

# Buchan Offshore Wind

Chapter 3: Fish and Shellfish Ecology

Offshore AEIR



BUC-C-R-021

**Buchan Offshore Wind**

**Additional Environmental Information**

**Report**

**Chapter 3 Fish and Shellfish Ecology**

## QMS Review

<b>Name</b>	<b>Company</b>	<b>Date</b>	<b>Reviewed</b>	<b>Approved</b>
VRD	Natural Power	18/06/2026	LJN	SMM
CMO	Buchan Offshore Wind	19/06/2026	CMO	DON

## CONTENTS

3.1	INTRODUCTION .....	3-1
3.1.1	Overview.....	3-1
3.1.2	Relationship to the Environmental Impact Assessment Report .....	3-1
3.1.3	Scope of This Report.....	3-2
3.2	CONSULTATION AND REQUESTS FOR ADDITIONAL ENVIRONMENTAL INFORMATION ..	3-3
3.2.1	Approach to Consultation and RAEI .....	3-3
3.2.2	Summary of Consultation Relevant to Fish and Shellfish Ecology .....	3-3
3.3	METHODOLOGY.....	3-24
3.3.1	Assessment Methodology .....	3-24
3.3.2	CEA .....	3-25
3.3.3	Valued Ecological Receptors (VERs) .....	3-25
3.4	MAXIMUM DESIGN SCENARIO .....	3-30
3.4.1	Mitigation Effectiveness and Confidence for Herring and Sandeel Receptors .....	3-37
3.5	GENERAL BASELINE CHARACTERISATION .....	3-40
3.5.1	Species Present at the Proposed Offshore Development Site.....	3-41
3.6	HERRING.....	3-43
3.6.1	Baseline.....	3-43
3.6.2	Direct Temporary Habitat Disturbance (Construction Phase) .....	3-58
3.6.3	Increases in Suspended Sediment Concentrations (SSC) and Deposition (Construction Phase) .....	3-61
3.6.4	Increases in Underwater Noise Leading to Mortality, Injury and Behavioural Effects – Herring (Group 3) (Construction Phase) .....	3-67
3.6.5	Long Term Habitat Loss (Operational Phase).....	3-73
3.6.6	Herring Cumulative Effects Assessment.....	3-75
3.7	SANDEEL.....	3-87
3.7.1	Baseline.....	3-87
3.7.2	Direct Temporary Habitat Disturbance (Construction Phase) .....	3-99
3.7.3	Increases in Suspended Sediment Concentrations (SSC) and Deposition (Construction Phase) .....	3-102
3.7.4	Increases in Underwater Noise Leading to Mortality, Injury and Behavioural Effects – Sandeel (Group 1) (Construction Phase).....	3-105
3.7.5	Long Term Habitat Loss (Operation Phase) .....	3-110

3.7.6	Sandeel Cumulative Effects Assessment .....	3-112
3.8	ALL OTHER SPECIES - LONG TERM HABITAT LOSS (INCLUDING MOORING CHAINS) ..	3-124
3.8.1	Mobile Fish with Spawning and Nursery Grounds Overlapping the Proposed Offshore Development Site .....	3-125
3.8.2	Mobile Fish and Squid with No Spawning and Nursery Grounds (Including Migratory Species) Overlapping the Proposed Offshore Development Site .....	3-126
3.8.3	Shellfish.....	3-126
3.8.4	Conclusion.....	3-126
3.9	CUMULATIVE EFFECTS ASSESSMENT .....	3-127
3.9.1	Direct Temporary Habitat Disturbance .....	3-129
3.9.2	Increases in SSC and Deposition .....	3-132
3.9.3	Increases in Underwater Noise .....	3-134
3.9.4	Long Term Habitat Loss .....	3-135
3.9.5	Colonisation of Structures and Infrastructure .....	3-136
3.9.6	EMF and Thermal Effects.....	3-137
3.9.7	Secondary Entanglement.....	3-138
3.10	DRAFT FISH MITIGATION PLAN.....	3-139
3.11	SUMMARY OF CONCLUSIONS .....	3-140
3.12	REFERENCES .....	3-141
APPENDIX 3.1 – CONSULTATION LOG .....		3-149
APPENDIX 3.2 – LIST OF OTHER DEVELOPMENTS CONSIDERED WITHIN THE CEA FOR FISH AND SHELLFISH ECOLOGY.....		3-173
APPENDIX 3.3 – LIST OF OTHER TIER 2 PLANS AND PROJECTS MDS AND IMPACT ASSESSMENT CONCLUSIONS RELEVANT TO FISH AND SHELLFISH ECOLOGY .....		3-182

## LIST OF TABLES

Table 3-1:	Summary of requests for Additional Environmental Information relevant to Fish and Shellfish Ecology and responses provided in this AEIR .....	3-4
Table 3-2	Valued Ecological Receptors used in the Fish and Shellfish Ecology assessment.....	3-27
Table 3-3	Maximum Design Scenarios considered for impacts on Fish and Shellfish Ecology (ticked items are scoped in).....	3-31
Table 3-4	Herring and sandeel mitigation effectiveness and confidence .....	3-38
Table 3-5	All fish and shellfish identified during site-specific survey work .....	3-42
Table 3-6	Direct temporary habitat disturbance of spawning and nursery grounds for herring in relation to the regional study area.....	3-58

Table 3-7 Temporal overlap (TTS) spawning potential results presented for Herring (Group 3) fish species during WTG concurrent piling.....	3-71
Table 3-8 Long term habitat loss of spawning and nursery grounds for herring in relation to the regional study area .....	3-74
Table 3-9 Direct temporary habitat disturbance of spawning and nursery grounds for sandeel in relation to the regional Study Area .....	3-99
Table 3-10 Long term habitat loss of spawning and nursery grounds for sandeel in relation to the regional Study Area.....	3-111
Table 3-11 Maximum Percentage (%) habitat loss of spawning and nursery grounds in the regional Study Area .....	3-125

## LIST OF FIGURES

Figure 3-1 Sediment suitability for herring spawning based on Folk (1954) sediment classification and spawning Grounds (Ellis et al., 2012; Coull et al., 1998).....	3-48
Figure 3-2 Herring baseline data.....	3-49
Figure 3-3 Herring ( <i>Clupea harengus</i> ) in the regional Study Area –NMPi group 0 with Spawning and Nursery Grounds .....	3-50
Figure 3-4 Average Density of Herring Larvae – IHLS (< 10mm) (Average Number of Individuals < 10 mm per m <sup>2</sup> per ICES Sub Rectangle) Over 10 Years (2016 – 2025).....	3-51
Figure 3-5 Herring potential spawning habitat heat map (in accordance with Kyle-Henney <i>et al.</i> , 2024) .3-54	
Figure 3-6 Herring baseline data and heat map (as per Kyle-Henney <i>et al.</i> , 2024) .....	3-57
Figure 3-7 Concurrent piling noise contours and herring (group 3) distribution at the proposed offshore development.....	3-69
Figure 3-8 Projects screened into the cumulative assessment for herring .....	3-77
Figure 3-9 Sediment suitability for sandeel spawning based on Folk (1954) sediment classification and spawning grounds (Ellis <i>et al.</i> , 2012).....	3-91
Figure 3-10 Sandeel baseline data .....	3-92
Figure 3-11 Probability of buried sandeel ( <i>Ammodytes</i> sp.) Presence Langton <i>et al.</i> (2021) with modelled spawning and nursery grounds.....	3-93
Figure 3-12 Predicted density of lesser sandeel in the North Sea Langton <i>et al.</i> (2021) with modelled spawning and nursery grounds.....	3-94
Figure 3-13 Sandeel potential spawning habitat heat map (in accordance with Reach <i>et al.</i> , 2024).....	3-96
Figure 3-14 Sandeel baseline data and heat map (as per Reach <i>et al.</i> , 2024).....	3-98
Figure 3-15 Concurrent piling noise contours and sandeel (group 1) distribution at the Proposed Offshore Development.....	3-107
Figure 3-16 Projects screened into the cumulative assessment for sandeel.....	3-114
Figure 3-17 Projects screened into the cumulative assessment for fish and shellfish receptors .....	3-128

## **3.1 INTRODUCTION**

### **3.1.1 Overview**

3-1 This Additional Environmental Information Report (AEIR) Chapter has been prepared to provide targeted additional environmental information in response to Request for Additional Environmental Information (RAEI) received from Marine Directorate – Licensing Operations Team (MD-LOT) on 18 December 2025, informed by consultation responses from NatureScot, in relation to fish and shellfish ecology. An overview of the Proposed Offshore Development and Application, and approach to responding to the RAEI is presented in **AEIR, Chapter 1: Introduction**.

3-2 This chapter has been prepared to supplement the Environmental Impact Assessment Report (EIAR) submitted in support of the Application and should be read alongside the relevant EIAR Chapter (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology).

### **3.1.2 Relationship to the Environmental Impact Assessment Report**

3-3 This chapter supplements Volume 2 Chapter 8: Fish and Shellfish Ecology of the EIAR and provides additional environmental information or clarification in response to matters raised through the RAEI issued by MD-LOT on 18 December 2025, informed by representations by NatureScot (01.10.2025) and subsequent consultation undertaken during the determination period.

3-4 Except where explicitly stated within this chapter, the assessment methodology, baseline information, and conclusions presented within the EIAR remain valid and unchanged.

3-5 This chapter should be read in conjunction with the following documents submitted as part of the Application:

- Volume 1, Chapter 4: Project Description;
- Volume 1, Chapter 5: EIA Methodology;
- Volume 2, Chapter 6: Marine Physical and Coastal Processes;
- Volume 2, Chapter 7: Benthic Intertidal Ecology;
- Volume 2, Chapter 8: Fish and Shellfish Ecology
- Volume 2, Chapter 11: Commercial Fisheries;
- Marine Physical and Coastal Processes Modelling Technical Report (Volume 3, Appendix 6.1: Marine and Coastal Physical Processes Modelling Technical Report);
- Underwater Noise Modelling Assessment (Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment);
- Buchan Environmental Survey Report (Volume 3, Appendix 7.1: Buchan Environmental Survey Report);

- Buchan Offshore Wind Farm - Export/Inter-Array Cable Electromagnetic Fields (EMF) Assessment (EMF Assessment) (Volume 3, Appendix 8.2: Electro Magnetic Field Assessment); and
- Report to Inform Appropriate Assessment (RIAA).

### 3.1.3 Scope of This Report

3-6 This chapter addresses those matters raised through the RAEI issued by MD-LOT on 18 December 2025 and subsequent consultation undertaken during the determination process relating to Fish and Shellfish Ecology. This chapter provides targeted additional environmental information or further clarification in response to requests raised by MD-LOT, informed by NatureScot (01 October 2025) and matters discussed through subsequent consultation where relevant (including technical workshop discussions (31 March 2026) and subsequent agreement on meeting minutes received on 28 April 2026).

3-7 The request from MD-LOT was as follows:

*MD-LOT requires that the following must be submitted in consideration of the NS representation:*

- *Further assessment on the potential impacts on sandeel and herring such that clear and informed conclusions on the significance of effect can be made. Detail should be provided for mitigation that is relied upon in making conclusions of significance of effect, including how such measures will mitigate the effects and the effectiveness and degree of confidence that can be placed on such measures*
- *An updated cumulative effects assessment to identify any significant cumulative effects to fish and shellfish receptors*

*The applicant is directed to the NS representation for further details. While the NS representation indicates that the above could be resolved through conditions to consent (if granted), MD-LOT considers that this information is necessary to reaching a reasoned conclusion on the likely significant effects of the development on the environment.*

3-8 The representation from NatureScot is included in **Section 3.2**.

3-9 This chapter of the AEIR provides an updated baseline, additional assessment, clarification of assessment methodologies and supporting evidence in relation to herring and sandeel receptors, including consideration of direct temporary habitat disturbance, increases in suspended sediment concentrations (SSC) and sediment deposition, underwater noise leading to mortality, injury and behavioural effects, and long-term habitat loss, alone and cumulatively.

3-10 The additional mitigation arising from the NatureScot representation (01.10.2025) has also been considered and incorporated into this response.

3-11 The conclusions presented within this report are consistent with, and do not materially alter, the conclusions presented within the EIAR.

## **3.2 CONSULTATION AND REQUESTS FOR ADDITIONAL ENVIRONMENTAL INFORMATION**

### **3.2.1 Approach to Consultation and RAEI**

- 3-12 A summary of all consultation undertaken during the determination phase is provided in **AEIR Chapter 1: Introduction**. For detail on consultation undertaken to inform the EIAR please refer to Volume 2, Chapter 8: Fish and Shellfish Ecology.
- 3-13 In accordance with the RAEI issued by MD-LOT on 18 December 2025, this AEIR focuses on responding to the RAEI items identified by the regulator in relation to fish and shellfish ecology. These items form the primary basis of the additional information presented within this chapter.
- 3-14 Consultation matters relevant to the provision of additional environmental information for this topic are presented in a single consolidated table (**Table 3-1**). This approach ensures consistency in how consultation feedback has been captured and addressed within this AEIR.
- 3-15 All items raised during the determination period on fish and shellfish ecology by NatureScot are presented and addressed in full in **Appendix 3.1 – Consultation Log**. These matters are addressed, where relevant, through clarification, signposting to the EIAR, or provision of additional supporting information where requested by MD-LOT.

### **3.2.2 Summary of Consultation Relevant to Fish and Shellfish Ecology**

- 3-16 **Table 3-1** presents a consolidated summary of consultation issues relevant to fish and shellfish ecology. For each item, it provides a summary of the issue raised and sets out how and where the matter has been addressed within this AEIR. The RAEI from MD-LOT specifically directs to the NatureScot consultation and therefore the RAEI from MD-LOT is addressed through both the direct comments and those provided by NatureScot, as presented below (**Table 3-1**).

**Table 3-1: Summary of requests for Additional Environmental Information relevant to Fish and Shellfish Ecology and responses provided in this AEIR**

