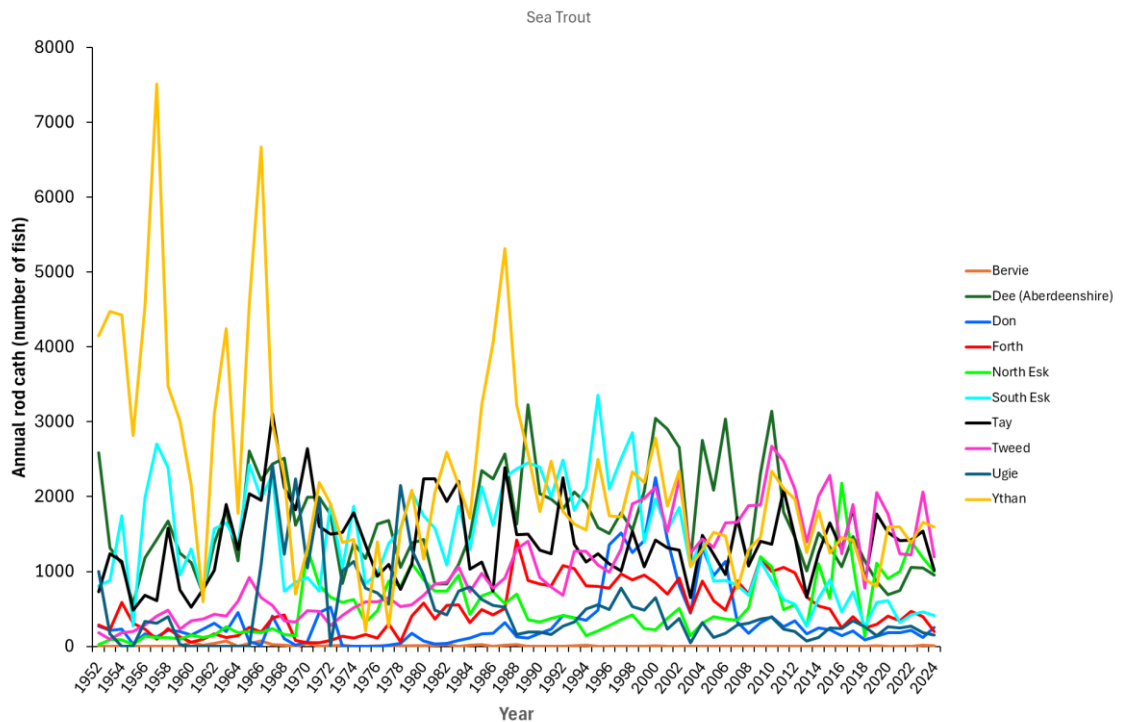
**Plate 8.1: Annual Rod Catches of Atlantic Salmon from Individual Scottish East Coast for the Years 1952-2024**



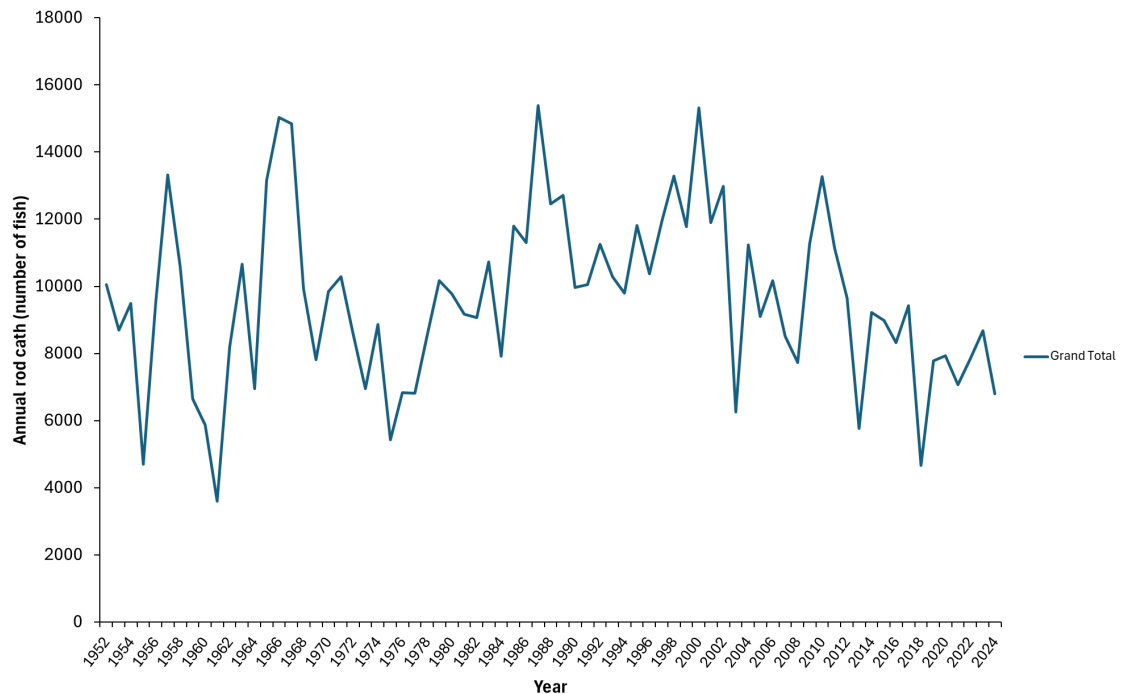
**Plate 8.2: Annual Rod Catches of Atlantic Salmon from all Scottish East Coast Rivers, for the Years 1952-2024**



**Plate 8.3: Annual Rod Catches of Sea Trout from Individual Scottish East Coast Rivers for the Years 1952-2024**



**Plate 8.4: Annual Rod Catches of Sea Trout from all Scottish East Coast, for the Years 1952-2024**



74. Little is known about the distribution and behaviour of sea lamprey during the marine phase of their lifecycle. Available reports suggest that they utilise a wide range of habitats, but evidence is limited and varied (Maitland, 2003). This lack of detailed understanding makes it difficult to predict their precise movements or habitat preferences in offshore environments. Recent studies indicate that sea lamprey occur in temperate waters across the North Atlantic, with tagging data showing offshore movements into western European marine waters. Their parasitic feeding on pelagic fish such as herring and mackerel has been documented, but precise migratory routes and habitat preferences remain poorly understood. Conservation assessments highlight that populations have declined in parts of their range due to barriers to spawning migration and habitat loss. It could be predicted that therefore sea lamprey are present within the Bellrock WFDA.
75. European eels are critically endangered, with recruitment having declined by around 95% since the 1980s (ICES, 2020). They are believed to spawn in the Sargasso Sea, although alternative spawning grounds may exist. Despite decades of research, no spawning adults or eggs have been directly observed in the Sargasso Sea, though recent satellite tagging has provided the first direct evidence of adult eels migrating thousands of kilometres to this region (Righton et al. 2016). Adult “silver” eels typically leave European rivers in autumn and early winter, mainly at night, but their behaviour during this phase is not well documented (Orpwood et al. 2015). Studies indicate that migrating eels generally swim at depths of 1 - 17 m, averaging around 10 m, and spend little time on the seabed, likely due to low temperatures below the thermocline. Juvenile eels (elvers) usually enter UK inland waters between February and April, also predominantly at night (Brujns and Durif, 2009).

76. The migratory nature of diadromous species means they may be sensitive to EMF generated by subsea cables. Salmonids and eels are believed to use the earth's geomagnetic field for navigation during long migrations. Laboratory and field studies suggest that eels and salmonids can detect magnetic fields (Durif et al. 2013; Gill et al. 2010), but the ecological significance of EMF exposure from subsea cables remains uncertain. Current evidence indicates that responses vary by species and life stage, and that EMF effects are likely to be subtle rather than acute. Nevertheless, the limited knowledge base introduces uncertainty in predicting interactions, and further monitoring is recommended for projects involving subsea infrastructure.

### 8.7.2.5 Elasmobranch Species

77. Elasmobranchs are cartilaginous fish that exhibit slow growth, late maturity, and low reproductive rates. Over 23 species have been recorded in the North Sea, with the below species likely to be present within the fish and shellfish ecology study area (Coull, et al. 1998; Daan et al. 2005; Baxter et al. 2011; Ellis et al. 2012).
78. Shark species in the fish and shellfish ecology study area:
- Spurdog;
  - Lesser spotted dogfish *Scyliorhinus canicula*; and
  - Smooth hound.
79. Ray species in the fish and shellfish ecology study area:
- Starry ray (found offshore in central North Sea (50–100 m depth);
  - Thornback ray, Spotted ray, Blonde ray *Raja brachyura* (widespread in inshore waters); and
  - Undulate ray *Raja undulata* (more common in southern UK waters).
80. Rarely seen species include common skate, basking shark, tope shark, and porbeagle shark *Lamna nasus*. Basking sharks are listed as 'Endangered' on the International Union for Conservation of Nature Red List, and tagging studies indicate that Scottish basking sharks predominantly migrate south along the west coast of the UK, rather than dispersing to the east coast of Scotland.
81. Elasmobranchs may be sensitive to subsea noise and EMF from underwater cables. Some species, such as thornback rays and dogfish, have been observed responding to EMF, though effects vary by species and individual behaviour (Gill Tet al. 2009). Nursery grounds of elasmobranch species, as outlined in **Figure 8.7a** and **Figure 8.7b (Volume III)**, generally do not overlap with identified grounds. However, overlaps are observed for spotted ray and spurdog within the fish and shellfish ecology study area, although these occur at low intensity.

### 8.7.2.6 Cephalopods

82. Cephalopods, such as squid, cuttlefish, and octopuses are short-lived, fast-growing molluscs that play a key role in marine ecosystems as both predators and prey. At least 48 species of cephalopods have been recorded in UK waters (Stephen, 1944), with commercially important species including:

- Long-finned squid *Loligo forbesi*, *Loligo vulgaris*;
- Short-finned squid *Todarodes sagittatus*, *Todaropsis eblanae*, *Illex coindetii*;
- Common cuttlefish *Sepia officinalis*;
- Common octopus *Octopus vulgaris*; and
- Lesser octopus *Eledone cirrhosa*.

83. Scottish squid fisheries peak in October to November, with landings primarily from coastal waters. Cuttlefish are more abundant in the English Channel but are scarce in the North Sea overall (Young *et al.* 2006).

### 8.7.2.7 Crustaceans

84. Commercially important crustaceans likely to be present within the fish and shellfish ecology study area include:

- Edible crab *Cancer pagurus*;
- European lobster *Homarus gammarus*;
- Nephrops;
- Velvet swimming crab *Necora puber*;
- Shore crab *Carcinus maenas*; and
- Squat lobster *Munida spp.*

85. Nephrops are particularly valuable in Scottish fisheries (see **Table 8.12**) and prefer fine, cohesive sediments for burrowing. Site-specific surveys have identified Nephrops within the Bellrock WFDA associated with burrowed mud habitats (which have been identified within the Bellrock WFDA). This is also highlighted and considered within **Chapter 7: Benthic Ecology (Volume II)** and **Chapter 11: Commercial Fisheries (Volume II)**. **Figure 8.4 (Volume III)** presents the spawning grounds of crustaceans, showing no overlap between spawning areas and the designated fish and shellfish ecology study area. Similarly, **Figure 8.8 (Volume III)** illustrates the nursery grounds for Nephrops, which also show no overlap with the fish and shellfish ecology study area. This suggests that, while Nephrops are present within the wider region, the most sensitive life stages (spawning and nursery) are not directly associated with the fish and shellfish ecology study area.

### 8.7.2.8 Molluscs

86. Based on commercial landings data, king scallops have been identified as the key commercial bivalve species present within the fish and shellfish ecology study area (**Table 8.12**).
87. Freshwater pearl mussel is a designated feature of several SACs on the east coast of Scotland. Whilst not itself a marine species (spending its entire lifecycle in freshwater river systems), the long-term survival of the freshwater pearl mussel depends ultimately upon diadromous fish host availability (Skinner et al. 2003). Juvenile Atlantic salmon and sea trout are host fish of the larval stage of freshwater pearl mussels (called glochidia), which attach themselves to fish gill filaments in the fast-flowing sections of rivers over July to September. Therefore, healthy populations of juvenile salmonid (Atlantic salmon and sea trout) fry and parr are required to ensure freshwater pearl mussel survival over winter before they detach from the gills and settle on the substrate in May and early June.
88. Due to this potential for secondary impacts on freshwater pearl mussel via impacts on salmonid fish, it is scoped in for further assessment. If no significant impacts are found for salmonid species, then logically there can be no pathway for significant effect upon freshwater pearl mussel, this is key to the assessment.

### 8.7.2.9 Designated Sites

89. The fish and shellfish ecology study area does not overlap with any designated site for fish or shellfish features (**Figure 8.14 (Volume III)**), with the closest site being the River Dee SAC at 117 km from the Bellrock WFDA. The Bellrock WFDA Scoping Report (**Appendix 1.1: Bellrock WFDA Scoping Report (Volume IV)**) considered designated sites, however, in line with NatureScot's representation on the Bellrock WFDA Scoping Report (**Table 8.2**), designated sites are scoped out from further consideration in this Chapter due to a lack of direct pathways for impact.

### 8.7.2.10 Summary of Species Taken Forward for Assessment

90. All key species identified in this section of the chapter are taken forward for assessment. Note that generally, species are not considered on an individual basis but by functional group (e.g. demersal fish, pelagic fish, or diadromous fish). Where species have a particular sensitivity and/or value, deserving of dedicated assessments this is carried out (as in the case of sandeel and spawning herring).

## 8.7.3 Predicted Future Baseline

91. Natural processes, combined with anthropogenic influences, will drive gradual changes in the fish and shellfish communities within the marine environment. As a result, some deviation from the existing baseline, as described in **Section 8.7**, is expected over time. This section presents an assessment of the predicted future baseline, assuming that the Bellrock Wind Farm Infrastructure is never installed.
92. Climate change is a key driver of shifts in fish and shellfish distribution and abundance due to increasing sea temperatures, ocean acidification, and changes in salinity, oxygen levels, and primary production. Climate change predictions are set out in **Chapter 18: Climate Change Risk**. Species-specific responses to these pressures vary, with some populations experiencing range shifts, changes in spawning and migration patterns, and alterations in recruitment success (Perry

et al. 2005; Pörtner et al. 2021). In the North Sea, warming waters have already driven many fish species, such as cod, to shift northward or into deeper, cooler waters (Engelhard et al. 2014). Shellfish species, including commercially important stocks like Nephrops, may also be affected, with changes in growth rates, survival, and reproductive success linked to oceanographic changes (Capet et al. 2020).

93. Climate-driven alterations in food availability and trophic dynamics could further impact fish and shellfish communities. For example, shifts in the distribution and timing of plankton blooms, driven by increasing sea temperatures, have already been observed in the North Sea (Edwards et al. 2020). These changes can lead to mismatches between the distribution of fish larvae and their prey, potentially reducing recruitment success for species that rely on specific seasonal food sources. Ocean acidification, another consequence of climate change, poses an additional challenge, particularly for shellfish species that rely on calcium carbonate for shell formation. Increased acidity may reduce shell strength, survival rates, and overall population stability (Gazeau et al. 2013).
94. Alongside climate-related changes, fish and shellfish communities may be affected by other anthropogenic pressures such as fishing activity, pollution, and habitat modification. While the future extent of these impacts in the fish and shellfish ecology study area is uncertain, changes in bottom trawling and other forms of seabed disturbance could influence local populations through direct mortality, habitat degradation, or altered community structures (Hiddink et al. 2017). Future changes in fishing activity could impact population dynamics, particularly for commercially targeted species.
95. Overall, climate change-related pressures are expected to drive notable shifts in fish and shellfish populations in the North Sea, particularly in terms of species distribution, recruitment success, and trophic interactions. However, predicting the precise nature of these changes remains challenging due to the complex interplay of environmental and anthropogenic factors. While substrate type, a key driver of habitat suitability for demersal and benthic species, is unlikely to change significantly, the broader ecological community may experience gradual but measurable shifts over the coming decades.

## 8.8 Assessment of Effects

96. The potential effects on fish and shellfish ecology that may occur during construction, O&M and decommissioning of the Bellrock Wind Farm Infrastructure are assessed in the following sections. The assessment of effects is divided into three sections with each relevant impact considered for each phase of the Bellrock Wind Farm Infrastructure. Potential impacts during construction are detailed in **Section 8.8.1**, impacts during O&M in **Section 8.8.2** and decommissioning in **Section 8.8.3**. The assessment follows the methodology set out in **Section 8.4** and is based on the realistic worst-case scenarios defined in **Section 8.6.2**, with consideration of the embedded mitigation measures identified in **Section 8.6.3**.

## 8.8.1 Potential Impacts During Construction

97. Site preparation works will take place prior to the commencement of construction for up to one year, at which point they will continue as construction works (rather than site preparation works). For the purposes of this assessment, site preparation works (i.e. sand wave levelling (if required), slope levelling for GBAs (if selected), boulder clearance, pre-lay grapnel run, and UXO clearance) have been assessed as part of the construction phase.

### 8.8.1.1 C1: Physical Disturbance and Temporary Habitat Loss

98. There is potential for direct physical disturbance and temporary habitat loss during the construction phase of the Bellrock Wind Farm Infrastructure. The principal sources of disturbance and temporary habitat loss would include seabed preparation (including sand wave levelling, slope levelling for gravity based anchors (if selected), boulder clearance, and pre-lay grapnel runs), UXO clearance, and the installation of the Wind Farm Infrastructure on the seabed. This also includes the temporary laying of mooring lines on the seabed prior to hook-up to the FOU's. The estimated spatial extent of these activities is detailed in **Table 8.10**.

99. A review by The Crown Estate (RPS, 2019), which analysed monitoring data from over 20 UK OWFs, found that sandy sediments tend to recover rapidly after cable installation, with little to no visible disturbance persisting in the years following installation.

100. Wind Farm Infrastructure such as anchors or mooring lines are laid on the seabed prior to the FOU's being towed to site for hook-up. This approach is used to streamline installation logistics during the construction phase.

101. DEAs are installed by being dragged across the seabed until they embed to the required depth. DEAs support horizontal loading only and are therefore suitable for use with catenary and semi-taut mooring lines. Installation is carried out using a tug or anchor-handling vessel, which pulls the anchor in a controlled manner across the seabed for up to 60 m to achieve the required depth and tension. The exact penetration depth and pull length will be confirmed during detailed design. Once positioned, the DEA is proof-loaded by applying a large horizontal tension for approximately 30 minutes, achieved either through bollard pull or by using a reaction anchor and tensioning devices such as in-line tensioners (see **Chapter 4: Project Description (Volume II)**). The total number of the DEAs expected to be installed using this technique are presented in **Table 8.10**.

102. Activities causing temporary habitat loss and disturbance will be carried out intermittently throughout the construction phase. The overall construction phase is expected to last up to seven years (with an additional year for site preparation works to be undertaken prior to the commencement of construction). However, once construction in a specific area of the Bellrock WFDA is completed, that area will no longer be affected by further disturbances. Recovery will begin immediately after construction ceases, allowing mobile species such as sandeel, fish, and shellfish to repopulate previously disturbed areas.

### 8.8.1.1.1 Sensitivity

#### 8.8.1.1.1.1 Spawning Grounds

103. The fish and shellfish species within the fish and shellfish ecology study area most sensitive to temporary habitat loss are those which spawn directly on or within seabed sediments, including demersal species (e.g. sandeel, cod, plaice, whiting) and some pelagic species that lay eggs directly upon the seabed (e.g. herring). These species are potentially vulnerable because egg deposition and early life stages may coincide with areas temporarily disturbed by construction activities (e.g. IAC installation).
104. Herring have highly specific spawning substrate requirements. Only gravel, sandy gravel, and gravelly sand (Folk, 1954) (**Figure 8.9 (Volume III)**) sediment classification have the potential to support herring spawning. This means herring spawning is limited by the availability of appropriate substrate and are therefore appropriate spawning habitat is vulnerable to disturbance or temporary loss. Further, herring are demersal spawners, laying eggs on the seabed, which then in turn are also sensitive to localised physical disturbance and habitat loss. Overall, herring spawning grounds have a **high** sensitivity to physical disturbance and temporary habitat loss.
105. Sandeel also have highly specific spawning substrate requirements and like herring (**Figure 8.11 (Volume III)**), are vulnerable to localised physical disturbance and habitat loss. Recovery of this species would be expected to occur relatively quickly as the sediments recover following installation of the Wind Farm Infrastructure when adults can return and also via larval colonisation of the sandy sediments. Evidence from other UK OWFs (e.g. Horns Rev, Jensen et al. 2004; BOWL, 2021) shows that sandeel and herring populations recover rapidly following construction disturbance, due to recolonisation from adjacent undisturbed grounds and larval recruitment. Sandeel are particularly sensitive to sub-surface disturbance during their overwintering period (Wright et al. 2000), but sediment recovery typically occurs within one to two years for sandy and muddy substrates (Newell et al. 1998; Desprez, 2000). Overall, given their specific spawning substrate requirements leading to vulnerability to local effects, sandeel have a **high** sensitivity to physical disturbance and temporary habitat loss.
106. All other species that broadcast spawn into the water column, have large spawning grounds that are not dependent on specific seabed substrates and therefore will have a lower sensitivity to temporary disturbance. The broadscale distribution of spawning grounds across the region and the ability to recover from short-term impacts indicate that these species (**Table 8.13**) are not particularly sensitive to localised or temporary disturbances or habitat loss. The species with the most sensitive spawning grounds spawn from late August to October (herring); September to April (Nephrops); and November to February (sandeel).
107. Overall sandeel and herring spawning grounds have a **high** sensitivity to physical disturbance and temporary habitat loss. All other species within the fish and shellfish ecology study area are deemed to be of low vulnerability, high recoverability, and **low** sensitivity.

#### 8.8.1.1.1.2 Nursery Grounds

108. Fish and shellfish species most sensitive to temporary habitat loss are those whose nursery grounds overlap with the fish and shellfish ecology study area. These include herring, mackerel, sprat, whiting, haddock, European hake, anglerfish, lemon sole, and sandeel (**Figure 8.5 to Figure 8.8 (Volume III)**).

109. These species utilise the area during early life stages for shelter, feeding, and growth, making it ecologically important (**Table 8.13**). However, due to their high mobility and broad regional distribution, juveniles are expected to temporarily relocate during construction-related disturbance and return once activities have ceased. Many of these species exhibit wide-ranging movements and are known to recolonise disturbed areas relatively quickly, particularly in dynamic sediment environments where habitat recovery is rapid.
110. The types of disturbance anticipated, including seabed preparation, cable installation, and vessel activity, are spatially and temporally limited. These pressures are unlikely to result in long-term changes to sediment composition or prey availability that would significantly affect nursery function. Several species, particularly cod, whiting, and sandeel, exhibit high-intensity nursery overlap based on Coull et al. (1998), suggesting the area provides important habitat for juvenile feeding and development.
111. Nursery habitats are dynamic and wide-ranging, typically extending across large areas of the North Sea. Juvenile fish and shellfish are highly mobile and capable of temporarily avoiding disturbed areas during short-term construction activities, returning once conditions stabilise. For example, plaice and whiting exhibit rapid post-disturbance recolonisation of sandy habitats (Rees et al. 1990), and sandeel larvae disperse widely before settling in suitable sediments (Ellis et al. 2012).
112. Shellfish species such as Nephrops, scallop, lobster, and edible crab tend to be less mobile, but recovery is generally quick following localised seabed disturbance. Studies from OWFs (Roach et al. 2018; RPS, 2019, Ossian OWFL, 2024) suggest that temporary construction closures can even benefit local crustacean populations by reducing fishing pressure during the disturbance period.
113. Given the broad distribution of nursery grounds, and the mobility and recoverability juvenile fish species, the overall sensitivity of nursery grounds to habitat loss is assessed as **low**.

#### 8.8.1.1.3 Diadromous Fish

114. Diadromous fish species such as Atlantic salmon and European eel migrate between freshwater and marine environments as part of their life cycle. During the marine phase, these species primarily occupy the water column and are therefore less affected by physical disturbance and seabed habitat loss caused by construction activities (Honkanen et al. 2024).
115. While temporary pressures such as increased turbidity may cause short-term behavioural changes, such as avoidance or altered migration routes, these species are highly mobile and capable of navigating around areas of disturbance (RPS, 2024, Honkanen et al. 2024). The footprint of construction within the Bellrock WFDA is relatively small compared to the broad migratory corridors used by these species, further reducing the likelihood of significant impact (Scottish Government, 2024).
116. Given their mobility, wide-ranging movements, and ability to adapt to changing marine conditions, diadromous fish are considered resilient to short-term, localised pressures. Therefore, their sensitivity to physical seabed disturbance and temporary habitat loss is assessed as **low**.

#### 8.8.1.1.1.4 Elasmobranchs

117. Species such as thornback rays and small-spotted catsharks are known to occur within the fish and shellfish ecology study area and can therefore be expected to be present in the Bellrock WFDA (**Figure 8.7 (Volume III)**). These elasmobranchs typically use the seabed for foraging, resting, and shelter, making them potentially vulnerable to temporary habitat disturbance during construction activities. Physical disruption of the seabed, such as anchor installation, cable laying, and seabed preparation, may lead to short-term displacement from preferred habitats.
118. However, elasmobranchs are generally considered to be highly mobile and behaviourally adaptable. They are capable of relocating away from areas of active disturbance and returning once construction has ceased. Recolonisation is expected to occur naturally, particularly in dynamic sediment environments where habitat recovery is relatively rapid. Given their mobility, broad habitat range, and resilience to short-term pressures, the sensitivity of elasmobranchs to temporary habitat disturbance is assessed as **low**.

#### 8.8.1.1.1.5 Marine Demersal Fish

119. Demersal fish species, including cod, whiting, and haddock, rely on benthic habitats for feeding, shelter, and spawning (González-Irusta and Wright, 2016; Ellis et al. 2012). These species are commonly found on sandy and muddy substrates across the continental shelf and are key components of mixed demersal fisheries (Fernandes et al. 2011).
120. Temporary habitat loss due to construction activities may displace individuals during normal foraging or resting periods. However, most demersal species exhibit broad regional distributions and moderate mobility, allowing them to relocate during disturbance and recolonise once seabed conditions stabilise (Aune et al. 2024; Rees et al. 1990). Recovery is typically rapid in dynamic sediment environments, where benthic prey communities also rebound quickly (Lambert et al. 2014).
121. In heavily fished areas, population resilience may be influenced by cumulative pressures such as discarding and bycatch (Elliott et al. 2018), but short-term construction impacts are generally considered low risk. Therefore, based on species traits, habitat recovery rates, and the spatially and temporally limited nature of offshore development, the sensitivity of demersal fish to temporary habitat loss is considered **low**.

#### 8.8.1.1.1.6 Marine Pelagic Fish

122. Pelagic fish species such as herring primarily occupy the water column, feeding and moving above the seabed. As such, they are not directly affected by seabed disturbance caused by construction activities such as IAC or anchor installation.
123. These species exhibit high mobility, often forming large schools and migrating over broad areas. Their behavioural adaptability allows them to avoid localised disturbances and return once conditions stabilise (ICES, 2021).
124. Given their ecological traits, wide distribution, and resilience to short-term disruption, the sensitivity of pelagic fish to temporary habitat loss is considered **low**.

#### 8.8.1.1.1.7 Cephalopods

125. Cephalopods such as common squid and cuttlefish use benthic habitats for spawning and shelter, often laying eggs on substrates like sand, gravel, or seagrass (Bloor, 2012; Hall et al. 2018). These species are known for their short life cycles (typically 1-2 years), high reproductive output, and rapid growth rates, which contribute to their ability to recolonise disturbed areas quickly (Boyle and Pierce, 1994).
126. Although construction activities may temporarily displace individuals or disrupt spawning grounds, the seasonal nature of spawning, combined with high fecundity and mobility, supports population recovery once seabed conditions stabilise. Cephalopods are also behaviourally adaptable and capable of shifting spawning locations in response to environmental changes (HM Government, 2009).
127. Therefore, based on observed recovery dynamics, the sensitivity of cephalopods to temporary habitat loss is considered **low**.

#### 8.8.1.1.1.8 Molluscs and Crustaceans

128. A number of commercially important shellfish species, including crab, lobster, Nephrops, and king scallop are known to inhabit the fish and shellfish ecology study area (**Table 8.12**). Construction activities such as site preparation works, SKS installation, subsea cable hub installation, and IAC laying may result in temporary habitat disturbance.
129. Recent evidence from UK OWF monitoring programmes indicates that recovery of sediment structure and biological communities following seabed disturbance is strongly influenced by substrate type. Sandy and muddy habitats, similar to those found within the fish and shellfish ecology study area, typically show recovery of species abundance and community structure within one to two years post-disturbance (O'Brien and Rippon, 2023; Blue Marine Foundation, 2023). In contrast, recovery in coarser or rocky substrates may take significantly longer, with some boulder habitats requiring up to a decade to re-establish baseline conditions.
130. Given the predominance of mobile sediments in the Bellrock WFDA and the resilience of shellfish species to short-term habitat disruption, recovery of shellfish populations is expected to occur naturally once construction activities cease. These conclusions are supported by long-term monitoring data from multiple UK OWFs (Outer Dowsing OWF, 2024). Therefore, both mollusc and crustacean species sensitivity is considered to be **low**.

#### 8.8.1.1.2 Magnitude

131. The worst-case area of seabed habitat within the Bellrock WFDA that would be temporarily disturbed or lost during construction is presented in **Table 8.10**.
132. IAC installation and DEA placement will cause short-term, localised disturbance. Recovery of sandy sediments has been shown to occur rapidly, with minimal long-term effects (RPS, 2019). Although construction may span up to seven years, disturbance will be intermittent and spatially limited. Recovery begins immediately once activities in a given area cease.
133. As evidenced in **Figure 8.9** and **Figure 8.10 (Volume III)**, the footprint for physical disturbance and temporary habitat loss does not overlap with the key high intensity or high confidence herring

spawning grounds, which are located in inshore waters. There is no meaningful distribution of preferred or high potential herring spawning habitat within the fish and shellfish ecology study area.

134. As presented in **Figure 8.12 (Volume III)** sandeels have a predicted density of buried number per sq m of 0 sq m which is less probable of buried sandeels. Similarly, sandeel spawning and burrowing habitat overlaps at low intensity and sediments are largely classed as to preferred habitat with some areas as unsuitable within the fish and shellfish ecology study area (**Figure 8.11 (Volume III)**).
135. For other species with spawning ground overlap (**Figure 8.2** and **Figure 8.4 (Volume III)**), the affected area represents a small proportion of available regional spawning habitat (Coull et al. 1998; Ellis et al. 2012).
136. Therefore, the magnitude of effect is predicted to be **negligible** for all receptors.

### **8.8.1.1.3**      *Significance of Effect*

137. Considering the **high** sensitivity for sandeel and herring spawning grounds and **low** sensitivity for all other species and a **negligible** magnitude, the significance of effect is **minor adverse** for sandeel and herring spawning grounds and **negligible adverse** for all other species which is **not significant** in EIA terms.
138. No additional mitigation measures are available to reduce the impact.

### **8.8.1.2**      **C2: Increased Suspended Sediment Concentrations and Sediment Re-deposition**

139. There will be increased SSCs and sediment redeposition during the construction phase of the Bellrock Wind Farm Infrastructure. Indirect impacts include increased turbidity (which can reduce faunal visibility and mobility) and smothering (particularly of the feeding appendages of filter feeders).
140. Areas of sediment disturbed during site preparation works and Wind Farm Infrastructure installation are assessed under the construction phase, as these activities represent discrete, short-term events. Any ongoing seabed interaction associated with mooring lines occurs during the operational phase and is assessed separately in **Section 8.8.2**. Therefore, the construction-phase disturbance considers only the temporary sediment mobilisation and localised redeposition arising directly from installation activities.

#### **8.8.1.2.1**      *Sensitivity*

##### **8.8.1.2.1.1**      *Spawning Grounds*

141. Lemon sole, cod, sprat, herring, and mackerel, Norway pout and withing (high intensity for sandeel) have spawning grounds that overlap with the fish and shellfish ecology study area (**Table 8.13, Figure 8.2 to Figure 8.4 (Volume III)**). These species are known to use benthic habitats for spawning, making them potentially sensitive to sediment deposition during construction. While herring spawning grounds are adjacent to the fish and shellfish ecology study area, they are still considered in the assessment due to proximity and ecological relevance.

142. For herring, potential increases in sediment load within suitable spawning habitats (Ellis et al. 2012) (**Figure 8.9 (Volume III)**) are not expected to pose a significant threat, as studies suggest herring eggs can tolerate relatively high sedimentation rates (Birklund and Wijsman, 2005). However, prolonged smothering or sediment accumulation beyond natural dispersion thresholds could be detrimental, particularly in low-energy environments. Additionally, sandeel also have highly specific spawning substrate requirements and like herring (**Figure 8.11 (Volume III)**), are potentially vulnerable to SSC and sediment re-deposition.
143. Given the natural resilience and dispersal capacity of these species, the sensitivity to increased SSCs and sediment redeposition is considered **medium** for herring and sandeel and **low** for all other receptor groups.

#### 8.8.1.2.1.2 Nursery Grounds

144. The fish and shellfish ecology study area overlaps with haddock, whiting, lemon sole and Norway pout nursery grounds (**Table 8.13**; Coull et al. 1998; Ellis et al. 2012 and **Figure 8.5 to Figure 8.8 (Volume III)**). Whiting is identified as having a high-intensity nursery ground within the fish and shellfish ecology study area, while the nursery grounds for others are either adjusted to the or in low intensity.
145. Nursery habitats for these species are typically broadly distributed across the North Sea, and juvenile fish are known to exhibit high mobility and environmental tolerance, allowing them to temporarily avoid disturbed areas and recolonise once conditions stabilise (Rees et al. 1990; Lambert et al. 2014). Species such as plaice, whiting, and sandeel have demonstrated rapid post-disturbance recovery in dynamic sediment environments, supporting the conclusion that nursery ground sensitivity to temporary habitat loss is **low**.

#### 8.8.1.2.1.3 Diadromous Fish Species

146. Diadromous fish species present in the area are expected to have some level of tolerance to naturally high SSC, as their migratory routes typically pass through estuarine environments where background SSC levels are significantly higher than those anticipated during construction of the Bellrock Wind Farm Infrastructure. Potential adverse effects are likely to be limited to short-term behavioural responses, such as avoidance (Boubee et al. 1996) or brief periods of altered swim direction and speed (Chiasson, 2011). However, these effects are not expected to create a barrier to migration between feeding grounds in the North Atlantic and the natal rivers or estuaries used by these species.
147. Research on the impacts of offshore increases in suspended sediments on diadromous species such as Atlantic salmon is limited (Kjelland et al. 2015). However, there is evidence to suggest that increased turbidity may actually benefit migrating Atlantic salmon by reducing predation due to decreased visibility (Gregory and Levings, 1998). Overall, for diadromous fish species identified in the fish and shellfish ecology study area the sensitivity is considered to be **low**.

#### 8.8.1.2.1.4 Elasmobranchs

148. Suspended sediment increases may temporarily affect foraging success in some elasmobranch species, particularly demersal species that rely on vision for foraging (Newport et al. 2021). However, these species are highly mobile and capable of avoiding areas of increased sediment loading, significantly reducing potential impacts. Therefore, the sensitivity is considered to be **low**.

#### 8.8.1.2.1.5 Marine Demersal Fish

149. Suspended sediment increases may temporarily affect foraging success in demersal fish species. However, demersal species are generally adaptable and display avoidance behaviour when exposed to elevated suspended sediment levels (Kjelland et al. 2015). Therefore, the sensitivity is considered to be **low**.

#### 8.8.1.2.1.6 Marine Pelagic Fish Species

150. Pelagic fish species are unlikely to be significantly impacted by temporary increases in suspended sediment because they have broad spatial ranges and can readily avoid turbid plumes (Wilber and Clarke, 2001). Sensitivity is considered **low**.

#### 8.8.1.2.1.7 Cephalopods

151. Since these species, if present, will primarily be feeding and foraging, there is a potential for temporary disruption to their feeding success due to increased sediment in the water column. Given their mobility, though lower than most pelagic fish, cephalopods can actively avoid areas of higher sediment concentration. Additionally, as they are not bottom dwelling, there is no risk of burial or smothering (Villanueva, Perricone, and Fiorito, 2017). Any behavioural changes or temporary reductions in feeding success due to suspended sediments are expected to be short-lived and reversible, with no long-term impact on population structure or function. Therefore, the sensitivity is considered to be **low**.

#### 8.8.1.2.1.8 Crustaceans

152. Unlike cephalopods, some crustacean species are less mobile and may not be able to avoid areas of increased sediment loading. However, species such as Nephrops have a high tolerance for sediment deposition and smothering (Johnson et al. 2013). Given that the sediment increase will be short-term and localised, any effects on individual crustaceans are expected to be minimal, with no significant risk to the wider population. Therefore, the sensitivity is considered to be **low**.

#### 8.8.1.2.1.9 Molluscs

153. Molluscs generally have limited mobility, which makes them more vulnerable to sediment deposition and smothering. However, sensitivity varies depending on the species, for example, scallops can swim short distances of only a few metres, primarily as a startle or escape response. This limited movement is nonetheless sufficient for individuals to avoid very localised and short-lived increases in suspended sediment, as predicted in **Chapter 6: Marine Geology, Oceanography and Physical Processes (Volume II)**, where SSC plumes are confined to areas immediately adjacent to the disturbance and dissipate rapidly. Mussels and other sessile bivalves are more tolerant of temporary increases in suspended sediment and can withstand short-term smothering in dynamic environments. Overall, given the small spatial extent and brief duration of sediment disturbance, mollusc sensitivity is considered to range from **low** to **medium** depending on species and life stage.

### 8.8.1.2.2 *Magnitude*

154. As outlined in **Chapter 6: Marine Geology, Oceanography and Physical Processes (Volume II)**, elevated SSCs can reduce visibility, impairing visual hunting strategies used by some fish and cephalopods. SSCs also reduce photosynthetic efficiency in phytoplankton due to diminished light penetration and spectral changes, and smothering can affect filter-feeding species, eggs, and larvae.
155. Elevated SSCs may temporarily affect fish and shellfish species through short-term changes in feeding efficiency or respiration; however, such effects are typically associated with prolonged or large-scale sediment disturbance, which is not anticipated for the Bellrock Wind Farm Infrastructure.
156. The fish and shellfish species present within the fish and shellfish ecology study area are generally adapted to dynamic sediment regimes and variable turbidity, particularly in offshore environments where natural sediment flux is high. Many species exhibit behavioural adaptations such as relocation or altered feeding strategies in response to short-term changes in water clarity.
157. Construction activities associated with the Bellrock Wind Farm Infrastructure are predicted to cause only temporary and localised increases in SSCs and sediment redeposition. These increases will be confined to areas immediately surrounding sand wave levelling, boulder clearance, cable installation, and anchor placement, and will dissipate rapidly due to prevailing hydrodynamic conditions.
158. Any sediment deposition that occurs will be thin, short-lived, and restricted to small areas. Studies indicate that such disturbances fall within the range of natural variability regularly experienced in dynamic offshore habitats, suggesting that fish and shellfish species are likely to tolerate them without long-term ecological consequences. As a result, the magnitude of impact is considered to be **negligible** for all receptors.

### 8.8.1.2.3 *Significance of Effect*

159. Considering the **low** sensitivity for all receptors with the exception of a **medium** for herring and sandeel spawning, the magnitude is **negligible**, and an effect of **negligible adverse** significance is predicted overall. For all other receptors, sensitivity is **low**, with a **low to medium** for molluscs, the magnitude is **negligible**, and an effect of **negligible adverse** significance is predicted which is **not significant** in EIA terms.
160. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

### 8.8.1.3 **C3: Underwater Noise and Vibration**

161. Underwater noise and vibration generated during construction activities, including UXO clearance as part of site preparation works, piling for the FOU driven piles, installation of gravel pads for subsea cable hubs, placement of cable protection, and vessel operations across the construction phase (including IAC installation) have the potential to affect fish and shellfish species. Such impacts may include physical injury, physiological stress, mortality, or behavioural effects such as avoidance or acoustic masking. Both sound pressure and particle motion are relevant mechanisms of impact. Historically, underwater noise assessments have focused on sound pressure; however,

recent research has demonstrated that particle motion is often more ecologically relevant for many fish and invertebrates (Hawkins and Popper, 2016; Popper et al. 2014). The effects of particle motion are poorly understood but are considered to be the relevant component of sound that could be detected by invertebrates and elasmobranchs, which lack gas-filled organs. Due to the comparative lack of research on particle motion effects, there are no thresholds that can be used in an EIA context. Useful pressure-based thresholds exist and are used in this assessment. It is noted and acknowledged that where pressure-based impact thresholds are applied to species that detect particle motion only, it will be the particle motion component associated with said pressure that may be detected by the individual.

162. Recent studies continue to refine understanding of the effects of underwater noise on fish and shellfish but highlight persisting uncertainty and limited empirical data for many taxa (Hawkins and Popper, 2016; Morley et al. 2013; Williams et al. 2015). The guidelines published by the Acoustical Society of America (Popper et al. 2014) remain the most comprehensive and widely applied reference for establishing thresholds for mortality, injury, and temporary threshold shift (TTS) in fish.
163. Detailed underwater noise modelling has been completed to quantify potential effects and is reported in **Appendix 9.2: Underwater Noise Modelling Report (Volume IV)**. Modelling for impact piling has been undertaken at three representative locations covering the extents of the Bellrock WFDA, giving a spread of various water depths, distances to shore and bathymetry stretching into deeper water to the east of the Bellrock WFDA (see Table 3-1 and illustrated in Figure 3-7 of **Appendix 9.2: Underwater Noise Modelling Report (Volume IV)**): The E boundary midpoint modelling location produced the greatest predicted sound levels and is therefore considered as the worst-case scenario location for underwater noise modelling.
164. All thresholds for injury and behavioural disturbance are derived from Popper et al. (2014) and Hawkins and Popper (2016), the most widely accepted peer-reviewed guidance for assessing noise effects on fish.

#### **8.8.1.3.1 Sensitivity**

165. Underwater noise has the potential to negatively affect fish species, ranging from physical injury or mortality to behavioural changes. The Acoustical Society of America has published peer-reviewed guidelines that provide directions and recommendations for establishing criteria, including those for injury and behavioural effects in fish. These guidelines (Popper et al. 2014) are the most comprehensive and reliable resource for understanding the impact of underwater noise on fish.
166. According to the guidelines from Popper et al. (2014), fish are categorised into the following groups based on the presence or absence of a swim bladder and its potential role in enhancing hearing sensitivity and range:
- Group 1: Fish without swim bladders. These species are sensitive only to particle motion (not sound pressure) and their sensitivity is limited to a narrow frequency range;
  - Group 2: Fish with swim bladders that do not contribute to hearing. These species are more sensitive to particle motion than sound pressure, and their sensitivity is limited to a narrow frequency range;

- Group 3: Fish with swim bladders located near, but not connected to, the ear (e.g. gadoids and eels). These species are sensitive to both particle motion and sound pressure; and
- Group 4: Fish with specialised structures that mechanically link the swim bladder to the ear. These fish are primarily sensitive to sound pressure, though they can also detect particle motion. They have a wide frequency range, extending into several kilohertz (kHz), and are generally more sensitive to sound pressure than fish in Groups 1, 2, and 3.