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
<b>Potential impacts on herring and sandeel</b>			
<p>MD-LOT RAEI  (informed by NatureScot representation as set out below.)</p>	<p>18.12.2025 RAEI (via email correspondence)</p>	<p>MD-LOT requires that the following must be submitted in consideration of the NS representation:</p> <ul style="list-style-type: none"> <li>• Further assessment on the potential impacts on sandeel and herring such that clear and informed conclusions on the significance of effect can be made. Detail should be provided for mitigation that is relied upon in making conclusions of significance of effect, including how such measures will mitigate the effects and the effectiveness and degree of confidence that can be placed on such measures</li> </ul>	<p>This AEIR has been prepared in response to the RAEI issued by MD-LOT on 18 December 2025.</p> <p>Additional information and assessments have been provided in relation to herring and sandeel receptors, including potential effects, mitigation measures and confidence in assessment conclusions.</p> <p>Requested information is provided throughout <b>Section 3.4.1 to Section 3.4.1</b>, including species-specific assessments for herring (<b>Section 3.6</b>) and sandeel (<b>Section 3.7</b>). Specific responses to the matters raised within the NatureScot representation, as referenced by the RAEI, are provided in the subsequent rows of this table.</p> <p><b>Table 3-4</b> and <b>Section 3.4.1</b> provide further detail on mitigation measures, including how they mitigate potential effects and the effectiveness and degree of confidence that can be placed on those measures.</p>
<b>CEA</b>			
<p>MD-LOT RAEI  (informed by NatureScot representation as set out below.)</p>	<p>18.12.2025 RAEI (via email correspondence)</p>	<ul style="list-style-type: none"> <li>• An updated cumulative effects assessment to identify any significant cumulative effects to fish and shellfish receptors.</li> </ul>	<p>Given the request for herring and sandeel species specific information and assessment, updated Cumulative Effects Assessments (CEA) are provided for herring and sandeel separately within <b>Section 3.6.6</b> and <b>Section 3.7.6</b> respectively.</p> <p>Additionally, an updated CEA is provided in <b>Section 3.9</b> for all other impacts and receptors considered within</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
			<p>the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13).</p> <p>The CEA considers the potential for cumulative effects on fish and shellfish receptors arising from the Proposed Offshore Development in combination with other relevant plans and projects within the relevant cumulative Study Areas (defined based on impact and receptor).</p>
<b>Advice from Consultees (NatureScot)</b>			
<p>MD-LOT RAEI (informed by NatureScot representation as set out below.)</p>	<p>18.12.2025 RAEI (via email correspondence)</p>	<p>The applicant is directed to the NS representation for further details. While the NS representation indicates that the above could be resolved through conditions to consent (if granted), MD-LOT considers that this information is necessary to reaching a reasoned conclusion on the significant effects of the development on the environment.</p>	<p>The additional information and assessments presented within this AEIR have been provided to address the matters identified by MD-LOT and NatureScot and to support a reasoned conclusion on the likely significant effects of the Proposed Offshore Development on fish and shellfish receptors.</p> <p>Specific responses to the individual matters raised within the NatureScot representation are provided in the subsequent rows of this table.</p>
<b>NatureScot Consultation (informing MD-LOT RAEI)</b>			
<b>General</b>			
<p>NatureScot</p>	<p>In consideration of the NatureScot representation 01.10.2025</p>	<p>The assessment for fish and shellfish ecology predicted the significance of effect to be Not Significant in EIA terms across all impact pathways, both alone and cumulatively.</p>	<p>Additional information has been provided in the form of updated baselines for herring and sandeel, respectively (<b>Section 3.6</b> and <b>Section 3.7</b>) in response to NatureScot's representation. Additionally, updated assessments are provided in this AEIR for the key areas highlighted in the RAEI and NatureScot representation including:</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
		<p>Although we broadly support most of the conclusions reached regarding significance in EIA terms, we note the following exceptions:</p> <ol style="list-style-type: none"> <li>1) We do not accept the conclusion of Not Significant for sandeel and herring for injury and behaviour changes (TTS) on the basis of the information provided.</li> <li>2) We do not consider predicted increases in SSC for herring and sandeel to be Not Significant on the basis of the information provided.</li> </ol> <p>Our interest in fish species and the conclusions being reached relate to the importance of these species as both prey species but also as fundamental building blocks in the food web chain and therefore marine ecosystem resilience. We do not consider the overall approach to assessing this receptor to be robust and identify that there are still gaps in knowledge around the impacts on fish</p>	<ol style="list-style-type: none"> <li>1) Updated underwater noise assessments for herring and sandeel both alone (<b>Section 3.6.4</b> and <b>Section 3.7.4</b>) and cumulatively with other plans and projects (<b>Section 3.6.6.3</b> and <b>Section 3.7.6.3</b>, respectively) are provided, supported by the updated baselines. Focus is on injury and TTS (behavioural changes).</li> <li>2) Updated increases in SSC and sediment deposition assessments for herring and sandeel both alone (<b>Section 3.6.3</b> and <b>Section 3.7.3</b>) and cumulatively with other plans and projects (<b>Section 3.6.6.2</b> and <b>Section 3.7.6.2</b>, respectively) are provided, supported by the updated baselines.</li> </ol> <p>Informed by additional evidence, site-specific data and habitat suitability assessments and support the conclusion that effects on fish and shellfish receptors remain Not Significant.</p> <p>Specific responses to each issue raised by NatureScot are provided in the subsequent rows of this table.</p> <p>As per NatureScot’s representation this document provides appropriate responses from <b>Section 3.3</b> onwards.</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
		<p>species from the development of a floating wind farm with a broad project envelope design.</p> <p>The advice we provide within this Appendix addresses specific elements of the assessment that we do not agree with and specifies where further work will be required to verify assessment conclusions with requirements for mitigation and monitoring.</p>	
<b>Baseline Characterisation</b>			
NatureScot	<p>In consideration of the NatureScot representation 01.10.2025</p> <p>Discussed 31.03.2026 in the fish and shellfish workshop and as per the NatureScot Post-Workshop Memo (28.04.2026)</p>	<p>Additional clarification requested regarding interpretation of baseline datasets, spawning and nursery grounds, habitat suitability and integration of site-specific survey data.</p> <p>Request for inclusion of additional references and consideration of datasets including reference to the FeAST tool and Essential Fish Habitat maps.</p>	<p>Where relevant additional information is available, this has been provided, taking into consideration the additional references identified by NatureScot and any new sources published following submission.</p> <p>Where additional information was not available (outside of that presented in the EIAR), the assessment conclusions remain robust as they are based on multiple lines of evidence including site-specific data, published datasets, habitat suitability assessments and a precautionary assessment approach.</p> <p>Additional information relating to baseline datasets, spawning and nursery grounds, habitat suitability and site-specific survey data is provided within <b>Section 3.5.1, Section 3.6.1</b> and <b>Section 3.7.1</b>, together with the relevant updated baseline tables and figures.</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
			<p>It should be noted that the FeAST tool was used within the original EIAR (e.g., EIAR Volume 2 Chapter 8: Fish and Shellfish Ecology, paragraph 8-141) and has also been used to inform the additional assessments within this AEIR and is referenced accordingly, however the limitations (limited breadth of species coverage) is noted.</p> <p>Additional emphasis has been placed on site-specific survey data, sediment information and other empirical evidence within the updated baseline characterisation. Map symbology and presentation have also been reviewed and updated throughout the chapter to improve readability and interpretation of baseline datasets, including the incorporation of spawning habitat suitability heat maps for herring (<b>Section 3.6.1.3</b> and <b>Figure 3-5</b>) and sandeel (<b>Section 3.7.1.3</b> and <b>Figure 3-13</b>) where appropriate.</p> <p>The eDNA survey data were considered within the baseline assessment (e.g., Volume 2 Chapter 8: Fish and Shellfish Ecology, paragraph 8-34), however, reference to these data was inadvertently omitted from the summary table. This has now been rectified and the eDNA data are included within <b>Table 3-5</b> of this AEIR. Additional discussion of site-specific environmental data is provided within <b>Section 3.4.1</b>.</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
<b>Figures and Visuals</b>			
NatureScot	<p>In consideration of the NatureScot representation 01.10.2025</p> <p>Discussed 31.03.2026 in the fish and shellfish workshop and as per the NatureScot Post-Workshop Memo (28.04.2026)</p>	Request for clearer presentation and interpretation of mapped datasets, including improved symbology	<p>Map symbology has been reviewed and updated throughout the chapter to improve readability, consistency and interpretation of baseline datasets.</p> <p>Updated figures are provided within the herring (<b>Section 3.6</b>) and sandeel (<b>Section 3.7</b>) assessments and include the introduction of spawning habitat suitability heat maps in line with the updated MarineSpace methodologies (MarineSpace 2013a, b) presented in Kyle-Henney <i>et al.</i>, (2024) and Reach <i>et al.</i> (2024) where appropriate.</p> <p>In addition to the figures specifically identified by NatureScot, all maps have been updated to ensure consistency of presentation throughout the chapter (<b>Section 3.4.1 to Section 3.9</b>).</p>
NatureScot	<p>In consideration of the NatureScot representation 01.10.2025</p> <p>Discussed 31.03.2026 in the fish and shellfish workshop and as per the NatureScot Post-Workshop Memo (28.04.2026)</p>	Request for simplification of fish and shellfish figures and improved readability, including clearer presentation of relative importance and spatial activity patterns	<p>Figures and visual outputs have been reviewed and updated throughout the chapter to improve readability, interpretation and consistency of presentation. This includes revised figure layouts, updated symbology, inclusion of all baseline datasets (clearly presented) and improved visualisation of species distribution, spawning grounds, nursery grounds and habitat suitability.</p> <p>Additional habitat suitability heat maps have been produced for both herring (<b>Section 3.6.1.3</b>) and sandeel (<b>Section 3.7.1.3</b>) to provide a clearer visual representation of the relative suitability of habitats within the regional Study Area and to support interpretation of the assessment conclusions.</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
<b>CIEEM Approach / Assessment Methodology</b>			
NatureScot	<p>In consideration of the NatureScot representation 01.10.2025</p> <p>Discussed 31.03.2026 in the fish and shellfish workshop and as per the NatureScot Post-Workshop Memo (28.04.2026)</p>	<p>Additional clarification requested regarding the assessment methodology including:</p> <ol style="list-style-type: none"> <li>1) assignation of VERs;</li> <li>2) application of the CIEEM approach and justification of the high level assessment conclusions for fish and shellfish receptors.</li> </ol>	<p>The following has been provided:</p> <ol style="list-style-type: none"> <li>1) The assessment methodology remains consistent with that presented within the EIAR and continues to follow the principles of the CIEEM Ecological Impact Assessment Guidelines. Valued Ecological Receptors (VERs) were selected based on ecological importance, conservation status, overlap with spawning and nursery grounds, commercial importance and sensitivity to the impacts being assessed. To provide additional clarity, <b>Section 3.3.3</b> and <b>Table 3-2</b> has been included within this AEIR to clearly identify the receptors considered within the EIAR assessment along with the basis for inclusion.</li> <li>2) The AEIR provides additional information on the CIEEM based approach, and with respect to specific receptors (herring and sandeel – see subsequent representations), provides the assessment information in a format more directly linked to the CIEEM criteria (<b>Section 3.3.1</b>).</li> </ol>
<b>Herring - Baseline Characterisation, Habitat Suitability and Impact Assessment</b>			
NatureScot	<p>In consideration of the NatureScot representation 01.10.2025</p> <p>Discussed 31.03.2026 in the fish and shellfish workshop and as per the NatureScot Post-</p>	<p>Additional clarification requested regarding herring spawning grounds, larval densities, habitat suitability and interpretation of baseline data within the Array Area and ECC</p>	<p>The updated herring baseline is provided in <b>Section 3.6.1</b>. Additional clarification and interpretation have been provided in relation to herring spawning grounds, nursery grounds, larval density data (IHLS data (2016 – 2025) which has been updated in this AEIR since the EIAR, due to more recent data being published in the public domain), habitat suitability and site specific baseline data at the Proposed Offshore Development Site.</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
	Workshop Memo (28.04.2026)		<p>The AEIR uses Coull <i>et al.</i> (1998), IHLS data, site-specific survey data and habitat suitability information together to inform the assessment. The updated baseline explains the limitations of each dataset, and clarifies how the datasets have been interpreted in combination.</p> <p>To support interpretation of herring spawning habitat suitability (<b>Section 3.6.1.3</b>), herring spawning habitat suitability heat map has been produced in accordance with Kyle-Henney <i>et al.</i> (2024) and is presented in <b>Figure 3-5</b> and also presented displaying the site specific baseline data (<b>Figure 3-6</b>). This has been used alongside the updated baseline evidence to support the assessment conclusions.</p> <p>The additional information provided within this AEIR improves transparency of the assessment process but does not alter the conclusions presented within the EIAR concluding that the likely significant effects remain Not Significant for herring receptors.</p>
NatureScot	<p>In consideration of the NatureScot representation 01.10.2025</p> <p>Discussed 31.03.2026 in the fish and shellfish workshop and as per the NatureScot Post-Workshop Memo (28.04.2026)</p>	<p>Concerns raised regarding how conclusions have been reached from potential impacts:</p> <ol style="list-style-type: none"> <li>1) SSC / deposition, linked to herring spawning specificity, spawning grounds (adults, larvae and eggs) and site specific baseline data</li> <li>2) underwater noise and the links to habitat disturbance on herring receptors based</li> </ol>	<p>Clarification on how conclusions have been reached has been provided. These are based on an updated structure within this AEIR to present all the relevant herring information in one section (<b>Section 3.6</b>) to enable the reader to consider all the relevant information together. This has been supported by an updated baseline, clear presentation of calculations and the production of additional figures, where required.</p> <ol style="list-style-type: none"> <li>1) The assessment of SSC, deposition linked to herring spawning has been bolstered through the</li> </ol>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
		<p>on the uncertainty surrounding the characterisation of the relative importance of the Proposed Offshore Development Site for herring.</p> <p>3) direct temporary habitat disturbance based on the sediment requirements during key life events e.g., spawning</p>	<p>updated herring baseline (<b>Section 3.6.1</b>) where new or updated (since submission of the EIAR) data have been incorporated into the assessment to support the conclusions reached in <b>Section 3.6.2</b> to <b>Section 3.6.5</b>.</p> <p>2) Underwater noise effects on herring receptors have been updated (<b>Section 3.6.4</b>), taking account of the update to the baseline information including the provision of spawning habitat suitability heat mapping (<b>Section 3.6.1.3</b>)</p> <p>The direct temporary habitat disturbance assessment draws on the herring spawning habitat suitability and the site specific baseline data alongside the habitat mapping and mapped spawning area data (<b>Section 3.6.2</b>).</p>
<b>Sandeel - Baseline Characterisation, Habitat Suitability and Impact Assessment</b>			
NatureScot	<p>In consideration of the NatureScot representation 01.10.2025</p> <p>Discussed 31.03.2026 in the fish and shellfish workshop and as per the NatureScot Post-Workshop Memo (28.04.2026)</p>	Additional clarification requested regarding sandeel habitat fidelity, spawning and nursery grounds and interpretation of suitable habitat	<p>The updated sandeel baseline is provided in <b>Section 3.7.1</b>. Additional clarification and interpretation have been provided in relation to sandeel habitat suitability using site specific baseline data at the Proposed Offshore Development Site.</p> <p>The AEIR uses Coull <i>et al.</i> (1998), Ellis <i>et al.</i> (2012), site-specific survey baseline data (including particle size analysis (PSA). eDNA, benthic grab and underwater imagery via drop down video (DDV) and habitat suitability information together to inform the assessment. The updated baseline explains the limitations of each dataset, including the broader spatial resolution of Ellis <i>et al.</i> (2012).</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
			<p>The assessment has considered both modelled habitat suitability information and site-specific survey data. Where site-specific PSA data were available, these data were used to provide a more detailed understanding of habitat suitability and to inform interpretation of the broader-scale modelled datasets. Additional narrative has been provided to explain how these datasets have been used together within the assessment.</p> <p>To support interpretation of sandeel spawning habitat suitability (<b>Section 3.7.1.3</b>), a sandeel spawning habitat suitability heat map has been produced in accordance with Reach <i>et al.</i> (2024) and is presented in <b>Figure 3-13</b> and also presented displaying the site specific baseline data (<b>Figure 3-14</b>) to allow further interpretation of the available data.</p> <p>The additional information provided within this AEIR improves transparency of the assessment process but does not alter the conclusions presented within the EIAR concluding that the likely significant effects remain Not Significant for sandeel receptors.</p>
NatureScot	<p>In consideration of the NatureScot representation 01.10.2025</p> <p>Discussed 31.03.2026 in the fish and shellfish</p>	<p>Concerns raised regarding how conclusions have been reached from potential impacts:</p> <ol style="list-style-type: none"> <li>1) SSC / deposition, linked to sandeel habitat specificity</li> <li>2) underwater noise and the links to habitat disturbance</li> </ol>	<p>Clarification on how conclusions have been reached has been provided. These are based on an updated structure within this AEIR to contain all the relevant sandeel information in one section (<b>Section 3.7</b>) to enable the reader to review all relevant information in one location. This has been supported by an updated</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
	workshop and as per the NatureScot Post-Workshop Memo (28.04.2026)	<p>on sandeel receptors based on their overwintering burial habits, particularly during concurrent piling</p> <p>3) direct temporary habitat disturbance based on the sediment requirements during key life events e.g., overwintering and spawning</p>	<p>narrative, clear presentation of calculations and the production of additional figures, where required.</p> <ol style="list-style-type: none"> <li>1) The assessment of SSC, deposition linked to sandeel habitat specificity been bolstered through the updated sandeel baseline (<b>Section 3.7.1</b>) where new or updated (since submission of the EIAR) data have been incorporated into the assessment to support the conclusions reached in <b>Section 3.7.2</b> to <b>Section 3.7.5</b>. Site specific baseline data has provided further information to support the conclusions reached.</li> <li>2) Underwater noise effects on sandeel receptors have been updated (<b>Section 3.7.4</b>), taking account of the update to the baseline information including the provision of spawning habitat suitability heat mapping (<b>Section 3.7.1.3</b>) and providing clearer links to other impacts e.g., direct temporary habitat disturbance (<b>Section 3.7.2</b>).</li> <li>3) The direct temporary habitat disturbance assessment (<b>Section 3.7.2</b>) draws on the sandeel spawning habitat suitability and the site specific baseline data alongside the habitat mapping and mapped spawning area data. Additional calculations are provided to determine the potential for disturbance to key sandeel habitat (<b>Table 3-9</b>).</li> </ol> <p>The additional information provided within this AEIR improves transparency of the assessment process but does not alter the conclusions presented within the EIAR concluding that the likely significant effects remain Not Significant for sandeel receptors.</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
<b>Maximum Design Scenario (MDS)</b>			
NatureScot	<p>In consideration of the NatureScot representation 01.10.2025</p> <p>Discussed 31.03.2026 in the fish and shellfish workshop and as per the NatureScot Post-Workshop Memo (28.04.2026)</p>	<p>Clarification and consideration within the context of the updated baseline characterisation discussed for herring and sandeel on the maximum design scenario propagating through to the impact assessment for herring and sandeel, including consideration of mitigation.</p> <p>This includes:</p> <ul style="list-style-type: none"> <li>• Direct temporary habitat disturbance</li> <li>• Increases in suspended sediment concentration and deposition</li> <li>• Increases in underwater noise</li> <li>• Long term habitat.</li> </ul>	<p>In order to address this point presented by NatureScot within the representation, and confirmed through a subsequent consultation workshop, the required information has been updated in the MDS table (<b>Section 3.4</b> and <b>Table 3-3</b>) including clarification of mooring chain assumptions and the derivation of impact footprints.</p> <p>The MDS has been reviewed against the assumptions presented within the EIAR and additional explanation has been provided regarding how impact areas have been calculated and applied within the fish and shellfish assessments.</p> <p>The parameters provided have been considered, along with appropriate mitigation, within the assessments within this AEIR (<b>Section 3.6</b> to <b>Section 3.9</b>) for the impacts listed, i.e.,</p> <ul style="list-style-type: none"> <li>• Direct temporary habitat disturbance</li> <li>• Increases in suspended sediment concentration and deposition</li> <li>• Increases in underwater noise</li> <li>• Long term habitat loss</li> </ul> <p>Additionally, <b>Section 3.4.1</b> provides <b>Table 3-4</b> which summarises the mitigation effectiveness and confidence for herring and sandeel.</p> <p>Additional information has also been provided regarding the calculation of potential habitat loss and overlap with spawning and nursery habitats. These updates improve transparency of the assessment</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
			<p>approach and impact footprint calculations but do not alter the overall assessment conclusions.</p> <p>In the original EIAR, mooring chain interactions were considered as part of temporary habitat disturbance during operation. Following consultation with NatureScot, this approach has been revised and mooring chain interactions are now assessed as part of the long-term habitat loss assessment.</p> <p>The additional information provided within this AEIR improves transparency of the assessment process but does not alter the conclusions presented within the EIAR concluding that the likely significant effects remain Not Significant for the fish and shellfish receptors assessed</p>
<b>Mitigation</b>			
MD-LOT / NatureScot	<p>18.12.2025 RAEI (via email correspondence)</p> <p>In consideration of the NatureScot representation 01.10.2025</p> <p>Discussed 31.03.2026 in the fish and shellfish workshop and as per the NatureScot Post-Workshop Memo (28.04.2026)</p>	<p>Embedded mitigation proposed for fish and shellfish largely constitutes consent plans.</p> <p>Request for development of a Fish Mitigation Plan (FMP), including mitigation, monitoring and sensitive scheduling considerations</p>	<p>The Applicant acknowledges that the majority of mitigation proposed constitutes consent plans. More explanation on mitigation measures, is provided in <b>Section 3.4.1. Table 3-10 (Section 3.4.1)</b> provides further detail on mitigation measures, including how they mitigate potential effects and the effectiveness and degree of confidence that can be placed on those measures.</p> <p>The Applicant is committed to the production of an FMP. <b>Section 3.10</b> provides a high level overview of the expected content. The FMP would be developed in consultation with NatureScot and MD-LOT, with a focus on herring and sandeel.</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
<b>Monitoring</b>			
MD-LOT / NatureScot	<p>18.12.2025 RAEI (via email correspondence)</p> <p>In consideration of the NatureScot representation 01.10.2025</p> <p>Discussed 31.03.2026 in the fish and shellfish workshop and as per the NatureScot Post-Workshop Memo (28.04.2026)</p>	Request for monitoring requirements relating to herring and sandeel receptors, as per the FMP	<p>The Applicant acknowledges NatureScot’s request regarding monitoring requirements for herring and sandeel receptors. This is addressed above (under Mitigation) and in <b>Section 3.10</b> and <b>Section 3.4.1</b></p> <p>The assessment presented within this AEIR does not rely upon future monitoring to conclude that effects are Not Significant. Rather, any future monitoring would be used to improve understanding of receptor responses, support adaptive management where appropriate and contribute to the wider evidence base for offshore wind developments.</p>
<b>Electromagnetic Fields (EMF) and Thermal Effects of Cables</b>			
MD-LOT / NatureScot	<p>18.12.2025 RAEI (via email correspondence)</p> <p>In consideration of the NatureScot representation 01.10.2025</p>	Request for consideration of emerging ScotMER research and clarification regarding EMF based on a poor collective understanding of EMF effects, particularly in relation to in-field measurements and potential impacts to sensitive receptors.	<p>The Applicant acknowledges NatureScot’s request regarding emerging research on EMF and thermal effects of subsea cables and is aware of ongoing ScotMER research relating to EMF effects on marine fish and shellfish receptors and will continue to review relevant evidence as it becomes available.</p> <p>The potential for contribution to relevant ScotMER research initiatives is welcomed and will be considered through development of the FMP in consultation with NatureScot and MD-LOT.</p> <p>Any new evidence published prior to final design will be reviewed and considered, where relevant, to</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
			inform cable design, installation and mitigation measures.
<b>Underwater Noise</b>			
NatureScot	<p>In consideration of the NatureScot representation 01.10.2025</p> <p>Discussed 31.03.2026 in the fish and shellfish workshop and as per the NatureScot Post-Workshop Memo (28.04.2026)</p>	Concerns raised regarding the assessment of underwater noise impacts (including concurrent piling assumptions) on herring and sandeel receptors, including the assessment of temporary threshold shift (TTS), behavioural effects, spawning and nursery receptors, assumptions regarding receptor mobility and recovery, overlap with spawning periods, and the justification for the conclusion of Not Significant effects.	<p>Further clarification has been provided regarding piling assumptions, including the maximum number of piling vessels that may operate concurrently and the assumptions used within the underwater noise assessment. These assumptions are consistent with those adopted elsewhere within the AEIR, and as per the EIAR.</p> <p>Underwater noise effects (particularly regarding injury and TTS (behavioural effects)) on herring and sandeel receptors have been updated in <b>Section 3.6.4 and Section 3.7.4</b>, respectively. This includes clarification regarding concurrent piling assumptions and the interpretation of overlap between underwater noise impact footprints and spawning and nursery habitats. The assessment has further accounted for the update to the baseline information including the provision of spawning habitat suitability heat mapping and providing clearer links to other impacts e.g., direct temporary habitat disturbance. This includes further explanation of the piling scenarios assessed, the maximum number of piling vessels assumed to operate concurrently, and the approach used to determine overlap with herring and sandeel receptors, with conclusions strengthened by the updated baseline incorporating newly available and updated data in <b>Section 3.6.1 and Section 3.7.1</b>.</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
			<p>Additional narrative has also been provided regarding the assumptions adopted within the assessment, including the use of stationary receptors as a precautionary worst-case scenario.</p> <p>The additional information provided within this AEIR improves transparency of the assessment process but does not alter the conclusions presented within the EIAR that the likely significant effects remain Not Significant for fish and shellfish receptors.</p>
<b>Particle Motion</b>			
NatureScot	In consideration of the NatureScot representation 01.10.2025	Request for consideration of emerging research relating to particle motion effects and opportunities to contribute to ScotMER research initiatives	<p>The Applicant acknowledges NatureScot’s request regarding emerging research on particle motion effects. The Applicant is aware of ongoing and emerging ScotMER research relating to particle motion and fish receptor sensitivities and will continue to review relevant evidence as it becomes available.</p> <p>The potential for contribution to relevant ScotMER research initiatives will be considered through development of the FMP (<b>Section 3.10</b>). The FMP will be drafted in consultation with NatureScot and MD-LOT.</p>
<b>UXO Clearance</b>			
NatureScot	In consideration of the NatureScot representation 01.10.2025	Clarification requested regarding underwater noise effects associated with UXO clearance activities, linked to the baseline characterisation and future assessment requirements	Underwater noise effects arising from UXO clearance were assessed within the EIAR and concluded to be Not Significant following application of the proposed mitigation hierarchy, including avoidance, relocation, micro-siting, low-order clearance techniques (e.g. deflagration) and, where necessary, high-order detonation.

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
			<p>The Applicant acknowledges that the assessment presented in the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.12.1.3 and supporting Volume 2, Appendix 8.1) uses the best available information at the time of writing and therefore the conclusion that likely significant effects are Not Significant, remains valid.</p> <p>This AEIR does not re-visit UXO clearance and reiterates that should any UXO clearance activities be required, such activities would be subject to separate assessment and licence applications informed by the detailed information available at that time.</p>
<b>Long Term Habitat Loss</b>			
NatureScot	<p>In consideration of the NatureScot representation 01.10.2025</p> <p>Discussed 31.03.2026 in the fish and shellfish workshop and as per the NatureScot Post-Workshop Memo (28.04.2026)</p>	<p>Clarification requested regarding the assessment of long-term habitat loss, including treatment of mooring chains and impacts on spawning and nursery habitats</p> <p>Additional request for clarity regarding habitat loss calculations and associated footprint assumptions</p>	<p>NatureScot requested that potential mooring chain interactions be considered as part of the long-term habitat loss assessment rather than temporary habitat disturbance.</p> <p>In response to this request, the assessment approach has been revised and mooring chain interactions are now included within the long-term habitat loss updated assessment for herring (<b>Section 3.6.5</b>), sandeel (<b>Section 3.7.5</b>) and all other fish and shellfish receptors (<b>Section 3.8</b>).</p> <p>The MDS table (<b>Table 3-3</b>) assumptions have also been updated accordingly. Additional information has also been provided regarding the calculation of habitat loss and overlap with spawning and nursery habitats,</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
			<p>where data are available in <b>Section 3.6.5</b> and <b>Section 3.7.5</b>.</p> <p>The additional information provided within this AEIR improves transparency of the assessment process but does not alter the conclusions presented within the EIAR concluding that the likely significant effects remain Not Significant for the fish and shellfish receptors.</p>
<b>Cumulative Effects Assessment</b>			
NatureScot	<p>In consideration of the NatureScot representation 01.10.2025</p> <p>Listed in the agreed workshop minutes (28.04.2026)</p>	Request for an updated CEA. Additional clarification requested regarding cumulative effects methodology, project screening approach and justification of conclusions for herring and sandeel receptors	<p>Given the request for herring and sandeel species specific information and assessment, updated Cumulative Effects Assessments (CEA) are provided for herring and sandeel separately within <b>Section 3.6.6</b> and <b>Section 3.7.6</b> respectively.</p> <p>Additionally, an updated CEA is provided in <b>Section 3.9</b> for all other impacts and receptors considered within the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13).</p> <p>The CEA considers the potential for cumulative effects on fish and shellfish receptors arising from the Proposed Offshore Development in combination with other relevant plans and projects within the relevant cumulative Study Areas (defined based on impact and receptor).</p> <p>In order to provide clarity on the plans and projects screened into the assessment, and considering the update to a number of project status', <b>Appendix 3.2</b> has been produced.</p>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
			<p>Additionally, following the workshop with NatureScot, a semi-quantitative approach was agreed whereby available information (at the time of writing) would be used in the CEA. To provide full transparency and links to where data has been sourced, <b>Appendix 3.3</b> is provided. Noting that Tier 3 plans and projects are not included due to the project status and lack of available information.</p> <p>Additional narrative has been provided to improve transparency regarding the cumulative effects assessment process, including the identification and screening of relevant developments, the assessment approach adopted and the basis for the conclusions reached. The updated assessment does not alter the overall conclusion that likely significant cumulative effects on fish and shellfish receptors are Not Significant.</p>
<b>Further advice and clarification from NatureScot</b>			
NatureScot	<p>In consideration of the NatureScot representation 01.10.2025</p> <p>Listed in the agreed workshop minutes (28.04.2026)</p>	Clarification and consideration within the context of the updated baseline characterisation discussed for herring and sandeel on the maximum design scenario propagating through to the impact assessment for herring and sandeel, including consideration of mitigation.	<p>In order to address this point presented by NatureScot within the representation, and confirmed through a subsequent consultation workshop, the required information has been updated in the MDS table (<b>Table 3-3</b>) and has been considered, along with appropriate mitigation, within the assessments within this AEIR (<b>Section 3.6</b> to <b>Section 3.9</b>) for the impacts specified, i.e.,:</p> <ul style="list-style-type: none"> <li>• Direct temporary habitat disturbance</li> </ul>

Consultee	Date / consultation Type	Summary	Relevance to this Chapter
		<p>This includes:</p> <ul style="list-style-type: none"> <li>• Direct temporary habitat disturbance</li> <li>• Increases in suspended sediment concentration and deposition</li> <li>• Increases in underwater noise</li> <li>• Long term habitat loss</li> </ul>	<ul style="list-style-type: none"> <li>• Increases in suspended sediment concentration and deposition</li> <li>• Increases in underwater noise</li> <li>• Long term habitat loss</li> </ul> <p>Additionally, <b>Section 3.4.1</b> provides <b>Table 3-4</b> which summarises the mitigation effectiveness and confidence for herring and sandeel.</p>

### 3.3 METHODOLOGY

3-17 In order to satisfy the RAEI from MD-LOT (informed by NatureScot's response) to provide additional information, specifically linked to the assessment of impacts on herring and sandeel, all information pertinent to the request is provided in stand-alone sections (**Section 3.6** and **Section 3.7** respectively) as per agreement with NatureScot during the workshop (31.03.2026) and confirmed in the workshop minutes (28.04.2026). Each section contains an updated baseline and the assessment of all relevant impacts for ease of interpretation both alone and cumulatively.

3-18 For all impacts and receptors, it is considered that the decommissioning phase effects are less than those assessed for construction (or in the case of long term habitat loss, operation) and therefore no further information is presented on decommissioning phase impacts within this AEIR. Therefore, the updated information is applicable in respect of both the construction and decommissioning phases and no likely significant effects are anticipated.

#### 3.3.1 Assessment Methodology

3-19 The methodology follows that presented in the EIAR (Volume 2 Chapter 8: Fish and Shellfish Ecology, Section 8.9), however to provide a clear, logical structure for the AEIR and support full consideration of impacts and assessment of likely significant effects, the assessment has been structured in line with CIEEM guidance (2022) providing clear headings, allowing impacts to be characterised and assessed in a stepwise manner, as follows:

- Direction of change i.e., is the effect positive or negative;
- Extent i.e., the spatial or geographical area over which the impact / effect may occur;
- Magnitude i.e., the size, amount, intensity or volume;
- Duration i.e., described in relation to ecological characteristics;
- Frequency and timing i.e., the number of times an activity will influence the resulting effect; and
- Reversibility i.e., is the effect reversible and recovery possible.

3-20 This enables justification of the conclusions provided in the EIAR to be linked more closely to the assessment and the baseline within this AEIR, as per MD-LOT and NatureScot request.

3-21 Where information is available, the FeAST tool (NatureScot, 2025a) which provides information on the sensitivity of select Scottish marine features of conservation importance, has been used. The Applicant is aware of current limitations, with only select features currently part of the tool. Where possible and relevant, the tool is used in the assessments, noting that for this AEIR the tool only provides information on sandeel. Where relevant marine features are not provided for in the tool, other data sources have been used as detailed in the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.7.10).

### 3.3.2 CEA

- 3-22 In order to satisfy the RAEI from MD-LOT (including NatureScot's response) to provide an updated Cumulative Effects Assessment (CEA), this section, along with **Section 3.9** provides the requested information.
- 3-23 The CEA methodology remains the same as presented in the EIAR (EIAR Volume 2 Chapter 8: Fish and Shellfish Ecology, Section 8.13). The cumulative assessment Study Area remains as per that presented in the EIAR (as presented in **Section 3.9, Figure 3-17**). The list of developments considered within the CEA for fish and shellfish (**Appendix 3.2**) has been updated following consultation with NatureScot and including any change to project tier since the original EIA application submission.
- 3-24 The plans and projects are assigned Tiers based on their stage of development, as per the EIAR, (EIAR Volume 2 Chapter 8: Fish and Shellfish Ecology, Section 8.13.1).
- 3-25 There are no operational OWF which are within the cumulative assessment Study Area that may overlap with construction activities for the Proposed Offshore Development.
- 3-26 **Appendix 3.3 (List of other Tier 2 Plans and Projects MDS and Impact Assessment Conclusions)** provides a summary of the assessments of other plans and projects, where available. These data are used to support the CEA for the Proposed Offshore Development, and where possible support the assessment quantitatively. Tier 3 projects have not been included in this list as detailed information is not published for these projects; however they are included in the assessment in a qualitative manner. Projects without sufficient published data to confirm their construction and operational dates are assumed to have a temporal overlap with the Proposed Offshore Development.

### 3.3.3 Valued Ecological Receptors (VERs)

- 3-27 This section addresses the RAEI consultation response issued by MD-LOT in consultation with NatureScot (01.10.2025) relating to the VER approach (refer to **Table 3-1**) and the provision of additional clarity in how the VERs were selected for each assessment (presented in **Table 3-2**).
- 3-28 The number of fish and shellfish species present within the study area is extensive, and therefore it is impractical to assess each individual species. As such, VER approach has been adopted as outlined in the CIEEM guidance (2022) to ensure the most important ecological features (i.e., species) are assessed. CIEEM methodology does not prescribe a detailed criteria for defining a VER, rather they are identified by considering:
- Value/importance - is the receptor important in a biodiversity or conservation context, i.e. critical prey resource, or a feature of designated sites;
  - Sensitivity to change - is the receptor vulnerable to the type of impact;
  - Magnitude and likelihood of impact - Even a valued receptor may not be a VER if it will not be affected, or effects are negligible. Conversely, a moderately valued feature may become a VER if the potential for impact magnitude is high; and

- Stakeholder and professional judgement – A moderately valued receptor may become a VER if it is prioritised by key stakeholders for its value to a particular sector or specific ecological function.
- 3-29 The selection of the VERs for the Proposed Offshore Development considered the above factors and utilised professional judgement to refine the final list, noting that the assessment should remain targeted to where likely significant effects may arise.
- 3-30 Through the process, it is accepted that different species will be sensitive to different potential impacts arising from the construction, O&M and decommissioning of the Proposed Offshore Development. Therefore, receptor groups have been identified within the assessment for each potential impact based on their biological traits, and their sensitivity to that impact, rather than assessing fixed groups of species throughout. Through identification of receptor groups, it is considered that all fish species that might be affected by the Proposed Offshore Development, even if not detailed in the VERs list, are appropriately assessed, as the groups identified for assessment of each impact are representative of any fish or shellfish species that may be present.
- 3-31 The complete list of VERs considered for each impact assessed within the EIA for Fish and Shellfish Ecology, is provided below (**Table 3-2**). This table has been produced to supplement the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.7.6, and provide additional clarity on the selection process for the VERs.