167. Within the fish and shellfish ecology study area, herring, sprat, and cod represent the most acoustically sensitive adult species. Adult herring and sprat are hearing specialists (Group 4) and therefore highly sensitive to sound pressure, whereas adult cod (Group 3) is sensitive to both pressure and particle motion but to a lesser degree.
168. In contrast, the spawning sensitivity of these species differs from adult sensitivity. ICES spawning maps and IHLS data (**Figures 8.9 (Volume III)**) show that herring spawning grounds occur well inshore of the Bellrock WFDA (mainly marginal habitat preference), mostly beyond the modelled ranges for temporary or permanent threshold shift (TTS or permanent threshold shift). As such, while adult herring have high acoustic sensitivity, there is no spatial overlap that would allow effects on herring spawning.
169. For other species, such as cod and haddock, adult fish may occur locally; however, spawning densities within the Bellrock WFDA are low. Spawning grounds are broad and not dependent on specific sediment types, and adults are capable of avoiding peak sound-exposure areas, reducing the likelihood of spawning disturbance.
170. Other demersal and pelagic adults, including haddock, whiting, and sandeel are hearing generalists (Groups 2 to 3) and have comparatively lower acoustic sensitivity.
171. Diadromous species (Atlantic salmon, sea trout and river lamprey) migrate through offshore waters only transiently as smolt, during their outmigration, and adults on their return to their natal river systems. These species fall within Group 2, with limited hearing sensitivity, and therefore their exposure to construction-related noise is expected to be brief and limited in magnitude.
172. Elasmobranchs (dogfish, skates, rays) and benthic invertebrates (crabs, lobsters, molluscs) lack gas-filled organs and are sensitive only to particle motion. This places elasmobranchs in the least sensitive Group 1. No quantitative impact thresholds exist for invertebrates, but they are generally thought to be less sensitive to noise than Group 1 fish. Empirical studies (e.g. Hawkins et al. 2015; Roberts and Elliott, 2017) report no mortality or sustained sub-lethal effects at sound levels comparable to those predicted for Bellrock WFDA. Cephalopods, such as squid and cuttlefish, can detect low-frequency particle motion and may exhibit short-term avoidance behaviour but recover rapidly (André et al. 2011).
173. Overall, adult Group 1 and Group 2 species, invertebrates and elasmobranchs exhibit **low** sensitivity, while adult Group 3 and Group 4 species exhibit **medium** sensitivity. Herring spawning is considered **high**-sensitivity as a life stage.

### 8.8.1.3.2 Magnitude

174. Modelling results presented in **Appendix 9.2: Underwater Noise Modelling Report (Volume IV)** show that, under the worst-case piling scenario of 3,000 kJ maximum hammer energy at the E boundary midpoint modelling location, peak pressure thresholds for potential injury occur within hundreds of metres of the pile, while cumulative sound exposure level criteria may extend to several kilometres if fish are assumed to be stationary. When realistic fleeing behaviour is considered, injury and mortality thresholds are not reached, and the range for temporary threshold shift reduces significantly. All piling will incorporate soft start and ramp-up procedures, which provide time for fish to leave the immediate area before the highest energy strikes occur. The likelihood of injury is therefore low, and effects are expected to be temporary and reversible.
175. To support the assessment of fish and shellfish ecology receptors, predicted injury ranges for the installation of a 6-metre diameter pile from the worst-case modelling location have been provided. The presented metrics include cumulative sound exposure level ( $SEL_{cum}$ ) for both fleeing and stationary receptors (**Table 8.14** and **Figure 8.15 (Volume III)**), as well as peak sound pressure level impact ranges ( $SPL_{peak}$ ), which derive from a single hammer strike at maximum hammer energy. The east modelling location produced the greatest predicted injury ranges and is therefore the primary focus of the injury assessment.
176. **Table 8.15** summarises the Peak Sound Pressure Level ( $SPL_{peak}$ ) Impact Ranges for a Single Pile Driving Strike at Maximum Hammer Energy at the Northwest Corner Modelling Location.

**Table 8.14: Summary of the Cumulative Sound Exposure Level ( $SEL_{cum}$ ) Impact Ranges for Fish using the Popper et al. (2014) Pile Driving Criteria Covering the Anchor Pile Modelling for Three Sequentially Installed Piles at the E-midpoint Modelling Location, Assuming Both Fleeing and Stationary Fish**

Fish Hearing Group	Response	Threshold, SEL (dB re 1 $\mu Pa^2s$ )	Range (km) Fleeing Fish	Range (km) Static Fish
Group 1 Fish: no swim bladder (particle motion detection)	Mortality	219	N/A	0.65
	Recoverable injury	216	N/A	1.1
	TTS	186	28	47
Group 2 Fish: where swim bladder is not involved in hearing (particle motion detection)	Mortality	210	N/A	2.8
	Recoverable injury	203	N/A	8.1
	TTS	186	28	47
Groups 3 and 4 Fish: where swim bladder is involved in hearing (primarily pressure detection)	Mortality	207	N/A	1.46
	Recoverable injury	203	N/A	8.1
	TTS	186	28	47
Eggs and larvae	Mortality	210	N/A	2.8

**Table 8.15: Summary of the Peak Sound Pressure Level (SPL<sub>peak</sub>) Impact Ranges for a Single Pile Driving Strike at Maximum Hammer Energy at the Northwest Corner Modelling Location**

Fish Hearing Group	Response	Threshold, SPL (dB re 1 µPa2s)	Range (m)
Group 1 Fish: no swim bladder (particle motion detection)	Mortality	213	150
	Recoverable injury	213	150
Group 2 Fish: where swim bladder is not involved in hearing (particle motion detection)	Mortality	207	380
	Recoverable injury	207	360
Groups 3 and 4 Fish: where swim bladder is involved in hearing (primarily pressure detection)	Mortality	207	360
	Recoverable injury	207	360
Eggs and larvae	Mortality	207	360

#### 8.8.1.3.2.1.1 Injury

177. Piling for FOU driven pile anchor installation will be the dominant impulsive-noise source during construction. The WCS assumes the installation of up to nine FOU driven piles per FOU using impact hammers operating at up to 3,000 kJ maximum blow energy (Section 3.2.2 of **Appendix 9.2: Underwater Noise Modelling Report (Volume IV)**). Each pile requires up to 2.99 hours per pile to install, with a maximum of three piles installed sequentially per 24-hour period.
178. Noise modelling results show that, for the worst-case 3,000 kJ scenario at the northwest corner location, peak-pressure injury thresholds (mortality or recoverable injury) extend to within several hundred metres of the pile, while cumulative sound-exposure levels could reach a few kilometres if fish are assumed stationary. When realistic avoidance behaviour is included, mortality and injury thresholds are not reached, and TTS effects for the most sensitive Group 4 species are significantly reduced.
179. All piling will employ soft start and ramp-up procedures, allowing fish to vacate the near-field area before peak energies are reached. Given the spatially limited extent of predicted injury zones, the intermittent nature of piling, and avoidance capacity of most species, the magnitude of potential injury is assessed as **low**. For herring spawning grounds, injury magnitude is **negligible**, as modelled peak-pressure and cumulative exposure ranges for the worst-case piling scenario do not intersect mapped spawning habitat (**Figures 8.9 (Volume III)**), and thus no exposure pathway exists for the spawning life stage.

#### 8.8.1.3.2.2 Behavioural Impacts

180. Behavioural responses to underwater noise depend on hearing sensitivity, noise characteristics, and ecological context. According to Popper et al. (2014), impulsive noise sources such as piling present a high risk of behavioural response within tens of metres, a moderate risk within hundreds of metres, and a low risk at distances of several kilometres from the source.

181. Modelled sound levels (**Table 8.14**) 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.
182. Monitoring from comparable Scottish offshore projects (e.g. Beatrice OWF 2021) showed no measurable long-term impacts on sandeel or cod distribution post-construction. Based on this evidence, the magnitude of behavioural impacts on fish and shellfish during piling is considered **low**. For herring spawning grounds, the magnitude of behaviour effects is **negligible**, because the predicted zones of behaviour response from piling do not fully overlap with spawning grounds (**Figure 8.9 (Volume III)**), and no behavioural displacement of the spawning life stage is anticipated.

#### 8.8.1.3.2.3 UXO Clearance

183. UXO clearance activities have the potential to cause short-duration, high-level impulsive noise.
184. Modelling of UXO detonations, also reported in **Appendix 9.2: Underwater Noise Modelling Report (Volume IV)**, considered charge weights up to 750 kg Trinitrotoluene 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. Low-order clearance methods will be used wherever practicable, substantially reducing source levels and impact ranges.
185. Given the short duration, small footprint, and infrequency of UXO events, the magnitude of impact from this source is considered **low**. For herring spawning grounds, the magnitude is **negligible**, even the largest modelled charge (<1 km potential mortal-injury range) it does not intersect fully with ICES-mapped spawning areas (**Figures 8.9 (Volume III)**), adoption of low-order clearance further reduces potential ranges.

#### 8.8.1.3.2.4 Other Construction Sources

186. Continuous, lower-level noise will arise from vessel movements, trenching, rock placement, and IAC installation. Modelled source levels (**Appendix 9.2: Underwater Noise Modelling Report (Volume IV)**) are substantially below continuous-noise thresholds for TTS (158 dB re 1  $\mu$ Pa over 12 hours) and recoverable injury (170 dB re 1  $\mu$ Pa over 48 hours) as defined by Popper et al. (2014).
187. 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. The magnitude of impact from these continuous sources is assessed as **low** and **negligible** for herring spawning grounds.
188. Embedded mitigation measures (including soft-start and ramp-up procedures for piling, and UXO clearance mitigation set out in the MMMP) are incorporated into the underwater noise prediction set out in **Section 8.6.3**.

### 8.8.1.3.3 Significance of Effect

189. The predicted effects of underwater noise and vibration during construction have been evaluated by combining the assessed sensitivities of Groups with the magnitude of the modelled impacts arising from anchor piling, UXO clearance and other construction activities.
190. Across the receptor groups, sensitivities range from **low** for Group 1 and Group 2, to **medium** for adult Group 3 and Group 4 and with **high** sensitivity for herring spawning grounds. Impact magnitude is **low** for most receptor groups, and **negligible** for herring spawning grounds given the demonstrated low overlap between noise impacts and spawning grounds. Overall, significance of effect is assessed as **minor adverse** for all receptors which is **not significant** in EIA terms.

### 8.8.1.4 C4: Changes in Fishing Activity

191. Changes in fishing activity refer to any alteration in the pattern, intensity, or distribution of fishing operations that may arise as a consequence of the Bellrock Wind Farm Infrastructure (see **Chapter 11: Commercial Fisheries (Volume II)**). During the construction phase, the presence of Safety Zones, installation vessels, anchor installation, IAC laying, and subsea cable hubs may temporarily restrict access to certain areas of seabed used by commercial fisheries. These restrictions have the potential to displace fishing operations, modify fishing routes, and create temporary barriers to navigation or gear deployment.
192. Safety Zones will be established around each FOU during its installation to protect both construction personnel and other sea users. These will temporarily limit access for fishing vessels during the installation of FOUs. Within the context of the wider fishing grounds available in the region, the area temporarily unavailable for fishing represents a very small proportion of the total grounds accessible to the fleets operating in northeast Scotland.
193. The **Commercial Fisheries Baseline Report (Appendix 11.1 (Volume IV))** identifies that the main fisheries operating within and around the Bellrock WFDA include demersal trawling for haddock, cod, whiting and Nephrops, and creel fishing for brown crab and lobster. Activity levels within the Bellrock WFDA itself are low, with only a small number of vessels, mainly under 15 m in length and based in ports such as Fraserburgh, Peterhead and Macduff, occasionally fishing within Bellrock WFDA. The Bellrock WFDA is not within any major spawning or nursery grounds identified by ICES some overlap partly as identified in **Table 8.13**, nor does it overlap with areas of consistently high fishing effort. Consequently, the potential for disruption to established fishing patterns or displacement of significant levels of effort is limited, and therefore the potential for changes in fishing activity to affect populations of fish and shellfish is also limited.

#### 8.8.1.4.1 Sensitivity

##### 8.8.1.4.1.1 Spawning Grounds

194. Spawning grounds are ecologically important areas that support the reproduction of fish species. If fishing activity was displaced onto existing spawning grounds as a result of the Bellrock Wind Farm Infrastructure, then spawning grounds that are spatially restricted and limited based on sediment type requirements (i.e. herring and sandeel) would potentially be vulnerable to disruption, although the potential for adverse effects would depend upon the gear type being used in that area. Other spawning grounds for pelagic spawners are widely distributed and would have a lower sensitivity as there would still be a wide area of spawning ground available regardless of changes

in the location of fishing activity. The sensitivity of spawning grounds for herring and sandeel is considered **medium** and **low** for all other species.

#### 8.8.1.4.1.2 Nursery Grounds

195. Nursery grounds support juvenile fish and are vital for population recruitment. Although the Bellrock WFDA does not directly intersect designated nursery grounds, high-intensity nursery use has been recorded for species such as herring and sandeel in nearby waters (**Table 8.13**; **Figure 8.10** and **Figure 8.13**). These areas may be indirectly affected by changes in fishing activity. However, due to the mobility of juvenile fish and the short-term nature of construction impacts, the sensitivity of nursery grounds is considered **low**.

#### 8.8.1.4.1.3 Diadromous Fish, Elasmobranchs, Marine Demersal Fish, Marine Pelagic Fish, Cephalopods

196. These groups are highly mobile and widely distributed. Their populations exist over wide spatial scales, so they are not sensitive to movements of existing fishing effort within their natural ranges. The sensitivity of these groups to changes in fishing activity is considered to be **low**.

#### 8.8.1.4.1.4 Crustaceans

197. Populations of crustaceans such as lobsters, crabs and Nephrops are less mobile than finfish and can be more prone to existing as distinct subpopulations at a local level, in association with certain habitat types. Studies such as Roach et al. (2018) demonstrate that temporary cessation of fishing activity can allow stock recovery. Overall, their sensitivity to changes in fishing activity is considered **low**.

#### 8.8.1.4.1.5 Molluscs

198. Molluscs (e.g. clams, oysters) are highly sensitive to physical damage caused by bottom-towed fishing gear. Bivalves are less mobile than finfish, often sedentary, and can be more prone to existing as distinct subpopulations at a local level, in association with certain habitat types. These local populations of molluscs are potentially vulnerable to new fishing pressures, should they move from elsewhere. The sensitivity of molluscs to changes in fishing activity is considered **medium**.

#### 8.8.1.4.2 Magnitude

199. During the construction phase, the magnitude of impact on fish and shellfish resulting from changes in fishing activity is expected to be low across all receptor groups. The temporary Safety Zones and construction activities will result in only short-term loss of access to limited areas of seabed. As shown in **Appendix 11.1: Commercial Fisheries Baseline Report (Volume IV)** (Section 3.4), the Bellrock WFDA accounts for less than 1 % of the total fishing area regularly used by vessels from surrounding ports, and the intensity of fishing within the Bellrock WFDA is low compared with other regional grounds.

200. Whilst **Chapter 11: Commercial Fisheries (Volume II)** identifies a potential moderate adverse effect during construction on the demersal otter trawl fleet targeting Nephrops in the eastern portion of the Bellrock WFDA, this is unlikely to cause a meaningful change to fishing mortality levels to the Nephrops population at the level of the functional unit (FU) which overlaps with the eastern portion of the Bellrock WFDA (FU34 Devil's Hole). FU34 is 20,436 km<sup>2</sup> in size and contains

1,861 km<sup>2</sup> of suitable Nephrops habitat, of which the Bellrock WFDA overlaps with 8.46 km<sup>2</sup> (0.45% of suitable habitat in FU34).

201. The temporary reduction in fishing activity within Safety Zones may even have a positive effect on local fish and shellfish populations by reducing fishing mortality during the construction phase (Hutton et al. 2021). As set out in **Chapter 11: Commercial Fisheries (Volume II)**, no significant changes in fishing activity are expected to occur as a result of the Bellrock Wind Farm Infrastructure. The magnitude of effect is assessed as **negligible** for all receptor groups.

#### **8.8.1.4.3**      *Significance of Effect*

202. Herring and sandeel spawning grounds are determined to be of **medium** sensitivity, whilst all other spawning grounds are of **low** sensitivity. Molluscs are of **medium** sensitivity, and all other receptors groups are of **low** sensitivity. Based upon the **negligible** magnitude of impact the effect for all receptor groups is **negligible adverse**, which is **not significant** in EIA terms.
203. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

#### **8.8.1.5**      **C5: Vessel Collision for Basking Shark**

204. Increased vessel traffic associated with construction activities, including the towing of FOU's (up to two at a time) from the integration port or wet storage area to the Bellrock WFDA, could raise the risk of vessel collisions with basking sharks within and enroute to the Bellrock WFDA. These potential collisions are of particular concern due to the basking shark's migratory behaviour, which often brings them into coastal waters during spring and summer, coinciding with peak construction activity.

##### **8.8.1.5.1**      *Sensitivity*

205. Their slow pace and large size make them more vulnerable to vessel collisions, particularly in areas of high vessel traffic. It is not clear how common interactions between vessels and basking sharks are, with little evidence of mortality caused by vessel strikes. Basking shark with healed injuries to dorsal fins consistent with vessel collisions have been observed, and it has been observed that whilst feeding near the surface, particularly during the summer months in the UK, basking shark tend not to exhibit avoidance behaviour when vessels are nearby, thereby potentially increasing the risk of collision with vessels (NatureScot, 2009). Whilst direct evidence of vessel collision presenting a meaningful risk to basking shark populations is limited, the sensitivity of basking sharks to vessel collisions is precautionarily considered **medium** due to their size, slow-moving nature, and migratory patterns.

##### **8.8.1.5.2**      *Magnitude*

206. Throughout the construction (and site preparation works) phase, the worst-case number of vessel round trips is approximately 1,615, with a maximum of 34 vessels within the Bellrock WFDA at any one time.
207. Based on the scale of vessel activity and the known vulnerability of basking sharks to vessel strikes there is a risk of collision within the fish and shellfish ecology study area. Basking sharks are large, slow-moving filter feeders that often swim near the surface, particularly during spring and summer

when they migrate into UK coastal waters, a period that coincides with peak construction activity for the Bellrock Wind Farm Infrastructure.

208. Embedded mitigation measures include the implementation of a Vessel Management and Navigational Safety Plan and EMP, as detailed in **Section 8.6.3**. The Vessel Management and Navigational Safety Plan includes specific guidance for vessel operators, which includes maintaining safe distances from basking sharks, avoiding deliberate approaches, and refraining from sudden changes in speed or direction. These measures collectively aim to minimise collision risk and reduce the potential for adverse effects on basking shark populations. These measures will be implemented in line with the Scottish Marine Wildlife Watching Code (NatureScot, 2017), which provides best-practice guidance for minimising disturbance to marine wildlife.
209. Although direct collision data involving basking sharks is limited, several studies and environmental assessments have identified vessel strikes as a credible risk. Witt et al. (2012) used satellite tracking to demonstrate that basking sharks frequently occupy areas of high vessel traffic, including regions targeted for offshore wind development. Speedie et al. (2009) reported that basking sharks are particularly vulnerable to fast-moving vessels due to their surface-oriented behaviour and slow swimming speed.
210. The North Sea is a known seasonal habitat for basking sharks, and their migratory patterns often bring them into proximity with offshore construction zones. While the risk of vessel collisions remains due to increased vessel traffic, the planned mitigations significantly reduce the likelihood of collisions, especially for stationary vessels. The risk primarily involves transiting vessels, and the measures in place are expected to sufficiently minimise the impact on basking sharks (as set out in **Section 8.6.3**).
211. The nature and scale of vessel activity associated with the construction phase of the Bellrock Wind Farm Infrastructure, combined with the species' biological traits and spatial overlap, results in a **negligible** magnitude of impact due to the elevated risk of accidental interactions.

#### **8.8.1.5.3**      *Significance of Effect*

212. Based upon the **medium** sensitivity of basking shark to collision risk, and the **negligible** magnitude of impact the effect is determined to be **negligible adverse**, and therefore **not significant** in EIA terms. While there may still be occasional interactions, these are not expected to result in significant harm to basking shark populations or their long-term survival in the region.

## **8.8.2**      **Potential Impacts during Operation and Maintenance**

### **8.8.2.1**      **O1: Physical Disturbance and Temporary Habitat Loss**

213. O&M activities within the Bellrock WFDA may result in temporary subtidal habitat loss or disturbance. The temporary habitat disturbance (**Table 8.10**), represents a very small proportion of the overall fish and shellfish ecology study area. Importantly, only a fraction of this disturbance is expected to occur at any one time, given the intermittent nature of operational activities.
214. Habitat disturbance will primarily result from the interaction of mooring lines with the seabed, the use of jack-up vessels during component replacement, and IAC repair activities. These impacts

are expected to be localised to the immediate footprint of the jack-up vessel spud cans or IAC maintenance activities. Recovery is anticipated following the removal of infrastructure.

215. While the spatial extent of disturbance is minimal, there is potential for repeat interactions with previously affected areas, such as reburial of IACs or re-use of jack-up vessel locations. These activities will occur intermittently over the 35-year operational life of the Bellrock Wind Farm Infrastructure (see **Chapter 4: Project Description (Volume II)**).

### **8.8.2.1.1**     *Sensitivity*

#### **8.8.2.1.1.1**   All Receptor Groups

216. The sensitivity of these receptors to physical disturbance and temporary habitat loss during O&M is assessed as **high** for herring and sandeel spawning grounds. For all other receptor groups, the sensitivity is considered **low**, consistent with the construction phase sensitivity presented in **Section 8.8.1.1.1**.

### **8.8.2.1.2**     *Magnitude*

217. This assessment reflects the limited spatial footprint of O&M activities, the intermittent and short-term nature of disturbance over the 35-year operational life, and the capacity of most species to recolonise or relocate. Even for sessile species the scale and frequency of disturbance are not expected to result in measurable population-level effects.
218. Overall, impacts are considered highly localised and temporary and are not expected to be ecologically significant at either the local or regional scale. The impact area resulting from physical disturbance and temporary habitat loss during the O&M phase of the Bellrock Wind Farm Infrastructure presented in **Table 8.10**, which is a spatially limited impact in the context of the wider habitats and populations and will only occur during maintenance activities. Therefore, the magnitude is assessed as **negligible** for all receptor groups.

### **8.8.2.1.3**     *Significance of Effect*

219. Based upon the **high** sensitivity for herring and sandeel spawning grounds, and the **low** sensitivity for all other spawning grounds and receptor groups, and the **negligible** magnitude of impact, the effect on all receptor groups is **negligible adverse**, and therefore **not significant** in EIA terms.
220. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

## **8.8.2.2**     **O2: Increased SSC and Sediment Re-deposition**

During the operational phase, catenary mooring lines and IACs may cause minor, localised seabed disturbance, leading to temporary increases in SSC. These interactions are typically limited to touchdown points and, as outlined in **Chapter 6: Marine Geology, Oceanography and Physical Processes (Volume II)**, may occur not only during storm conditions but also intermittently during normal daily operation due to cyclic tensioning of the moorings. However, as outlined in **Chapter 6: Marine Geology, Oceanography and Physical Processes (Volume II)**, sediment transport rates in the area are low, and the resuspended material, composed mainly of native sand, is expected to settle rapidly. Given the small spatial footprint and short duration of these events, no measurable ecological impact on fish or shellfish receptors is anticipated.

### 8.8.2.2.1 Sensitivity

#### 8.8.2.2.1.1 All Receptor Groups

221. The sensitivity of receptors to increased SSCs and sediment re-deposition during O&M is assessed as **medium** for herring and sandeel spawning grounds, and **low** for all other spawning grounds, **low to medium** for molluscs, and **low** for all other receptor groups, consistent with the construction phase sensitivity presented in **Section 8.8.1.2.1**.

### 8.8.2.2.2 Magnitude

222. The magnitude of impact from increased SSC and sediment re-deposition during the O&M phase of the Bellrock Wind Farm Infrastructure is 0.0255 km<sup>3</sup>, which is a spatially limited impact in the context of the wider habitats and populations. Unlike construction, O&M activities are less intensive and occur intermittently over a much longer timeframe, meaning the magnitude of impact is lower than during construction. The magnitude of impact is assessed as **negligible** for all receptor groups. These assessments reflect the localised and temporary nature of sediment disturbance, the rapid settlement of resuspended native seabed material, and the resilience or mobility of affected species.

### 8.8.2.2.3 Significance of Effect

223. Based upon the **low** sensitivity for all receptors except a **medium** sensitivity of herring and sandeel spawning grounds, the **low to medium** sensitivity for molluscs, and the **low** sensitivity for all other receptor groups, there is a **negligible** magnitude of impact, the effect is determined to be **negligible adverse** for all receptor groups, which is **not significant** in EIA terms.

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

### 8.8.2.3 O3: Underwater Noise and Vibration

225. Underwater noise has the potential to arise from FOU operation, hydrodynamic movement of the FSSs, and the tensioning and slackening of the mooring lines during the O&M phase. While airborne noise from WTG machinery can transmit through the structure into the water column, its contribution is minor compared to underwater sources. This impact is relevant throughout the operational life of the Bellrock Wind Farm Infrastructure and has the potential to cause direct or indirect effects on fish and shellfish receptors. Studies have shown that operational noise measurements from floating and fixed WTG designs (Fortune et al. 2023; Equinor, 2015) indicate that tonal components generally occur below 1 kHz and at levels far below those associated with impulsive piling.

226. The assessment presented below is informed by **Appendix 9.2: Underwater Noise Modelling Report (Volume IV)**, which provides the modelling results and evidence supporting the conclusions of underwater noise.

### 8.8.2.3.1 Sensitivity

#### 8.8.2.3.1.1 All Receptor Groups

227. The sensitivity of receptor groups to underwater noise and vibration during O&M is assessed as **high** for herring spawning grounds, **low** for Group 1 and 2 fish, **medium** for adult Group 3 and 4 fish, and consistent with the construction phase sensitivity presented in **Section 8.8.1.3.1**.

### 8.8.2.3.2 Magnitude

228. The operation of FOU's may produce continuous underwater noise, generally characterised by low-frequency tonal components (<1 kHz) and low sound-pressure levels. Measurements and modelling (**Appendix 8.1: Electromagnetic Fields Assessment Report (Volume IV)**) indicate broadband source levels of 140–160 dB re 1  $\mu$ Pa @ 1 m, with sound pressure levels decreasing to below 130 dB Root Mean Square within a few hundred metres of each FOU. These levels are substantially below the Popper et al. (2014) continuous-noise thresholds for TTS (158 dB over 12 h) or recoverable injury (170 dB over 48 h).
229. Field studies at operational OWFs have shown similar results. Andersson et al. (2011) and Sigraay and Andersson (2011) reported that WTG generated noise from fixed bottom structures was only high enough to elicit possible behavioural reactions in fish or invertebrates within a few metres of a WTG. Putland (2022) found that floating WTG operational noise is comparable in level and spectrum to that of fixed-bottom designs. Risch et al. (2023), analysing acoustic data from the Kincardine and Hywind Scotland floating OWFs, showed that sound levels above median North Sea ambient conditions extended to roughly 3–4 km from array centres, but remained well below injury or disturbance thresholds for fish and shellfish.
230. Occasional tensioning or slackening of mooring lines may produce transient “pinging” or “snapping” sounds. These have been documented not only at the Hywind Demonstrator in Norway (Martin et al. 2011; Stephenson, 2015) but also at UK floating wind sites, including Kincardine and Hywind Scotland, where operational acoustic monitoring identified similar short-duration broadband transients associated with mooring-line strain events (Risch et al. 2023). Modelling of equivalent transient events indicates cumulative sound exposure levels ( $SEL_{cum}$ ) below 156 dB re 1  $\mu$ Pa<sup>2</sup>s at 150 m, which are below the thresholds for recoverable injury or TTS for Group 3 and 4 fish species (Popper et al. 2014).
231. 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.
232. Given the low intensity, narrow frequency range, and rapid attenuation of operational sound, the magnitude of impact on fish and shellfish receptors is considered **low** and **negligible** for herring spawning grounds.

### 8.8.2.3.3 Significance of Effect

233. Based upon the **high** sensitivity of herring spawning grounds, the **low** sensitivity of Group 1 and 2 fish, the **medium** sensitivity of adult Group 3 and 4 fish, and the **low** magnitude of impact (magnitude for herring is **negligible**), the effect is determined to be **minor adverse** for all receptor groups, and therefore **not significant** in EIA terms.

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

#### 8.8.2.4 O4: Changes in Fishing Activity

235. Changes in fishing activity during the O&M phase may arise from the presence of the permanent Bellrock Wind Farm Infrastructure, and ongoing maintenance operations. These features may influence fishing patterns, access to traditional grounds, and the distribution of effort within the surrounding area. As outlined in **Chapter 11: Commercial Fisheries (Volume II)**, the primary driver of operational phase changes is the presence of subsurface structures and the potential for gear interaction or navigational avoidance.

236. An application will be made for Safety Zones up to 500 m around each FOU during major maintenance. Consideration will also be given to an application for up to 500 m operational Safety Zones throughout the O&M phase. Outside these periods, fishers may voluntarily avoid areas around FOUs and IACs due to concerns over gear snagging or vessel safety, which can result in informal displacement of mobile gear fisheries, particularly demersal trawling. Static gear fisheries such as creeling and potting may continue to operate within or adjacent to the Bellrock WFDA, subject to regulatory guidance and operational protocols. Maintenance activities, including cable repairs and component replacement, may cause temporary disruption to fishing operations. These events are intermittent and spatially limited, typically involving jack-up vessels for major repairs that occupy small footprints for short durations. While fishers may temporarily relocate during these operations, the overall impact on fishing patterns is expected to be minimal.

##### 8.8.2.4.1 Sensitivity

###### 8.8.2.4.1.1 Spawning Grounds

237. During the O&M phase, the sensitivity of spawning grounds relates primarily to potential long-term changes in habitat quality and accessibility rather than short-term displacement of fishing activity. For species such as herring and sandeel, which rely on spatially restricted spawning grounds with defined sediment characteristics, as any alteration to seabed conditions could affect reproductive success. However, the seabed footprint of operational infrastructure is limited relative to the wider availability of suitable spawning grounds, reducing the overall risk of significant impact. For pelagic spawners, spawning grounds are more widely distributed and less dependent on specific seabed conditions since the availability of alternative spawning habitat reduces vulnerability to localised changes. As such, sensitivity during the O&M phase for herring and sandeel is considered **medium** and **low** for all other receptor species.

###### 8.8.2.4.1.2 Nursery Grounds

238. Although the O&M phase may lead to some displacement of fishing activity, the Bellrock WFDA does not overlap with major nursery grounds, the higher-intensity nursery of sandeel and herring has been recorded in nearby waters (**Figure 8.10** and **Figure 8.13 (Volume III)**). It is predicted that fishing exclusion or redistribution will not alter the functioning of these habitats. The sensitivity of nursery grounds is therefore considered to be **low**.

#### 8.8.2.4.1.3 Diadromous Fish, Elasmobranchs, Marine Demersal Fish, Marine Pelagic Fish, Cephalopods

239. These receptor groups are highly mobile, widely distributed, and able to utilise alternative habitats across broad spatial ranges, meaning localised shifts in fishing effort around operational infrastructure are unlikely to affect population dynamics or ecological function. The sensitivity of these receptor groups to changes in fishing activity during O&M is therefore considered **low**.

#### 8.8.2.4.1.4 Crustaceans

240. Crustaceans (e.g. lobsters, crabs, Nephrops) are commercially important species that support valuable fisheries. They are generally associated with benthic habitats such as burrowed mud or rocky substrates, and their populations can be influenced by local fishing pressure. Evidence (Roach et al. 2018) indicates that temporary cessation of fishing activity can allow stock recovery, suggesting resilience to short-term changes in fishing effort. Within the Bellrock WFDA, exclusion of fishing activity during O&M could reduce local fishing pressure, potentially providing small, localised benefits to crustacean populations. The sensitivity of crustaceans to changes in fishing activity during the O&M phase is therefore considered **low**.

#### 8.8.2.4.1.5 Molluscs

241. Molluscs (e.g. clams, scallops, oysters) are sessile species that can be targeted by dredge and pot fisheries. Their sensitivity is linked to their limited mobility and dependence on specific seabed conditions. However, the Bellrock WFDA is not located within major mollusc harvesting grounds, meaning displacement of fishing activity is unlikely to result in population-level effects. While local populations could be vulnerable to new fishing pressures if displaced from other areas, the overall risk remains limited. The sensitivity of molluscs to changes in fishing activity during the operational phase is therefore considered **medium**.

#### 8.8.2.4.2 Magnitude

242. The permanent Bellrock Wind Farm Infrastructure could create physical barriers to fishing operations. The Bellrock WFDA, while not currently a heavily fished area, could exclude future access to mobile fishing techniques due to fishers concerns of gear snagging.
243. Another key factor influencing fishing activities during the O&M phase is the ongoing need for maintenance and servicing of the Bellrock Wind Farm Infrastructure. Maintenance vessels, installation of additional infrastructure, and periodic repairs may temporarily disrupt fishing operations in localised areas. While fishing activity may shift to other regions as a result of these operational changes, the overall area of impact is expected to be minimal in relation to the broader fishing grounds in the North Sea.
244. Despite these potential changes, it should be noted that the O&M phase is not expected to cause significant disruptions to fishing activities. The Bellrock WFDA is not located in a heavily fished area, and the effects of operational activities are likely to be localised and of limited duration. Furthermore, the O&M phase is expected to offer long-term stability for local fish populations in the absence of fishing pressure, potentially benefiting local fish stocks.
245. As noted in **Chapter 11: Commercial Fisheries (Volume II)**, the assessment of potential reduction in access to, or exclusion from, established fishing grounds with the Bellrock WFDA determined that moderate adverse effects are likely in relation the Nephrops demersal otter trawl fishery during

the O&M phase. However, this relates solely to fishing activity and does not alter the underlying distribution or sensitivity of fish and shellfish receptors.

246. Any O&M phase restriction in fishing activity is expected to be small in spatial extent relative to the availability of suitable habitat in the wider region, including extensive Nephrops grounds beyond the Bellrock WFDA. Accordingly, the magnitude of change relevant to fish and shellfish receptors is assessed as **negligible**.

#### **8.8.2.4.3**     **Significance of Effect**

247. The sensitivity during the O&M phase for changes in fishing activity is considered **medium** for herring and sandeel spawning grounds and molluscs, and **low** for all other receptor groups. The magnitude is **negligible** for all receptors and the significance of effect from changes in fishing activity is assessed as **negligible adverse** for all receptors, reflecting the localised and small-scale nature of any displacement of fishing effort. The predicted effects are temporary, spatially limited and fully reversible, with no long-term or population-level consequences anticipated for fish, shellfish ecology, which therefore is **not significant** in EIA terms.

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

#### **8.8.2.5**     **O5: Vessel Collision for Basking Shark**

249. Increased vessel traffic during the O&M phase of the Bellrock Wind Farm Infrastructure could elevate the risk of vessel collisions with basking sharks in the fish and shellfish ecology study area, similar to the construction phase outlined in **Section 8.8.1.5**.

##### **8.8.2.5.1**     **Sensitivity**

250. The sensitivity of basking shark to vessel collision during O&M is assessed as **medium**, consistent with the construction phase sensitivity presented in **Section 8.8.1.5.1**.

##### **8.8.2.5.2**     **Magnitude**

251. It is anticipated that up to 21 O&M vessels may be active at any given time within the Bellrock WFDA, with a total of 211 round trips occurring per year. When considering the anticipated vessel activity associated with the O&M phase of the Bellrock Wind Farm Infrastructure, vessel presence in the fish and shellfish ecology study area will be elevated, thereby marginally increasing the likelihood of accidental interactions with basking sharks.

252. O&M activities will result in increased vessel presence, O&M activities will involve increased vessel presence (see **Chapter 4: Project Description (Volume II)**). While this represents a notable level of vessel traffic within the Bellrock WFDA, the actual overlap with basking shark presence is expected to be limited both spatially and temporally. In addition, mitigation measures such as implementation of a EMP, adherence to operator guidelines (e.g. reducing speed and avoiding sudden course changes), and monitoring will further minimise risk (as outlined in **Section 8.6.3**). Therefore, although the potential consequence of a strike could be severe for individual sharks, the likelihood of interaction is low, keeping the overall magnitude at **negligible**.

### 8.8.2.5.3 Significance of Effect

253. Due to the **medium** sensitivity of vessel collision with basking sharks and the **negligible** magnitude of impact the overall significance of effect is considered as **negligible adverse** and therefore **not significant** in EIA terms.
254. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

### 8.8.2.6 O6: Electromagnetic Fields

255. EMF may arise due to the operation of IACs during the O&M phase. The Bellrock WFDA EMF modelling report can be found in **Appendix 8.1: Electromagnetic Fields Assessment Report (Volume IV)**. The conduction of electricity through subsea power cables will result in the emission of localised EMFs, which could potentially impact the sensory mechanisms of some species of fish and shellfish, particularly electrosensitive species (including elasmobranchs) and diadromous fish species, which may use the Earth's geomagnetic field to orient themselves during long-distance migrations (Centre for Marine and Coastal Studies, 2003; Hutchison et al. 2020). This section includes assessment of the impacts of EMFs from the dynamic IACs in the water column, in addition to buried IACs, on fish and shellfish receptors within the fish and shellfish ecology study area. For the exposed dynamic sections in particular, modelled EMF strengths remain low and attenuate rapidly with distance and therefore do not result in materially different exposure levels compared to buried cable sections; as such, no additional or elevated effects on fish and shellfish receptors are anticipated.
256. The maximum target burial depth for the IACs is 2.5 m, ensuring that the majority of the cables are buried beneath the seabed, where the sediment type allows. For non-buried cables, rock protection will be used, with a rock berm height of 0.47 m. These embedded mitigation measures ensure that a minimum distance between fish and shellfish receptors and EMFs associated with seabed cables are maintained, thereby reducing the maximum field strengths that receptors are exposed to and minimising potential behavioural or physiological effects.
257. IACs will comprise armoured 3-phase single-core (trefoil arrangement) high-voltage submarine cables, which mitigate both electric and magnetic fields to an extent. Static sections of cables will be buried or otherwise protected, with a target minimum burial depth of 0.5 m and a maximum target burial depth of 2.5 m. This configuration causes the total electric field (E field) to cancel itself out to a large extent. Any remaining E field is shielded by the metallic sheath and the cable armour. The remaining magnetic field (B field) cannot be shielded and will form a localised field around the cable. The varying AC B field will also produce an associated induced electric field (Ei) in any material that moves through the B field. This includes water flowing through the B field and an animal swimming through the B field. Both B and Ei fields will be generated by IACs during the operational phase.
258. With regards to receptor sensitivity, a number of organisms in the marine environment are known either to be sensitive to EMFs or have the potential to detect them. These organisms can be categorised into two groups based on their mode of magnetic field detection, which may be Ei detection or B detection.

259. Species with the ability to detect magnetic fields, B, do so directly through the forces on specialised particles called magnetite. Species with magnetite are sensitive to the geomagnetic field and use it to orient themselves during navigation and migration. Examples of these types of species include teleosts (bony fish i.e. Atlantic salmon, sandeel), crustaceans (lobsters, crabs, prawns and shrimps), and molluscs (snails, bivalves, and cephalopods).
260. Species with the ability to detect  $E_i$  are considered to be 'electro-receptive,' the majority of which are elasmobranchs (sharks, skates, and rays). These can detect the presence of a magnetic field either indirectly by detection of the electrical field induced by the movement of water through a magnetic field or directly by their own movement through that field. Many elasmobranchs use this ability to detect the small magnetic fields produced by prey species during foraging. Elasmobranchs may also use  $E_i$  caused by the Earth's geomagnetic field for navigation (Molteno and Kennedy, 2009).
261. In general, there is a lack of knowledge on the effect of EMF on many fish and shellfish species (Levitt et al. 2022), particularly diadromous species, which leads to a level of uncertainty regarding the potential impact of EMF on diadromous species. Where evidence exists for EMF effects on a species group, or where there is particular concern for a group (i.e. diadromous fish), these are considered separately below.

### 8.8.2.6.1 Sensitivity

#### 8.8.2.6.1.1 Diadromous Fish Species

262. There is potential for diadromous fish species to pass through the Bellrock WFDA during migrations and foraging.
263. Swedpower (2003) found no measurable impact when subjecting Atlantic salmon and sea trout to magnetic fields twice the magnitude of the geomagnetic field. Additionally, Armstrong et al. (2015) and Marine Scotland Science (2016) reported no behavioural changes in Atlantic salmon exposed to magnetic fields comparable to or greater than those produced by subsea cables. Similarly, Gill et al. (2023) confirmed that while salmonids can detect magnetic fields, there is no evidence of strong avoidance or disruption to migration patterns. These results indicate that EMFs from operational cables are unlikely to present a significant barrier to Atlantic salmon movement.
264. Similarly, studies conducted by Marine Scotland Science (Armstrong et al. 2015) and Walker (2001) found no evidence of unusual behaviour in Atlantic salmon associated with magnetic fields and EMFs produced by cables. This is further confirmed by a study undertaken by the Bureau of Ocean Energy Management which found that energised cables do not appear to present a strong barrier to the natural seasonal movement patterns of migratory fish (Bureau of Ocean Energy Management, 2016).
265. Any potential impacts on movement and behaviour in salmonids would be closely linked to the proximity of the fish to the EMF source. Gill and Barlett (2010) suggest that any impact associated with EMFs on the migration of Atlantic salmon and sea trout would be dependent on the depth of water and the proximity of home rivers to development sites. During the later stages of marine migration, sea trout and Atlantic salmon rely on their olfactory system to find and identify their natal river. During these stages, they are likely to be migrating in the mid to upper layers of the water column.

266. Studies on migratory European eel have found short-term (tens of minutes) changes in the speed and timing of migration with exposure to AC electric subsea cables, even though overall direction remained unaffected (Öhman et al. 2007; Westerberg and Lagenfelt, 2008). Swedish studies observed some deviation of eel swimming direction within 500 m of an OWF IAC system, however, there was no impact in the eels' ability to pass over the cable system, so impacts on migration were considered unlikely (Westerberg, 2000). Further study of European eel migration over a 130-kilovolt (kV) three-phase AC cable found significantly slower swimming speeds as eels passed over the cable, however, there was no impact on individuals' ability to pass over the cable, i.e. no barrier effect (Westerberg and Lagenfelt, 2008).
267. As a general principle, unlike EMF generated from direct current (DC), an EMF from a 50 hertz (Hz) AC cable will be fluctuating too rapidly (50 times per second) to meaningfully interact with the Earth's geomagnetic field in any one direction, which is why AC fields are not considered an issue for magnetic compasses. The same principle will apply to species using magnetic sensory systems for long distance navigation according to the Earth's geomagnetic field (Normandeau et al. 2011).
268. Given the above evidence base, as a worst-case, any EMF effects on migrating diadromous fish are expected to result in temporary behavioural reactions only, rather than cause a barrier to migration or result in longer-term impacts via foraging and navigational confusion. The sensitivity of diadromous fish to EMF is considered, as a group, to be **low**.