**Table 3-2 Valued Ecological Receptors used in the Fish and Shellfish Ecology assessment**

Impact	Receptor Group	VERs
Direct temporary habitat disturbance	Mobile fish with spawning and nursery grounds overlapping the Proposed Offshore Development Site	Herring Sandeel Other marine fish - anglerfish, blue whiting, cod, European hake, haddock, lemon sole, ling, mackerel, Norway pout, plaice, saithe, spotted ray, sprat, spurdog, tope shark and whiting
	Mobile fish and squid with no spawning and nursery grounds (including migratory species) overlapping the Proposed Offshore Development Site	Elasmobranchs: common skate; thornback ray Migratory diadromous species: Atlantic salmon, European eel, river lamprey, sea lamprey, sea trout, Squid
	Shellfish present within the Proposed Offshore Development Site	Scallops Crabs (velvet and edible) and lobsters <i>Nephrops</i>
Increases in Suspended Sediment Concentrations (SSC) and deposition	<p>Mobile fish with spawning and nursery grounds overlapping the local Study Area</p> <p><i>Note that that in the EIAR, the receptor group was labelled as 'Mobile fish with spawning and nursery grounds overlapping the Proposed Offshore Development Area' due to a typo. The EIAR correctly assessed potential impacts within the local Study Area.</i></p>	Herring Sandeel Other marine fish - anglerfish, blue whiting, cod, common skate, European hake, haddock, lemon sole, ling, mackerel, Norway pout, plaice, saithe, spotted ray, sprat, spurdog, thornback ray, tope shark and whiting
	<p>Mobile fish and squid with no spawning and nursery grounds (including migratory species) overlapping the local Study Area</p> <p><i>Note that that in the EIAR, the receptor group was ' Mobile fish and squid with no spawning and nursery grounds (including migratory species) overlapping the 'Proposed Offshore Development Area'. The section correctly assesses potential impacts within the local Study Area.</i></p>	Migratory diadromous species: Atlantic salmon, European eel, river lamprey, sea lamprey, sea trout, Squid

Impact	Receptor Group	VERs
	Shellfish present within the local Study Area  <i>Note that that in the EIAR, the receptor group was 'Shellfish present within the 'Proposed Offshore Development Area' 'The section correctly assesses potential impacts within the local Study Area.</i>	Scallops Crabs (velvet and edible) and lobsters <i>Nephrops</i>
Increases in underwater noise leading to mortality, injury, or behavioural effects	Hearing Group 1 (Popper <i>et al.</i> , 2014) (i.e., fishes with no swim bladder or other gas chamber)	Sandeel, lemon sole, dab, plaice, mackerel, elasmobranchs, river and sea lamprey
	Hearing Group 2 (Popper <i>et al.</i> , 2014) (i.e., fishes with swim bladders in which hearing does not involve the swim bladder or other gas volume)	Salmonids (Atlantic salmon and sea trout)
	Hearing Group 3 (Popper <i>et al.</i> , 2014) (i.e., fishes in which hearing involves a swim bladder or other gas volume)	Herring, sprat, cod, ling, hake, whiting, haddock, horse mackerel and anglerfish
	Eggs and Larvae	Eggs and larvae have the same mortality and potential mortal injury criteria as Group 2 fish
	Shellfish and Squid	Scallops Crabs (velvet and edible) and lobsters <i>Nephrops</i> Squid
Long term habitat loss	Mobile fish with spawning and nursery grounds overlapping the Proposed Offshore Development Site	Herring Sandeel Other marine fish - anglerfish, blue whiting, cod, European hake, haddock, lemon sole, ling, mackerel, Norway pout, plaice, saithe, spotted ray, sprat, spurdog, tope shark and whiting
	Mobile fish and squid with no spawning and nursery grounds (including migratory species) overlapping the Proposed Offshore Development Site	Elasmobranchs: common skate; thornback ray Migratory diadromous species: Atlantic salmon, European eel, river lamprey, sea lamprey, sea trout, Squid
	Shellfish present within the Proposed Offshore Development Site	Scallops Crabs (velvet and edible) and lobsters

Impact	Receptor Group	VERs
		<i>Nephrops</i>
Colonisation of structures/infrastructure and increases in local biodiversity	Mobile marine fish present at the Proposed Offshore Development Site	Herring Sandeel Other marine fish - anglerfish, blue whiting, cod, common skate, European hake, haddock, lemon sole, ling, mackerel, Norway pout, plaice, saithe, spotted ray, sprat, spurdog, thornback ray, tope shark and whiting Migratory diadromous species: including Atlantic salmon, European eel, river lamprey, sea lamprey, sea trout Squid
	Shellfish present within the Proposed Offshore Development Site.	Scallops Crabs (velvet and edible) and lobsters <i>Nephrops</i>
EMF and thermal effects of cables	Electrosensitive species present within the Proposed Offshore Development Site	Elasmobranchs: blonde ray; common skate; cuckoo ray; lesser spotted dogfish; nursehound; sandy ray; smoothhound; spotted ray; starry ray; spurdog; thornback ray; and tope shark. Migratory diadromous species: including Atlantic salmon, European eel, river lamprey, sea lamprey, sea trout
	Shellfish present within the Proposed Offshore Development Site	Scallops Crabs (velvet and edible) and lobsters <i>Nephrops</i>
	Other marine fish present within the Proposed Offshore Development Site.	Anglerfish, blue whiting, cod, European hake, haddock, herring, lemon sole, ling, mackerel, Norway pout, plaice, sandeel, saithe, sprat, squid and whiting
Secondary entanglement (e.g. within discarded fishing gear)		All species

### **3.4 MAXIMUM DESIGN SCENARIO**

- 3-32 In response to the RAEI from MD-LOT (informed by NatureScot's representation) further information on the MDS is provided (**Table 3-3**).
- 3-33 The table has been expanded with more detail provided to reflect only the elements highlighted in the RAEI from MD-LOT (informed by NatureScot's representation), namely:
- direct temporary habitat disturbance;
  - increases in SSC and deposition;
  - increases in underwater noise; and
  - long term habitat loss.
- 3-34 This updated table accounts for the inclusion of the footprints associated with mooring chains to long term habitat loss (noting, this was originally assessed as temporary habitat disturbance during operation) and provides a clearer breakdown of the MDS values and how these were calculated, in line with the RAEI from MD-LOT (informed by NatureScot's representation).
- 3-35 The MDS for the impacts which do not feature in this table remain the same as in the EIAR: Volume 2 Chapter 8: Fish and Shellfish Ecology, namely:
- colonisation of structures / infrastructure and increases in local biodiversity;
  - EMF and thermal effects of cables; and
  - secondary entanglement (e.g., within discarded fishing gear).
- 3-36 This table should be read alongside EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Table 8-12 to build on the existing information.

**Table 3-3 Maximum Design Scenarios considered for impacts on Fish and Shellfish Ecology (ticked items are scoped in)**

Likely Significant Impact	Phase <sup>1</sup>			Maximum Design Scenario	Justification
	C	O	D		
Direct temporary habitat disturbance	✓	✓	✓	<p><b>Construction</b></p> <p><b>Inter-array cable</b> Inter-array cable lay total length is 210,000 m. Working width is 10 m. Total area for inter-array cabling is 210,000 m x 10 m = <b>2,100,000 m<sup>2</sup></b>.</p> <p><b>Export cable</b> 3 x Export Cable (86,500 m) = 259,500 m Edge of option area to each of the Offshore Substation Platform (OSPs) (up to three) = 15,000 m + 20,000 m + 30,000 m = 65,000 m Export interconnector cable to each of the three substations = 10,000 m + 10,000 m + 20,000 m = 40,000 m</p> <p>Total length of cable = 259,500 m + 65,000 m + 40,000 m = 364,500 m Working width is 10 m. Total area is 364,500 m x 10 m = 3,645,000 m<sup>2</sup></p> <p>Joint pit area = (30 m x 17.5 m) + (50 m x 17.5 m) Total joint pit area is 1,400 m<sup>2</sup> (allowing for sufficient tolerances noting this provides far larger area than that provided in the PD (EIAR Volume 2, Chapter 4 – Project Description)).</p> <p>Total area for export cable with joint pit is <b>3,646,400 m</b></p>	<p>The impact of temporary habitat disturbance can arise from cable trenching, sand wave clearance, drag embedment anchor installation and JUVs. Construction is the assumed worse case and all temporary habitat disturbance encountered during O&amp;M and Decommissioning will be less than that calculated for construction.</p> <p>The total area is calculated based on the largest area of impact.</p>

<sup>1</sup> C = Construction, O = Operation and maintenance, D = Decommissioning

Likely Significant Impact	Phase <sup>1</sup>			Maximum Design Scenario	Justification
	C	O	D		
				<p><b>Sandwave clearance</b> Sandwave clearance using jetting tool (between KP 24.8 and KP 26.3) equates to 1,500 m The maximum width of 36.2 m, therefore the estimated area is <math>1,500 \times 36.2 = 54,300 \text{ m}^2</math></p> <p><b>Anchor placement</b> Anchor Placement (drag embedment) for a distance of 75 m per anchor (of which there are nine on each of the 70 = 630).</p> <p>Each anchor assumed to be 6 m x 6 m x 6 m. Therefore, the total length for one anchor is <math>75 \text{ m} + 6 \text{ m} = 81 \text{ m}</math> x anchor width of 6 m Equating to an area of <math>486 \text{ m}^2</math> per anchor Totalling <b>306,180 m<sup>2</sup></b> for all 630 anchors.</p> <p>However, there is potential for reaction anchors to be used doubling the value giving a maximum disturbance area of <b>612,360 m<sup>2</sup></b>.</p> <p>Therefore, the worst case for direct temporary habitat disturbance is: <b><math>2,100,000 \text{ m}^2 + 3,646,400 \text{ m}^2 + 54,300 \text{ m}^2 + 612,360 \text{ m}^2</math></b> <b><math>= 6,413,060 \text{ m}^2</math> (6.413 km<sup>2</sup>)</b></p> <p><b>Total temporary habitat disturbance is = 6,413,060 m<sup>2</sup> (6.413 km<sup>2</sup>)</b></p>	
Increases in Suspended Sediment Concentrations (SSC) and deposition	✓	✓	✓	<p><b>Construction</b> The worst-case values for increases in SSC and modelling are defined as follows:</p> <ul style="list-style-type: none"> <li>• Maximum distance = 15 km (south easterly direction)</li> <li>• Maximum SSC = up to 270 mg/l rapidly declining after 7 days</li> </ul>	The maximum values have been used from the three modelled scenarios (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes), irrespective of scenario and therefore location.

Likely Significant Impact	Phase <sup>1</sup>			Maximum Design Scenario	Justification														
	C	O	D																
				<ul style="list-style-type: none"> <li>Maximum level of deposition estimated = 12 cm</li> <li>Maximum duration = 12 days</li> </ul> (see EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes and EIAR Volume 3, Appendix 6.1: Marine and Coastal Processes Modelling Technical Report)	This provides a worst case irrespective of location or activity.  Maximum distance sediment transported enables the local Study Area to be defined.														
Increases in underwater noise leading to mortality, injury, or behavioural effects	✓	✓	✓	<p><b>Maximum areas of impact for concurrent piling</b>            The maximum areas of impact for noise are provided in <b>Table a</b> below (information taken from the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology).</p> <p><b>Table a: Maximum impact areas (km<sup>2</sup>) for all hearing groups for concurrent piling (Unweighted SEL<sub>cum</sub>)</b></p> <table border="1"> <thead> <tr> <th>Hearing Group</th> <th>Mortality</th> <th>Recoverable Injury</th> <th>TTS / Behavioural</th> </tr> </thead> <tbody> <tr> <td>Group 1</td> <td>6.8</td> <td>17</td> <td rowspan="3">21,000</td> </tr> <tr> <td>Group 2</td> <td>130</td> <td>1,500</td> </tr> <tr> <td>Group 3</td> <td>370</td> <td>1,500</td> </tr> </tbody> </table> <p>The MDS for each of the different piling scenarios are provided below for context:</p> <p><b>WTG Anchor Piling</b>            Up to nine anchors (on mooring lines) for up to 70 floating turbines (totalling 630 piles)</p> <p>Maximum pile length is 54 m and maximum penetrating depth of the seabed is 45 m.</p> <p>Maximum pile diameter is 4.5 m.            Maximum hammer energy up to 1,800 kJ (100%).</p>	Hearing Group	Mortality	Recoverable Injury	TTS / Behavioural	Group 1	6.8	17	21,000	Group 2	130	1,500	Group 3	370	1,500	Noise impact areas and ranges allow the local Study Area to be defined. The maximum areas are used in the assessment are derived from the worst-case scenario outputs, for stationary fish, enabling a precautionary approach to assessment.  The maximum design scenario includes all activities with the potential to create underwater noise.
Hearing Group	Mortality	Recoverable Injury	TTS / Behavioural																
Group 1	6.8	17	21,000																
Group 2	130	1,500																	
Group 3	370	1,500																	

Likely Significant Impact	Phase <sup>1</sup>			Maximum Design Scenario	Justification
	C	O	D		
				<p>One pile installed in approximately 30 hours with 25.5 hours between two pile driving for a single vessel. Up to three vessels working in parallel at any one time.</p> <p>Driven pile installation will use a maximum of two vessels, a construction vessel with AHC crane (one or two) and one or two guard vessels. Work will be undertaken 24/7.</p> <p><b><u>OSPs</u></b> Maximum of three OSFs within the Proposed Offshore Development Site. 4 legged jacket base with 12 piles, maximum pile diameter 3.4 m, pile length 68 m (5 m pile stick up once installed). Maximum hammer energy 4400 kJ. Installed via impact driving with no interruptions. Total driving time is 1920 minutes.</p> <p><b><u>IRC</u></b> One IRC platform along the export cable corridor, between the OSP(s) and the onshore grid connection point. 4 legged jacket base with 12 piles, maximum pile diameter 3.4 m, pile length 45 m (5 m pile stick up once installed). Maximum hammer energy 4400kJ. Installed via impact driving with no interruptions. Total driving time is 1920 minutes.</p> <p>Unexploded Ordnance (UXO) Clearance during construction UXO clearance will favour low ordination deflagration over high order detonation.</p>	

Likely Significant Impact	Phase <sup>1</sup>			Maximum Design Scenario	Justification
	C	O	D		
				<p>Maximum are of impact ranges from &lt;50 m to 550 m for mortality and 60 m to 910 m for mortal injury (arising from high-order detonation).</p> <p>Construction is expected to take up to six years (EIAR Volume 2, Chapter 4: Project Description).</p>	
Long term habitat loss	χ	✓	✓	<p><b>Mooring Systems</b> Suction Pile Anchors maximum area of seabed take plus scour protection per WTG is 6,840 m<sup>2</sup>. Total for all WTGs is 6,840 m<sup>2</sup> x 70 = 478,800 m<sup>2</sup> <b>Maximum area of seabed take is 478,800 m<sup>2</sup>.</b></p> <p><b>Mooring chains</b> 50 m of forerunner segment at 161 mm (0.161 m) diameter for 9 mooring lines at 70 WTGs, results in a maximum area of 0.161 m x 50 m = 8.05 m<sup>2</sup> for one mooring line. Total for all mooring lines = 8.05 m<sup>2</sup> x (70 x 9) = 5,071.5 m<sup>2</sup></p> <p>Additionally, up to 800 m x 1 m of the mooring line could be intermittently in contact with the seabed = 800 m x 1 m = 800 m<sup>2</sup> per mooring line Totalling 800 m x (70 x 9) = 504,000 m<sup>2</sup> for all mooring lines</p> <p><b>Maximum area of seabed take is 5,071.5 m<sup>2</sup> + 504,000 m<sup>2</sup> = 509,071.5 m<sup>2</sup>.</b></p> <p><b>OSP and IRC Foundations</b></p>	<p>Long term habitat loss during operation is assumed to present the worst case across the Proposed Offshore Development phases.</p> <p>Calculated based on the largest area of effect. For WTG mooring systems, suction pile anchors represent the worst case as this will result in the largest area of seabed take.</p> <p>The greatest amount of cable protection (export cable and inter-array cable (including substation inter-connectors)) and the maximum number of sub-structures assuming three OSPs, one IRC and 630 anchors and mooring lines.</p> <p>For OSP and IRC foundations, suction bucket jackets represent the worst case as these foundations result in the largest area of seabed take.</p>

Likely Significant Impact	Phase <sup>1</sup>			Maximum Design Scenario	Justification
	C	O	D		
				<p>Suction bucket jackets – maximum area of seabed take plus scour protection per OSP is 27,800 m<sup>2</sup>.  For three OSPs is 27,800 m<sup>2</sup> x 3 = 83,400 m<sup>2</sup>.  Maximum area of seabed take (plus scour protection) for one IRC is 34,000 m<sup>2</sup>.  Totalling 83,400 m<sup>2</sup> + 34,000 m<sup>2</sup> = 117,400 m<sup>2</sup>  <b>Maximum area of seabed take is 117,400 m<sup>2</sup></b></p> <p><b><u>Export Cable Protection (including crossings)</u></b>  Total cable protection volume is 773,378 m<sup>3</sup>.  Maximum berm height is 1.8 m.  Area of seabed is 773,378 m<sup>3</sup> / 1.8 m = 429,654.4 m<sup>2</sup>  <b>Maximum area of seabed take is 429,654.4 m<sup>2</sup></b></p> <p><b><u>Inter Array Cable (IAC) Protection (including crossings)</u></b>  Total cable protection volume for the inflection berm is 20,720 m<sup>3</sup> and for the IACs is 199,500 m<sup>3</sup>.  The total volume of cable protection is 220,220 m<sup>3</sup>.  Maximum inflection berm height is 1.5m.  Area of seabed is 220,220 m<sup>3</sup> / 1.5 m = 146,813.3 m<sup>2</sup>  <b>Maximum area of seabed take is 146,813.3 m<sup>2</sup></b></p> <p>The total area of long term habitat loss (including the consideration of mooring line movement in long term habitat loss) is:  <b>478,800 m<sup>2</sup> + 509,071.5 m<sup>2</sup> + 117,400 m<sup>2</sup> + 429,654 m<sup>2</sup> + 146,813.3 m<sup>2</sup> = 1,681,739 m<sup>2</sup> (1.68) km<sup>2</sup>.</b></p>	Mooring chains are considered for long term habitat loss.

### 3.4.1 Mitigation Effectiveness and Confidence for Herring and Sandeel Receptors

- 3-37 **Table 3-4**, provides a summary of the mitigation proposed and its expected effectiveness relative to each of the impacts assessed in **Section 3.6** and **Section 3.7**.
- 3-38 The expected effectiveness and confidence are assigned based on professional judgement relative scale of low, moderate / medium and high.
- 3-39 Mitigation commitments considered for fish and shellfish ecology were presented in the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, and EIAR Volume 3, Appendix 1.1: Commitments and Mitigation Register) and include:
- EM 4 – Micrositing of infrastructure
  - EM 9 – Cable Plan (CaP) provide additional mitigation measures such as burial depths and requirements for additional rock protection.
  - EM 12 - Piling Strategy (PS) provides additional mitigation for noise
  - EM13 - Use of low order deflagration where possible, should UXO clearance be required.
- 3-40 As requested in the RAEI by MD-LOT (18.12.2025), informed by NatureScot’s representation (01.10.2025), the following mitigation commitment has been made in addition to those presented in EIAR:
- AEM 57 – development and adherence to an FMP arising out of this AEIR process.

**Table 3-4 Herring and sandeel mitigation effectiveness and confidence**

Impact	Mitigation measure	Mechanism	Evidence base	Expected effectiveness	Confidence
Direct temporary habitat disturbance	<ul style="list-style-type: none"> <li>EM4 - Infrastructure will be micro-sited, where practicable, around any sensitive seabed habitats including Annex I habitat and PMF species.</li> <li>EM 5 - Development of and adherence to an Environmental Management Plan (EMP).</li> <li>AEM57 - Development and adherence to an FMP.</li> </ul>	Reduce the disturbance to important fish and shellfish habitat and processes, minimising any potential effects	Project design parameters	High	High
Increases in SSC and sediment deposition	<ul style="list-style-type: none"> <li>EM4 - Infrastructure will be micro-sited, where practicable, around any sensitive seabed habitats including Annex I habitat and PMF species.</li> <li>EM 9 - Development of and adherence to a Cable Plan (CaP).</li> <li>AEM57 Development and adherence to an FMP.</li> </ul>	Reduce the potential effect increases in SSC and sediment deposition could have on sensitive spawning habitats and periods	Literature, site specific modelling and baseline monitoring evidence	High	Medium/High
Increases in underwater noise leading to behavioural effects, injury or mortality.	<ul style="list-style-type: none"> <li>EM12 - Development of and adherence to a PS (or equivalent, after consultation with stakeholders) (including details on soft-start and ramp up procedures for piling).</li> </ul>	Reduce exposure of fish to underwater noise, particularly during key periods such as spawning	Literature and published research, site specific modelling and baseline monitoring evidence (i.e., to determine presence / absence and / or suitable habitat)	Moderate	Medium

Impact	Mitigation measure	Mechanism	Evidence base	Expected effectiveness	Confidence
	<ul style="list-style-type: none"> <li>EM13 - Use of appropriate clearance methods, should UXO clearance be required.</li> <li>AEM57 - Development and adherence to an FMP.</li> </ul>				
Long term habitat loss	<ul style="list-style-type: none"> <li>EM9 - Development of and adherence to a CaP.</li> <li>AEM57- Development and adherence to an FMP.</li> </ul>	Reduce the loss of important fish and shellfish habitat and ensure any other mitigation is considered through an FMP.	Project design parameters	High	High
Cumulative effects	<ul style="list-style-type: none"> <li>As above for individual impacts alongside adaptive management</li> </ul>	Detect and respond	Monitoring framework	Moderate	Medium

### 3.5 GENERAL BASELINE CHARACTERISATION

- 3-41 In line with the RAEI from MD-LOT (including NatureScot’s response), the Applicant is providing this section to build on the baseline characterisation presented in the EIAR, Volume 2 Chapter 8 – Fish and Shellfish Ecology. This updated baseline enables additional detail to address the request including the incorporation of additional references and data, including the International Herring Larvae Survey (IHLS) 2025 data, which has been used to inform this AEIR (Section 3.6.1).
- 3-42 The majority of the Array Area is comprised silty sand and the offshore section of the ECC (between KP 50 and the Array Area) is distributed with silty sands and gravelly silty sands. As the ECC approaches the shoreline, the distribution of gravelly sediment increases (gravelly sand to sandy gravel) and within three kilometres of the landfall the sediments are largely categorised as sand (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes).
- 3-43 The seabed along the ECC predominantly comprises sand and gravel with areas of bedrock in the closest nearshore and generally silty sand moving further offshore. The Array Area predominantly comprises gravelly silty sand and silty sand in the south and silty sand in the north. Mobile sediments are noted across the ECC in the form of ripples, megaripples and sandwaves (EIAR Volume 1, Chapter 4: Project Description).
- 3-44 The Proposed Offshore Development Site and the regional Study Area (as defined in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.5 (as allowing the Proposed Offshore Development Site to be put in context with the fish ecology of the wider area, selected to capture relevant migratory routes of species such as Atlantic salmon and other diadromous species, and to incorporate regionally important commercial species)) provide habitat for many fish and shellfish species found within the North Sea. Franco *et al.* (2022) developed essential fish habitat maps for fish and shellfish species in Scotland which demonstrate potential for presence (both high and low confidence) of:
- lesser sandeel (*Ammodytes marinus*),
  - Norway lobster (*Nephrops*) (*Nephrops norvegicus*);
  - herring (*Clupea harengus*),
  - plaice (*Pleuronectes platessa*),
  - lemon sole (*Microstomus kitt*),
  - common sole (*Solea solea*),
  - anglerfish (*Lophius piscatorius*),
  - whiting (*Merlangius merlangus*),
  - cod (*Gadus morhua*),
  - haddock (*Melanogrammus aeglefinus*),
  - Norway pout (*Trisopterus esmarkii*),

- blue whiting (*Micromesistius poutassou*),
- hake (*Merluccius merluccius*),
- sprat (*Sprattus sprattus*),
- mackerel (*Scomber scombrus*) and
- squid (*Loligo forbesii*)

in the regional Study Area, and

- Nephrops,
- herring,
- sole,
- anglerfish,
- whiting,
- cod,
- haddock,
- Norway pout,
- hake,
- sprat

3-45 Within the local Study Area (as defined in the EIAR Volume 2 Chapter 8: Fish and Shellfish Ecology, Section 8.5 (designed to capture the extent of Proposed Offshore Development specific, direct impacts (e.g., SSC) and delineate the overlap with fish and shellfish ecology receptors)). These data do have restrictions due to the geographical coverage i.e., only inshore data is available for some species, however these remain useful in this context.

3-46 These information sources have been considered in addition to the evidence presented in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.7 (where they were originally not presented) to strengthen the assessments, providing confidence in assessment conclusions.

### **3.5.1 Species Present at the Proposed Offshore Development Site**

3-47 This section provides an update to the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.7.1.1) through the provision of additional information. Noting that this does not change the overarching conclusions reached within the EIAR i.e., the impacts from the Proposed Offshore Development are predicted not to result in likely significant effects on the fish and shellfish receptors.

3-48 A benthic baseline survey was undertaken to characterise the subtidal environment (EIAR Volume 3, Appendix 7.1: Buchan Environmental Survey Report). As part of the survey campaign, water sampling for environmental DNA (eDNA) was carried out which allowed identification of

fish and shellfish species present. Fish and shellfish identified during the drop-down video (DDV) campaign were also noted (Table 3-5). A total of 42 species were identified, comprising 39 finfish and three shellfish species.

- 3-49 The results of the eDNA survey detected 34 different taxa across the samples. Herring and whiting were the most frequently occurring taxa, present in 97% of all water samples (with the majority identified within bottom and mid water samples) and sandeel occurred in 14% of the samples (with the majority identified within the top water samples).
- 3-50 The videos also recorded monkfish (*Lophius* sp.) and sandeel. Monkfish was identified from drop down video footage recorded approximately halfway along the ECC and approximately 6 km from landfall. Monkfish are included in the UK Biodiversity Action Plan (UK BAP) for deep water fish, as well as being a PMF in Scottish waters.