#### 8.8.2.6.1.2 Elasmobranch Species

269. Several field studies have examined the behaviour of fish and other species around AC submarine cables in the USA. Observations from three energised 35 kV AC subsea power cable sites off California, connecting offshore platforms to shore, showed no significant attraction or repulsion of fish toward the cables, despite the cables being unburied along much of the route (Love et al. 2016).
270. Elasmobranchs, including sharks, skates, and rays, are the most electro-sensitive fish species, capable of detecting weak voltage gradients in their environment, even as low as 0.5  $\mu\text{V}/\text{m}$  (Gill et al. 2005). Both attraction and repulsion to electric fields have been observed in these species. For example, the spurdog found in the fish and shellfish ecology study area, avoided electrical fields at 10  $\mu\text{V}/\text{cm}$  (Gill and Taylor, 2001). However, this threshold is much higher than the levels associated with offshore electrical cables. A study funded by the Collaborative Offshore Wind Research into the Environment showed that the lesser spotted dogfish and thornback ray could respond to EMFs typical of subsea cables, though their responses were unpredictable, sometimes showing increased searching behaviour when the cables were energized (Gill et al. 2009).
271. Further research suggests that EMFs at 50 Hz to 60 Hz are undetectable by elasmobranchs. For instance, Kempster and Colin (2011) noted the potential for basking sharks to detect EMFs, but no significant evidence exists regarding the impact of EMFs on this species. In contrast, Kempster et al. (2013) found that small sharks did not detect EMFs from sources at frequencies above 20 Hz, and Hart and Collin (2015) reported no repellent effects from magnetic fields at 14,800 gauss, suggesting limited sensitivity in sharks to these fields.
272. In summary, the range within which these species can detect electric fields is typically limited to a few meters around buried cables at depths of 1 to 2 m (CSA, 2019).

273. Demersal elasmobranchs, which live closer to the seafloor, are more likely to encounter higher EMF levels when near subsea cables. These species are typically exposed for longer periods, although the rapid decay of EMFs with distance (both horizontally and vertically) significantly limits potential impacts (Bochert and Zettler, 2006). Therefore, the sensitivity of the receptor is deemed **medium**.

#### 8.8.2.6.1.3 Crustaceans

274. Crustaceans, including lobsters and crabs, have shown responses to electromagnetic fields, with research on spiny lobsters *Panulirus argus* demonstrating their use of a magnetic map for navigation (Boles and Lohmann, 2003). However, it's uncertain whether other crustaceans, such as the commercially significant brown crab and European lobster, can detect magnetic fields similarly. Research on European lobsters has found no neurological response to magnetic field strengths significantly higher than those encountered near buried power cables (Normandeau et al. 2011; Ueno et al. 1986).
275. In a study by Hutchison et al. (2018), the lobster species *Homarus americanus* showed a statistically significant but subtle change in behaviour when exposed to EMF from an high voltage direct current cable. Despite this, the presence of the EMF did not block the lobsters' movement across the cable (Hutchison et al. 2018). However, caution is advised when applying these results to AC cables, because results from DC fields aren't directly applicable to AC fields.
276. Additionally, post-construction monitoring of operational OWFs suggests that EMF from submarine cables has not significantly impacted crustaceans. For example, a review by Bilinski (2021) found no conclusive evidence of adverse effects on marine invertebrates from EMF exposure near subsea cables, and recent studies supported by the Crown Estate and Cefas continue to report minimal ecological impact at operational sites.
277. Chronic exposure to 2.8 mT DC EMF during embryonic development in laboratory conditions led to reduced size in newly hatched larvae of European lobsters and edible crabs, and a reduced swimming speed in European lobsters (Harsanyi et al. 2022). It should be noted that 2.8 mT is not predicted by the Bellrock WFDA modelling report, even at 0.2 m from the centre of a 3-phase single core (trefoil arrangement) IAC. Field strength will be 54  $\mu$ T at 1 m from the centre of a 3-phase single core IAC (trefoil arrangement) **Appendix 8.1: Electromagnetic Fields Assessment Report (Volume IV)**. Interestingly, adult edible crabs showed a preference for sheltering in areas exposed to EMF, compared to control areas (Scott et al. 2018). However, it's important to note that the EMF intensity used in these studies (2.8 mT) is much greater (approximately 50 times greater) than the worst-case scenario for this project (54.7  $\mu$ T) and is DC, which is not directly comparable to the AC systems. Therefore, the sensitivity of this receptor is considered **medium**.

#### 8.8.2.6.1.4 All Other Receptor Groups

278. Beyond crustaceans, limited evidence exists for the effects of EMFs on other species. Some studies suggest responses to EMFs in fish species like cod and plaice (Gill et al. 2005). Monitoring studies from operational fixed-bottom structure OWFs indicate no significant changes in fish populations due to EMF. EMF from cabling does not appear to significantly affect fish or other mobile organisms that are attracted to hard substrates for foraging and protection (Leonhard, 2011).

279. A study investigating the impact of EMFs on lesser sandeel larvae found no effect on their spatial distribution, with similar findings for herring in a previous study (Cresci et al. 2020). Further supporting evidence comes from a study at the Nysted OWF in Denmark, which assessed the impacts of EMF on fish assemblages during power transmission. The study found no significant differences in fish community composition after the OWF's operation (Hvidt et al. 2005).
280. Overall, while there is some evidence suggesting that EMF may affect certain species, the evidence is limited, and all receptor species are considered to have **low** sensitivity to EMF.

#### 8.8.2.6.2 **Magnitude**

281. A study has been undertaken to model the EMF emissions (**Appendix 8.1: Electromagnetic Fields Assessment Report (Volume IV)**) arising from a 3-phase single core (trefoil arrangement) IAC, which will be buried where possible, but will also be present in the water column. The modelled EMF produced were highly localised, reducing rapidly from the source due to the single 3-core cables used. The decrease in magnetic fields occurs both in the vertical water column and horizontally along the seabed. The magnetic fields reduced to below 1  $\mu\text{T}$  at a distance of greater than 5 m from the centre of the bundle of three 66 kV cables. No meaningful effects are known to occur at these strengths. For context, measurements of background levels of magnetic fields due to the Earth's geomagnetic field in the northeast Atlantic are 50  $\mu\text{T}$  (Tasker et al. 2010).
282. **Appendix 8.1: Electromagnetic Fields Assessment Report (Volume IV)** demonstrates the very localised nature of EMFs around worst-case 3-phase single core (trefoil arrangement) IACs and the rapid decay of field strength with distance. Mitigation measures as outlined in **Table 8.11** which states that IACs will comprise armoured 3-phase single-core (trefoil arrangement) high-voltage submarine cables, which mitigate both electric and magnetic fields to an extent. Static sections of cables will be buried or otherwise protected, with a target minimum burial depth of 0.5 m and a maximum target burial depth of 2.5 m. Cable trench width may vary to accommodate greater burial depths, subject to the conclusions of a CBRA. While some species, particularly elasmobranchs and crustaceans, could potentially exhibit localised or short-term behavioural responses in very close proximity to cables (less than 5 m), there is no evidence of barrier effects, long-term disruption to migration, or population-level impacts. As such, the overall magnitude of impact across all fish and shellfish receptors is assessed as **negligible** for all receptors.

#### 8.8.2.6.3 **Significance of Effect**

283. Based upon the **medium** sensitivity of both diadromous fish and crustacean receptor groups, and the **low** sensitivity of all other receptor groups, and the **negligible** magnitude of impact, the effect is determined to be **negligible adverse** for all receptor groups, and therefore **not significant** in EIA terms.

#### 8.8.2.7 **O7: Permanent Habitat Loss**

284. There will be habitat loss during the O&M of the Bellrock Wind Farm Infrastructure. Direct impacts to fish and shellfish will occur as a result of the continuous physical presence of the Bellrock Wind Farm Infrastructure (i.e. anchors and associated scour protection, IACs and associated cable protection, and subsea cable hubs) on the seabed throughout the operational phase. Any pre-existing existing habitat within the footprint of Bellrock Wind Farm Infrastructure on the seabed will be lost. As set out in **Table 8.10** the worst-case total area of permanent habitat loss is 2.93 km<sup>2</sup>.

### 8.8.2.7.1 Sensitivity

#### 8.8.2.7.1.1 Spawning grounds

285. Spawning habitat is widespread, and while herring and sandeel spawning is more spatially constrained and therefore more sensitive to loss, rock deposits and artificial substrates are unlikely to overlap with or directly replace suitable herring or sandeel spawning habitat. The sensitivity of most receptor groups is considered **low** with a **high** sensitivity for herring and **medium** for sandeel.

#### 8.8.2.7.1.2 Nursery grounds

286. Some fish nursery grounds overlap with the Bellrock WFDA, but the scale of habitat loss expected will not prevent these nursery areas from functioning. The sensitivity of fish nursery grounds to the O&M phase of the Bellrock Wind Farm Infrastructure is considered **low**.

#### 8.8.2.7.1.3 Diadromous Fish

287. These species, including Atlantic salmon, sea trout, and eel, are highly mobile and migrate through the area rather than relying on fixed habitats within the Bellrock WFDA. As such, long-term habitat loss is unlikely to significantly constrain their populations or alter their migratory behaviour. The sensitivity of diadromous fish species is considered **low**.

#### 8.8.2.7.1.4 Elasmobranchs

288. Elasmobranchs are generally able to forage across different substrates. While individuals may lose access to habitat at a localised level, their mobility allows relocation to nearby suitable habitats. In addition, many elasmobranchs are adapted to naturally dynamic environments and can tolerate short-term changes in turbidity or sediment deposition. Therefore, the sensitivity is considered to be **low**.

#### 8.8.2.7.1.5 Marine Demersal Fish

289. Most demersal fish species are generalists able to forage across different substrates, but sandeel require sandy sediments to burrow and would be directly affected if such habitat is replaced with rock or hard substrate. The sensitivity of marine demersal fish is considered **low** (**medium** for sandeel).

#### 8.8.2.7.1.6 Cephalopods

290. These species are generally mobile, capable of relocating to alternative habitats, and are not strongly dependent on a single sediment type. The sensitivity of cephalopods is considered **low**.

#### 8.8.2.7.1.7 Crustaceans

291. While some individuals may be displaced from soft sediments by rock placement or scour protection, crustaceans are mobile and can relocate to nearby suitable habitats. In addition, many species (e.g. lobsters, crabs) can utilise hard substrate habitats created by rock placement for shelter and foraging, which may represent a beneficial effect by increasing habitat complexity and providing additional resources.

292. However, Nephrops are more dependent on burrowed muddy sediment and have limited ability to adapt to permanent habitat loss. Nephrops are widely distributed across the North Sea, meaning that while localised habitat loss may occur within the Bellrock WFDA, the broader Nephrops stock

is unlikely to be significantly affected. Overall, the sensitivity of crustaceans to the operational phase is considered **low**, except for Nephrops, as suitable mud habitats cannot be replaced once lost, the sensitivity is considered **medium**.

#### 8.8.2.7.1.8 Molluscs

293. As mollusc species are generally sessile, loss of habitats occupied by these species during rock deposits will occur, with some burial of individuals, and species favouring finer sediments may be deterred from recolonising the hard substrates. The extent of habitat across the fish and shellfish ecology study area means that measurable population level effects on soft sediment molluscs are not anticipated. The sensitivity of molluscs to the permanent loss of habitat is considered as **low**.

#### 8.8.2.7.2 Magnitude

294. The continuous footprint of the Bellrock Wind Farm Infrastructure on the seabed is considered as part of the O&M phase.

295. As shown in **Table 8.10**, the worst-case total footprint of infrastructure on the seabed during the O&M phase (i.e. anchors and associated scour protection, IACs and associated cable protection, and subsea cable hubs) is presented in **Table 8.10** within the Bellrock WFDA. This will be a loss of soft sediment habitats (sands, gravels, and muds). These areas of habitat loss will be discrete, in the immediate vicinity of seabed infrastructure, small, and isolated within large areas of broadscale sediment (the total footprint of the fish and shellfish ecology study area presented in **Table 8.10**). Therefore, this impact is considered to be highly localised.

296. The magnitude of permanent habitat loss for all receptor groups is assessed as **negligible**, given the very small proportion of total available habitat affected and the localised footprint of infrastructure relative to the availability of similar habitat across the wider fish and shellfish ecology study area.

#### 8.8.2.7.3 Significance of Effect

297. Based upon the range of sensitivities from **high** for herring spawning grounds, **medium** for sandeel spawning grounds, **low** for all other spawning grounds, **medium** for sandeel and **low** for all other demersal fish, **medium** for Nephrops and **low** for all other crustaceans and all other receptor groups, there is a **negligible** magnitude of impact. The effect is **minor adverse** for herring spawning grounds, and **negligible adverse** for all other receptor groups, and therefore **not significant** in EIA terms.

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

#### 8.8.2.8 O8: Introduction of Hard Structures

299. The introduction of hard subsurface structures in the form of the of SKSs and associated scour protection, FSSs (where relevant), and cable protection such as rock placement associated with surface-laid cables and cable crossings, is a key component of the Bellrock WFDA. This impact focuses on the potential effects of these hard structure additions on marine habitats and species, during the O&M phase.

300. The habitat type present in the Bellrock WFDA will change due to presence of infrastructure. Specifically, the seabed will shift from a predominantly sandy environment to areas of hard and artificial substratum. This change alters the physical characteristics of the benthic habitat, potentially influencing species composition and ecological function over time.
301. As outlined in **Chapter 6: Marine Geology, Oceanography and Physical Processes (Volume II)**, the presence of FOU's within the Bellrock WFDA may enhance vertical water-column mixing, increasing nutrient flux into the Sub-surface Chlorophyll Maximum and potentially boosting local primary productivity. The assessment in **Chapter 6: Marine Geology, Oceanography and Physical Processes (Volume II)** determined that changes to water column structure would result in a minor adverse and therefore, not significant effect. While this mechanism could, in principle, increase planktonic prey availability for early life-stage fish and pelagic feeders, the effect is expected to be highly localised and small relative to natural variability. As such, no material change to prey availability or to the conclusions of the fish and shellfish assessment is anticipated.

#### 8.8.2.8.1 Sensitivity

##### 8.8.2.8.1.1 Spawning grounds

302. While spawning habitats are ecologically important, they are spatially extensive and relatively resilient to small-scale habitat change. The rock placement associated with non-buried IACs and crossings does not overlap with sandy spawning areas and does not create suitable habitat for these species. Spawning grounds, particularly for herring and sandeel, are considered to have **low** sensitivity to changes in habitat.

##### 8.8.2.8.1.2 Nursery grounds

303. While nursery habitats are important for juvenile development, they are widely distributed and function at a scale far greater than the discrete footprint of rock placement. The areas where rock is deposited are not predicted to coincide with important nursery habitat, so the function of nursery areas will not be affected. Therefore, all receptors for nursery grounds are considered of **low** sensitivity to the introduction of hard structures.

##### 8.8.2.8.1.3 Diadromous Fish

304. These species are highly mobile and use large spatial scales during their life cycles. Migration corridors or freshwater entry points are not affected by the small areas of rock placement, so there is no mechanism for meaningful impact on their migration or spawning success. Diadromous fish have therefore **low** sensitivity to the introduction of hard structures.

##### 8.8.2.8.1.4 Elasmobranchs

305. These species are mobile and forage across wide areas. While some elasmobranchs use sandy seabed habitats for egg deposition or foraging, the scale of rock deposits is too small to interfere with population-level processes. No new critical habitat is created or lost. Elasmobranchs (sharks, skates, and rays) have **low** sensitivity to changes hard structures.

#### 8.8.2.8.1.5 Marine Demersal Fish

306. Many demersal species are flexible and can use both soft and hard substrate habitats for foraging and shelter. The introduction of rock may actually provide some new microhabitats that could be utilised, but the scale is too small to materially benefit or impact populations. Marine demersal fish, such as cod, whiting, and saithe, have **low** sensitivity overall to hard structures.

#### 8.8.2.8.1.6 Cephalopods

307. Some cephalopods may opportunistically use rocky substrate for shelter or hunting, but they are highly mobile and can easily avoid unsuitable habitat. Given the very limited footprint of rock placement relative to the wider habitat available, only negligible effects are expected. Cephalopods (e.g. squid, octopus, cuttlefish) are assessed as having **low** sensitivity to hard structures.

#### 8.8.2.8.1.7 Crustaceans

308. Unlike molluscs, many crustaceans are mobile and are known to utilise rocky areas for shelter, refuge, and foraging. The introduced substrate could therefore provide some additional habitat opportunities, although at a very small scale relative to their distribution. Crustaceans (e.g. lobsters and crabs) are considered to have **low** sensitivity to hard structures.

#### 8.8.2.8.1.8 Molluscs

309. As sessile benthic organisms, molluscs are more vulnerable to direct habitat change, but the rock deposits do not represent suitable habitat for most mollusc species. Sessile molluscs that favour sandy or muddy sediments will not benefit from the new substrate, but because the footprint (**Table 8.10**) is small relative to available habitat, the sensitivity remains low. Therefore molluscs are assessed as having **low** sensitivity.

#### 8.8.2.8.2 Magnitude

310. The magnitude of impact is the same as set out in **Section 8.8.2.7**, namely a total footprint of introduction of hard substrate set out in **Table 8.10**.
311. Evidence from studies of artificial reef and scour-protection structures indicates that changes in local assemblage composition may occur, often driven by increased surface complexity; however, responses are variable and strongly site-specific, and do not reliably translate to population-level increases (e.g. Linley et al. 2007). Given the extremely small footprint of rock placement within the Bellrock WFDA, any such changes would be highly localised and ecologically negligible.
312. The magnitude of the impact from the introduction of hard substrate is assessed as **no change** for all receptor groups, except from cephalopods and crustaceans, as the footprint of change is extremely limited and does not overlap with critical habitats, and will not meaningfully influence the functioning of the receptor populations. For cephalopods and crustaceans, the magnitude is assessed as **negligible**, reflecting that while some localised habitat alteration occurs, the effect is too small in scale to affect populations and in some cases may provide additional microhabitats.

### 8.8.2.8.3 Significance of Effect

313. Based on the low sensitivity of receptor groups and the small, highly localised footprint of hard-structure introduction, effects are assessed as **low** with a magnitude of **no change** for most receptor groups except for cephalopods and crustaceans the magnitude is **negligible**. Therefore, the significance of effect is no effect for most receptors and cephalopods and crustaceans assessed as **negligible beneficial**. While some very localised microhabitats may be created for mobile crustaceans or cephalopods, the scale is insufficient to result in measurable population-level benefit. Overall, effects are **not significant** in EIA terms.
314. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms.

### 8.8.2.9 O9: Secondary Entanglement with SKSs

315. To date, there have been no recorded instances of megafauna entanglement from mooring systems of renewable devices. However, entanglement in fishing gear is known to occur in Scottish waters and therefore resulting in the potential for a risk of secondary entanglement (i.e. fish and shellfish receptors become entangled in ghost fishing gears entangled in the subsea infrastructure).
316. The risk of secondary entanglement from the Wind Farm Infrastructure is therefore assessed within this section. This secondary entanglement can occur when mobile fish and shellfish receptors become ensnared in marine debris, such as lost or abandoned (ghost) fishing gear that has accumulated on mooring lines and dynamic IACs associated with the Wind Farm Infrastructure (see diagram in **Chapter 4: Project Description (Volume II)**). The presence of ghost fishing gear wrapped around SKS could extend the spatial impact range of the mooring lines or dynamic IACs, as ghost nets can span tens of metres, potentially leading to higher local bycatch rates.

#### 8.8.2.9.1 Sensitivity

317. Fish and shellfish receptors that become temporarily entangled within marine debris associated with SKSs may become injured or be at higher risk of predation, whereas long-term entanglement may lead to starvation. The risk of entanglement for these species is likely influenced by the type of marine debris (nets, lines, fishing gear, etc.), the characteristics of the mooring components, and the overall configuration of the array which could lead to an increase in secondary entanglement (Farr et al., 2021).
318. There is no direct evidence of fish and shellfish becoming entangled in marine debris associated with renewable energy installations, however research on marine mammals can provide insights into likely sensitivities.
319. Overall, given the relatively static or slow moving nature of marine debris entangled on SKSs, it is judged that the vast majority of fish and shellfish receptors are small and mobile enough to respond to the visual cues presented by the debris and not become entangled within it. The majority of fishing gear is used in a mobile (e.g. trawl net) or baited (e.g. pots and creels) context, that would not apply in the same when entangled upon SKSs. The risk increases with megafauna that may not respond to the visual cues presented by the marine debris and therefore may not alter swimming behaviour to avoid the debris. These megafauna may swim through the marine debris, become entangled.

320. Benjamins et al. (2014) provided a qualitative assessment of relative entanglement risk across various marine megafauna groups, factoring in biological aspects such as body size, sensory abilities, and feeding behaviours, alongside physical attributes of mooring systems like flexibility, pre-tension, and footprint. The findings suggest the large megafauna with limited manoeuvrability are at greater risk from entanglement, compared to smaller more-mobile species.
321. In this context, it is considered that basking shark may have an increased sensitivity to secondary entanglement, compared to other fish and shellfish receptors, although it should be noted there are no records of this occurring.
322. The overall secondary entanglement risk for fish and shellfish receptors in relation to floating OWFs remains relatively uncertain due to the limited number of dedicated studies and monitoring efforts, particularly regarding the potential for ghost fishing gear to accumulate on mooring lines or dynamic IAC. Given that no cases of fish and shellfish entanglement have been recorded involving marine debris stuck with the mooring systems or dynamic IACs of marine renewable energy devices or similar infrastructure (Copping et al., 2020), the primary entanglement risk from the Wind Farm Infrastructure is considered **low** for all fish and shellfish, except for basking shark, which are assessed as having a **medium** sensitivity to entanglement.

#### 8.8.2.9.2 *Magnitude*

323. The prevalence of abandoned or lost fishing gear in the area of Bellrock WFDA is influenced by local oceanographic conditions, fishing gear losses and their drift rates once lost. These unknowns make secondary entanglement very difficult to quantify. Benjamins et al. (2014) are currently evaluating the secondary entanglement risk among offshore renewable structures. Primary findings identify significant knowledge gaps, such as the lack of in-situ observations of fishing gear stuck on infrastructure and insufficient information on species abundance and behaviour around floating OWF structures. It should be noted that large fishing nets are not expected to be used within the Bellrock WFDA due to the presence of floating infrastructure (once constructed). Instead, static fishing gear (e.g. fish traps, crab and prawn creels, and electronic jiggers) could be used, as it has been trialled at the Hywind Scotland floating OWF (Wright et al., 2023). The tests indicated the viability of deploying static gear under suitable sea and weather conditions. During the four trial trips, no gear was lost or snagged in the structures.
324. The magnitude of impact of secondary entanglement with SKSs is therefore considered to be **low**.

#### 8.8.2.9.3 *Significance of Effect*

325. Receptor sensitivities are **medium** for basking shark, and **low** for all other receptor groups, and there is a **low** magnitude of impact. The effect is **minor adverse** for all receptor groups, and therefore **not significant** in EIA terms.

#### 8.8.2.9.4 *Mitigation*

326. No additional mitigation is considered necessary because the likely effect is **not significant** in EIA terms. However, the following measures will further reduce the risk of entanglement, and will be set out within the MMMP and OMP:

- Monitoring for large strains on mooring lines:
  - It is expected that a similar method of monitoring would be undertaken as per Kincardine Offshore Windfarm. On Kincardine Offshore Windfarm this has to date been undertaken by load cells attached to the mooring devices and subsea cables, designed to alert the operator if there is unexpected load on the devices which can then be examined. Alternatively, a position monitoring system could achieve the same monitoring outcome; and
- Surveys: SKSs and dynamic IACs will be regularly checked by ROV:
  - This would ensure that there was no material such as discarded nets, ropes or other debris which could increase the risk of entanglement for fish and shellfish.

#### 8.8.2.9.5 *Residual Significance of Effect*

327. Taking into account additional mitigation which would reduce the magnitude, the residual significance of effect of secondary entanglement with SKSs, would be **negligible adverse** for all receptors, which is **not significant** in EIA terms.

### 8.8.3 Potential Impacts during Decommissioning

328. Decommissioning impacts will be associated with the removal the Wind Farm Infrastructure. While the precise decommissioning methodology will be finalised at a later stage, decommissioning is expected to result in impacts that are similar in nature to those identified for the construction phase, but generally lower in magnitude due to the reduced scale and shorter duration of activities. The potential for seabed disturbance during cable recovery will depend on the final technique selected (e.g. grapnel runs, cutting, or localised sediment removal). Whilst impact magnitudes are likely to be reduced in comparison to construction, on a precautionary basis for the following decommissioning phase impacts, the significance of effect is assessed to be the same as for the construction phase (**Section 8.8.1**):

- D1: Physical disturbance and temporary habitat loss (**Section 8.8.1.1.3**);
- D2: Increased SSCs and sediment re-deposition (**Section 8.8.1.2.3**);
- D3: Underwater noise and vibration (**Section 8.8.1.3.3**);
- D4: Changes in fishing activity (**Section 8.8.1.4.3**); and
- D5: Vessel collision for basking shark (**Section 8.8.1.5.3**).

## 8.9 Cumulative Effects Assessment

329. The CEA follows the methodology set out in **Chapter 5: EIA Methodology (Volume II)** and summarised in **Section 8.4.2**.

### 8.9.1 Screening of Potential Cumulative Impacts

330. Potential impacts from the Bellrock Wind Farm Infrastructure-alone assessment are brought forward into the CEA. Some potential impacts considered for the Bellrock Wind Farm Infrastructure-alone assessment may be specific to a particular phase of development (e.g. construction, O&M or decommissioning). The potential for cumulative effects with other plans or projects requires spatial and/or temporal overlap with the Bellrock Wind Farm Infrastructure ZOI during the relevant phases of development. Therefore, impacts associated with a certain phase may be screened out from further consideration where no plans or projects have been identified that have the potential for cumulative effects during the same temporal period and/or across the same spatial extent. All impacts considered in the Bellrock Wind Farm Infrastructure-alone assessment (**Section 8.8**) were initially brought forward for CEA impact pathway screening (**Table 8.16**). Impact screening considered the ZOI of the impacts and the plans and projects identified in **Table 8.17**. Impacts with no rationale for cumulative effects i.e. those assessed as no change or where impacts were highly spatially and/or temporally constrained, and therefore would not contribute to a cumulative effect, were screened out.

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**Table 8.16: Summary of Potential Cumulative Effects (Impact Screening)**

Impact	Phase	Project-Along Residual Effects Significance	Potential for Cumulative Effects	Rationale
Physical Disturbance and temporary habitat loss	Construction, O&M and decommissioning	Not Significant (negligible to minor adverse)	Yes	<p>Temporary habitat loss and disturbance will be highly localised and short-term. However, the Bellrock OfTDA lies immediately adjacent to, and overlaps with, the Bellrock WFDA, introducing comparable contact activities within the same spatial area across all project phases.</p> <p>Therefore, the potential for physical disturbance and temporary habitat loss to fish and shellfish has been screened into the CEA.</p>
Increased SSC and Sediment Re-deposition	Construction, O&M and decommissioning	Not Significant (negligible adverse)	Yes	<p>Increased SSC and sediment re-deposition will be highly localised and temporary. For the Bellrock WFDA, sediment plumes generated during construction dissipate rapidly, with fine particulate concentrations reducing to negligible levels beyond the immediate works area.</p> <p>The Bellrock OfTDA lies immediately adjacent to, and partially overlaps with, the Bellrock WFDA, meaning there is a plausible pathway for shared spatial and temporal exposure to elevated SSC for fish and shellfish receptors. Accordingly, the potential for cumulative effects from increased SSC and sediment re-deposition has been screened into the CEA.</p>
Underwater Noise and Vibration	Construction, O&M and decommissioning	Not Significant (negligible to minor adverse)	Yes	<p>Disturbance is a short-term behavioural change that is caused by noise exposure and typically resolves within hours to days after the exposure ends. Disturbance is likely to have greater effect ranges and areas than the modelled permanent threshold shift. Impact ranges have the potential to overlap with other projects if they are pile driving at the same time.</p> <p>The potential for disturbance to fish and shellfish from operational OWFs from underwater noise has been screened out of the CEA.</p> <p>Therefore, the potential for disturbance to fish and shellfish from underwater noise and vibration has been screened into the CEA for potential construction and decommissioning phase cumulative impacts.</p>

Impact	Phase	Project-Alone Residual Effects Significance	Potential for Cumulative Effects	Rationale
Changes in Fishing Activity	Construction, O&M and decommissioning	Not Significant (negligible adverse)	No	<p>A reduction in fishing activity is anticipated in the Bellrock WFDA during construction, O&amp;M and decommissioning. <b>Chapter 11: Commercial Fisheries (Volume II)</b> identifies a moderate adverse significant effect on Nephrops trawling, reflecting economic and operational disruption for this specific fishing sector.</p> <p>However, fishing effort in the Bellrock WFDA represents a small proportion of regional activity, and displacement from this small area does not result in ecologically meaningful pressure on fish or shellfish receptors.</p> <p>Therefore, while commercial fishing receptors may experience significant operational effects, the associated ecological pressure from changes in fishing activity remains negligible, and no cumulative impact to fish and shellfish is anticipated. No cumulative impact will be anticipated.</p>
Vessel Collision for Basking Sharks	Construction, O&M and decommissioning	Not Significant (minor adverse)	No	<p>With robust mitigation measures in place, the risk to basking shark is low, and the potential for the Bellrock Wind Farm Infrastructure to contribute to a cumulative effect is minimised.</p> <p>Therefore, the potential for disturbance to basking sharks from vessel collision has been screened out of the CEA.</p>
EMF	O&M	Not Significant (negligible adverse)	Yes	<p>There is a potential for behavioural effects of EMF on migratory species to occur repeatedly, if an individual moves through multiple operational OWFs, interconnector and cable projects/plans. Repeated effects of EMF may alter migratory behaviour cumulatively.</p> <p>Therefore, the potential for EMF to fish and shellfish has been screened into the CEA for potential O&amp;M phase cumulative impacts.</p>
Permanent habitat loss	O&M	Not Significant (negligible to minor adverse)	Yes (Bellrock OFTDA only)	<p>There is potential for cumulative long term habitat loss and disturbance due to the presence of the Bellrock Wind Farm Infrastructure and the Offshore Transmission Infrastructure associated with the Bellrock OFTDA only.</p> <p>Therefore, the potential for permanent habitat loss to fish and shellfish has been screened into the CEA for potential O&amp;M phase cumulative impacts.</p>

Impact	Phase	Project-Alone Residual Effects Significance	Potential for Cumulative Effects	Rationale
Introduction of hard structures	O&M	Not Significant (no change to Negligible beneficial)	No	<p>Colonisation of hard structures is not considered to result in adverse effects and is therefore not considered to contribute to cumulative effects.</p> <p>Therefore, the potential for this impact to fish and shellfish has been screened out of the CEA.</p>
Secondary Entanglement with SKSs	O&M	Not Significant (Minor Adverse)	No	<p>Effect significance without mitigation is not significant (minor adverse) without mitigation. However, there is also mitigation in place to monitor entanglement of marine debris in SKSs, which further limits the risk to fish and shellfish.</p> <p>With mitigation measures in place, the risk is sufficiently low that the potential for the Bellrock Wind Farm Infrastructure to contribute to a cumulative effect is minimised.</p> <p>Therefore, the potential for secondary entanglement with SKSs has been screened out of the CEA.</p>

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## 8.9.2 Screening of Other Plans, Projects and Activities

331. Potential cumulative plans and projects were identified and screened in Appendix 5.3: Cumulative Effect **Assessment Long List of Projects (Volume IV)**. For this CEA, a 60 km distance is used to identify possible projects as this distance encompasses the ZOI for all relevant Bellrock Wind Farm Infrastructure impacts as well as incremental changes over the wider relevant area. The plans and projects which have been subsequently scoped into the CEA for fish and shellfish ecology are outlined in **Table 8.17**. Given that there is no potential pathway for impact to fish and shellfish ecology due to the Bellrock Onshore Transmission Infrastructure, the Bellrock OnTDA has not been considered further within the CEA. The Proposed Bellrock OfTDA however, remains as part of the Tier 1 assessment, due to a potential receptor impact pathway.

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**Table 8.17: Short List of Plans/Projects Screened in Within the Cumulative Effect Assessment (CEA) for Fish and Shellfish Ecology**

Project/Plan	Development Type	Status	Construction Period	Operational Period	Closest Distance to Bellrock WFDA (km)	Rationale
<b>Tier 1</b>						
Bellrock OfTDA	Offshore transmission (export cables, interconnector cables, offshore substations (OfSSs) and reactive compensation station(s))	Pre-planning	2031 to 2036	2036 onwards	0	Direct spatial and temporal overlap with the Bellrock WFDA; potential for concurrent UXO clearance, piling and seabed disturbance. Operationally, overlapping cumulative EMF corridors could influence migratory fish.
Muir Mhòr (ScotWind)	OWF	Planning (Application submitted)	2028 to 2031	2032 onwards	52	Operational overlap with Bellrock WFDA; cumulative EMF and noise effects.
Ossian (ScotWind)	OWF	Planning (Application submitted)	2031 to 2038	2038 onwards	9	Construction may overlap with Bellrock Wind Farm Infrastructure construction and O&M phases.
<b>Tier 2</b>						
Morven (ScotWind)	OWF	Planning (Scoping report submitted)	2027 to 2030	2030 onwards	35	Within regional proximity to Bellrock WFDA; noise impacts on pelagic and migratory fish.
Eastern Green Link 3	Cables	In Planning (Scoping submitted)	2028 to 2033	2034 onwards	32	Construction may overlap with Bellrock Wind Farm Infrastructure construction and O&M phases.

Project/Plan	Development Type	Status	Construction Period	Operational Period	Closest Distance to Bellrock WFDA (km)	Rationale
Eastern Green Link 5	Cables	In Planning (Scoping submitted)	2030 to 2035	2036 onwards	30	Construction may overlap with Bellrock Wind Farm Infrastructure construction and O&M phases.
Ossian Wind Farm Export Cable	Cables	In Planning (Scoping submitted)	2029 to 2032	2033 onwards	29	Cumulative EMF and seabed disturbance possible.
CampionWind (ScotWind)	OWF	Planning (Scoping report submitted)	Currently unknown	Currently unknown	24	Construction ends before Bellrock WFDA; shared receptor ranges and operational EMF overlap.
<b>Tier 3</b>						
Cedar (INTOG)	OWF	Pre-Planning	Currently Unknown	Currently Unknown	21	Proximity suggests potential EMF and piling noise overlap during Bellrock Wind Farm Infrastructure operation.

## 8.9.3 Assessment of Cumulative Effects

### 8.9.3.1 Potential Cumulative Effects during Construction

#### 8.9.3.1.1 *Physical Disturbance and Temporary Habitat Loss*

##### 8.9.3.1.1.1 Sensitivity

332. The sensitivity of receptors to physical disturbance and temporary habitat loss is assessed as **low** and **high** depending on the receptor group, consistent with the construction phase sensitivity presented in **Section 8.8.1.1**.

##### 8.9.3.1.1.2 Magnitude

###### 8.9.3.1.1.2.1 Tier 1

333. Physical disturbance and temporary habitat loss within the Bellrock WFDA is primarily associated with site preparation works and installation of SKSs, IACs and subsea cable hubs (outlined in **Section 8.6.2** and **Section 8.8.1.1**). The Bellrock OfTDA will include the Bellrock Offshore Transmission Infrastructure which is expected to comprise of OfSSs, offshore reactive compensation station(s) and associated scour protection, interconnector cables and associated cable protection, and offshore export cables and associated cable protection, along with any site preparation works limited to the immediate footprint of these installations. Consequently, cumulative physical disturbance and temporary loss to fish and shellfish are confined to the areas directly affected by the installation of the Bellrock Wind Farm Infrastructure and Bellrock Offshore Transmission Infrastructure. Activities across both Development Areas will be intermittent during the construction phase and reversible in nature. Therefore, the magnitude of cumulative impact under Tier 1 remains **negligible**.

###### 8.9.3.1.1.2.2 Tier 2 and Tier 3

334. Tier 2 and Tier 3 assessments are not required for this impact, as the identified impact pathway is applicable only to the Bellrock WFDA and Bellrock OfTDA. Accordingly, no Tier 2 and 3 projects are scoped in for this impact, as reflected in **Table 8.17**.

##### 8.9.3.1.1.3 Cumulative Effects

335. Given that receptors are of **low** to **high** sensitivity, and the cumulative magnitude of impact is **negligible**, the cumulative effect of physical disturbance and temporary loss of seabed habitats during construction is assessed as **minor adverse**.

#### 8.9.3.1.2 *Increased Suspended Sediment Concentrations and Sediment Re-deposition*

##### 8.9.3.1.2.1 Sensitivity

336. The sensitivity of receptors to physical disturbance and temporary habitat loss is assessed as **low** and **high** depending on the receptor group, consistent with the construction phase sensitivity presented in **Section 8.8.1.2**.

### 8.9.3.1.2.2 Magnitude

#### 8.9.3.1.2.2.1 Tier 1

337. For the Bellrock WFDA alone, site preparation works and construction activities (installation of SKS, IACs and subsea cable hubs) are predicted to result in temporary increases in SSCs and localised sediment re-deposition. These impacts are largely confined to the immediate area of disturbance, short-term in duration, and highly reversible, and the magnitude of impact has assessed as **negligible**.
338. For the Bellrock OFTDA, sediment disturbance and re-deposition associated with the construction phase is expected to be locally constrained to the vicinity of the site preparation works and construction works, intermittent, temporary, and reversible, with SSCs and re-deposition diminishing rapidly with distance from the works.
339. As they overlap, only the Bellrock WFDA and the Bellrock OFTDA lie close enough for any spatial or temporal interaction of SSC and sediment re-deposition effects. However, SSC increases and re-deposition from both areas remain highly localised, short-term and rapidly diminishing with distance. Even if construction works occurred at the same time, sediment plumes are not expected to materially interact or increase exposure for fish and shellfish receptors. Consequently, the cumulative magnitude under Tier 1 remains **negligible**.

#### 8.9.3.1.2.2.2 Tier 2 and Tier 3

340. Tier 2 and Tier 3 assessments are not required for this impact, as the identified impact pathway is applicable only to the Bellrock WFDA and Bellrock OFTDA. Accordingly, no Tier 2 and 3 projects are scoped in for this impact, as reflected in **Table 8.17**.

### 8.9.3.1.2.3 Cumulative Effects

341. Given that receptor sensitivity is **low** and **high**, depending on the receptor group, and the cumulative magnitude of impact is **negligible**, the cumulative effect of increased SSCs and sediment re-deposition during construction is assessed as **minor adverse** for the high sensitivity receptor groups and **negligible adverse** for the low sensitivity receptor groups.

### 8.9.3.1.3 Underwater Noise and Vibration

342. Underwater noise during construction will primarily result from impact piling associated with the installation of the FOU driven piles. Additional sources include UXO, cable installation, trenching, rock placement, and construction vessel activity. The cumulative assessment considers the potential for combined or overlapping effects on fish and shellfish receptors when the Bellrock Wind Farm Infrastructure is considered in combination with other OWFs and marine developments identified in **Section 8.9** and **Appendix 9.2: Underwater Noise Modelling Report (Volume IV)**.
343. Underwater noise during construction has the potential to generate cumulative impacts on fish and shellfish ecological receptors when considered alongside other offshore developments in the region. Based on the worst-case modelled underwater noise impact range due to piling (**Appendix 9.2: Underwater Noise Modelling Report (Volume IV)**), any developments located within a precautionary buffer of 60 km of Bellrock WFDA have been considered in this assessment. Developments beyond this threshold have been excluded. In the following sections, each impact will be assessed according to the assigned Tier of the relevant plan or project.

#### 8.9.3.1.3.1.1 Sensitivity

344. The sensitivity of receptors to underwater noise and vibration is assessed as ranging from **low** to **medium** to **high** depending on the receptor group, consistent with the construction phase sensitivity presented in **Section 8.8.1.3.1**.

#### 8.9.3.1.3.1.2 Magnitude

##### 8.9.3.1.3.1.2.1 Tier 1

345. Tier 1 considers the Bellrock Wind Farm Infrastructure in combination with operational, under construction, consented, and submitted projects, including the Bellrock OfTDA (**Table 8.17**).

346. For Tier 1 projects, several OWFs in the regional vicinity may undertake piling within overlapping or adjacent timelines. Based on Subacoustech (2025) modelling, the injury threshold for fish is predicted to extend up to approximately 12 km, with behavioural disturbance potentially extending up to 60 km. The nearest operational or consented projects are located >8 km from the Bellrock WFDA (**Table 8.17**), meaning that overlap of physical injury zones is unlikely. However, overlap of behavioural disturbance zones could occur if multiple projects conduct piling concurrently (**Figure 8.16 (Volume III)**).

347. Given the limited predicted overlap of injury zones between projects, and that any behavioural disturbance arising from concurrent piling would be short-term, intermittent, and below thresholds associated with population-level effects, the magnitude of cumulative impact is assessed as **negligible** for herring spawning grounds and **low** for all other receptor groups.

##### 8.9.3.1.3.1.2.2 Tier 2

348. Tier 2 considers the Bellrock Wind Farm Infrastructure in combination with all Tier 1 projects plus those with an issued Scoping Report or Opinion.

349. Projects at the scoping stage are at least 20 km from the Bellrock WFDA. Even assuming worst-case concurrent piling, modelled ranges of potential disturbance ( $\leq 60$  km) would likely represent minor additive exposure for mobile fish species. Given the uncertainties in construction timing and technology selection, the probability of temporal overlap is low (**Figure 8.16 (Volume III)**). The magnitude of cumulative impact is therefore considered **negligible** for herring spawning grounds and **low** for all other receptor groups.

##### 8.9.3.1.3.1.2.3 Tier 3

350. Tier 3 considers the Bellrock Wind Farm Infrastructure in combination with all Tier 1 and Tier 2 projects, plus projects with Crown Estate Scotland Option to Lease Agreements (**Table 8.17**).

351. At this tier, regional-scale development (including INTOG projects and potential interconnectors) would increase the spatial density of offshore construction activity across the wider North Sea. However, given the sequential nature of construction programmes and the temporary character of piling, cumulative exposure at any one location remains limited. Fish and shellfish receptors are expected to recover rapidly once noise-generating activities cease. Magnitude is assessed as **negligible** for herring spawning grounds and **low** for all other receptor groups.

### 8.9.3.1.3.1.3 *Cumulative Effects*

352. Based on the **low**, **medium** and **high** sensitivity of the various receptor groups, and the **negligible** magnitude of cumulative impact for herring spawning grounds and the low magnitude of cumulative impact for all other receptors across Tiers 1-3, reflecting the limited predicted overlap of injury zones, the short-term and intermittent nature of behavioural disturbance, and exposure levels remaining below population-level thresholds, the cumulative effect of construction-related underwater noise is assessed as **minor adverse** for all receptor groups, and therefore **not significant** in EIA terms.