**Table 3-5 All fish and shellfish identified during site-specific survey work**

Common Name	Species	Survey
<b>FINFISH</b>		
American plaice	<i>Hippoglossoides platessoides</i>	eDNA
Anglerfish	<i>Lophius piscatorius</i>	eDNA DDV
Atlantic cod	<i>Gadus morhua</i>	eDNA
Atlantic herring	<i>Clupea harengus</i>	eDNA
Atlantic mackerel	<i>Scomber scombrus</i>	eDNA
Clingfish	<i>Gobiesocidae</i> sp.	DDV
Common dab	<i>Limanda limanda</i>	eDNA Benthic grab
Common dragonet	<i>Callionymus lyra</i>	eDNA
Common ling	<i>Molva molva</i>	eDNA
Crystal goby	<i>Crystallogobius linearis</i>	eDNA
Dragonet	<i>Callionymus</i> sp.	DDV
European plaice	<i>Pleuronectes platessa</i>	eDNA DDV
European sprat	<i>Sprattus sprattus</i>	eDNA
Fivebeard rockling	<i>Ciliata mustela</i>	eDNA
Flatfish	Pleuronectiformes	DDV
Fourbeard rockling	<i>Enchelyopus cimbrius</i>	eDNA
Goby	<i>Gobiidae</i> sp.	DDV Benthic grab
Haddock	<i>Melanogrammus aeglefinus</i>	eDNA
Hooknose	<i>Agonus cataphractus</i>	eDNA
Lemon sole	<i>Microstomus kitt</i>	eDNA
Lesser sandeel	<i>Ammodytes tobianus</i>	eDNA DDV Benthic grab
Long-spined bullhead	<i>Taurulus bubalis</i>	eDNA
Northern rockling	<i>Ciliata septentrionalis</i>	eDNA
Norwegian topknot	<i>Phrynorhombus norvegicus</i>	eDNA

Common Name	Species	Survey
Norway pout	<i>Trisopterus esmarkii</i>	eDNA
Pollack	<i>Pollachius pollachius</i>	eDNA
Poor cod	<i>Trisopterus minutus</i>	eDNA
Rock gunnel	<i>Pholis gunnellus</i>	eDNA
Saithe	<i>Pollachius virens</i>	eDNA
Sand goby	<i>Pomatoschistus minutus</i>	eDNA
Sculpin (Bullhead)	<i>Cottidae</i> sp.	DDV
Shorthorn sculpin / Bull rout	<i>Myoxocephalus scorpius</i>	eDNA
Smooth blenny / shanny	<i>Lipophrys pholis</i>	eDNA
Spotted dragonet	<i>Callionymus maculatus</i>	eDNA
Thickback sole	<i>Microchirus variegatus</i>	eDNA
Three-spined stickleback	<i>Gasterosteus aculeatus</i>	eDNA
Turbot	<i>Scophthalmus maximus</i>	eDNA
Whiting	<i>Merlangius merlangus</i>	eDNA
Witch flounder	<i>Glyptocephalus cynoglossus</i>	eDNA
<b>SHELLFISH</b>		
King scallop	<i>Pecten maximus</i>	DDV
Queen scallop	<i>Aequipecten opercularis</i>	Benthic grab
Norway lobster ( <i>Nephrops</i> )	<i>Nephrops norvegicus</i>	DDV

3-51 Several other shellfish including shrimp, crabs, hermit crabs, clams and squat lobsters were reported in the environmental report (EIAR Volume 3, Appendix 7.1: Buchan Environmental Survey Report); these are assessed in EIAR Volume 2, Chapter 7: Benthic Intertidal Ecology as benthic receptors.

### 3.6 HERRING

3-52 This section provides an updated baseline and the assessment for herring, in response to the RAEI issued by MD-LOT, following the advice of NatureScot. An updated baseline is provided to support the robust assessment conclusions and does not alter any of the conclusions presented in the EIAR for herring i.e., effects are Not Significant for fish and shellfish for all impacts.

#### 3.6.1 Baseline

3-53 The Proposed Offshore Development Site (total area of 416 km<sup>2</sup>) is located in International Council for the Exploration of the Sea (ICES) fishing area IVa, with the regional Study Area overlapping both area IVa and IVb.

3-54 Herring form discrete stocks around the UK, with the Orkney / Shetland (north of the Proposed Offshore Development Site) and Buchan (hugging the coastline around Aberdeenshire) (both autumn spawning) stocks of relevance to the Proposed Offshore Development (**Figure 3-1**).

3-55 The North Sea herring stocks exhibit temporal fluctuations in recruitment, characterised by periods of both recruitment failure and depression (depleting the stocks) and high recruitment (increasing stock levels) (Corten, 2013). Herring recruitment has been low in recent years, experiencing a low reproductivity regime since 2002 (ICES, 2025a, b).

### 3.6.1.1 Baseline Characterisation

- 3-56 Atlantic herring (*Clupea harengus*) are present at the Proposed Offshore Development Site and were identified during baseline surveys in 97% of the eDNA samples, present at each sampling location, throughout all depths (EIAR Volume 3, Appendix 7.1; Buchan Environmental Survey Report). The baseline eDNA samples were collected May - June (EIAR Volume 3, Appendix 7.1; Buchan Environmental Survey Report), prior to defined spawning periods (defined as August to September in Coull *et al.* (1998)).
- 3-57 eDNA data can be influenced by environmental degradation and spatial drift (Rishan *et al.*, 2023). Additionally, the use of eDNA is unable to distinguish between different life history stages and should be used with some degree of caution pertaining to the use as a spawning ground identifier and should be used as an indicator of herring presence.
- 3-58 Although baseline eDNA data identified herring presence throughout the Proposed Offshore Development Site, the Particle Size Analysis (PSA) data identified limited areas of suitable habitat for spawning, mainly present at the landfall end of the ECC, with the exception of a number of discrete patches further along the ECC and into the Array Area (**Figure 3-2**). These data also broadly correspond with mapped areas of spawning (Coull *et al.*, 1998) (**Figure 3-1**), however differ to mapped predicted habitat (EMODnet – European Commission, 2023).
- 3-59 The baseline characterisation is based primarily on point data, and therefore there is reliance on the predictive mapped layers (e.g., EMODnet based on Folk (1954)) to help interpret data gaps in line with Kyle-Henney *et al.* (2024) (updated MarineSpace, 2013) and it is therefore acknowledged that herring presence cannot be ruled out.

### 3.6.1.2 Herring Spawning and Nursery Grounds

- 3-60 Herring form dense shoals and undertake regular migrations between feeding, spawning, and overwintering grounds (Stobo, 1982). Although population abundance varies annually, recent evidence indicates a widespread decline in the abundance of newly hatched herring larvae at spawning grounds across much of the North Sea (ICES, 2025a,b).
- 3-61 The Proposed Offshore Development Site overlaps with defined herring spawning grounds (Coull *et al.*, 1998) of undetermined intensity, on the southern half of the ECC and to the north of the Array Area (supporting the Buchan and Orkney / Shetland spawning populations of herring, respectively).
- 3-62 During migration activities, herring have been shown to congregate near spawning locations in the months prior to spawning. Herring gather in environmental conditions similar to those they will later spawn in, before moving to specific spawning beds (Maravelias *et al.* 2000).
- 3-63 In the regional Study Area, herring (both juvenile and adults following spawning) are known to move north towards plankton abundant feeding grounds (particularly the Viking Bank and the Orkney / Shetland areas) following spawning, and move in a clockwise circuit within the North Sea, before moving eastwards towards the Skagerrak and Kattegat to overwinter (Petitgas, 2010). However, evidence has further shown that herring spawning typically occurs north of the Moray Firth, with larvae drifting down from Orkney and Shetland, indicating spawning occurs

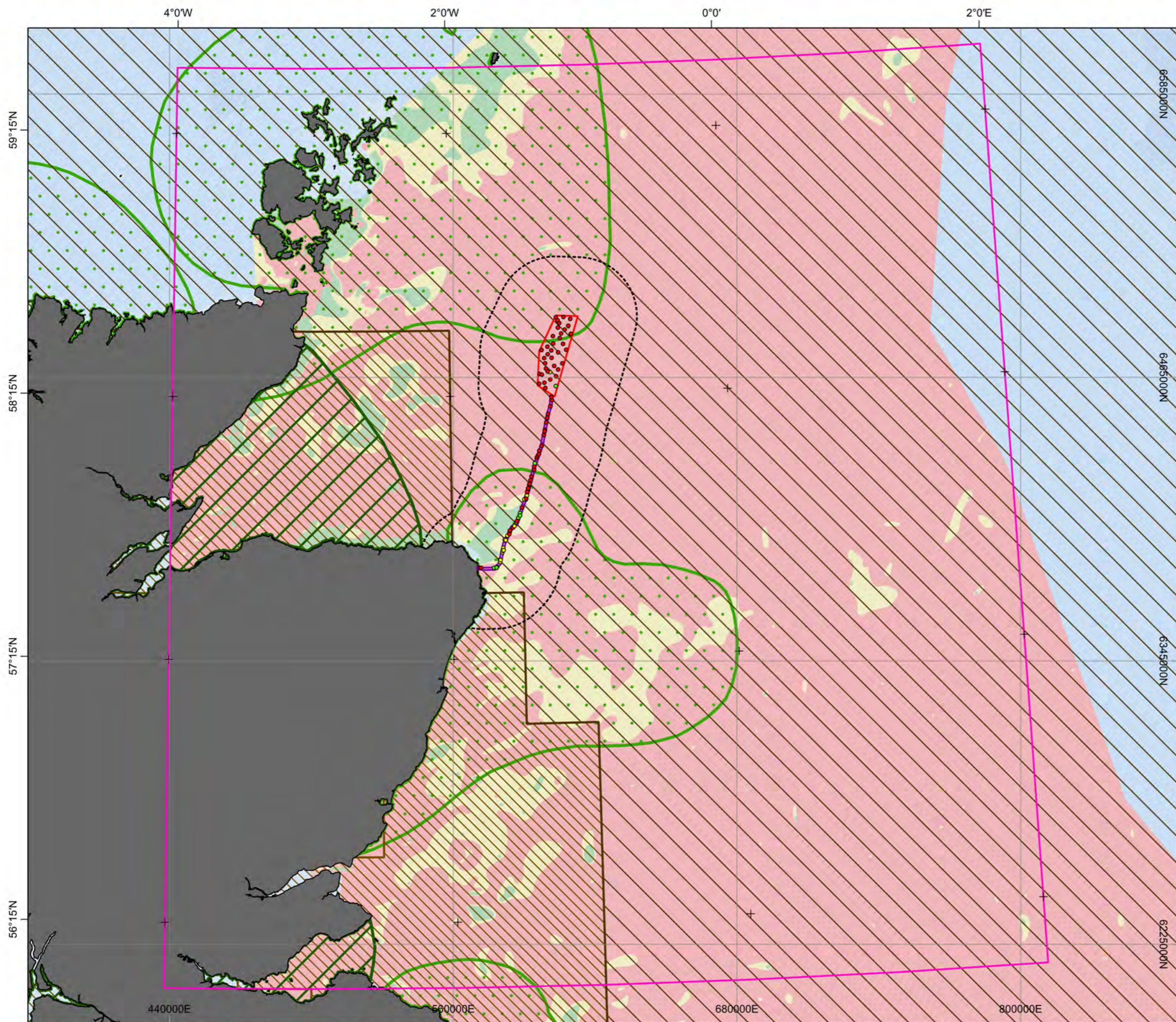
much further north, and with the majority of the herring stock known to spawn over a relatively narrow time period of two weeks (Boyle and New., 2018).

- 3-64 Herring are considered most sensitive during their spawning period which, in the North Sea, is typically condensed into a two-week period at the start of September (Boyle and New, 2018). exhibit fidelity to spawning grounds and season (Frost and Diele, 2022), and it has been suggested (Skaret *et al.*, 2003) that herring can modify their spawning time with prevailing conditions to optimise reproduction and survival of their offspring.
- 3-65 It has also been demonstrated that herring can move between spawning events, within the same season (Frost and Diele, 2022; Haegele & Schweigert, 1985). Moll *et al.* (2025) further state that providing alternative breeding sites carry a sufficient capacity for additional spawners, their use might partially compensate for spawning bed degradations.
- 3-66 Herring nursery grounds are typically situated in more sheltered, inshore areas resulting from post-hatching larval drift. Low intensity nursery grounds have widespread overlap of the Proposed Offshore Development Site, however no high intensity herring nursery grounds overlap with the Proposed Offshore Development Site (Ellis *et al.*, 2012 and Coull *et al.*, 1998) (**Figure 3-1**). Inshore nursery grounds do overlap the local Study Area at the western extent (west of Fraserborough situated within the Moray Firth) (Coull *et al.*, 1998) and south of the ECC (Ellis *et al.*, 2012) at Peterhead.
- 3-67 Ellis *et al.* (2012) data is considered less accurate due to the lack of granularity within the dataset encompassing a much larger area, based on ICES rectangles, and therefore the Coull *et al.*, (1998) data is considered to be more representative (Kyle-Henney *et al.*, 2024) alongside the high intensity Ellis *et al.* (2012) data. It is also stated (Frost and Diele, 2022; Šaškov *et al.* 2014) that the extent of potentially suitable spawning habitat is often far larger than the actual areas used for spawning.
- 3-68 Herring are demersal spawners, aggregating in specific spawning beds to lay eggs on suitable substrate type based on specific sediment characteristics i.e., clean, coarse sand, gravel, shells and small stones (Scottish Government, 2017). Sediments with high structural complexity allow a greater surface area to be in contact with seawater, thereby increasing oxygen supply and metabolic waste disposal which in turn significantly improves development rates and egg survival on grounds which do not experience strong tides and currents (Frost and Diele, 2022). Herring spawn in waves with first time spawners following repeat spawners resulting in a build-up of egg masses consisting of different developmental stages (Skaret and Slotte, 2017).
- 3-69 EMODnet uses broad scale predictive mapping methods to map European seabed data and assign habitats. Where available, this is validated with habitat point source data (from baseline surveys). A large proportion of the Proposed Offshore Development Site is mapped as having unsuitable habitat in line with EMODnet predicted modelling (based on Folk (1954) 16 classification) (**Figure 3-1**). However, preferred herring spawning habitat is predicted to be present to the southern extent of the ECC only (EMODnet) (**Figure 3-1**).

- 3-70 In addition, modelled group 0 herring presence (Aires *et al.*, 2014; Scottish Government (Marine Directorate), 2015) highlights areas of higher probability of herring within the south west of the local Study Area and partially overlapping the ECC (**Figure 3-3**).
- 3-71 The Essential Fish Habitat (Franco *et al.*, 2022) data for herring is limited as only inshore data are provided, however given the mapped locations of herring (Coull *et al.*, 1998), it provides additional context. These data indicate that the herring habitat is limited in the Proposed Offshore Development Site showing largely low potential suitability (low to moderate confidence) with discrete patches of areas of high potential suitability (high confidence) (Franco *et al.*, 2022), conflicting other data sources.
- 3-72 The PSA data collected during baseline surveys provides accurate characterisation and identified limited areas of suitable habitat for herring spawning (including within the mapped spawning grounds to the north of the Array Area). Discrete locations of suitable herring spawning habitat were identified within the Array Area. Only one location with 'preferred' habitat (south east) and one with 'marginal' habitat (north of the 'preferred' habitat) were identified with these data confirming suitable habitat present along the landfall end of the ECC (**Figure 3-1**).
- 3-73 The International Herring Larvae Survey (IHLS) is based on direct field observations, providing a high level of confidence in both presence and absence data, and can therefore be regarded as a direct indicator of herring spawning activity (Kyle Henney *et al.*, 2024). Kyle-Henney *et al.* (2024) categorise larval abundance representing 'spawning hot spots' as follows:
- 51 – 200 larvae per m<sup>2</sup> = medium density;
  - 201 – 600 larvae per m<sup>2</sup> = high density; and
  - >600 larvae per m<sup>2</sup> = very high density.
- 3-74 The herring larval data averaged over the ten most recent years (2016 - 2025) show the average density of herring larvae (< 10 mm). This data shows low abundance of herring larvae across the Proposed Offshore Development Site. The density increases to 'high' (as per Kyle Henney *et al.*, 2024) at landfall, coinciding with the predicted spawning and nursery grounds (Ellis *et al.*, 2012 and Coull *et al.*, 1998) (**Figure 3-4**).
- 3-75 The southern extent of the local Study Area (ICES rectangle - 43E8 (ICES sub-rectangle 43E81)) provides the largest average count ('very high' (as per Kyle Henney *et al.*, 2024)) of herring larvae (<10 mm) averaged over the 10 years (**Figure 3-4**), however this does not directly overlap with the Proposed Offshore Development Site. It is highlighted that these data are manipulated (for ease of interpretation) to represent individual ICES rectangles in this case and the exact sample location could be anywhere within the ICES sub-rectangle area.
- 3-76 The portion of the Orkney / Shetland herring stock spawning ground overlapping the north of the Array Area, demonstrates consistently low abundances indicating the area is not widely used by herring (**Figure 3-4**).
- 3-77 These data broadly support the location of the nursery grounds (Ellis *et al.*, 2012; Coull *et al.*, 1998) and validate the IHLS data which shows higher average densities to the south west of the

local Study Area, evidencing higher historical herring larvae (< 10mm) abundances (Kyle-Henney *et al.*, 2024).

- 3-78 Despite widespread herring presence in the Proposed Offshore Development Site (identified during baseline eDNA surveys), in line with the Folk (1954) sediment classification applied to the PSA data collected during baseline surveys, and evidence of historical herring use (IHLS (**Figure 3-4**)), limited areas of suitable habitat for herring spawning exist within the Proposed Offshore Development Site, concentrated along the landfall end of the ECC and with discrete patches identified within the Proposed Offshore Development Site.
- 3-79 Furthermore, the regional Study Area is shown to have alternative (mapped (EMODnet)) suitable habitat in confirmed areas of high herring usage (IHLS) (generally consistent with mapped spawning and nursery areas (Coull *et al.*, 1998; Ellis *et al.*, 2012)) (**Figure 3-1 to Figure 3-5**).



Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.1: Sediment suitability for herring spawning based on Folk (1954) sediment classification and spawning grounds (Ellis et al., 2012; Coull et al., 1998)**

**Key**

- Array Area
- Export Cable Corridor (ECC)
- Local Study Area
- Regional Study Area

**Coull et al. (1998)**

- Nursery ground - undetermined intensity
- Spawning ground - undetermined intensity

**Ellis et al. (2012)**

- Nursery ground - high intensity
- Nursery ground - low intensity

**Site specific baseline data:**  
Herring habitat potential (Folk, 1954; Kyle-Henney et al., 2024)

- Preferred
- Marginal
- Unsuitable

Herring habitat suitability (Folk, 1954; Kyle-Henney et al., 2024)

- Preferred
- Marginal
- Unsuitable

Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland.  
Folk, R.L. (1954) The distance between grain size and mineral composition in sedimentary rock nomenclature. *Journal of Geology*, 62: 344 – 359.  
Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters. Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and Nursery Grounds of Selected Fish Species in UK Waters.  
Kyle-Henney, M., Reach I., Barr N., Warner I., Lowe S., and Lloyd Jones D., 2024. Identifying and Mapping Atlantic Herring Potential Spawning Habitat: An Updated Method Statement. Not to be used for Navigation.

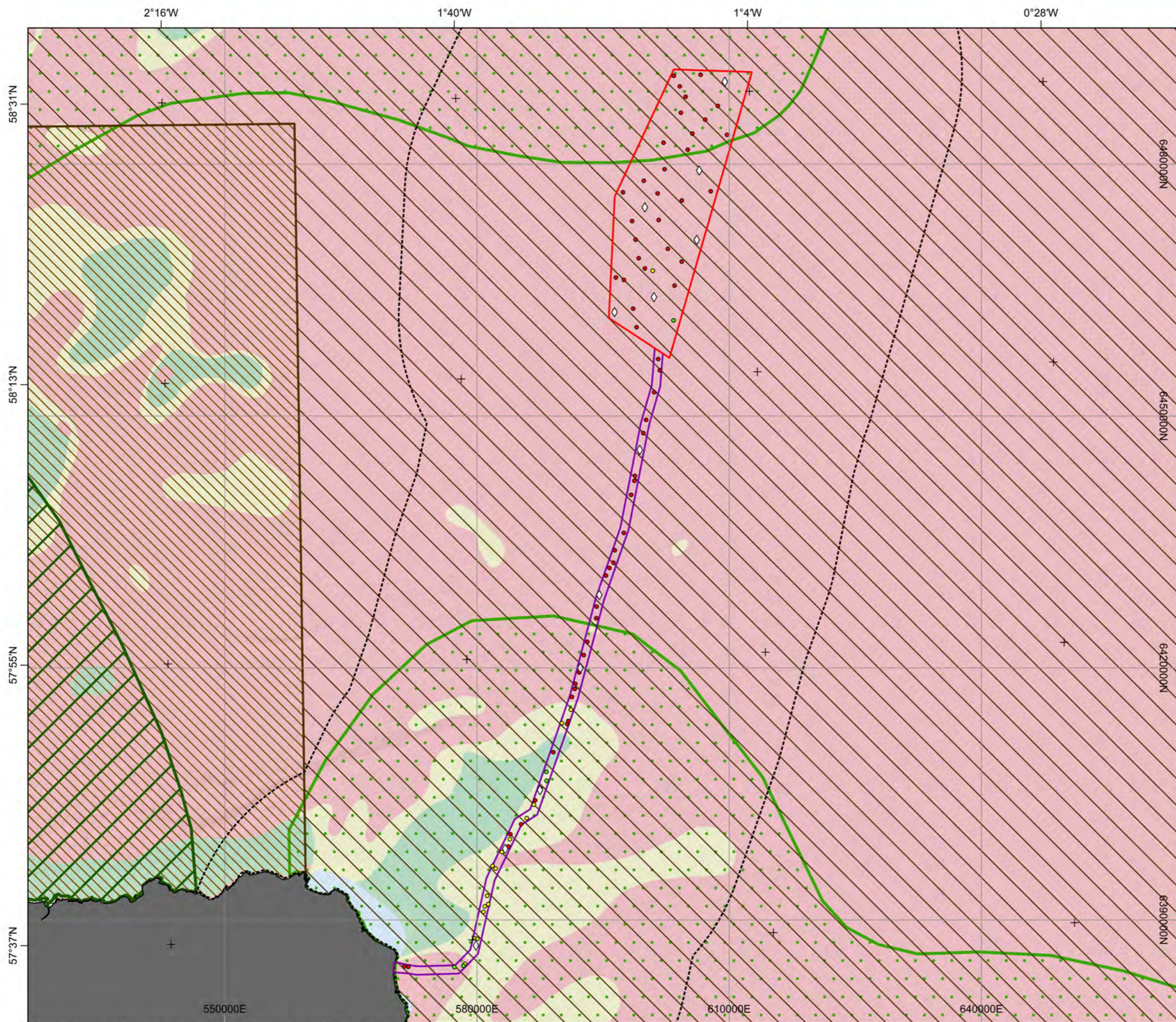
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Graticules: WGS84

Date: 18-06-26    Prepared by: AC    Checked by: ME

EIA Ref No: BUC-C-MP-NP-0362  
Map Ref: GB204095\_M\_380\_A



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Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.2: Herring site specific baseline data gathered for the project in 2023**

**Key**

- Array Area
- Export Cable Corridor (ECC)
- Local Study Area
- Regional Study Area

**Coull et al. (1998)**

- Nursery ground - undetermined intensity
- Spawning ground - undetermined intensity

**Ellis et al. (2012)**

- Nursery ground - high intensity
- Nursery ground - low intensity

**Site specific baseline data:**

Herring spawning potential (Folk, 1954; Kyle-Henney et al., 2024)

- Preferred
- Marginal
- Unsuitable

Herring habitat suitability (Folk, 1954; Kyle-Henney et al., 2024)

- Preferred
- Marginal
- Unsuitable

eDNA sampling

- ◇ Herring presence

Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland.  
 Folk, R.L. (1954) The distance between grain size and mineral composition in sedimentary rock nomenclature. *Journal of Geology*, 62: 344 – 359.  
 Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters. Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and Nursery Grounds of Selected Fish Species in UK Waters.  
 Kyle-Henney, M., Reach I., Barr N., Warner I., Lowe S., and Lloyd Jones D., 2024. Identifying and Mapping Atlantic Herring Potential Spawning Habitat: An Updated Method Statement. Not to be used for Navigation.

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 Graticules: WGS84

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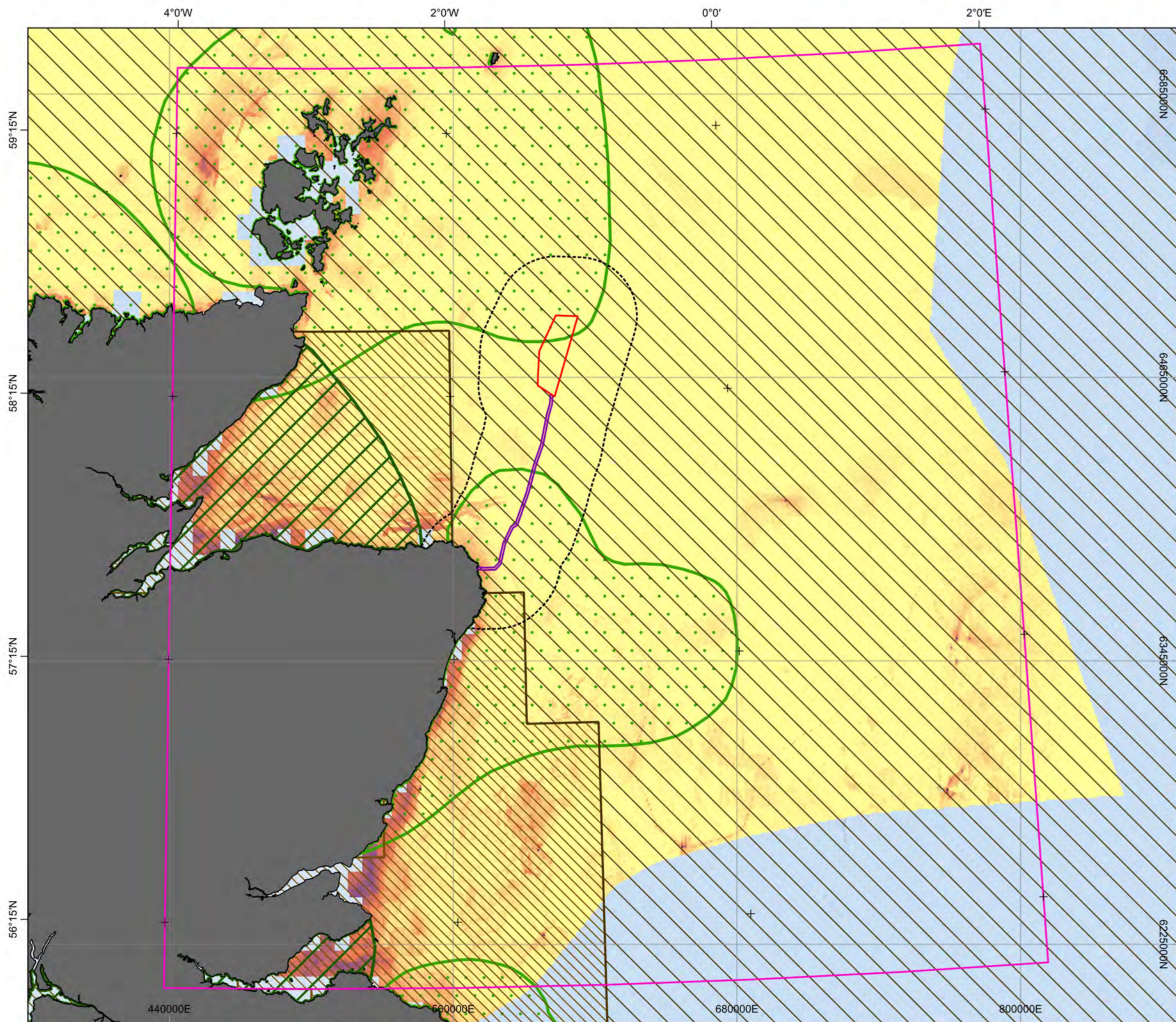
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Date: 18-06-26    Prepared by: AC    Checked by: ME

EIA Ref No: BUC-C-MP-NP-0373  
 Map Ref: GB204095\_M\_391\_A



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Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.3: Herring (*Clupea harengus*) in the regional study area – NMPi group 0 with spawning and nursery grounds**

**Key**

- Array Area
- Export Cable Corridor (ECC)
- Local Study Area
- Regional Study Area

**Coull et al. (1998)**

- Nursery ground - undetermined intensity
- Spawning ground - undetermined intensity

**Ellis et al. (2012)**

- Nursery ground - high intensity
- Nursery ground - low intensity

**Modelled probability of group 0 herring**

- 0.000000
- 0.166800
- 0.333600
- 0.505455

Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland. Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters. Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and Nursery Grounds of Selected Fish Species in UK Waters. Not to be used for Navigation.

**Scale @ A3: 1:1,600,000**  
 Coordinate System: WGS 84 UTM Zone 30N  
 Graticules: WGS84

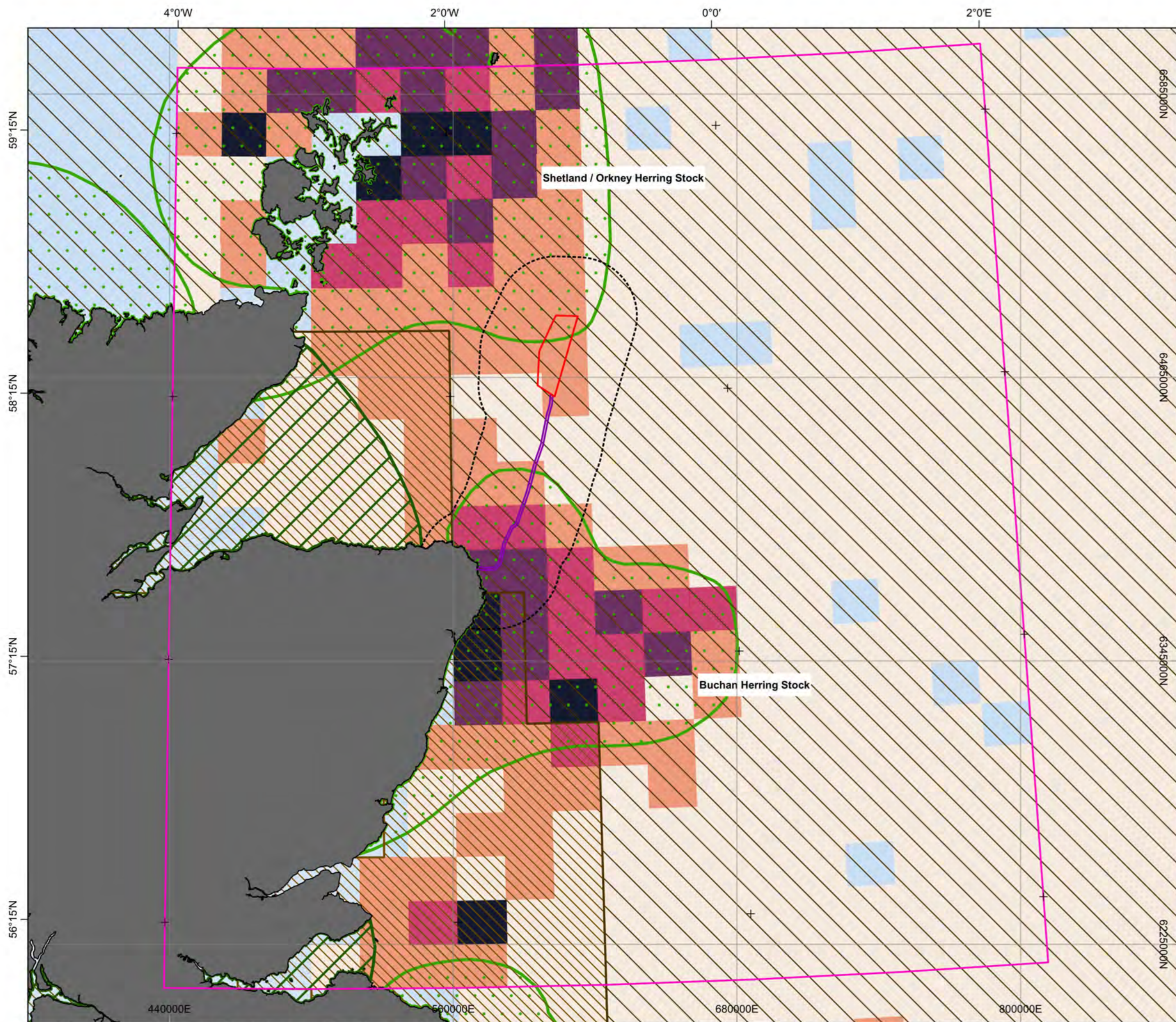
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Date: 18-06-26    Prepared by: AC    Checked by: ME

EIA Ref No: BUC-C-MP-NP-0363  
 Map Ref: GB204095\_M\_381\_A



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Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.4: Average density of herring larvae – IHLS (< 10mm) (average number of individuals < 10 mm per m² per ICES sub rectangle) over 10 Years (2016-2025)**

**Key**

- Array Area
- Export Cable Corridor (ECC)
- Local Study Area
- Regional Study Area

**Coull et al. (1998)**

- Nursery ground - undetermined intensity
- Spawning ground - undetermined intensity

**Ellis et al. (2012)**

- Nursery ground - high intensity
- Nursery ground - low intensity

**Average density of herring larvae (< 10 mm)**

- 0
- 1 - 50 larvae per m² = low intensity
- 50 - 200 larvae per m² = medium density
- 200 - 600 larvae per m² = high density
- > 600

Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland. Creative Commons International Council for the Exploration of the Sea (ICES) International Herring Larvae Surveys (IHLS) is licensed under CC BY 4.0. ICES Eggs and Larvae Database, 2025, ICES, Copenhagen, Denmark. The dataset includes information about spatial distribution and abundance of herring larvae in the North Sea based on the data from the International Herring Larvae Surveys (IHLS). Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters. Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and nursery grounds of selected fish species in UK waters. Kyle-Henney, M., Reach I., Barr N., Warner I., Lowe S., and Lloyd Jones D., 2024. Identifying and Mapping Atlantic Herring Potential Spawning Habitat: An Updated Method Statement. Not to be used for Navigation.

Scale @ A3: 1:1,600,000  
 Coordinate System: WGS 84 UTM Zone 30N  
 Graticules: WGS84

Date: 18-06-26    Prepared by: AC    Checked by: ME

EIA Ref No: BUC-C-MP-NP-0364  
 Map Ref: GB204095\_M\_382\_A



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### 3.6.1.3 Herring Spawning Habitat Suitability Assessment

- 3-80 In line with the RAEI from MD-LOT in consultation with NatureScot, in order to provide further reassurance in the assessment conclusions reached, a spawning habitat suitability confidence heat map has been produced for herring. This follows the methodology in Kyle-Henney *et al.*, (2024) (i.e., the 2024 updated MarineSpace methodology), updating the MarineSpace (2013a) report.
- 3-81 This methodology assigns a confidence score to multiple layers (e.g., fishing effort, delineated spawning areas, suitable habitat types ('preferred' and 'marginal') and larvae presence) based on the data quality underlying them (method, vintage, positioning, coverage, quality standards, and indicator of habitat). Where multiple layers overlap, scores are multiplied together, with the resulting score indicating the overall confidence of the herring spawning suitability in that area.

#### Methodology

- 3-82 The methodology follows Kyle-Henney *et al.*, (2024):
- Stage 1: Identify relevant scales. This is the regional Study Area identified in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology;
  - Stage 2: Identify suitable herring habitat i.e., 'preferred' and 'marginal habitats' in line with Folk (1954) 16 sediment categories (from EMODnet). This identifies the base map for the assessment. Areas outside of suitable habitat are not taken forward for heat mapping; and
  - Stage 3: Broadscale habitat characterisation. Apply the regional Study Area, the Proposed Offshore Development Site, Coull *et al.* (1998) spawning data, Vessel Monitoring System (VMS) (pelagic), averaged IHLS data.

#### Data Layers

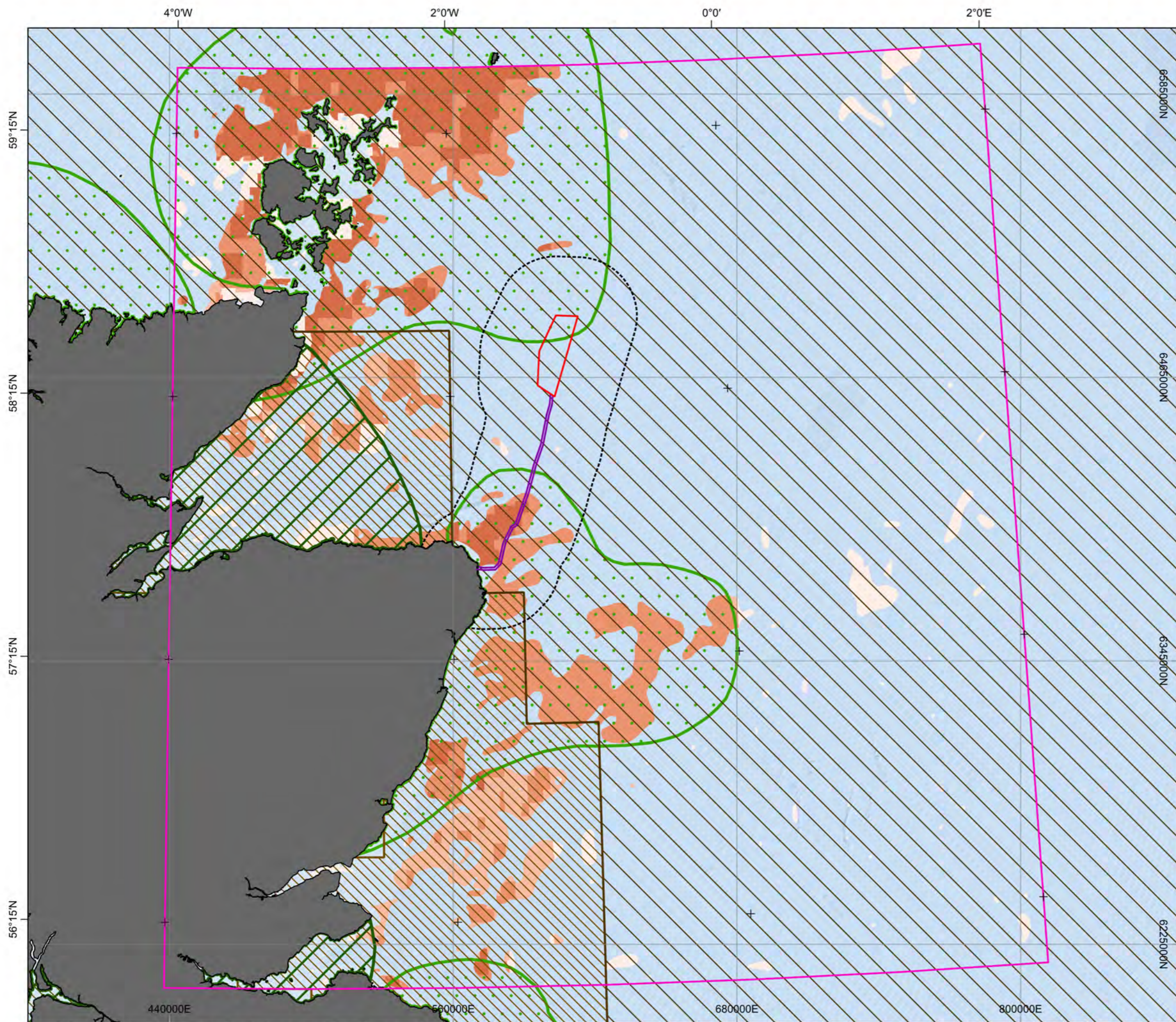
- 3-1 The data layers used are based on the methodology in Kyle-Henney *et al.* (2024):
- Sediment data (EMODnet, based on Folk (1954) 16 refinement);
  - Fisheries VMS (pelagic);
  - Coull *et al.* (1998) spawning grounds; and
  - International Herring Larvae Survey (IHLS) (averaged over 10 most recent full years).
- 3-83 Heat maps are initially constructed using the sediment data, and then overlapping these combined suitable habitat areas with the remaining layers to increase confidence.

#### Confidence Scoring

- 3-84 Each data layer (**Figure 3-5**) was assigned the normalised score as per Kyle-Henney *et al.* (2024) between 0.1 and 0.9 (lowest confidence if the value is 1 (i.e., there are no layers present), and increases to 0.1 where multiple layers overlap). The combined confidence from each layer was calculated by multiplying overlapping layers normalised scores, where a higher confidence in exposure pathway is expected where multiple data layers overlap (**Figure 3-5**).

### *Herring Spawning Habitat Suitability*

- 3-85 The heat map (**Figure 3-5**) shows an area of high heat and therefore potential spawning habitat to the north (with some overlap) of the ECC approaching landfall. This maps the area with the highest potential for herring spawning habitat, noting that this is surrounded by areas of 'medium' heat.
- 3-86 Whilst the use of heat maps is a useful way to visualise multiple overlapping data sources, caution is advised based on the modelled nature of the data, and further consideration of individual layers is required to allow overall justification for the conclusions drawn.



Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.5: Herring potential spawning habitat heat map (in accordance with Kyle-Henney et al., 2024)**

**Key**

- Array Area
- Export Cable Corridor (ECC)
- Local Study Area
- Regional Study Area

**Coull et al. (1998)**

- Nursery ground - undetermined intensity
- Spawning ground - undetermined intensity

**Ellis et al. (2012)**

- Nursery ground - high intensity
- Nursery ground - low intensity

**Site specific baseline data:**  
Herring potential spawning habitat  
(Kyle-Henney et al., 2024)

- <math>< 0.028</math>
- <math>0.028 - 0.042</math>
- <math>0.042 - 0.056</math>
- <math>0.056 - 0.750</math>

Sources: Eerf, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland.  
Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters.  
Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and Nursery Grounds of Selected Fish Species in UK Waters.  
Kyle-Henney, M., Reach I., Barr N., Warner I., Lowe S., and Lloyd Jones D., 2024. Identifying and Mapping Atlantic Herring Potential Spawning Habitat: An Updated Method Statement. Not to be used for Navigation.

**Scale @ A3: 1:1,600,000**  
Coordinate System: WGS 84 UTM Zone 30N  
Graticules: WGS84

0 20 40 60 80 km

N

Date: 18-06-26    Prepared by: AC    Checked by: ME

EIA Ref No: BUC-C-MP-NP-0365  
Map Ref: GB204095\_M\_383\_A

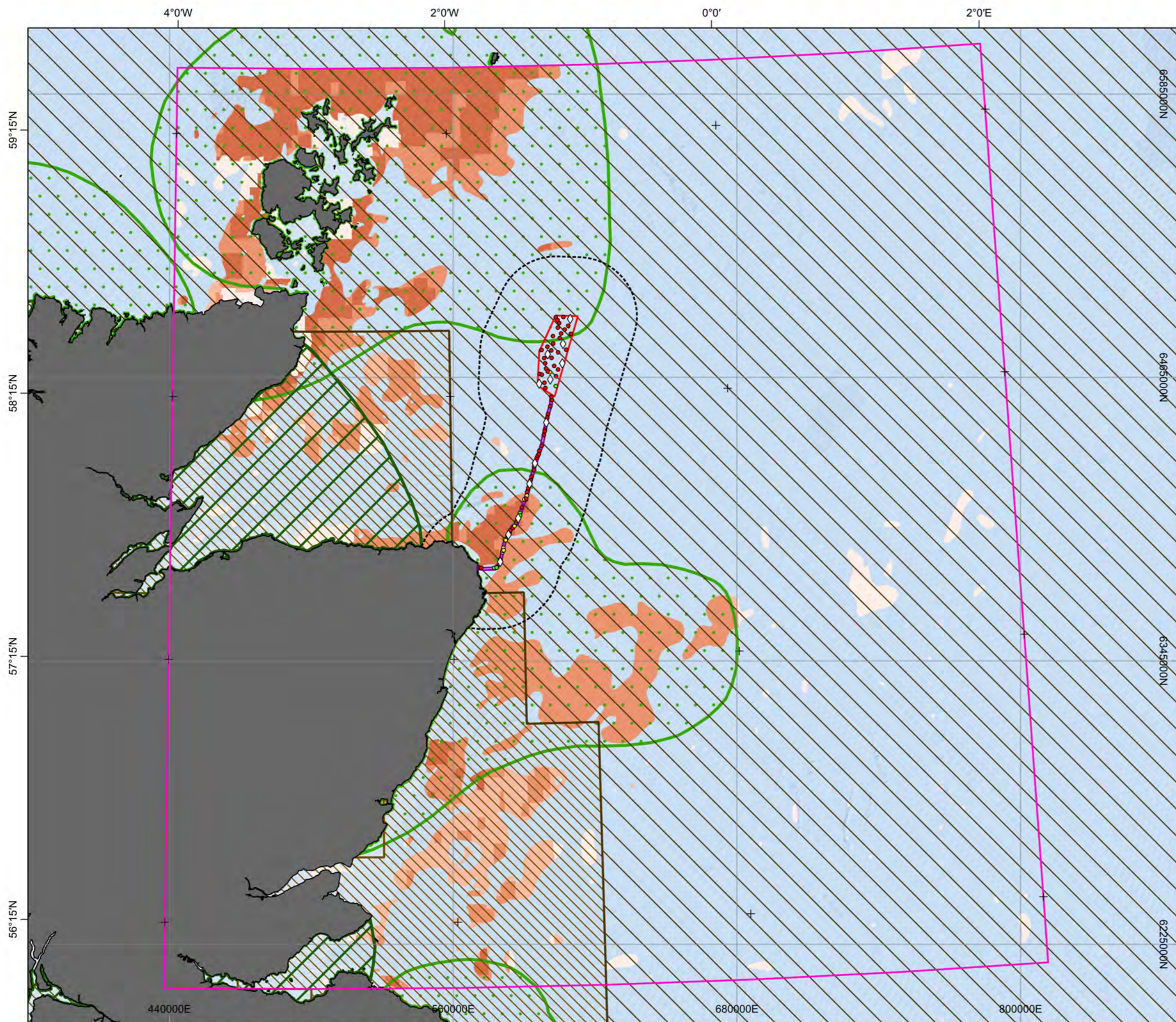


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- 3-87 Preferred and marginal habitats (**Figure 3-1**) (EMODnet) underpin all other layers in the model and it is clear in the heat map (**Figure 3-5**) that this is a large driver in the geographical spread of areas with high potential spawning habitat.
- 3-88 The baseline PSA data obtained throughout the Proposed Offshore Development Site indicates that areas of suitable habitat were extremely limited within the Array Area (restricted to two localised discrete patches in the south). Suitable habitat was, however, more widespread within the southern extent of the ECC (approaching landfall) (**Figure 3-1**), broadly in line with EMODnet mapped habitat, but with some patchiness. As previously noted, (**Section 3.6.1.1**), baseline PSA data is a more reliable indicator of true suitable habitat, and this has been used in conjunction to inform conclusions.
- 3-89 The model also considers overlap of Coull *et al.* (1998) spawning grounds (as informed by Kyle-Henney *et al.*, 2024) where areas of mapped ‘suitable’ (comprising ‘preferred’ and ‘marginal’) habitat overlapping spawning areas drive the modelling output (**Figure 3-1** and **Figure 3-5**). This is broadly in line with the area of highest heat (and confidence) (**Figure 3-5**).
- 3-90 The area with the highest confidence covered 4,755.04 km<sup>2</sup> in the regional area, with 18.88 km<sup>2</sup> overlapping with the Proposed Offshore Development Site, equating to the Proposed Offshore Development overlapping 0.40% of the highest potential spawning habitat within the regional area. It is still considered that this represents an over estimation when compared to baseline data available (**Figure 3-6**).
- 3-91 The model uses only presence or absence for IHLS data. Whilst this provides evidence of herring larvae presence, it can prove misleading, without consideration of relative densities. The IHLS data averaged over the 10 years (2016 – 2025) provides clearer reflection on the actual relative density in each ICES sub-rectangle (**Figure 3-4**), and demonstrates that the areas of higher averaged IHLS density are broadly reflected in the heat-map, although the highest averaged densities are located south of the ECC landfall location indicating spawning hot-spots (Kyle-Henney *et al.*, 2024). The highest potential for herring habitat is inshore, immediately north of the ECC at landfall (**Figure 3-5**). Through this combined approach considering both presence and absence and relative abundances of herring larvae, it indicates that higher confidence can be placed in the ‘presence’ data as a driver of areas of high potential.
- 3-92 Additional pelagic VMS data is also included to further strengthen the output, as presented in the EIAR Volume 2, Chapter 11: Commercial Fisheries indicating presence through catch.
- 3-93 To further provide confidence in the assessment, the heat map is also considered in relation to the baseline data (**Figure 3-6**) which identified herring throughout the Proposed Offshore Development Site in eDNA samples (**Section 3.6.1.3**), however considering the lack of widespread suitable habitat throughout the Proposed Offshore Development Site, these data require careful consideration and knowledge of the eDNA methodology and data limitations, for the wider application.
- 3-94 Although there is eDNA evidence of herring throughout the Proposed Offshore Development Site (**Figure 3-2** and **Figure 3-6**), the general density of herring (larvae) (IHLS) historically, remains low apart from the southern extent of the local Study Area along the ECC approaching

landfall, (ICES rectangle - 43E8 (ICES sub-rectangle 43E81)) which provides the largest average count ('very high' (as per Kyle Henney *et al.*, 2024)) of herring larvae (<10 mm) averaged over the 10 years (**Section 3.6.1.2 and Figure 3-4**). Also noting the adjacent areas also have higher densities of herring larvae which reduce with increasing distance from land and correlate with the mapped herring spawning grounds (Coull *et al.*, 1998) (**Figure 3-4**).

- 3-95 A combined approach further building on the heat map as a whole (**Figure 3-5**), and the individual component layers, with consideration of the supporting evidence, concludes that despite the ECC overlapping an area considered to have high herring spawning potential, the actual area of potential habitat could be an overestimate. This is due to the patches of unsuitable habitat (baseline PSA data (**Figure 3-1**)). The map does, however, indicate widespread alternative potential spawning habitat, overlapping the defined spawning areas (Coull *et al.*, 1998) outside the Proposed Offshore Development Area.
- 3-96 It is therefore considered that the area of the Proposed Offshore Development is of low importance to herring for the purposes of spawning or nursery activities.



Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.6: Herring baseline data and heat map (as per Kyle-Henney et al., 2024)**

**Key**

- Array Area
- Export Cable Corridor (ECC)
- Local Study Area
- Regional Study Area

**Coull et al. (1998)**

- Nursery ground - undetermined intensity
- Spawning ground - undetermined intensity

**Ellis et al. (2012)**

- Nursery ground - high intensity
- Nursery ground - low intensity

**Site specific baseline data:**  
 Herring potential spawning habitat  
 (Kyle-Henney et al., 2024)

- < 0.028
- 0.028 - 0.042
- 0.042 - 0.056
- 0.056 - 0.750

Herring habitat suitability (Folk, 1954;  
 Kyle-Henney et al., 2024)

- Preferred
- Marginal
- Unsuitable

eDNA sampling

- ◇ Herring presence

Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland.  
 Folk, R.L. (1954) The distance between grain size and mineral composition in sedimentary rock nomenclature. *Journal of Geology*, 62: 344 - 359.  
 Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters. Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and Nursery Grounds of Selected Fish Species in UK Waters.  
 Kyle-Henney, M., Reach I., Barr N., Warner I., Lowe S., and Lloyd Jones D., 2024. Identifying and Mapping Atlantic Herring Potential Spawning Habitat: An Updated Method Statement. Not to be used for Navigation.

**Scale @ A3: 1:1,600,000**  
 Coordinate System: WGS 84 UTM Zone 30N  
 Graticules: WGS84

0 20 40 60 80 km

N

Date: 18-06-26    Prepared by: AC    Checked by: ME

EIA Ref No: BUC-C-MP-NP-0374  
 Map Ref: GB204095\_M\_392\_A



Notes: a) Information on this plan is directly reproduced from digital and other material from different sources. Minor discrepancies may therefore occur. Where further clarification is considered necessary, this is noted through the use of text boxes on the plan itself. b) For the avoidance of doubt and unless otherwise stated: 1. this plan should be used for identification purposes only, unless otherwise stated in accompanying documentation. 2. Buchan Offshore Wind Ltd accepts no responsibility for the accuracy of data supplied by third parties. 3. Buchan Offshore Wind Ltd accepts no liability for any use which is made of this plan by a party other than its client. No third party who gains access to this plan shall have any claim against Buchan Offshore Wind Ltd in respect of its contents.

### 3.6.2 Direct Temporary Habitat Disturbance (Construction Phase)

3-97 See **Section 3.6.1** for a summary of herring baseline information and data.