## 8.9.3.2 Potential Cumulative Effects during Operation & Maintenance

### 8.9.3.2.1 *Physical Disturbance and Temporary Habitat Loss*

#### 8.9.3.2.1.1 Sensitivity

353. The sensitivity of receptors to this impact pathway is detailed in **Section 8.8.2.1**, where all receptors vary from **low** to **high**.

#### 8.9.3.2.1.2 Magnitude

##### 8.9.3.2.1.2.1 *Tier 1*

354. The Bellrock WFDA-alone assessment concludes that O&M activities will generate localised, intermittent, and reversible seabed disturbance from the mooring line abrasion, occasional jack-up vessel deployment, and infrequent IAC repair works. These pressures affect small areas at any one time, do not persist and result in a negligible magnitude of impact for the Bellrock WFDA alone.

355. Within the Bellrock OfTDA, activities with the potential to give rise to this impact are limited to maintenance, repair and/or replacement of interconnector cables and export cables, localised reburial/de-burial works, and occasional maintenance at the OfSSs and reactive compensation station(s) (if required). These activities are likely to give rise to impacts that are infrequent, restricted to discrete locations, and smaller in nature than those associated with the Bellrock Wind Farm Infrastructure, with no routine activities expected to disturb the seabed.

356. Although the Bellrock OfTDA overlaps with, and extends outwards to landfall from the Bellrock WFDA, the scale, frequency, and spatial extent of disturbance within the OfTDA are small relative to the Bellrock WFDA footprint. Disturbance footprints remain confined to the immediate vicinity of installed infrastructure, and associated maintenance activities, and there is no realistic mechanism for the spatially discrete O&M activities in each area to combine to create a materially greater cumulative impact than that assessed for the Bellrock WFDA alone.

357. Only the Bellrock WFDA and the Bellrock OfTDA have the potential for spatial or temporal interaction of O&M-related seabed disturbance. However, disturbance events in both areas are infrequent, localised, and restricted to small maintenance footprints. For fish and shellfish, any impacts would be limited to localised and short-term displacement in the immediate vicinity of maintenance works. Given the limited scale and non-overlapping nature of the disturbances, the cumulative magnitude under Tier 1 remains **negligible**.

#### 8.9.3.2.1.2.2 Tier 2 and Tier 3

358. Tier 2 and Tier 3 assessments are not required for this impact, as the identified impact pathway is applicable only to the Bellrock WFDA and Bellrock OfTDA. Accordingly, no Tier 2 and 3 projects are scoped in for this impact, as reflected in **Table 8.17**.

#### 8.9.3.2.1.3 Cumulative Effects

359. Based upon the **high** sensitivity of herring and sandeel spawning grounds, the **low** sensitivity of all other receptor groups, combined with the **negligible** cumulative magnitude of impact, the cumulative effect during O&M is assessed as **negligible adverse**, and **minor adverse** for herring and sandeel.

### 8.9.3.2.2 Increased Suspended Sediment Concentrations and Sediment Re-deposition

#### 8.9.3.2.2.1 Sensitivity

360. The sensitivity of receptors to this impact pathway is detailed in **Section 8.8.2.2** where receptor vary from **low** to **medium**.

#### 8.9.3.2.2.2 Magnitude

##### 8.9.3.2.2.2.1 Tier 1

361. Only the Bellrock WFDA and the Bellrock OfTDA are close enough for any potential interaction of O&M-related suspended sediment or sediment re-deposition. However, SSC increases associated with mooring line sweep zones, occasional jack-up vessel footprints, or localised cable maintenance works are extremely small, short-lived, and limited to the immediate vicinity of each activity. Within the Bellrock OfTDA, only infrequent interconnector cable and export cable repair, replacement, and/or localised re-burial/de-burial works, and occasional OfSSs and reactive compensation station(s) maintenance (if required) have the potential to resuspend sediment. For fish and shellfish, any exposure would be restricted to brief, highly localised increases in suspended particles that disperse and settle rapidly, with no mechanism for plumes from the two areas to interact. As such, the cumulative magnitude under Tier 1 remains **negligible**.

##### 8.9.3.2.2.2.2 Tier 2 and Tier 3

362. Tier 2 and Tier 3 assessments are not required for this impact, as the identified impact pathway is applicable only to the Bellrock WFDA and Bellrock OfTDA. Accordingly, no Tier 2 and 3 projects are scoped in for this impact, as reflected in **Table 8.17**.

#### 8.9.3.2.2.3 Cumulative Effects

363. Based upon the **medium** sensitivity of herring and sandeel spawning grounds, the **low** to **medium** sensitivity for molluscs, and the **low** sensitivity for all other receptor groups, and the **negligible** magnitude of impact, the effect is determined to be **negligible adverse** for all receptor groups.

### 8.9.3.2.3 Electromagnetic Fields

364. During operation, EMFs will be generated by the IACs associated with the Bellrock Wind Farm Infrastructure. The Bellrock Wind Farm Infrastructure will include both static buried and dynamic IACs connecting the WTGs to the subsea cable hubs. This cumulative assessment evaluates

whether combined or repeated exposure to EMFs from multiple developments could influence fish and shellfish ecology receptors, either through attraction, avoidance, or disruption of navigation and migration.

365. The assessment draws upon findings from the **Appendix 8.1 Electromagnetic Fields Assessment Report (Volume IV)** which modelled magnetic and induced electric fields for representative receptor species (e.g. brown crab, thornback ray, Atlantic salmon, basking shark). Results from this study have been used to determine the realistic detection thresholds and to evaluate the potential for cumulative interaction with other projects identified in **Table 8.17**.

#### 8.9.3.2.3.1 Sensitivity

366. Electroreceptive species such as elasmobranchs (e.g. thornback ray, spurdog) and migratory teleosts (e.g. Atlantic salmon) are most sensitive to low-frequency electromagnetic stimuli. Benthic invertebrates such as crabs and lobsters may also respond to strong magnetic gradients, though evidence indicates behavioural rather than physiological effects. Based on available literature and Arcadis (2025), receptor sensitivity to EMFs is classified as **low to medium**.

##### 8.9.3.2.3.1.1 Magnitude

###### 8.9.3.2.3.1.1.1 Tier 1

367. **Appendix 8.1: Electromagnetic Fields Assessment Report (Volume IV)** indicates that for IACs (66 kV, 1,100 A AC configuration):

- Induced voltages for modelled species range from ~ 9 mV for Atlantic salmon to ~162 mV for large rays at 0.2 m from the cable, rapidly declining to  $\leq 0.5$  mV at 20 m distance; and
- Cable burial and trefoil phasing reduce far-field magnetic flux density, resulting in minimal field overlap beyond localised near-field zones.

368. Given these values, exposure zones are small and receptors are transient, passing through EMF fields only briefly. Export cables from nearby operational or consented projects are separated by several kilometres and are generally buried to similar or greater depths. As such, EMF fields from other projects will not combine with the EMF from the Bellrock Wind Farm Infrastructure. The remaining potential cumulative pathway is repeated exposures to EMFs as an animal moves long distances and potentially passes subsea cables from other projects, for example in the case of diadromous fish migrations. Based on results for Bellrock Wind Farm Infrastructure alone, it is not expected that effects on species from passing in proximity to a cable are meaningful enough to accumulate to cause effects of greater significance over the course of longer distance travel. The magnitude of cumulative impact is therefore 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.

###### 8.9.3.2.3.1.2 Tier 2

369. Additional projects at the scoping stage may contribute further EMF sources within the broader region. However, field strength attenuates rapidly, and multiple AC cable systems operating in proximity do not linearly amplify magnetic field strength (**Appendix 8.1: Electromagnetic Fields Assessment Report (Volume IV)**). Given the spacing between developments and the limited

potential for spatial overlap of unburied or exposed cables, cumulative exposure is expected to be minimal. The magnitude of cumulative impact is therefore assessed as **negligible**.

#### 8.9.3.2.3.1.3 Tier 3

370. Under a future regional development scenario involving multiple additional OWFs and cable networks, cumulative EMF exposure would increase proportionally with the number of cables. However, these effects would remain highly localised (<5 m from each cable) and would not spatially connect across the region. Migratory species traversing multiple cable routes would experience brief, intermittent exposure events below behavioural threshold levels. Magnitude is therefore assessed as **negligible**.

#### 8.9.3.2.3.2 Cumulative Effects

371. Based on the **low to medium** sensitivity of electroreceptive species and the **negligible** magnitude of cumulative impact across Tiers 1-3, reflecting the small spatial extent of EMF exposure zones, rapid attenuation of magnetic and electric fields with distance, and the transient nature of receptor movement, the cumulative effect of operational EMFs is assessed as **negligible adverse** for all receptor groups, and therefore **not significant** in EIA terms.

#### 8.9.3.2.4 Permanent Habitat Loss

372. Permanent habitat loss during the O&M phase of the Bellrock Wind Farm Infrastructure arises from the long-term presence of SKSs, scour protection, associated cable protection, and subsea cable hubs that remain in situ throughout the project lifetime. These structures represent a permanent, physical alteration of the seabed environment. The cumulative assessment evaluates the additive contribution of Bellrock WFDA in combination with other operational and proposed offshore developments identified in **Table 8.17**, focusing on the potential for regional-scale habitat modification that could influence fish and shellfish ecology.

##### 8.9.3.2.4.1 Sensitivity

373. Benthic and demersal fish species that utilise the seabed for feeding or spawning (e.g. flatfish, sandeels, gadoids) may be moderately sensitive to localised habitat alteration where sediment type and structure are modified. Epibenthic crustaceans such as brown crab and lobster are generally adaptable to small-scale substrate variation. Pelagic species are not directly reliant on benthic habitats and therefore exhibit low sensitivity. Overall, receptor sensitivity is assessed as **low, medium, and high**, depending on the specific receptor.

##### 8.9.3.2.4.2 Magnitude

###### 8.9.3.2.4.2.1 Tier 1

374. Tier 1 considers the Bellrock Wind Farm Infrastructure in combination with the Bellrock OFTDA (**Table 8.17**).

375. The cumulative area of permanent seabed change resulting from Bellrock Wind Farm Infrastructure, in combination with the Bellrock OFTDA, represents a negligible proportion of the regional seabed area. Each other plan and project considered in Tier 1 introduces small, discrete footprints widely separated across the North Sea. While localised replacement of soft sediment with hard substrata may alter species composition at the microhabitat level, these changes are

highly localised and do not result in any measurable loss of ecological function for fish and shellfish receptors.

376. The magnitude of cumulative impact is therefore assessed as **negligible**, reflecting minor localised and non-degrading habitat change within an extensive, heterogeneous regional environment.

#### 8.9.3.2.4.3 Cumulative Effects

377. Based on the low to high sensitivity of receptor groups and the negligible magnitude of cumulative permanent habitat loss, reflecting the very small, combined footprint of Bellrock Wind Farm Infrastructure and the OfTDA, and the widely separated, discrete and minor footprints of other Tier 1 projects, the cumulative effect on all receptor groups is assessed as no more than minor adverse, and therefore not significant in EIA terms.

### 8.9.3.3 Potential Cumulative Effects during Decommissioning

#### 8.9.3.3.1 *Physical Disturbance and Temporary Habitat Loss*

##### 8.9.3.3.1.1 Sensitivity

378. The sensitivity of receptors to physical disturbance and temporary habitat loss is assessed as **low** and **high** depending on the receptor group, consistent with the construction phase sensitivity presented in **Section 8.8.1.1**.

##### 8.9.3.3.1.2 Magnitude

###### 8.9.3.3.1.2.1 *Tier 1*

379. Decommissioning activities for the Bellrock WFDA are expected to be localised, short-term, intermittent and highly reversible. These activities affect small areas at any one time and result in a negligible magnitude of impact for the Bellrock WFDA alone.
380. Within the Bellrock OfTDA, decommissioning activities are likely to include removal of export cables, interconnector cables, cable protection, the reactive compensation station, OfSS fixed bottom substructures and associated scour protection. Where these works occur within the Bellrock WFDA, they will contribute to small, localised disturbance footprints similar in scale to the Bellrock WFDA works. Disturbance along the remaining export cable route will be confined to narrow, linear sections outside the Bellrock WFDA and therefore will not add to disturbance within the Bellrock WFDA footprint.
381. For fish and shellfish, disturbance associated with these activities would be limited to short-term displacement of demersal species and localised disruption of sediment habitats used by spawning or burrowing species. Given the discrete footprints, localised extent, and short-duration nature of decommissioning activities in both areas, there is no credible mechanism for effects to combine such that a materially greater impact occurs. The cumulative magnitude is therefore assessed as **negligible**.

#### 8.9.3.3.1.2.2 Tier 2 and Tier 3

382. Tier 2 and Tier 3 assessments are not required for this impact, as the identified impact pathway is applicable only to the Bellrock WFDA and Bellrock OfTDA. Accordingly, no Tier 2 and 3 projects are scoped in for this impact, as reflected in **Table 8.17**.

#### 8.9.3.3.1.3 Cumulative Effects

383. Considering the **high** sensitivity for sandeel and herring spawning grounds and **low** sensitivity for all other species and the **negligible** magnitude of cumulative impact, the significance of effect is **minor adverse** for sandeel and herring spawning grounds and **negligible adverse** for all other species which is **not significant** in EIA terms.

### 8.9.3.3.2 Increased Suspended Sediment Concentrations and Sediment Re-deposition

#### 8.9.3.3.2.1 Sensitivity

384. The sensitivity of receptors to this impact pathway is detailed in **Section 8.8.1.2**, where receptor sensitivity ranged from **low** to **medium**.

#### 8.9.3.3.2.2 Magnitude

##### 8.9.3.3.2.2.1 Tier 1

385. Decommissioning within the Bellrock WFDA, including the removal of SKSs, scour protection, IACs, associated cable protection and subsea cable hubs, may temporarily suspend and re-deposit sediments. These effects are localised, short-term, intermittent and highly reversible, producing small sediment plumes that dissipate rapidly. For fish and shellfish, exposure would be limited to brief, low-level increases in suspended particles within a small area around each work site.

386. Within the Bellrock OfTDA, decommissioning activities such as removal of interconnector cables, export cables, and the reactive compensation station(s) and OfSS fixed bottom substructures may also give rise to temporary sediment suspension and re-deposition. As in the Bellrock WFDA, disturbance will be highly localised and short lived, with sediment settling quickly and with no lasting effect on habitat used by fish or shellfish.

387. Given these spatially discrete footprints, the very limited extent of sediment suspension, and the short duration of disturbance in both areas, there is no credible mechanism for plumes to combine or extend into a wider area of relevance to fish or shellfish. As such, the cumulative magnitude is assessed as **negligible**.

##### 8.9.3.3.2.2.2 Tier 2 and Tier 3

388. Tier 2 and Tier 3 assessments are not required for this impact, as the identified impact pathway is applicable only to the Bellrock WFDA and Bellrock OfTDA. Accordingly, no Tier 2 and 3 projects are scoped in for this impact, as reflected in **Table 8.17**.

#### 8.9.3.3.2.3 Cumulative Effects

389. Given that receptor sensitivity ranges from **low** to **medium** and the cumulative magnitude of impact is **negligible**, the cumulative effect of increased suspended sediment concentrations and sediment

re-deposition during decommissioning is assessed as **negligible adverse** and **not significant** in EIA terms.

### 8.9.3.3.3 Underwater Noise and Vibration

390. Underwater noise generated during the decommissioning of the Bellrock Wind Farm Infrastructure will primarily arise from the removal of the FOU, SKSs, IACs, subsea cable hubs, and decommissioning activities. Decommissioning may involve techniques such as cutting or mechanical extraction. Additional underwater noise will result from the operation of decommissioning vessels involved in lifting, cable retrieval, and seabed clearance activities.
391. Noise generated during decommissioning is characteristically short-term, intermittent, and generally of lower intensity than construction-phase piling. This cumulative assessment evaluates whether underwater noise from decommissioning could spatially or temporally overlap with other plans or projects identified in **Table 8.17**, including future offshore wind developments and subsea infrastructure projects.

#### 8.9.3.3.3.1 Sensitivity

392. The sensitivity of receptors to underwater noise and vibration is assessed as ranging from **low** to **medium** to **high** depending on the receptor group, consistent with the construction phase sensitivity presented in **Section 8.8.1.3.1**.

#### 8.9.3.3.3.2 Magnitude

##### 8.9.3.3.3.2.1 Tier 1

393. Tier 1 considers the Bellrock Wind Farm Infrastructure in combination with operational, under construction, consented, and submitted plans/projects, including the Bellrock OfTDA (**Table 8.17**)
394. Decommissioning of the Bellrock Wind Farm Infrastructure will occur long after the construction phases of most Tier 1 projects have concluded. At that time, the majority of these developments will be in the operational phase, generating only low-level, non-impulsive underwater noise. Consequently, there is a very low likelihood that Bellrock Wind Farm Infrastructure decommissioning activities will overlap temporally with any major noise-generating activities at other Tier 1 sites, aside from perhaps the decommissioning of the Bellrock Offshore Transmission Infrastructure, within the Bellrock OfTDA, however, these activities are not expected to be particularly noisy in comparison to piling during construction.
395. Any interaction with operational noise fields from adjacent developments will have no meaningful cumulative effect due to rapid sound attenuation with distance and the inherently low intensity of operational noise. The magnitude of cumulative impact for Tier 1 is therefore considered **negligible** for herring spawning grounds and **low** for all other receptor groups.

##### 8.9.3.3.3.2.2 Tier 2

396. Tier 2 includes developments for which a Scoping Report or Scoping Opinion has been issued. Some Tier 2 projects may ultimately reach the end of their operational life during a similar timeframe to the Bellrock WFDA. However, Tier 2 projects are located at least 20 km from the Bellrock WFDA.

397. Given these spatial separations, underwater noise generated during Bellrock Wind Farm Infrastructure decommissioning activities would attenuate rapidly and is highly unlikely to combine with noise from other Tier 2 projects in a way that would increase the magnitude of impact. Decommissioning noise is also significantly lower in intensity than construction piling and is of short-term duration.
398. The magnitude of cumulative impact for Tier 2 is therefore considered **negligible** for herring spawning grounds and **low** for all other receptor groups.

#### 8.9.3.3.3.2.3 Tier 3

399. Tier 3 considers future developments with CES Option to Lease Agreements and other long-term infrastructure programmes that may ultimately undergo decommissioning in the wider region.
400. In a full regional build-out scenario, several offshore wind projects may enter decommissioning within the same broad period. However, decommissioning programmes are typically implemented sequentially, with removal works phased over multiple years. This phasing significantly reduces the likelihood of overlapping high-intensity underwater noise emissions across different sites.
401. Decommissioning noise remains highly localised, short-term, and substantially lower in intensity than construction piling. Fish and shellfish receptors are expected to recover quickly following cessation of activity. The magnitude of cumulative impact for Tier 3 is therefore considered **negligible** for herring spawning grounds and **low** for all other receptor groups.

#### 8.9.3.3.3.3 Cumulative Effects

402. Based on the **low to high** sensitivity of receptor groups and the **negligible** magnitude of cumulative impact for herring spawning grounds and the **low** magnitude of cumulative impact for all other receptors, across Tiers 1-3, reflecting the short-term, intermittent and lower-intensity nature of decommissioning noise, the limited potential for temporal overlap with other major noise-generating activities, and rapid attenuation of sound with distance, the cumulative effect on all receptor groups is assessed as no worse than **minor adverse**, and therefore **not significant** in EIA terms.

## 8.10 Inter-related and Interacting Impacts

### 8.10.1 Inter-relationships

403. The construction, O&M and decommissioning of the Bellrock Wind Farm Infrastructure have the potential to result in inter-related effects on fish and shellfish ecology. These effects occur when multiple impacts interact, either cumulatively over the project's lifetime or across different environmental receptors.
404. The changes to fish and shellfish ecology have potential secondary effects on other key receptors, which are outlined in **Table 8.18**.

**Table 8.18: Changes to Fish and Shellfish Ecology that have Potential Secondary Effects**

Impact Category	Description
Physical disturbance and temporary habitat loss	Seabed preparation and cable laying may displace or damage key fish and shellfish species.
Permanent habitat loss	Permanent infrastructure (anchors and scour protection, IACs and cable protection, and subsea cable hub) may alter habitat conditions.
Increased SSC and re-deposition	Sediment plumes generated during construction may reduce water quality and smother benthic species.
EMF from subsea cables	EMF emissions may affect species that rely on electroreception, such as elasmobranchs (sharks, skates, rays).
Colonisation of hard structures	The introduction of artificial structures may create new habitats, altering species composition.
Underwater noise and vibration	High-intensity sound levels may affect fish behaviour, communication, and physiology.

405. The potential inter-related impacts on fish and shellfish ecology are as followed:

**Chapter 6: Marine Geology, Oceanography and Physical Processes (Volume II):** Changes to benthic habitats and sediment dynamics may indirectly affect fish and shellfish populations, particularly where species rely on benthic organisms for food or spawning substrate. For example, reductions in filter-feeding species can alter sediment composition and water clarity, which in turn may influence habitat quality for fish and shellfish;

- **Chapter 7: Benthic Ecology (Volume II):** Any changes to fish and shellfish populations could influence benthic ecological processes, and vice versa, as benthic habitat condition and prey availability can also affect fish and shellfish distribution, feeding and recruitment. This Chapter explores the relationships between benthic organisms and their surrounding environment, including how disturbances such as habitat loss, pollution, or changes in sedimentation can affect these communities. It is essential for understanding the impacts of human activities on the deep-sea and coastal ecosystems where many marine species rely on benthic habitats.
- **Chapter 9: Marine Mammals (Volume II):** Reduced fish populations may impact prey availability for species such as seals and cetaceans. However, given the mobility of marine mammals and their ability to exploit alternative food sources, this effect is predicted to be negligible. This Chapter reviews the behaviour, distribution, and vulnerability of marine mammals, assessing how human activities can disrupt their habitats and feeding patterns;
- **Chapter 10: Offshore Ornithology (Volume II):** Changes in fish distribution and abundance may affect seabird foraging behaviour and survival. However, due to the adaptability of seabirds and the localised nature of impacts, effects on foraging success are considered minor. This Chapter discusses how offshore developments or ecological shifts might alter the availability of food sources for seabirds, as well as the resilience of these species to environmental changes; and

- **Chapter 11: Commercial Fisheries (Volume II):** Any changes to fish and shellfish populations could influence fishing yields. However, as the predicted effects on fish ecology are predominantly negligible to minor, commercial fisheries are also expected to experience limited impact under the assumption that fishing access remains broadly unchanged. If fishing were restricted or prohibited within the Bellrock WFDA during the O&M phase this could potentially benefit fish stocks at a localised level within the Bellrock WFDA, although this would be unlikely to have a measurable effect at the population level due to the relatively small size of the Bellrock WFDA in comparison to the distributional range of most populations.