3-98 Construction activities have the potential to cause direct temporary habitat disturbance resulting from pre-construction seabed preparation activities such as boulder clearance and pre-lay grapnel run (PLGR), the installation of anchors, IRC and OSP foundations, and through cable installation activities, including trenching, laying, burial and protection. It is noted there will also be the use of jack up barges during construction for nearshore export cable works at the transition joint bays (HDD), however this is considered to make a negligible contribution overall due to the limited habitat disturbed in discrete areas.

3-99 The effects from this impact during operation and decommissioning are considered to be less than during construction and therefore the conclusions presented within this section for construction are also applicable and valid for operational and decommissioning effects.

#### 3.6.2.1 Assessment of Likely Significant Effect

3-100 The methodology for assessing the effects of direct temporary habitat disturbance on herring (**Section 3.6.2.1**, below) is detailed in **Section 3.3.1**.

##### Direction of Change

3-101 Direct temporary habitat disturbance may affect individuals directly through the disturbance of key habitat e.g., spawning and nursery habitat, and indirectly through the resultant loss of feeding habitat and prey species.

##### Extent and Magnitude

3-102 Direct temporary habitat disturbance will arise from a number of different construction activities including pre-sweeping sand wave clearance (0.054 km<sup>2</sup>), cable laying activities (cable ploughing via simultaneous lay and bury and through the use of a tracked jetting tool using the post-lay burial method) (including export cable joint pit) (5.75 km<sup>2</sup>), mooring lines and drag embedment anchor placement (0.61 km<sup>2</sup>) (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology – Section 8.10). Direct temporary habitat disturbance up to 6.41 km<sup>2</sup> (see **Table 3-3** for calculation) forms the basis of this assessment.

3-103 During construction, the area of maximum direct temporary habitat disturbance of the defined herring spawning and nursery grounds within the regional Study Area (i.e., the area of overlap of the herring spawning and nursery grounds within the regional Study Area) are very low (i.e., < 0.1%) (**Table 3-6** and **Figure 3-1**).

**Table 3-6 Direct temporary habitat disturbance of spawning and nursery grounds for herring in relation to the regional study area**

	Coull <i>et al.</i> , 1998		Ellis <i>et al.</i> , 2012	
	Area	% Overlap	Area	% Overlap
<b>Spawning</b>	30,914.5	0.021%	No data	No data
<b>Nursery</b>	65,27.83	0.098%	(H) 21,635.44 (L) 95,182.94	0.03% 0.007%

- 3-104 The Proposed Offshore Development Site is not considered to be important for herring because of limited spawning and nursery ground overlap (Coull *et al.*, 1998) with any areas of ‘preferred’ habitat and isolated and patchy, with more suitable habitat (aligning with records of higher larval density) located beyond the local Study Area (**Figure 3-1**).
- 3-105 The heat map (**Figure 3-5**) produced for herring spawning habitat potential concluded that inshore areas represent the highest potential for herring spawning within the Proposed Offshore Development Area, however clearly illustrates improved and extensive areas of spawning habitat within the regional Study Area but outside of the local Study Area.

### **Duration**

- 3-106 Construction is expected to take approximately six years. Ground preparation and site investigation works are anticipated to last approximately 12 months, with boulder removal undertaken for around 16 months over a three-year period alongside any required UXO clearance. Construction of each OSP platform is expected to take around one month, totalling up to three months. Anchoring and mooring pre-lay activities are anticipated to take approximately 14 months in total, spread over three years to allow for seasonal breaks. (EIAR - Volume 1, Chapter 4: Project Description).
- 3-107 Although there is overlap in some activities proposed timings, these will be undertaken at different discrete locations i.e., mooring line installation is separate to cable installation.
- 3-108 The multi-year construction programme will mean that multiple spawning periods have the potential to be affected, noting that the potential overlap is highly limited due to the very short duration of herring spawning (two weeks).

### **Timing and Frequency**

- 3-109 Herring are considered most sensitive during their spawning period which, in the North Sea, can be condensed into a two week period (Boyle and New, 2018) within the defined spawning period (August and September (Coull *et al.*, 1998)). Therefore, there is the potential for impact for two weeks, each year over the indicative construction period, of approximately six years.
- 3-110 Most of the construction will occur during summer months due to the offshore location of the Proposed Offshore Development, which will largely be outside of the herring spawning season (August and September (Coull *et al.*, 1998)), noting that construction is not limited to summer months and would be weather dependent. The multi-year construction programme will mean that there is the potential for repeat disturbance over the six years (approximate) construction period, incorporating multiple spawning periods.
- 3-111 However, although there is overlap in some activities within the proposed programme (EIAR Volume 1, Chapter 4: Project Description), it is considered that operations will not be continuous and the potential for interaction is minimal.

## Reversibility

- 3-112 It is known that the recoverability of the seabed is linked to substrate type (Newell *et al.*, 1998; Desperey, 2000) with finer fraction sediments shown to return to baseline species abundance approximately two years following disturbance, and total recovery within four years (Desperey, 2000), however this can take up to five years (Bonsdorff, 1983). In some instances (BOEM, 2020) temporary habitat disturbance from cable installation has been shown to recover within four months.
- 3-113 At the Proposed Offshore Development Site, the habitat is expected to recover quickly as sediments are mobile, replenishing quickly through natural processes ensuring the existing spawning habitat is retained (Volume 2, Chapter 6: Marine and Coastal Physical Processes). Features and local processes would not suffer any long term alteration and trenches would typically infill within a matter of weeks, (Volume 2, Chapter 6: Marine and Coastal Physical Processes).
- 3-114 Herring are prolific spawners, producing a large number of eggs (reportedly up to 67,000 in the Buchan Stock (Barreto and Bailey, 2015)). Herring eggs are sensitive to seabed disturbance leaving them vulnerable to physical disturbance, however they undergo rapid hatching between 7 to 32 days (Skaret and Slotte, 2017) without disturbance, with larvae carried on currents to nursery grounds. This enables maximum survival and maturation of individuals and thus maintains population dynamics. When not spawning, herring are mobile and have the ability to relocate to other suitable areas (**Figure 3-5**) within the defined herring stock population spawning ground.
- 3-115 Herring populations are sensitive to habitat disturbance, particularly during spawning events which could lead to a temporary reduction in spawning success, and therefore maintaining the population (NatureScot, 2023b), however given the high fecundity any effects are not expected at population level. Additionally, the supporting habitats are considered to recover quickly (i.e., within weeks) at the Proposed Offshore Development Site, following temporary disturbance.

### 3.6.2.2 Conclusion

- 3-116 Direct temporary habitat disturbance will be confined to the Proposed Offshore Development Site within the footprint of construction activities.
- 3-117 Herring are present at the Proposed Offshore Development Site and within the local and regional Study Areas which have alternative suitable habitat in areas of high herring usage (IHLS) (generally consistent with mapped spawning and nursery areas (Coull *et al.*, 1998; Ellis *et al.*, 2012)).
- 3-118 Population effects are expected to be minimal throughout the construction period as spawning is typically expected to be condensed into a two-week period (Boyle and New, 2018). Any displacement or avoidance of spawning habitat during construction is considered unlikely due to the lack of suitable habitat at the Proposed Offshore Development Site (within the local Study Area), however should any impact occur it would be temporary, based on limited disturbance to spawning areas, and is not considered to affect herring at a population level.

- 3-119 The seabed will return to its natural state due to the natural hydrodynamics present in the North Sea, replenishing quickly through natural processes. Any displacement or avoidance during construction would be temporary, with herring expected to quickly return following the cessation of work.
- 3-120 Considering the potential for herring presence, and given the localised, relatively small spatial extent of the construction activities, the temporary intermittent and reversible nature of the work, and relatively short duration, it is considered any likely effect from direct temporary habitat disturbance during construction is Not Significant for herring (including eggs and larvae).
- 3-121 Therefore, the provision of the additional information within **Section 3.6.2** does not alter the original assessment conclusions, i.e., there are no likely significant effects predicted for herring as a result of direct temporary habitat disturbance during construction of the Proposed Offshore Development.

### **3.6.2.3 Secondary Mitigation and Residual Effect**

- 3-122 Given that no likely significant effects are predicted for herring for direct temporary habitat disturbance, no secondary mitigation is proposed in addition to the Project-level and fish and shellfish specific embedded mitigation measures as described in the EIAR Volume 2 Chapter 8: Fish and Shellfish Ecology, Section 8.11 and the inclusion of Additional Embedded Mitigation (AEM) for development of a Fish Mitigation Plan (FMP) which would be produced post-consent in consultation with MD-LOT and NatureScot (**Section 3.10**). These measures are summarised as follows:
- EM4 - Infrastructure will be micro-sited, where practicable, around any sensitive seabed habitats including Annex I habitat and PMF species.
  - EM 5 - Development of and adherence to an Environmental Management Plan (EMP).
  - AEM57 - Development and adherence to an FMP.
- 3-123 As the mitigation proposed will already be embedded in the Proposed Offshore Development design and no additional secondary mitigation is proposed, the post-mitigation residual effects of direct temporary habitat disturbance during construction on herring receptors is Not Significant.

### **3.6.3 Increases in Suspended Sediment Concentrations (SSC) and Deposition (Construction Phase)**

- 3-124 See **Section 3.6.1** for a summary of herring baseline information and data.
- 3-125 The information and assessment presented in this section is supported by the information presented in the EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes and EIAR Volume 3, Appendix 6.1: Marine and Coastal Physical Processes Modelling Technical Report).
- 3-126 Construction activities within the Proposed Offshore Development Site which directly interact with the seabed, including sandwave clearance and cable installation activities, have the potential to disturb the seabed, increasing SSC in the water column and the associated deposition elsewhere.

- 3-127 In the EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes, three scenarios were simulated focussing on bedform (sand wave) clearance, and the two remaining scenarios focussing on cable trenching activities along the ECC, representing the worst case impact upon the surrounding environment through sediment deposition and an increase in SSC. Jetting is considered to give rise to the greatest levels of SSC and therefore deposition.
- 3-128 It is also noted that during operation, mooring chains have the potential to be intermittently in contact with the seabed during tidal cycles causing an increase in SSC. A total of 800 m<sup>2</sup> per mooring chain totalling 0.50 km<sup>2</sup>(**Table 3-3**) will be causing the sediment to be disturbed and suspended. Although this will produce localised increased in SSC, SSC levels are not expected to be above those experienced naturally, with limited deposition expected outside the direct footprint of the disturbance.
- 3-129 The effects from this impact during operation and decommissioning are considered to be less than during construction and therefore the conclusions presented within this section for construction are also applicable and valid for operational and decommissioning effects.

#### **3.6.3.1 Assessment of Likely Significant Effect**

- 3-130 The methodology for assessing increases in SSC and sediment deposition on herring (**Section 3.6.3.1**, below) is detailed in **Section 3.3.1**.

##### **Direction of Change**

- 3-131 Construction activities within the Proposed Offshore Development Site which directly interact with the seabed, including sandwave clearance and cable installation activities, have the potential to disturb the seabed, increasing SSC in the water column and the associated deposition elsewhere which may indirectly and directly affect individuals through smothering and change or loss of habitat function.
- 3-132 SSC levels are highly influenced by depth, location and season, as well as prevailing currents, and impacts arising from the construction of the Proposed Offshore Development will only lead to effects within the local Study Area (i.e., within 25 km based on the maximum plume distance of 15 km used to inform the local Study Area (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.5; EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes)). Increases in SSC and sediment deposition may affect individuals directly through smothering but also indirectly through distortion to vision affecting feeding, clogging of gills, and affecting spawning success. Suspended sediments contain a valuable food source in the form of non-refractory particulate organic matter (Grant, 1996).

##### **Extent and Magnitude**

- 3-133 Sediment throughout the Proposed Offshore Development Site varies, with the Array Area predominantly comprised of silty sand with coarser fractions present to the south and the ECC comprising finer sediment (silty sand) moving to coarser sediments (gravelly sand to sandy gravel) as the ECC approaches landfall (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes).

- 3-134 Sediment within the Array Area has limited potential for mobility as medium silt sediments are predicted to remain immobile under the prevailing current and wave regimes (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes).
- 3-135 Out of the three scenarios modelled<sup>2</sup> over a representative period (including a spring cycle), Scenario 2 modelled cable trenching close to landfall (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes) i.e., overlapping the herring spawning ground as defined by Coull *et al.* (1998). However, for fish and shellfish ecology, the worst case parameters for the receptors are reflected across multiple modelled scenarios so it would not be representative to select one of the modelled scenarios to assess alone. In order to adopt a precautionary approach, the maximum parameters (i.e., concentration of SSC, duration, distance and depth of deposition) across the span of the modelling (regardless of scenario or location) are used as the worst case and form the basis of this assessment.
- 3-136 Sediment mobilised during construction activities will be temporarily deposited on the seabed but will be remobilised and transported via natural hydrodynamic processes. Sediment remains in the water column for varying times depending on the sediment properties. Larger sediment particles such as gravel and sand settle back to the seabed faster, due to their weight whereas finer particulate matter can remain in the water column for a longer period of time.
- 3-137 Finer sediments along the ECC have the potential to travel the furthest up to a maximum of 15 km (within the local Study Area) along the ECC (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes) (between landfall and the southern extent of the ECC (to KP 30) due to predicted higher current velocities (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes). However, sediment transport is modelled to move in a south easterly direction.
- 3-138 The currents experienced in the northern half of the ECC (closest to the Array Area) have the potential to mobilise medium size silt sediments with limited mobility potential for fine and coarse sediment predicted (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes). The fastest currents are predicted at the southern section of the ECC where medium silt sediment may potentially be mobile for 44% of the time, with greater predicted mobility for coarser sediments (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes).
- 3-139 Maximum SSC values of 270 mg/l (rapidly declining after seven days following sediment release) will be restricted to areas proximal to the sediment release location. Site specific (within the Array Area) sampling for SSC returned values up to 250 mg/l, recorded during a December 2023 storm event. Although enhanced SSC may exceed natural variation in the short term during release, the highest concentrations will be highly localised and transient, with values rapidly returning within the levels of natural variability (including storm events), within approximately

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<sup>2</sup> Scenario 1. Sandwave pre-sweeping activities. Scenario 2- ECC trenching activities between KP 10 and KP 20. Scenario 3 – ECC trenching between KP 64 and KP 74. Full descriptions available in the EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes and EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology.

12 days (EIAR Volume 3, Appendix 6.1: Marine and Coastal Physical Processes Modelling Technical Report).

- 3-140 The thickness of the material to be deposited is predicted to be up to 12 cm and will be highly localised to the source of disturbance. Following this deposition, tidal currents would rapidly integrate sediment into the prevailing sediment transport regime, resulting in non-discernible deposition thicknesses in relation to natural variability (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes).
- 3-141 Given the very limited area of suitable spawning habitat within the Proposed Offshore Development Site and the local Study Area (**Figure 3-1** and **Figure 3-2**), and the limited potential for sediment mobilisation over large distances particularly due to the coarse sediments near the ECC landfall (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes), no likely significant effects on herring during spawning are anticipated. This conclusion is supported by the generally low use of the Proposed Offshore Development Site by herring (greatest use is inshore along the ECC) (**Section 3.5.1** and **Figure 3-4**), with limited evidence of high heat spawning hotspots overlapping the local Study Area (**Figure 3-5**). The proportion of fine sediment will be limited and therefore this will not be in sufficient quantities to be distinguishable above background levels (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes).

### **Duration**

- 3-142 See Section **3.6.2.1 – Duration**.

### **Timing and Frequency**

- 3-143 See Section **3.6.2.1 – Timing and Frequency**.
- 3-144 During construction a number of activities will mobilise the seabed throughout the construction period. The three modelled scenarios (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes) state that for sandwave pre-sweeping the work is assumed to be continuous for seven days and the work along the ECC sediment plumes would be released hourly during the 24/7 working at 100 individual release locations.
- 3-145 It is therefore considered that there is the potential for multiple exposures within relatively short periods of time, however, considering the time for SSC to become imperceptible (i.e., within 12 days) is days not hours, in order to adopt a precautionary approach, the exposure is considered to be continuous throughout construction, rapidly dissipating within the maximum 12 days, following cessation of activity.

### **Reversibility**

- 3-146 It is known the recoverability of the seabed is linked to substrate type (Newell *et al.*, 1998; Desprez, 2000) with finer fraction sediments shown to return to baseline species abundance approximately two years following disturbance, and total recovery within four years (Desprez, 2000), however this can take up to five years (Bonsdorff, 1983). Features and local processes would not suffer any long term alteration and any trenches would typically infill within a matter of weeks, (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes).

- 3-147 In areas which will experience increases in SSC and deposition, the habitat is expected to recover quickly as the North Sea is naturally dynamic, replenishing quickly through natural processes ensuring the existing spawning habitat is retained. Features and local processes would not suffer any long term alteration and trenches would typically infill within a matter of weeks, (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes).
- 3-148 While the herring habitat will be subject to increases in SSC and deposition, it is considered that based on the general conditions of the sediment and the North Sea, mobilised sediment is likely to settle in areas with similar characteristics.
- 3-149 Herring are highly mobile migratory species capable of moving away from an increase in SSC (i.e., vertically and horizontally migrate) outside of their spawning period. During the spawning period, herring are less likely to move away from sources of disturbance and remain at the spawning location. The MarESA pressure benchmark for smothering and siltation rate changes to herring (depth of vertical sediment overburden) is 5 cm for light deposition and 30 cm for heavy deposition (Tyler-Walters *et al.*, 2023). Further evidence indicates herring can bury between 8 and 12 cm depth (Holland *et al.*, 2005; JNCC, 2018), the maximum predicted deposition depth.
- 3-150 Although it has been reported that herring egg burial under a thin layer of sediment may result in substantial egg mortality (Messieh *et al.*, 1981), a number of studies (Appleby and Scarratt, 1989; Messieh *et al.*, 1981 and Kiorbe *et al.*, 1981) indicate that herring egg development may be tolerant to very high levels of SSC, with detrimental effects only seen if the deposited sediment is not removed. Griffin *et al.* (2009) suggests that larval survival rates could be reduced at SSCs as low as 250 mg/l, given their reliance on visual cues for predation which could ultimately affect foraging success. However, maximum feeding incidence and intensities were found to occur at highly elevated concentrations (500 mg/l), only above this, feeding activity has been reported to decrease (Boehlert and Morgan, 1985). Conversely, Bone and Moore (2008) suggest that SSCs could enhance feeding rates by providing a clear visual contrast to prey items on the perceptive scale used by larvae.
- 3-151 The sediment associated with herring habitat will settle rapidly, herring are expected to recover quickly and populations will remain unaffected due to their relative adaptability and reproductive biology i.e., high fecundity, quick maturation.

### **3.6.3.2 Conclusion**

- 3-152 The increase in SSC and sediment deposition will be confined to the extent of the sediment plume arising from the construction activities at the Proposed Offshore Development within the local Study Area, with the greatest increases and levels of SSC and deposition only present in the immediate vicinity of the works.
- 3-153 The effects will be temporary and short term in any one location with SSCs rapidly declining within seven days of sediment release and the maximum sediment deposition (of 12 cm) decreasing after a maximum of 12 days, noting the repeating nature of this impact throughout the construction phase. The greatest area of effect will be restricted to the area proximal to the release point, rapidly declining with increasing distance and time.

- 3-154 Herring are sensitive to an increase in SSC and sediment deposition during the spawning phase of their lifecycle, due to their sediment affinity during spawning. Outside of this, their mobile nature means that they are able to avoid the small areas of increased SSC that may be generated by construction of the Proposed Offshore Development. There is a general lack of use of the Array Area by herring for spawning due to lack of suitable sediment (**Figure 3-2**), however spawning may occur close to landfall where more suitable sediment is present, noting that use of small discrete patches of suitable sediment is considered unlikely in view of the fact that large areas of more suitable habitat are present within the regional Study Area (e.g. within the Moray Firth and around Orkney, supporting the Buchan and Orkney / Shetland herring populations, respectively).
- 3-155 The exposure of eggs (and adults) to sediment will be limited given the short spawning period and limited suitable spawning habitat within the Proposed Offshore Development Site within the local Study Area. Elevated SSC is expected to quickly fall to background levels and it is therefore considered that deposition is unlikely to affect the development of eggs and larvae.
- 3-156 Considering the limited suitable habitat and herring presence overlapping the Proposed Offshore Development Site, the relatively small spatial extent of the construction activities in relation to the availability of suitable habitat beyond the local Study Area, (i.e., in the regional Study Area) and the temporary intermittent nature of the work, it is considered any likely effect from an increase in SSC and sediment deposition during construction is Not Significant for herring.
- 3-157 Therefore, the provision of the additional information within **Section 3.6.3** does not alter the original assessment conclusions, i.e., there are no likely significant effects predicted for herring as a result of increases in SSC and deposition during construction of the Proposed Offshore Development.

### **3.6.3.3 Secondary Mitigation and Residual Effect**

- 3-158 Given that no likely significant effects are predicted for herring for increases in SSC and sediment deposition, no secondary mitigation is proposed in addition to the embedded mitigation measures as described in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.11 and the inclusion of AEM for development of an FMP which would be produced post-consent in consultation with MD-LOT and NatureScot (**Section 3.10**). These measures are summarised as follows:
- EM4 - Infrastructure will be micro-sited, where practicable, around any sensitive seabed habitats including Annex I habitat and PMF species.
  - EM 9 - Development of and adherence to a CaP.
  - AEM57 Development and adherence to an FMP.
- 3-159 As the mitigation proposed will already be embedded in the Proposed Offshore Development design and no additional secondary mitigation is proposed, the post-mitigation residual effects of increases in SSC and sediment deposition during construction herring receptors is Not Significant.

### **3.6.4 Increases in Underwater Noise Leading to Mortality, Injury and Behavioural Effects – Herring (Group 3) (Construction Phase)**

- 3-160 See **Section 3.6.1** for a summary of herring baseline information and data.
- 3-161 The assessment as presented in the EIAR Volume 2 Chapter 8: Fish and Shellfish Ecology, Section 8.12.1.3 is presented below. Herring is assessed as a stationary receptor however both stationary and fleeing values are presented for context.
- 3-162 The information and assessment presented in this chapter is supported by the information presented in EIAR Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment.
- 3-163 This section should be read alongside the EIAR Volume 2 Chapter 8: Fish and Shellfish Ecology, Section 8.12.1.3 and Appendix 8.1 which provides the background on the noise modelling and the full outputs.
- 3-164 The effects from this impact during operation and decommissioning are considered to be less than during construction.

#### **3.6.4.1 Assessment of Likely Significant Effect**

- 3-165 The methodology for assessing the effects of underwater noise on herring (**Section 3.6.4.1**, below) is detailed in **Section 3.3.1**.

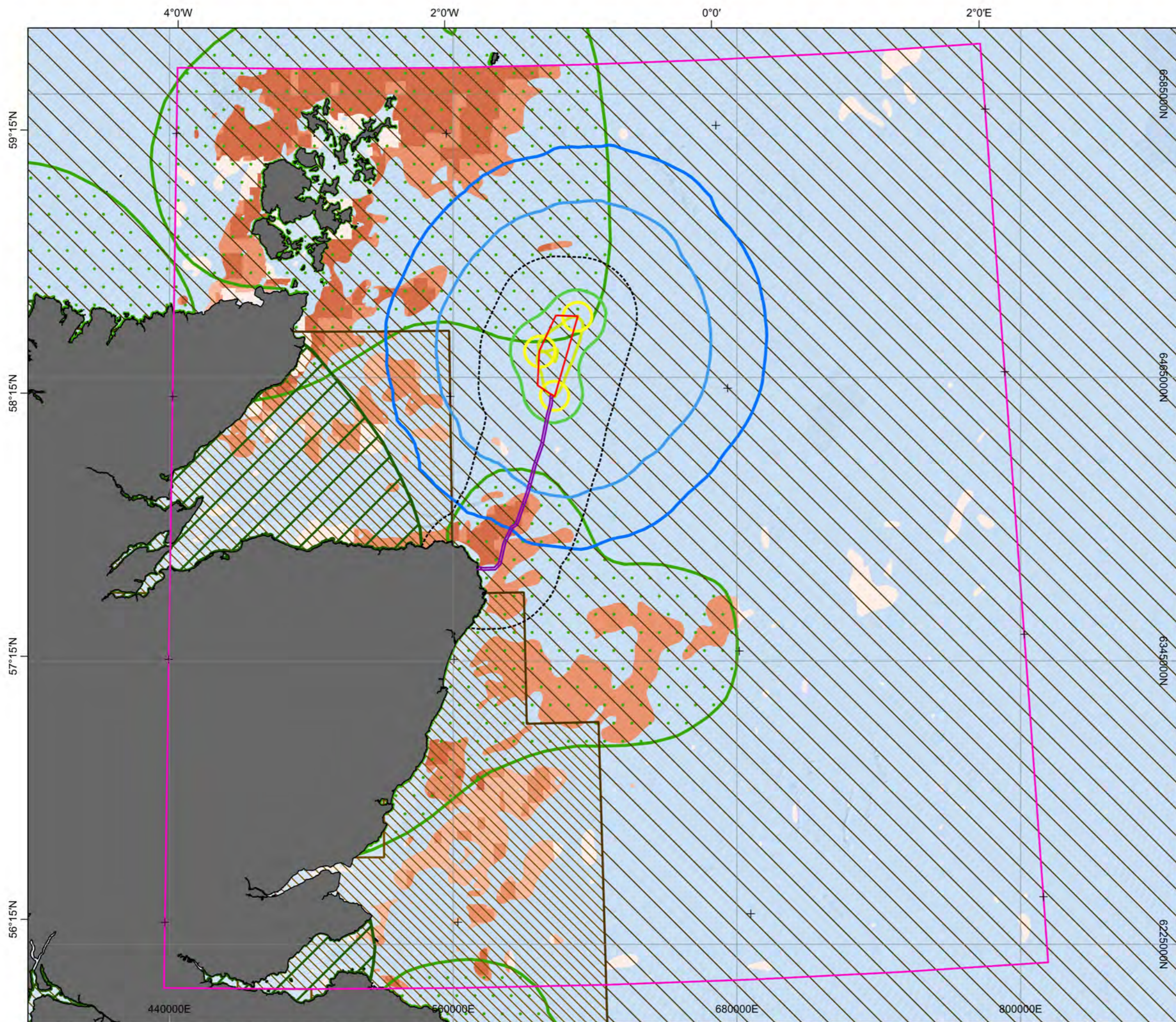
##### **Direction of change**

- 3-166 During noise generating activities, particularly piling, herring will be affected by the impulsive noise generated. Herring (a Group 3 fish) are the most sensitive to noise (Popper *et al.*, 2014 and RWE, 2024). Herring are mobile and therefore, although they possess the ability to move and avoid noise, this could potentially result in the avoidance of spawning and nursery grounds.