406. **Table 8.19** 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.

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**Table 8.19: Fish and Shellfish Ecology Inter-relationships**

Topic and Description	Related Chapter(s)	Where Addressed in this Chapter	Rationale
Physical disturbance and temporary habitat loss	<p><b>Chapter 6: Marine Geology, Oceanography and Physical Processes (Volume II);</b></p> <p><b>Chapter 7: Benthic Ecology (Volume II);</b></p> <p><b>Chapter 11: Commercial Fisheries (Volume II);</b> and</p> <p><b>Chapter 9: Marine Mammals (Volume II).</b></p>	<p><b>Section 8.8.1.1 and Section 8.8.2.1</b></p>	<p>Seabed disturbance during construction, O&amp;M or decommissioning may temporarily displace fish and smother benthic prey species. Interactions are relevant to geology (sediment disturbance), benthic habitats (substrate removal), marine mammals (trophic links), and fisheries.</p>
Increased SSCs and sediment re-deposition	<p><b>Chapter 6: Marine Geology, Oceanography and Marine Processes (Volume II);</b> and</p> <p><b>Chapter 7: Benthic Ecology (Volume II).</b></p>	<p><b>Section 8.8.1.2 and Section 8.8.2.2</b></p>	<p>Increased SSCs can smother benthic species and affect water quality. The effects discussed in this Chapter highlight how suspended sediment impacts benthic habitats and marine organisms, which is important for assessing potential impacts to broader marine ecosystems.</p>
Permanent habitat loss	<p><b>Chapter 7: Benthic Ecology (Volume II);</b> and</p> <p><b>Chapter 11: Commercial Fisheries (Volume II).</b></p>	<p><b>Section 8.8.2.7</b></p>	<p>Permanent habitat loss, whether through development of infrastructure or ongoing industrial activities, can disrupt critical ecosystems and affect fisheries. This section examines long-term effects of habitat alteration, which is key for assessing the implications of development on benthic species and commercial fisheries.</p>
Underwater noise and vibration	<p><b>Chapter 7: Benthic Ecology (Volume II);</b> and</p> <p><b>Chapter 9: Marine Mammals (Volume II).</b></p>	<p><b>Section 8.8.1.3 and Section 8.8.2.3</b></p>	<p>Underwater noise and vibration from industrial activities can disturb marine mammals and benthic organisms. This section evaluates the biological effects of noise pollution, such as displacement or behavioural changes in marine species, making it essential for assessing risks to sensitive species in the area.</p>

Topic and Description	Related Chapter(s)	Where Addressed in this Chapter	Rationale
EMFs	<b>Chapter 7: Benthic Ecology (Volume II);</b> and <b>Chapter 11: Commercial Fisheries (Volume II).</b>	<b>Section 8.8.2.4</b>	EMFs from underwater cables can affect the behaviour and navigation of marine species. This section addresses the potential impacts of EMFs on marine life and fisheries, ensuring that their potential effects are incorporated in impact assessments.
Introduction of hard substrate	<b>Chapter 6: Marine Geology, Oceanography and Physical Processes (Volume II);</b> <b>Chapter 7: Benthic Ecology (Volume II);</b> and <b>Chapter 11: Commercial Fisheries (Volume II).</b>	<b>Section 8.8.2.8</b>	The introduction of FOU, SKS, IAC and subsea cable hubs and scour protection, and other hard substrates can alter local habitats and create new environments for marine organisms. This section explores how artificial habitats may support certain species while potentially displacing others, offering critical information for understanding changes in biodiversity and marine ecosystem dynamics.
Changes in Fishing Activity	<b>Chapter 11: Commercial Fisheries (Volume II).</b>	<b>Section 8.8.1.4 and Section 8.8.2.7</b>	Construction and O&M may temporarily displace fisheries, altering fishing pressure on local fish populations. Linked to commercial fisheries assessment and population-level pressures.
Vessel collision for basking sharks	<b>Chapter 12: Shipping and Navigation (Volume II).</b>	<b>Section 8.8.1.5 and Section 8.8.2.7</b>	Although basking shark is considered under fish/shellfish, vessel traffic increases collision risk.

## 8.10.2 Interactions

407. 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 8.20**, **Table 8.21**, and **Table 8.22** below. 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.
408. 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 8.22** and **Table 8.23**).

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**Table 8.20: Potential Interaction Between Impacts – Construction**

<b>Potential Interaction Between Construction Impacts</b>					
<b>Impact</b>	<b>C1: Physical disturbance and temporary habitat loss</b>	<b>C2: Increased SSCs and sediment re-deposition</b>	<b>C3: Underwater noise and vibration</b>	<b>C4: Changes in fishing activity</b>	<b>C5: Vessel collision for basking shark</b>
<b>C1: Physical disturbance and temporary habitat loss</b>		Potential	Yes	Yes	No
<b>C2: Increased SSCs and sediment re-deposition</b>	Potential		No	Yes	No
<b>C3: Underwater noise and vibration</b>	Yes	No		Yes	Yes
<b>C4: Changes in fishing activity</b>	Yes	Yes	Yes		No
<b>C5: Vessel collision for basking shark</b>	No	No	Yes	No	

Table 8.21: Potential Interaction Between Impacts - Operation and Maintenance

Potential Interaction Between O&M Impacts									
Impact	O1: Physical disturbance and temporary habitat loss	O2: Increased SSCs and sediment re-deposition	O3: Underwater noise and vibration	O4: Changes in fishing activity	O5: Vessel Collision for basking sharks	O6: EMFs	O7: Permanent habitat loss	O8: Introduction of hard substrate	O9: Secondary Entanglement with SKSs
O1: Physical disturbance and temporary habitat loss		Yes	Yes	Yes	Yes	Yes	Yes	No	No
O2: Increased SSCs and sediment re-deposition	Yes		Yes	No	Yes	Yes	Yes	No	No
O3: Underwater noise and vibration	Yes	Yes		Yes	Yes	Yes	Yes	Yes	No
O4: Changes in fishing activity	Yes	Yes	Yes		Yes	Yes	Yes	No	No
O5: Vessel Collision for basking sharks	No	No	Yes	No		No	No	No	Yes
O6: EMFs	No	No	No	Yes	Yes		Yes	No	No

Potential Interaction Between O&M Impacts									
Impact	O1: Physical disturbance and temporary habitat loss	O2: Increased SSCs and sediment re-deposition	O3: Underwater noise and vibration	O4: Changes in fishing activity	O5: Vessel Collision for basking sharks	O6: EMFs	O7: Permanent habitat loss	O8: Introduction of hard substrate	O9: Secondary Entanglement with SKSs
<b>O7: Permanent Habitat Loss</b>	Yes	Yes	Yes	Yes	Yes	Yes		No	No
<b>O8: Introduction of Hard Substrate</b>	Yes	Yes	Yes	Yes	Yes	Yes	Yes		No
<b>O9: Secondary Entanglement with SKSs</b>	No	No	No	No	Yes	No	No	No	

Table 8.22: Potential Interaction Between Impacts - Decommissioning

Potential Interaction Between Decommissioning Impacts					
Impact	D1: Physical disturbance and temporary habitat loss	D2: Increased SSCs and sediment re-deposition	D3: Underwater noise and vibration	D4: Changes in fishing activity	D5: Vessel collision for basking shark
D1: Physical disturbance and temporary habitat loss		Yes	Yes	Yes	Yes
D2: Increased SSCs and sediment re-deposition	Yes		Yes	Yes	Yes
D3: Underwater noise and vibration	Yes	Yes		Yes	Yes
D4: Changes in fishing activity	Yes	Yes	Yes		Yes
D5: Vessel collision for basking shark	Yes	Yes	Yes	Yes	

**Table 8.23: Potential Interactions Between Impacts - Phase and Lifetime Assessment**

Highest Significance of Effect Level					
Receptor	Construction	O&M	Decommissioning	Phase Assessment	Lifetime Assessment
<ul style="list-style-type: none"> <li>▪ Spawning grounds;</li> <li>▪ Nursery grounds;</li> <li>▪ Diadromous fish;</li> <li>▪ Elasmobranchs;</li> <li>▪ Marine demersal fish;</li> <li>▪ Marine pelagic fish;</li> <li>▪ Cephalopods;</li> <li>▪ Crustaceans; and</li> <li>▪ Molluscs.</li> </ul>	Minor adverse	Minor adverse	Minor adverse	<p><b>Construction:</b> No greater than individually assessed impact during construction, fish and shellfish may be exposed to underwater noise (e.g. from UXO clearance and piling), habitat disturbance from seabed preparation, and increased SSCs. However, these pressures are expected to be localised, temporary, and episodic, with limited spatial overlap. Most fish and shellfish species are mobile and capable of avoiding areas of elevated noise or turbidity, reducing the likelihood of additive or synergistic effects. The potential for vessel interaction or changes in prey availability to interact with noise impacts is also limited, as individuals are assumed to be excluded from the immediate disturbance footprint. Once noisy activities cease, the footprint of disturbance and any changes to prey resource will diminish rapidly. Therefore, the interaction of these pressures is not expected to increase the overall significance level beyond what has been assessed individually.</p> <p><b>Operation and Maintenance:</b> No greater than individually assessed impact operational noise from WTGs is highly localised, and any associated changes to habitat or prey availability are confined to the immediate infrastructure footprint. The magnitude of impact is negligible, and the spatial extent of these pressures overlaps minimally. While maintenance activities and vessel movements may introduce short-term noise or disturbance, these events are episodic and low in intensity, and fish and shellfish are generally resilient to such fluctuations. Any potential interactions between underwater noise, habitat change, and water quality</p>	<p>No greater than individually assessed impact.</p> <p>The greatest magnitude of effect would be the spatial footprint of construction noise and the habitat disturbance from seabed preparation, installation of IACs etc. Once this disturbance impact has ceased all further impacts during construction, O&amp;M and decommissioning would be small scale, localised and episodic. The potential for EMF to cause barrier effects has already been captured in the standalone barrier effect <b>Section 8.8.2.4</b>. It is therefore considered that over the project lifetime these impacts would not interact to change the significance level overall.</p>

Highest Significance of Effect Level					
Receptor	Construction	O&M	Decommissioning	Phase Assessment	Lifetime Assessment
				<p>effects during O&amp;M are localised, temporary, and negligible, and do not result in a cumulative increase in significance.</p> <p><b>Decommissioning:</b> No greater than individually assessed impact. Although, specific removal techniques are yet to be confirmed, decommissioning impacts are expected to resemble those of construction, excluding piling. Habitat disturbance from IAC and SKS removal, temporary increases in SSC, and vessel noise will be short-term and spatially limited. Once these activities conclude, any remaining impacts across decommissioning are expected to be small-scale, localised, and episodic. There is no evidence to suggest long-term displacement or population-level effects on fish and shellfish. Therefore, over the lifetime of the Bellrock Wind Farm Infrastructure, these pressures are not expected to interact in a way that increases the significance level beyond individual assessments.</p>	

## 8.11 Summary

409. Fish and shellfish ecology data for the fish and shellfish ecology study area was gathered through a comprehensive desktop review of existing research and datasets, supplemented by site-specific surveys.
410. **Table 8.24** presents a summary of the assessment of potential effects on fish and shellfish ecology during the construction, O&M and decommissioning phases of the Bellrock Wind Farm Infrastructure.
411. The assessed impacts include:
- Physical disturbance and temporary habitat loss;
  - Increased suspended sediment concentrations and sediment re-deposition;
  - Underwater noise and vibration;
  - Changes in fishing activity;
  - Vessel collision for basking shark;
  - EMFs;
  - Permanent habitat loss; and
  - Introduction of hard substrate.
412. The assessment concluded no significant effects on any fish and shellfish receptors, taking account of embedded mitigation measures incorporated into the project design and management during the construction, O&M and decommissioning of the Wind Farm Infrastructure. Consequently, the assessment concludes that the Bellrock Wind Farm Infrastructure will not result in significant adverse effects on identified fish and shellfish receptor groups.

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**Table 8.24: Summary of Potential Effects for Fish and Shellfish Ecology**

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
<b>Construction</b>							
C1: Physical disturbance and temporary habitat loss	Spawning Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
		High for herring spawning	Negligible	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
		High for sandeel spawning	Negligible	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Nursery Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Diadromous Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Elasmobranchs	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Marine Demersal Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Marine Pelagic Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Cephalopods	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Molluscs and Crustaceans	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
C2: Increased SSCs and sediment re-deposition	Spawning Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
		Medium for herring spawning	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
		Medium for sandeel spawning	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Nursery Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Diadromous Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Elasmobranchs	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Marine Demersal Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Marine Pelagic Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Cephalopods	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Crustaceans	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Molluscs	Low to Medium	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
C3: Underwater noise and vibration	Spawning Grounds	Low for Group 1 and Group 2	Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
		Medium for adult Group 3 and Group 4	Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
		High for herring spawning	Negligible	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Nursery Grounds	Low	Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Diadromous Fish	Low	Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Elasmobranchs	Low	Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Marine Demersal Fish	Medium (cod)	Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Marine Pelagic Fish	Medium (for herring and sprat)	Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Cephalopods	Low	Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Crustaceans	Low	Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Molluscs	Low	Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
C4: Changes in fishing activity	Spawning Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
		Medium for herring spawning	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
		Medium for sandeel spawning	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Nursery Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Diadromous Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Elasmobranchs	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Marine Demersal Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Marine Pelagic Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Cephalopods	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Crustaceans	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Molluscs	Medium	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
C5: Vessel collision for basking shark	Basking shark	Medium	Negligible	Negligible	None	Negligible adverse (not significant)	N/A

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
<b>Operation and Maintenance</b>							
O1: Physical disturbance and temporary habitat loss	Spawning Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
		High for herring spawning	Negligible	Minor adverse	None	Minor adverse (not significant)	Negligible adverse (not significant)
		High for sandeel spawning	Negligible	Minor adverse	None	Minor adverse (not significant)	Negligible adverse (not significant)
	Nursery Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Diadromous Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Elasmobranchs	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Marine Demersal Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Marine Pelagic Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Cephalopods	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Crustaceans	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Molluscs	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
O2: Increased SSCs and sediment re-deposition	Spawning Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
		Medium for herring spawning	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
		Medium for sandeel spawning	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Nursery Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Diadromous Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Elasmobranchs	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Marine Demersal Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Marine Pelagic Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Cephalopods	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Crustaceans	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Molluscs	Low to Medium	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
O3: Underwater noise and vibration	Spawning Grounds	Low for Group 1 and Group 2	Low	Minor adverse	None	Minor adverse (not significant)	N/A
		Medium for adult Group 3 and Group 4	Low	Minor adverse	None	Minor adverse (not significant)	N/A
		High for herring spawning	Negligible	Minor adverse	None	Minor adverse (not significant)	N/A
	Nursery Grounds	Low	Low	Minor adverse	None	Minor adverse (not significant)	N/A
	Diadromous Fish	Low	Low	Minor adverse	None	Minor adverse (not significant)	N/A

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Elasmobranchs	Low	Low	Minor adverse	None	Minor adverse (not significant)	N/A
	Marine Demersal Fish	Medium (cod)	Low	Minor adverse	None	Minor adverse (not significant)	N/A
	Marine Pelagic Fish	Medium (herring, sprat)	Low	Minor adverse	None	Minor adverse (not significant)	N/A
	Cephalopods	Low	Low	Minor adverse	None	Minor adverse (not significant)	N/A
	Crustaceans	Low	Low	Minor adverse	None	Minor adverse (not significant)	N/A
	Molluscs	Low	Low	Minor adverse	None	Minor adverse (not significant)	N/A
O4: Changes in fishing activity	Spawning Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
		Medium for herring spawning	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
		Medium for sandeel spawning	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Nursery Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Diadromous Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Elasmobranchs	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Marine Demersal Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Marine Pelagic Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Cephalopods	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Crustaceans	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Molluscs	Medium	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
O5: Vessel Collision for basking sharks	Basking shark	Medium	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
O6: EMFs	Spawning Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible to Minor adverse (not significant)
	Nursery Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible to Minor adverse (not significant)
	Diadromous Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible to Minor adverse (not significant)
	Elasmobranchs	Medium	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible to Minor adverse (not significant)
	Crustaceans	Medium	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible to Minor adverse (not significant)
	All other receptor groups	Low	Negligible	Negligible	Negligible adverse	None	Negligible adverse (not significant)

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
O7: Permanent habitat loss	Spawning Grounds	Low	Negligible	Negligible adverse (Minor adverse for herring spawning)	None	Negligible adverse (not significant)	Minor adverse (not significant)
		High for herring spawning	Negligible	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
		Medium for sandeel spawning	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Nursery Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Diadromous Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Elasmobranchs	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Marine Demersal Fish	Low (Medium for sandeel)	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Marine Pelagic Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Cephalopods	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Crustaceans	Low (Medium for Nephrops)	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Molluscs	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
O8: Introduction of hard substrate	Spawning Grounds	Low	No Change	No significance of effect	None	No significance of effect	N/A
	Nursery Grounds	Low	No Change	No significance of effect	None	No significance of effect	N/A
	Diadromous Fish	Low	No Change	No significance of effect	None	No significance of effect	N/A
	Elasmobranchs	Low	No Change	No significance of effect	None	No significance of effect	N/A
	Marine Demersal Fish	Low	No Change	No significance of effect	None	No significance of effect	N/A
	Marine Pelagic Fish	Low	No Change	No significance of effect	None	No significance of effect	N/A
	Cephalopods	Low	Negligible	Negligible beneficial	None	Negligible beneficial (not significant)	N/A
	Crustaceans	Low	Negligible	Negligible beneficial	None	Negligible beneficial (not significant)	N/A

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Molluscs	Low	No Impact	No significance of effect	None	No significance of effect	N/A
O9: Secondary Entanglement with SKSs	Spawning Grounds	Low	Low	Minor Adverse	Monitoring mooring lines for mechanical strain, and visual inspection by ROV. Set out in MMMP and OMP	Negligible adverse (not significant)	N/A
	Nursery Grounds	Low	Low	Minor Adverse		Negligible adverse (not significant)	N/A
	Diadromous Fish	Low	Low	Minor Adverse		Negligible adverse (not significant)	N/A
	Elasmobranchs	Low (Medium for basking shark)	Low	Minor Adverse		Negligible adverse (not significant)	N/A
	Marine Demersal Fish	Low	Low	Minor Adverse		Negligible adverse (not significant)	N/A
	Marine Pelagic Fish	Low	Low	Minor Adverse		Negligible adverse (not significant)	N/A
	Cephalopods	Low	Low	Minor Adverse		Negligible adverse (not significant)	N/A
	Crustaceans	Low	Low	Minor Adverse		Negligible adverse (not significant)	N/A
	Molluscs	Low	Low	Minor Adverse		Negligible adverse (not significant)	N/A

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
<b>Decommissioning</b>							
D1: Physical disturbance and temporary habitat loss	Spawning Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
		High for herring spawning	Negligible	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
		High for sandeel spawning	Negligible	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Nursery Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Diadromous Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Elasmobranchs	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Marine Demersal Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Marine Pelagic Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Cephalopods	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Crustaceans	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
	Molluscs	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Negligible adverse (not significant)
D2: Increased SSCs and sediment re-deposition	Spawning Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
		Medium for herring spawning	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
		Medium for sandeel spawning	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Nursery Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Diadromous Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Elasmobranchs	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Marine Demersal Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Marine Pelagic Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Cephalopods	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Crustaceans	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
	Molluscs	Low to Medium	Negligible	Negligible adverse	None	Negligible adverse (not significant)	Minor adverse (not significant)
D3: Underwater noise and vibration	Spawning Grounds	Low for Group 1 and Group 2	Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
		Medium for adult Group 3 and Group 4	Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
		High for herring spawning	Negligible	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Nursery Grounds	Low	Negligible to Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Diadromous Fish	Low	Negligible to Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Elasmobranchs	Low	Negligible to Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Marine Demersal Fish	Medium (cod)	Negligible to Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Marine Pelagic Fish	Medium (for herring and sprat)	Negligible to Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Cephalopods	Low	Negligible to Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Crustaceans	Low	Negligible to Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
	Molluscs	Low	Negligible to Low	Minor adverse	None	Minor adverse (not significant)	Minor adverse (not significant)
D4: Changes in fishing activity	Spawning Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
		Medium for herring spawning	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
		Medium for sandeel spawning	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A

Potential Impact	Receptor(s)	Sensitivity	Magnitude of Impact	Significance of Effect	Secondary Mitigation	Residual Significance of Effect	Cumulative Residual Significance of Effect
	Nursery Grounds	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Diadromous Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Elasmobranchs	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Marine Demersal Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Marine Pelagic Fish	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Cephalopods	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Crustaceans	Low	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
	Molluscs	Medium	Negligible	Negligible adverse	None	Negligible adverse (not significant)	N/A
D5: Vessel collision for basking shark	Basking shark	Medium	Low	Minor adverse	None	Minor adverse (not significant)	N/A

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## 8.12 References

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