##### **Extent and Magnitude**

- 3-167 The underwater noise assessment considers all fish as stationary receptors; however this is not considered realistic for most fish species for the majority of the time (i.e., outside of key life history events e.g., spawning) during piling and therefore is considered highly precautionary.
- 3-168 During noise producing activities, the potential for herring (and other Group 3 fish) individuals to be impacted is dependent on the level of exposure to noise (defined based on mortality, recoverable injury and TTS (behavioural) modelled contours). The greatest impact will arise from the overlap of noise with herring within spawning and nursery grounds, potentially affecting congregating and use of the areas for key life events i.e., spawning.
- 3-169 The predicted noise (TTS) contours extend into mapped herring spawning grounds (Coull *et al.*, 1998) (**Figure 3-7**) which exist to the north of the Array Area (Orkney / Shetland stock) and the south of the Export Cable Corridor (Buchan stock).
- 3-170 The maximum area of impact for concurrent piling noise arises from TTS (21,000 km<sup>2</sup>) for stationary fish, with injury and mortality considerably less (EIAR Volume 2, Chapter 8: Fish and

Shellfish Ecology, Table 8-27). Full breakdown of the areas of impact are presented in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Group 3 Noise Assessment, Section 8.12.1.3.



Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.7: Concurrent piling noise contours and herring (group 3) distribution at the proposed offshore development**

**Key**

- Array Area
- Export Cable Corridor (ECC)
- Local Study Area
- Regional Study Area

**Coull et al. (1998)**

- Nursery ground - undetermined intensity
- Spawning ground - undetermined intensity

**Ellis et al. (2012)**

- Nursery ground - high intensity
- Nursery ground - low intensity

**Unweighted SELs concurrent noise contours**

- 207 dB (stationary)
- 203 dB (fleeing)
- 203 dB (stationary)
- 186 dB (fleeing)
- 186 dB (stationary)

**Site specific baseline data:**  
 Herring potential spawning habitat (Kyle-Henney et al., 2024)

- < 0.028
- 0.028 - 0.042
- 0.042 - 0.056
- 0.056 - 0.750

Sources: Eeri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland.  
 Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters.  
 Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and Nursery Grounds of Selected Fish Species in UK Waters.  
 Kyle-Henney, M., Reach I., Barr N., Warner I., Lowe S., and Lloyd Jones D., 2024. Identifying and Mapping Atlantic Herring Potential Spawning Habitat: An Updated Method Statement. Not to be used for Navigation.

**Scale @ A3: 1:1,600,000**  
 Coordinate System: WGS 84 UTM Zone 30N  
 Graticules: WGS84

0 20 40 60 80 km

N

Date: 18-06-26 | Prepared by: AC | Checked by: ME

EIA Ref No: BUC-C-MP-NP-0366  
 Map Ref: GB204095\_M\_384\_A



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- 3-171 The noise overlapping the Orkney / Shetland and Buchan herring stock spawning grounds, has negligible to no potential to impact herring engaged in spawning activity.
- 3-172 The TTS noise contour (186 dB – stationary) does overlap the Orkney / Shetland and Buchan herring stock spawning grounds (Coull *et al.*, 1998) (**Figure 3-7**), this includes areas of mapped (EMODnet) suitable sediment and limited areas of high potential spawning density (**Figure 3-5** and **Figure 3-7**) though this is only at the outer edges of the contours and considering the decreasing levels of noise with distance it is considered highly unlikely to lead to high levels of TTS.
- 3-173 The spawning and nursery grounds overlapping the Proposed Offshore Development Site, increase the potential for the presence of eggs and larvae to be affected by Project related noise. Eggs and larvae are considered organisms of concern by Popper *et al.* (2014), due to their vulnerability, reduced mobility and small size. Thresholds of effects for eggs and larvae have been defined separately within the Popper *et al.* (2014) guidance, with damage expected to occur at 210 dB SEL<sub>cum</sub> or >207 dB SPL<sub>peak</sub>. Fish eggs and larvae are considered stationary receptors.
- 3-174 Eggs and larvae are susceptible to mortality in the immediate vicinity of piling operations (up to 7.4 km at the OSP location (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Table 8-23) (eggs and larvae have the same mortality and potential mortal injury criteria as Group 2 fish) for stationary receptors, although this represents a very small proportion of the overall spawning and nursery areas (<0.1%). However, though some improved sediment and thus spawning potential is present nearshore, this area is considered less suitable than the large areas of suitable potential spawning habitat located within the Moray Firth, around Orkney, or to the south of the Proposed Offshore Development.

### Duration

- 3-175 Impact piling operations will only last a maximum of 840 hours over the three year impact piling period.

### Timing and Frequency

- 3-176 Work has the potential to span multiple the spawning seasons defined by Coull *et al.* (1998)).
- 3-177 It is possible, although unlikely, that construction may occur concurrently at the three modelled locations. It is also acknowledged that the OSP and IRC will also undergo piling operations, however these are much shorter in duration and present very isolated, short term and temporary impacts. There will be no concurrent piling of the IRC / OSP and the WTGs.
- 3-178 While the percentage of overlap of a spawning area presented above provides useful context, it does not take into account the short term and temporary nature of the work, spanning multiple (three) years, compared to the available spawning potential. As such, the proportion of spawning potential impacted has been calculated for herring (**Table 3-7**), using the greatest area of potential effect (TTS area for concurrent WTG piling).

3-179 This is considered highly conservative, given the refined timing and areas used for herring spawning activities and the actual location and extent of habitat present (i.e., is based upon spawning ground extent and not modelled areas of potential spawning habitat).

**Table 3-7 Temporal overlap (TTS) spawning potential results presented for Herring (Group 3) fish species during WTG concurrent piling**

Species	Data Source (spawning intensity where available)	Spawning potential (km <sup>2</sup> h)	Impacted spawning potential (km <sup>2</sup> h)	Proportion of spawning potential impacted (%)
Herring	Folk (1954) (Suitable habitat - Marginal (marginal))	50,376,946	645,346.8	1.28%
Herring	Folk (1954) (Suitable habitat - Preferred (preferred))	19,093,882	253,705.2	1.33%

### Reversibility

3-180 The values for mortality are considered negligible. Although the noise impact areas are larger for injury and for behavioural (TTS) effects, it is considered herring are able to fully recover quickly based on the mobile nature of these receptors, returning to normal behaviours and returning to habitats, shortly after disturbance and following cessation of noise. This has been reported to be within 24 hours (Popper *et al.*, 2014).

3-181 Herring are known to be reactive to underwater noise stimulus when not engaged in spawning, however evidence (e.g., Skaret *et al.*, 2005) suggests that the strong biological drivers to engage in spawning once a spawning event commences, reduces the susceptibility of herring to be behaviourally disturbed by noise (passing vessel noise in the case of the cited study) for the duration of spawning.

3-182 Herring show a strong affinity to specific sediment type and may not move to avoid noise stimuli (**Section 3.6.1**). However, herring shown to experience a temporary reduction in hearing sensitivity (TTS), regain this following cessation of noise (Popper *et al.*, 2014).

3-183 Additional information has been included in this submission to support characterising the relative importance of the Proposed Offshore Development Site for herring (i.e., assignation of potential spawning habitat, see **Figure 3-5**).

#### 3.6.4.2 Conclusion

3-184 Underwater noise will be relatively localised and of short duration in terms of construction timings, with rapid recovery predicted for the furthest reaching effects (TTS).

3-185 The strong biological drivers for herring to engage in spawning once a spawning event commences, reduces the susceptibility of herring to be behaviourally disturbed by noise for the duration of spawning.

- 3-186 The updated baseline (**Section 3.6.1**) provides additional certainty in characterising the relative importance of the Proposed Offshore Development Site for herring, through the provision of additional information strengthening the baseline, including the heat map for spawning potential (**Figure 3-5**). This demonstrates the areas of highest spawning potential do not overlap the Proposed Offshore Development Site, with baseline data further suggesting the area is not heavily used by herring (**Figure 3-6**).
- 3-187 Herring are reliant on sediment for spawning, and when considering the baseline evidence of herring presence in the area (**Figure 3-4** and **Figure 3-6**), the availability of suitable alternative habitat (**Figure 3-1** and **Figure 3-5**), the limited proportion of spawning habitat (indicating herring presence) with the potential impacted by TTS, it can be concluded the likely effect is assessed as Not Significant for herring.
- 3-188 Although eggs and larvae from a number of species could be present at the Proposed Offshore Development Site, the maximum area affected is considered to be negligible in size in comparison to the spawning and nursery areas in the regional Study Area. Mortality from noise is expected to occur to a maximum of 7.4 km from source (OSP) for eggs and larvae (based on stationary fish (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, and Appendix 8.1: Underwater Noise Assessment, Table 4-23)). Underwater noise will be relatively localised and of short duration in terms of construction timings and it is considered any likely effect from increases in underwater noise during construction is Not Significant for eggs and larvae.
- 3-189 Therefore, the provision of the additional information within **Section 3.6.4** does not alter the original assessment conclusions, i.e., there are no likely significant effects predicted for herring as a result of increases in underwater noise leading to mortality, injury and behavioural effects arising during construction of the Proposed Offshore Development.

### **3.6.4.3 Secondary Mitigation and Residual Effect**

- 3-190 Given that no likely significant effects are predicted for herring for increases in underwater noise, no secondary mitigation is proposed in addition to the Project-level embedded mitigation measures as described in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.11 and the inclusion of AEM for development of an FMP which would be produced post-consent in consultation with MD-LOT and NatureScot (**Section 3.10**). These measures are summarised as follows:
- EM12 - Development of and adherence to a Piling Strategy (PS) (or equivalent, after consultation with stakeholders) (including details on soft-start and ramp up procedures for piling).
  - EM13 - Use of appropriate clearance methods, should UXO clearance be required.
  - AEM57 - Development and adherence to an FMP.
- 3-191 As the mitigation proposed will already be embedded in the Proposed Offshore Development design and no secondary mitigation is proposed, the post-mitigation residual effects of increases in underwater noise during construction on Group 3 herring receptors is Not Significant.

### 3.6.5 Long Term Habitat Loss (Operational Phase)

3-192 In line with the RAEI from MD-LOT (including NatureScot's response), the long term habitat loss now includes the addition of mooring chains and is assessed accordingly (noting mooring chains were previously assessed in the EIA Volume 2 Chapter 8: Fish and Shellfish Ecology, for direct temporary habitat disturbance during operation).

3-193 See **Section 3.6.1** for a summary of herring baseline information and data.

#### 3.6.5.1 Assessment of Likely Significant Effect

3-194 The methodology for assessing long term habitat loss during operation on herring (**Section 3.6.5.1**, below) is detailed in **Section 3.3.1**.

##### Direction of change

3-195 Long term habitat loss will result from anchors, mooring lines, cable protection, foundations of the substation and IRC, and all associated scour protection being placed directly over the existing habitat.

3-196 Although herring are a pelagic species, they rely on specific sediment to spawn and lay eggs onto, therefore herring are sensitive to the loss of this habitat (**Section 3.6.1**).

##### Extent and Magnitude

3-197 In addition to the permanent static infrastructure, mooring chains have the potential to be intermittently in contact with the seabed during tidal cycles thereby resulting in the inability for the area to be used resulting in habitat loss. A total of 800 m of mooring chain on each of the nine anchors at the 70 turbine locations has the potential to impact an additional 0.504 km<sup>2</sup> (**Table 3-3**).

3-198 The worst case for long term habitat loss includes mooring systems (anchors) (0.479 km<sup>2</sup>), mooring chains (0.51 km<sup>2</sup>), OSP and IRC foundations (0.117 km<sup>2</sup>), export cable protection (including crossings) (0.43 km<sup>2</sup>) and inter array cabling (including crossings) (0.147 km<sup>2</sup>), totalling 1.68 km<sup>2</sup> (**Table 3-3**).

3-199 Long term habitat loss is confined to the physical area of infrastructure within the Proposed Offshore Development Site, at locations where herring are present and where there is a high potential of spawning habitat (**Figure 3-5** and **Figure 3-13**).

3-200 The Proposed Offshore Development Site overlaps with defined spawning grounds (Coull *et al.*, 1998), on the southern half of the ECC and to the north of the Array Area (supporting the Buchan and Orkney / Shetland spawning populations of herring, respectively).

3-201 The worst case for long term habitat loss will result in loss of 1.68 km<sup>2</sup> (**Table 3-3**) habitat representing 0.4 % of the total Proposed Offshore Development Site. Values are provided for the maximum habitat loss in terms of herring habitat, which are very low (i.e., <0.03%) (**Table 3-8**) and assume all loss overlaps herring spawning grounds. These values are considered highly conservative, given that potential spawning habitat (**Figure 3-1**, **Figure 3-6** and **Figure 3-13**) overlapping defined spawning and nursery areas is limited.

**Table 3-8 Long term habitat loss of spawning and nursery grounds for herring in relation to the regional study area**

	<i>Coull et al., 1998</i>		<i>Ellis et al., 2012</i>	
	Area	% Overlap	Area	% Overlap
<b>Spawning</b>	30,914.5	0.005%	No data	No data
<b>Nursery</b>	6,527.83	0.026%	(H) 21,635.44 km <sup>2</sup> (L) 95,182.94 km <sup>2</sup>	0.008% 0.002%

3-202 The habitat overlapped by the Proposed Offshore Development Site is not considered to be important for herring spawning due to a lack of suitable sediment (**Section 3.6.1**). Although there was evidence of herring throughout the Proposed Offshore Development Site during baseline surveys, given the timing (May – June, 2023), it is considered that this is down to pre-spawning migration congregating activities (**Section 3.6.1.1**, *Maravelias et al.* 2000).

### **Duration and Timing**

3-203 Long term habitat loss will arise from the placement of infrastructure which will remain in place for the life of the Project (i.e., 35 years).

### **Frequency**

3-204 Once the infrastructure is in place, the habitat will be lost and it is expected that there will only be maintenance activities for existing infrastructure footprints and therefore the ‘as built’ footprint will remain for the life of the Project.

### **Reversibility**

3-205 Impacts are long term and habitat will be lost where infrastructure is placed with no long term reversibility (i.e., over the 35 years). Although the habitat loss is considered long term, this area of loss is very small, limited to areas of seabed surface infrastructure, relative to that available in the regional Study Area and will be spread out within the Proposed Offshore Development Site. It is also considered, that the habitat will quickly recover through natural processes, following decommissioning when all infrastructure is removed.

### **3.6.5.2 Conclusion**

3-206 The impacts seen will be localised and habitat loss will be limited to the footprint of the Proposed Offshore Development infrastructure (including cable protection) and the immediate vicinity (e.g., for mooring chains) for 35 years of operation in the marine environment.

3-207 Given the lack of high potential spawning habitat overlapping the Proposed Offshore Development Site, long term habitat loss will not impact upon the herring populations overall as there are more suitable areas of potential spawning habitat outside of the Proposed Offshore Development Site within the Buchan spawning ground (**Figure 3-5**).

3-208 Although these impacts will be long term in duration, it is considered that given the relatively small area of seabed lost to long term habitat loss (including the limited spawning habitat), the wide distribution of herring habitat in the regional Study Area, and the low usage of the

Proposed Offshore Development Site by herring for spawning, any effects of long term habitat loss during operation and maintenance are therefore Not Significant for herring.

3-209 Therefore, the provision of the additional information within **Section 3.6.5** does not alter the original assessment conclusions, i.e., there are no likely significant effects predicted for herring as a result of long term habitat loss during operation of the Proposed Offshore Development.

### **3.6.5.3 Secondary Mitigation and Residual Effect**

3-210 Given that no likely significant effects are predicted for herring for long term habitat loss, no secondary mitigation is proposed in addition to the Project-level and fish and shellfish specific embedded mitigation measures as described in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.11 and the inclusion of AEM for development of an FMP which would be produced post-consent in consultation with MD-LOT and NatureScot (**Section 3.10**). These measures are summarised as follows:

- EM9 - Development of and adherence to a CaP.
- AEM57- Development and adherence to an FMP.

3-211 As the mitigation proposed will already be embedded in the Proposed Offshore Development design and no additional secondary mitigation is proposed, the post-mitigation residual effects of long term habitat loss during operation on herring receptors is therefore Not Significant.

### **3.6.6 Herring Cumulative Effects Assessment**

3-212 This CEA builds on that presented in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13.3 and the two should be read in conjunction.

3-213 The herring CEA follows the CEA methodology presented in **Section 3.3.2**, in line with RAEI from MD-LOT (including NatureScot's response), building on that provided in the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish, Section 8.13). The updated herring baseline (**Section 3.6.1**) has been used for this assessment.

3-214 Where the export cable route (or corridor) is considered for other plans or projects, in the assessment, this is stated, noting that this information is not publicly available for all sites.

3-215 Within this section, the assessment is presented for only the impacts forming the basis of the AEIR relating to herring. The impacts where additional information is presented are:

- Direct temporary habitat disturbance;
- Increases in SSC and deposition;
- Increases in underwater noise leading to mortality, injury and behavioural effects; and
- Long term habitat loss
- **Section 3.9** provides the additional information requested as part of the CEA for all receptors for the following remaining impacts:
- Colonisation of structures and infrastructure;

- EMF and thermal effects; and
- Secondary entanglement.

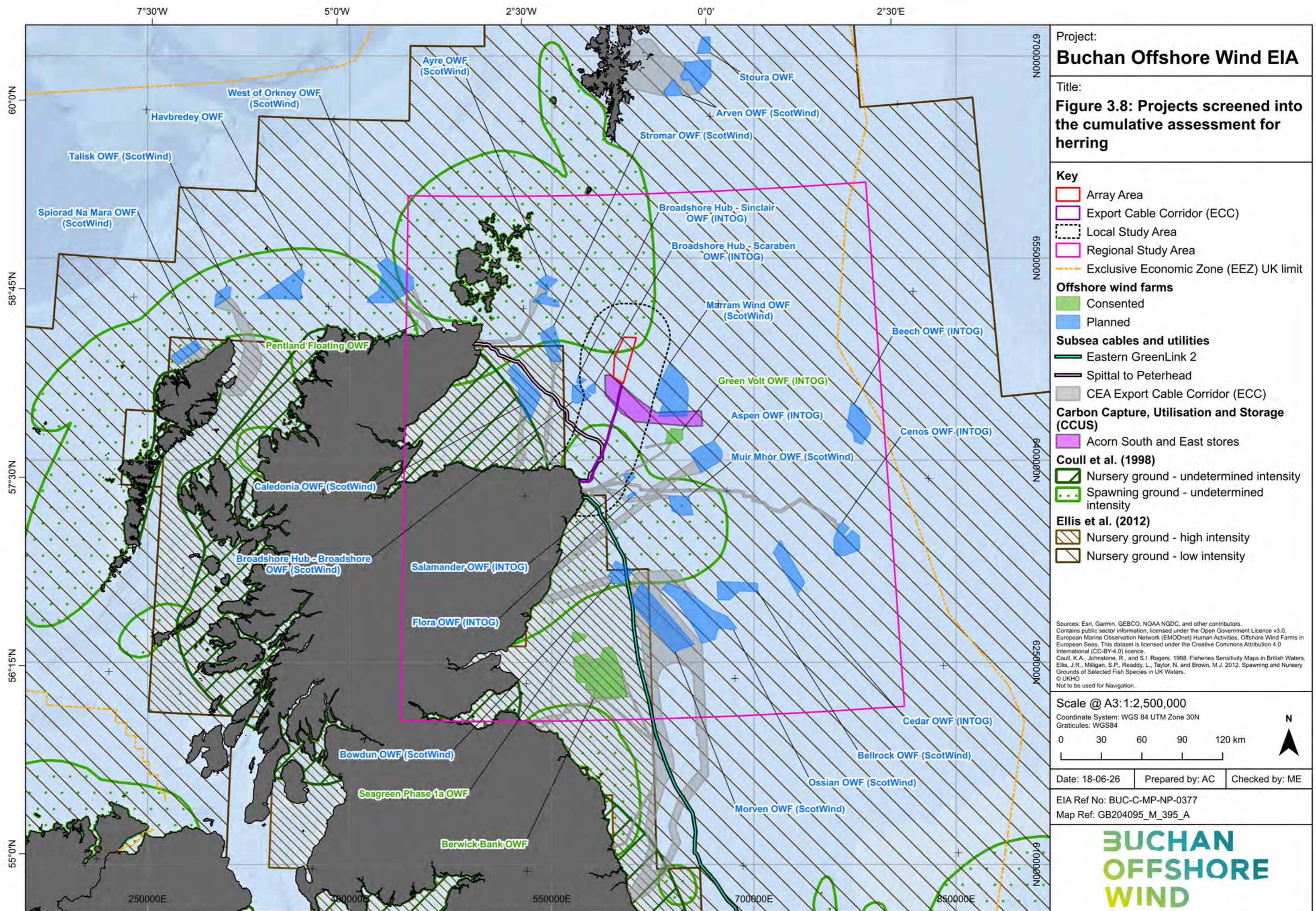
### 3.6.6.1 Direct Temporary Habitat Disturbance

3-216 A number of offshore developments fall within the cumulative assessment Study Area (**Figure 3-8**). Direct Temporary habitat Disturbance can only occur within the footprints of the proposed plans or projects.

3-217 Accordingly, plans and projects considered for this cumulative impact assessment have been refined from in the full list to those projects which also overlap the same herring spawning grounds as that potentially impacted by the Proposed Offshore Development (i.e., the Buchan, and the Orkney / Shetland grounds) (Coull *et al.*, 1998) (**Figure 3-8**).

3-218 The following plans and projects are therefore considered in the CEA for herring for the impact of direct temporary habitat disturbance:

- West of Orkney OWF (including export cable);
- Ayre OWF (including export cable);
- Stromar OWF (including export cable);
- Muir Mhòr (including export cable);
- Salamander OWF (including export cable);
- Flora OWF;
- Bowdun OWF (including export cable);
- EGL2;
- Aspen export cable route (not the OWF);
- Cenos export cable route (not OWF);
- Morven and Ossian export cable route (Not OWFs);
- Spittal – Peterhead Subsea Cable Link; and
- Carbon capture, compression energy infrastructure installation.



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## Construction

- 3-219 It is considered that the predominant impact to Herring with respect to direct temporary habitat disturbance is an impact on the potential spawning habitat for this species. Once in their larval or adult phase, herring are pelagic in nature and not subject to this impact in a manner that could lead to likely significant effects at a cumulative level.
- 3-220 The habitat present within the Proposed Offshore Development Site is largely unsuitable for herring spawning because the sediment is too fine (**Figure 3-5** and **Figure 3-6**). The overlap of the Proposed Offshore Development Site with herring spawning grounds is small, with limited potential spawning habitat, in proportion to the available habitat in the regional Study Area. Historical use (IHLS and baseline data) is varied, although has been shown to be highest outside of the Proposed Offshore Development Site (**Figure 3-3** and **Figure 3-4**).
- 3-221 The maximum area of habitat disturbance at the Proposed Offshore Development Site is <0.1% of the herring spawning ground (**Table 3-3, Section 3.6.2**) and was considered very low (**Section 3.6.2**), and Not Significant for herring for the Proposed Offshore Development alone.
- 3-222 The worst case for temporary habitat disturbance for the other plans and projects (alone) (**Appendix 3.3**) provides a range of values (between 1.76 km<sup>2</sup> (Spittal to Peterhead Subsea Cable Link) and 69.1 km<sup>2</sup> West of Orkney OWF) (**Appendix 3.3**) which were similarly assessed as Not Significant.
- 3-223 The total cumulative area of habitat disturbance across all projects considered, including the Proposed Offshore Development Site (6.413 km<sup>2</sup>) is 219.72 km<sup>2</sup><sup>3</sup> (**Appendix 3.3**), equating to a small proportion (i.e., 0.71 %) of the overall available herring spawning habitat (Coull *et al.*, 1998) in the regional Study Area (30,915 km<sup>2</sup>).
- 3-224 The conclusions of the CEAs for these other projects was that the impact of direct temporary habitat disturbance on herring was Not Significant following the implementation of embedded mitigation (similar to those proposed for the Proposed Offshore Development). This conclusion was based on the overall area to be potentially impacted, the short term and temporary nature of the work, and the natural dynamics of the North Sea leading to rapid recovery of habitats. The mitigation measures for the Proposed Offshore Development are presented in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.11). Common proposed mitigation for other projects include (noting that not all of the below are recommended for each project):
- The production of suitable Plans e.g., CaP, Piling Strategy, MMMP, EMP;
  - Sensitive engineering considerations for design and placement of infrastructure;

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<sup>3</sup> West of Orkney OWF (69.10 km<sup>2</sup>), Ayre OWF (18 km<sup>2</sup>), Muir Mhor OWF (7.73 km<sup>2</sup>), Salamander OWF (5.18 km<sup>2</sup>), Bowdun OWF (19.41 km<sup>2</sup>), EGL2 (7.6 km<sup>2</sup>), Aspen OWF (23.94 km<sup>2</sup> for the whole Project), Cenos OWF (10.63 km<sup>2</sup> for the whole Project), Ossian OWF (49.95 km<sup>2</sup>), Spittal to Peterhead Subsea Cable Link (1.76 km<sup>2</sup>), the Proposed Offshore Development (6.413 km<sup>2</sup>).

- FMPs are also included as mitigation (Muir Mhòr OWF) to present specific mitigation for fish and shellfish where e.g., the In Principle FMP shows how likely significant effects on behaviour from underwater noise during spawning can be reduced to levels which are Not Significant.
- 3-225 As direct temporary habitat disturbance impacts on Herring spawning are only present within the footprint of construction work, effects will be highly localised and the cumulative area will be a product of discrete localised areas within each project's development areas, noting that of the area of the spawning and nursery ground impacted by the Proposed Offshore Development, is in the main not suitable for herring spawning due to sediment types.
- 3-226 Herring spawning is predicted to only occur during a short window (approximately two weeks) within the overall spawning period, and as such, impacts from each project during that small window will not constitute the full impact area for any one project, and as such the overall areas presented are a gross overestimation of the impacted area at any one time. It is recognised that this will be a multi-year impact depending on the projects' construction schedules, however in each year, the area of impact will be small and discrete and considerably less than that described above.
- 3-227 Furthermore, seabed recovery is expected to be rapid with recoverability of the seabed for the Proposed Offshore Development Site considered in the order of months to years (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes) (**Figure 3-1** and **Figure 3-5**). This is comparable to all other projects considered that may act cumulatively (National Grid and SSENT, 2022; Desperes, 2000, Dernie *et al.*, 2003). As such, though the impact may present over multiple years, recovery of areas where work is complete will ensure that the full area is never fully impacted in any one year.
- 3-228 All of the projects assessed this impact alone and cumulatively as Not Significant and it is considered that no additional mitigation was required, outside of embedded / in-built mitigation proposed (**Appendix 3.3**). Although not specifically stated as an embedded mitigation measure for direct temporary habitat disturbance, the production and implementation of an FMP will ensure that further assessment is undertaken, following Consent, ensuring the likely impacts, based on the confirmed design parameters, are assessed for sensitive species, including herring. This will allow a more refined assessment of work in any one year, with a refined consideration of the cumulative picture.
- 3-229 Considering the baseline which describes the lack of suitable habitat for herring over much of the Proposed Offshore Development Site, the localised, small extent and temporary intermittent nature of the construction activities for each plan or project, and the fact the overall cumulative footprints are very small and discrete in comparison with the wider extent of the herring spawning grounds, the Proposed Offshore Development's negligible contribution cumulatively with that of other plans and projects remains Not Significant for direct temporary habitat disturbance for herring.

## Operation and Maintenance

- 3-230 It is considered, based on **Appendix 3.2**, that when Buchan OWF is operational, so will all other listed projects and therefore the same projects are considered for the operation and maintenance cumulative assessment, as for construction for direct temporary habitat disturbance.
- 3-231 The effects of direct temporary habitat disturbance during operation and maintenance for all plans and projects are expected to be less than those predicted for the construction phase as the activities are lesser in nature and scale (**Section 3.6.6.1**) and due to the mobile nature of the receptor, the alternative available habitat, the temporary nature of the impact and the small spatial extent disturbed in comparison.
- 3-232 Therefore, the Proposed Offshore Development's negligible contribution cumulatively with the contribution to others is Not Significant for direct temporary habitat loss for herring during operation and maintenance.

## Decommissioning

- 3-233 The effects of direct temporary habitat disturbance during decommissioning will be less than those predicted for the construction phase with conclusions remaining as per the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13) i.e., Not Significant for herring.

### 3.6.6.2 Increases in Suspended Sediments and Deposition

- 3-234 A number of neighbouring offshore developments fall within the cumulative assessment Study Area (**Figure 3-8**). Increases in SSC and deposition can occur within the footprints of the proposed plans or projects as well as outside through sediment transport pathways.
- 3-235 Accordingly, plans and projects considered for this cumulative impact assessment have been refined from the full list to those projects which also overlap the same herring spawning grounds as that potentially impacted by the Proposed Offshore Development (i.e., the Buchan, and the Orkney / Shetland grounds) (Coull *et al.*, 1998), and those within the range of sediment transport pathway considered (25 km based on precautionary sediment transport maximum (**Figure 3-8**)).
- 3-236 The Plans and projects screened in for increases in SSC and deposition for herring are the same as those in **Section 3.6.6.1**.

## Construction

- 3-237 It is considered that the predominant impact to Herring with respect to increases in SSC and deposition is an impact on the potential spawning and nursery habitat and behaviour for this species. Once in their adult phase, herring are pelagic in nature, highly mobile, and there is not considered to be any potential for likely significant effects on mobile non spawning adults at a cumulative level.
- 3-238 The sediment composition throughout the Proposed Offshore Development Site is mainly silty sand to gravelly sand, with finer sediment present in the Array Area, changing to coarser

sediment (i.e., gravel) and bedrock approaching landfall, with patches of finer sediment present (**Section 3.6.1**) (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes).

- 3-239 For the Proposed offshore Development, the impacts arising from the worst case parameters (i.e., maximum distance travelled by SSC of 15 km (south easterly direction), maximum SSC up to 270 mg/l rapidly declining after seven days, and the maximum level of deposition estimated at 12 cm) (**Table 3-3**) were considered to be Not Significant for the Proposed Offshore Development, alone.
- 3-240 The worst case for increases in SSC for the other plans and projects (alone) (**Appendix 3.3**) provides a maximum range of SSC from 0.1 km (Ossian OWF) to 20 km (Muir Mhòr OWF), with the majority of other considered projects predicting SSC effects extending up to between approximately 4 km and 17 km (**Appendix 3.3**).
- 3-241 Maximum concentrations for the other plans and projects range from hundreds of thousands of mg/l in the immediate vicinity (Cenos OWF) to 200 mg/l at Muir Mhor OWF, rapidly decreasing in less than one week (maximum six days for Muir Mhòr OWF), however for the majority of projects SSC returns to background levels typically within three days from cessation of the impact (e.g., Aspen OWF, Ayre OWF, Cenos OWF, Salamander OWF, Bowdun OWF and Muir Mhòr OWF) (**Appendix 3.3**).
- 3-242 Sediment deposition across the plans and projects varies, ranging (where data available) between > 1 cm (Ossian WOF, Muir Mhòr OWF) to 100 cm (Salamander OWF) linked to direct disposal mounds resulting from release of sediment from a dredger (resulting in the disaggregation of finer material and potentially forming an armoured seabed layer of coarser sediment) (**Appendix 3.3**).
- 3-243 The other plans and projects similarly all assessed increases in SSC and deposition as Not Significant (alone).
- 3-244 The conclusions of the CEA for these other projects was that the impact of increases in SSC and sediment deposition on herring was Not Significant following the implementation of embedded mitigation (similar to those proposed for the Proposed Offshore Development). This conclusion was based on the overall area to be potentially impacted, the short term and temporary nature of the work, and the natural dynamics of the North Sea leading to rapid recovery of habitats. The mitigation measures for the Proposed Offshore Development are presented in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.11) and listed above (**Section 3.6.6.1**).
- 3-245 It is acknowledged that if the Proposed Offshore Development is constructing alongside one or more of the other plans or projects, and to a similar programme, that multiple sources of elevated SSC are probable. However, given the generally low levels once at a distance from the source, and the rapid dispersion of SSC in the water column, and limited deposition away from the relevant projects, any potential impacts would be very small and short lived.
- 3-246 Herring spawning is predicted to only occur during a short window (approximately 2 weeks) within the overall spawning period, and as such, potential interaction of multiple projects with that small window are highly unlikely. It is recognised that this will be a multi-year impact depending on the project's construction schedules, however in each year, the projects under

construction and the area of impact will be small and discreet and overall the impact will be considerably less than that considered within this assessment.

- 3-247 Considering the baseline (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.7) which describes the lack of suitable habitat for herring over much of the Proposed Offshore Development Site, and considering that the potential area of effect is limited at each project location with SSC and deposition decreasing rapidly with distance from the source at all projects, and the intermittent nature of the construction activities, the Proposed Offshore Development's negligible contribution cumulatively with the contribution to other plans and projects is therefore Not Significant for SSC and sediment deposition on herring.

### **Operation and Maintenance**

- 3-248 It is considered, that when Proposed Offshore Development is operational, so will all other listed projects and therefore the same plans and projects are considered for the operation and maintenance cumulative assessment, as for construction for increases in SSC and deposition.
- 3-249 The assessment for the Proposed Offshore Development alone, identified no likely significant effects on all fish and shellfish receptors from increases in SSC and sediment deposition from operation and maintenance activities. This was due to the dynamic nature of the North Sea, the limited plume distance, the temporary nature of the impact and the small spatial extent disturbed in comparison with the alternative available habitat EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13.3.2).
- 3-250 The effects of an increase in SSC and sediment deposition during operation and maintenance is expected to be less than those predicted for the construction phase (EIAR Volume 2, Chapter 8: Fish and Shellfish, Section 8.13.3.1). The associated operation and maintenance activities are less in nature and scale. Therefore, the Proposed Offshore Development's negligible contribution cumulatively with the contribution to others is Not Significant for increases in SSC and sediment deposition for herring during operation and maintenance.

### **Decommissioning**

- 3-251 The effects of increases in SSC and sediment deposition during decommissioning will be less than those predicted for the construction phase with conclusions remaining as per the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13) i.e., Not Significant for herring.

#### **3.6.6.3 Increases in Underwater Noise**

- 3-252 A number of offshore developments fall within the cumulative assessment Study Area (**Figure 3-8**). Increases in underwater noise can occur within the footprints of the proposed plans or projects as well as outside through propagation.
- 3-253 Accordingly, plans and projects considered for this cumulative impact assessment have been refined from the full list to those projects which also overlap the same herring spawning grounds as that potentially impacted by the Proposed Offshore Development (i.e., the Buchan, and the Orkney / Shetland grounds) (Coull *et al.*, 1998), and those plans and projects which are within

double the maximum range of TTS (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes), 178 km (double the 89 km predicted TTS range for the Proposed Offshore Development Site) as this represents the maximum potential for noise contours to overlap between projects (**Figure 3-7** and **Figure 3-17**)

3-254 For the purposes of the CEA, and to take a precautionary approach, it is considered that the projects screened in are constructing at the same time as the Proposed Offshore Development. The following Plans and projects are screened in for the cumulative assessment of increases in underwater noise on herring:

- Marram Wind OWF;
- Spittal – Peterhead Subsea Cable Link
- Green Volt OWF (including export cable);
- Ayre OWF (including export cable);
- Caledonia OWF (including export cable);
- Salamander OWF (including export cable);
- Aspen OWF (including export cable);
- Muir Mhòr OWF (including export cable);
- EGL2;
- Bowdun OWF;
- Pentland OWF (including export cable);
- Ossian OWF;
- Morven OWF (including export cable);
- West of Orkney OWF (including export cable);
- Bellrock OWF;
- Cenos export cable route (not OWF);
- Seagreen 1a;
- Berwick and Marr Bank (including export cable);
- Broadshore Hub - Sinclair OWF;
- Broadshore Hub - Scaraben OWF;
- Broadshore Hub - Broadshore OWF;
- Stromar OWF (including export cable);
- Flora OWF;
- Cedar OWF; and

- Beech OWF.

3-255 To ensure a precautionary approach, the assessment is based on receptors being stationary, the impact distances reduce considerably for fleeing receptors (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology). The assessments for these other projects concluded impacts were Not Significant following the implementation of embedded mitigation (similar to those proposed for the Proposed Offshore Development). These are presented in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.11) and listed above (**Section 3.6.6.1**).

3-256 The predominant noise source that may act cumulatively on herring is from impact piling. Though it is recognised that cable laying and other construction activities other than piling can generate underwater noise and contribute to a cumulative underwater noise impact, the noise arising from such activities as cable installation and rock placement is non-impulsive, of low magnitude, and is unlikely to have any potential to act cumulatively when considering the distances between projects and the low levels of noise emitted from such non-impulsive sources. As such it is considered that it is only piling impacts that have the potential to lead to a significant cumulative effect and is therefore the subject of the assessment text below.

### Construction

3-257 The effects of underwater noise on herring were assessed as Not Significant for the Proposed Offshore Development, alone (**Section 3.6.4**). Impacts arising from impact piling range from mortality and recoverable injury at close range, and TTS over potentially larger distances.

3-258 There is limited possibility that individuals would be cumulatively impacted by mortality or recoverable injury as impact ranges at these thresholds are small for each development, typically affecting approximately 1-2% of the herring spawning ground at any one time from each project which overlaps the spawning ground. It is acknowledged any fish in the immediate vicinity of piling operations would be subject to mortality and recoverable injury, however it is not considered that there is potential for any significant cumulative impacts from mortality and recoverable injury (including on eggs and larvae which are subject to these impacts ) due to the small overall area of impact arising from each development relative to the availability of habitat which is primarily located outside of the Proposed Offshore Development Site and thus not affected by the Proposed Offshore Development (**Figure 3-7** and **Figure 3-6**).

3-259 The greatest potential for cumulative effects from underwater noise arises from the impact of TTS, with the maximum range for the Proposed Offshore Development calculated at 66 km (21,000 km<sup>2</sup>) for concurrent piling. The worst case for increases in underwater noise for the other plans and projects (**Appendix 3.3**) provides TTS impact ranges between 25 km (Bowdun OWF) and 110 km (Muir Mhòr OWF), and areas between 47 km<sup>2</sup> (Bellrock OWF) and 20,000 km<sup>2</sup> (Muir Mhòr OWF), which were all assessed as Not Significant at a project level (**Appendix 3.3**), noting that not all projects report equivalent parameters, and models used varied between projects (**Appendix 3.3**).

3-260 Though potentially large areas may be affected, due to the intermittent nature of the impacts, and the discrete activity of spawning by herring, it is considered that the impact to spawning potential for any one project is <2%. It is not possible to sum the impact areas for each

development for TTS as overlapping areas would generate an overestimate of the full picture, and not be representative of the actual impact which, due to the general availability of piling vessels, will not all be able to install at the same points in time. TTS recovery is also very rapid (within 24 hours (Popper *et al.*, 2014)) and it has been reported (McCauley *et al.*, 2000) that fish have been shown to return to normal behaviour patterns between noise generating events within 30 minutes following cessation of the noise generating activity. As such, though it is recognised that multiple disturbance events may arise, the impact to the spawning potential from each development is small when the duration of spawning periods is considered, and as recovery from each event will be quick allowing reestablishment of any activities, the overall potential to impact herring will be limited.

- 3-261 Therefore, it is considered that the Proposed Offshore Development's contribution cumulatively with all other projects considered is Not Significant for increases in underwater noise for herring.

### **Operation and Maintenance**

- 3-262 The effects of increases in underwater noise during operation and maintenance are expected to be less than those predicted for the construction phase, and therefore Not Significant for herring (**Section 3.6.6.1**. See the EIA, (EIA Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.12.2.4).

### **Decommissioning**

- 3-263 The effects of increases in underwater noise during decommissioning will be less than those predicted for the construction phase as there will be no impact piling, with conclusions remaining as per the EIA (EIA Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13 i.e., Not Significant for herring.

### **3.6.6.4 Long Term Habitat Loss**

- 3-264 A number of neighbouring offshore developments fall within the cumulative assessment Study Area (**Figure 3-8**). Plans and projects have been refined (based on those in **Appendix 3.2**) for herring based on plans and projects which are present in the same herring spawning grounds (i.e., the Buchan and Orkney / Shetland grounds) (Coull *et al.*, 1998) which overlap the Proposed Offshore Development Site (**Figure 3-8**).
- 3-265 The plans and projects screened in for long term habitat loss for herring are the same as those in **Section 3.6.6.1**.
- 3-266 It is considered that long term habitat loss is an impact that presents after the completion of construction work and during the lifetime of the Proposed Offshore Development and as such the assessment is undertaken based on the footprint of infrastructure only, during the operation and maintenance and decommissioning phases only.

### **Operation and Maintenance**

- 3-267 It is considered that the predominant impact to Herring with respect to long term habitat loss is an impact on the potential spawning habitat for this species. Once in their larval or adult phase,

herring are pelagic in nature and not subject to this impact in a manner that could lead to likely significant effects at a cumulative level.

- 3-268 The habitat present within the Proposed Offshore Development Site is largely unsuitable for herring spawning because the sediment is too fine (**Figure 3-5** and **Figure 3-6**). The overlap of the Proposed Offshore Development Site with herring spawning grounds is small, with limited potential spawning habitat, in proportion to the available habitat in the regional Study Area. Historical use (IHLS and baseline data) is varied, although has been shown to be highest outside of the Proposed Offshore Development Site (**Figure 3-3** and **Figure 3-4**).
- 3-269 The maximum area of long term habitat loss at the Proposed Offshore Development Site is 1.68 km<sup>2</sup> (**Table 3-3** and **Section 3.6.5**), and the overlap of the Proposed Offshore Development with herring spawning and nursery grounds is negligible in terms of the wider available habitat (<0.03 % (**Section 3.6.5**)) (**Figure 3-5** and **Figure 3-6**). This was assessed as Not Significant for herring.
- 3-270 The worst case for long term habitat loss for the other plans and projects (alone) (**Appendix 3.3**) provides a range of values between 0.09 km<sup>2</sup> (Seagreen 1A OWF) and 19.27 km<sup>2</sup> (Ossian OWF), which were similarly assessed as Not Significant. This conclusion was based on the limited extent of long term habitat loss and the significant alternative habitat available.
- 3-271 The total area of long term habitat loss (Based on the refined plans and projects (for herring) and available data<sup>4</sup>) including the proposed Offshore Development is 46.87 km<sup>2</sup> (**Appendix 3.3**) equating to a small proportion (i.e., 0.15 %) of the overall available herring spawning habitat (Coull *et al.*, 1998) in the regional Study Area (30,915 km<sup>2</sup>). This value is however considered an overestimate as not all impacted habitat will be located in areas of high spawning potential or suitable sediments.
- 3-272 The conclusions of the CEAs for these other projects was also that the impact of long term habitat loss was Not Significant following the implementation of embedded mitigation (similar to those proposed for the Proposed Offshore Development). The mitigation measures for the Proposed Offshore Development are presented in the EIA Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.11 and listed above (**Section 3.6.6.1**).
- 3-273 The majority of the plans and projects screened into the CEA for long term habitat loss do not overlap defined areas of high spawning potential (**Figure 3-1**, **Figure 3-5** and **Figure 3-8**). Areas of long term habitat loss will be highly localised and restricted to the footprint of the plans and projects infrastructure only and therefore the cumulative area will be made up of discrete localised areas at each plan or project, instead of one continuous area.
- 3-274 Cumulatively it is considered the temporary disturbance to the herring spawning and nursery habitat overlapping the Proposed Offshore Development (i.e., the Buchan and Orkney / Shetland

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<sup>4</sup> West of Orkney OWF – 7.34 km<sup>2</sup>, Ayre OWF – 3.04 km<sup>2</sup>, Muir Mhor 2.76 km<sup>2</sup>, Salamander OWF – 6.95 km<sup>2</sup>, Bowdun OWF – 2.25 km<sup>2</sup>, Aspen 1.36 km<sup>2</sup>, Cenos OWF – 1.9 km<sup>2</sup>, Ossian OWF – 19.27 km<sup>2</sup>, Spittal – Peterhead Subsea Cable Link – 0.31 km<sup>2</sup>, with the Proposed Offshore Development (1.68 km<sup>2</sup>) = **46.87 km<sup>2</sup>**

spawning stocks) is very small, based on the very small overlap with suitable habitat and habitat with high spawning potential (**Table 3-6, Section 3.6.2, Figure 3-5 and Figure 3-6**).

- 3-275 The values presented are highly precautionary and assume all loss is within the spawning area. It is also considered there is considerable availability of high spawning potential (**Figure 3-6**) within the cumulative assessment Study Area, including within defined spawning grounds (Coull *et al.*, 1998) (**Section 3.6.1.2**).
- 3-276 The overall cumulative project footprints are very small (**Appendix 3.3**) in comparison with the wider extent of spawning grounds and the long term loss of habitat is not expected to affect herring in any significant manner. The impact of long term habitat loss on herring from the Proposed Offshore Development's cumulatively with other plans and projects is therefore considered Not Significant.

### **Decommissioning**

- 3-277 The effects of long term habitat loss during decommissioning will be less than those predicted for the operation and maintenance phase with conclusions remaining as per the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13) i.e., Not Significant for herring.

## **3.7 SANDEEL**

- 3-278 This section provides an updated baseline and the assessment for sandeel, RAEI from MD-LOT (including NatureScot's response). An updated baseline is provided to support the robust assessment conclusions and does not alter any of the conclusions presented in the EIAR for sandeel i.e., effects are Not Significant for all impacts.

### **3.7.1 Baseline**

- 3-279 Sandeel in the North Sea and adjacent waters are managed by the EU and ICES using six sandeel management areas. The Proposed Offshore Development Site (total area of 416 km<sup>2</sup>), within the regional Study Area and is located within Sandeel Management Area IV covering the North Sea and supporting the largest area of sandeel stocks (Marine Scotland, 2024). There are five species of sandeel found in Scottish waters, however *Ammodytes marinus* (typically found at depths of 20-80 m) is the most abundant sandeel in Scottish waters (Marine Scotland, 2024).
- 3-280 Sandeel are present within the Moray Firth (Sandeel Area IV (ICES)) and are a key species of ecological importance in the North Sea food web, forming a vital prey resource for birds and marine mammals during the summer months (Fernandez-Betelu *et al.*, 2024). Sandeel are of both commercial importance and conservation importance as a PMF (Howson *et al.*, 2012) and feature on the Scottish Biodiversity List (SBL) (NatureScot 2020). In addition, there are two MPAs in the wider regional Study Area which are important for sandeel: North-West Orkney MPA and Turbot Bank MPA, although the Proposed Offshore Development Site does not overlap either MPA.
- 3-281 Adult sandeel are largely resident, remaining within approximately 32 km of their original location (NatureScot, 2023a), with burial within sandy sediments forming a key adaptation to

their environment. Sandeel presence is largely driven by available habitat suitable for burrowing behaviour.

- 3-282 Sandeel have a defined spawning period between November and February, in line with the overwintering period (Coull *et al.*, 1998), however this has been more recently quoted (Scottish Government, 2023) as being between December and January in Scotland. Following this overwintering period, fish emerge in early spring for a feeding period lasting until summer (Henriksen *et al.*, 2024)
- 3-283 Sandeel exhibit complex seasonal and diel behaviour patterns and rarely emerge from the seabed, where they remain predominately buried, except to spawn and feed (NatureScot, 2023a). Sandeel remain buried between September and February (when they are considered most sensitive to seabed disturbance), except when they emerge between December and January to spawn (Scottish Government, 2023). Larvae hatch between February and April (Wright & Bailey, 1996; Régnier *et al.*, 2017 in Marine Scotland, 2024). Larvae typically drift within water currents for up to three months before settling on the seabed.
- 3-284 A Sandeel (Prohibition of Fishing) (Scotland) Order 2024 came into force in March 2024, prohibiting fishing for sandeel in all Scottish territorial waters, following the successful implementation of an east coast closed area, in place since 2000 (Scottish Government, 2024).
- 3-285 Given sandeel importance in the wider North Sea marine food web, the PrePARED project (Fernandez-Betelu *et al.*, 2024), through a number of geographical workstreams, aims to improve understanding of how seabirds and marine mammals respond to OWF developments and the mechanisms underpinning these responses, particularly with respect to changes in prey distribution<sup>5</sup> and availability. See EIAR Volume 2, Chapter 9: Offshore and Intertidal Ornithology and EIAR Volume 2, Chapter 10: Marine Mammals and other Megafauna for more information.

### 3.7.1.1 Baseline Characterisation

- 3-286 Recorded sandeel distributions are widespread throughout Scottish seas as presented in the Geodatabase of Marine features adjacent to Scotland (GeMS) (NatureScot, 2025b; GeMS, 2019). Lesser sandeel (*Ammodytes marinus*) were identified during baseline surveys (grab samples, eDNA and DDV) (EIAR Volume 3, Appendix 7.1; Buchan Environmental Survey Report) (**Figure 3-10**).
- 3-287 eDNA sampling indicated that detections were concentrated along the ECC, with the highest recordings around the 12 nm Territorial Sea limit (**Figure 3-10**). Ten out of the twelve locations sampled for eDNA provided evidence of Ammodytidae DNA, with detections primarily concentrated along the ECC within both top and bottom water samples. At five of these locations, detections were further refined to species level and identified as lesser sandeel (**Figure 3-10**). Sandeel were also confidently identified in three DDV survey images, with potential occurrence identified in a further two images. All confirmed observations were located

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<sup>5</sup> <https://owecprepared.org/about/>

along the landward half of the ECC, coinciding with areas of suitable sandy sediment habitat. A further four individuals were identified within two grab samples just outside the 12 nm Territorial Sea limit (**Figure 3-10**). The limitations of eDNA data are presented in **Section 3.6.1.1**.

3-288 The presence of lesser sandeel in the Proposed Offshore Development Site coincides with areas of suitable sandy sediment habitat (derived from baseline characterisation PSA results) and overlaps areas of high-intensity spawning grounds (Ellis *et al.*, 2012; Coull *et al.*, 1998) (**Figure 3-10**). Baseline PSA data are primarily derived from point sampling locations and therefore predictive mapped sediment layers (e.g., EMODnet based on Folk (1954)) were also used to support interpretation of spatial data gaps in line with Reach *et al.* (2024) (updated MarineSpace, 2013b). Accordingly, the presence of sandeel cannot be ruled out across areas of suitable habitat within the wider Proposed Offshore Development Site.

### 3.7.1.2 Sandeel Spawning and Nursery Grounds

3-289 The Array Area and the ECC overlap with mapped sandeel spawning and nursery grounds (Ellis *et al.*, 2012; Coull *et al.*, 1998) (**Figure 3-9**). Given the resident nature of sandeel, their demersal egg stage and specific sediment preferences, larvae and juveniles are also considered likely to overlap mapped spawning grounds (Ellis *et al.*, 2012).

3-290 Sandeel are prolific demersal spawners reaching maturity around two years of age and are therefore considered relatively slow growing (NatureScot, 2023a), producing a large batch of sticky eggs (between 4,000 and 20,000 (Rowley, 2008)) which attach to the seabed. Larvae typically hatch between one and three months after spawning (Wright and Balley, 1996), however increasing temperature during incubation period has been shown to result in shorter egg development (Régnier *et al.*, 2018). After hatching, they float in currents as plankton for up to three months before settling on the seabed (NatureScot, 2023a). Evidence from post-construction monitoring infers sandeel larvae can rapidly recolonise an area upon cessation of construction activities if the sediment composition does not change (Leonhard *et al.*, 2006; Beatrice Offshore Wind Farm, 2021). These life-history characteristics support successful recruitment, survival and maintenance of local population dynamics.

3-291 Higher intensity (Ellis *et al.*, 2012) spawning and nursery areas are present within inshore locations along the coastline (**Figure 3-9**), in line with sandeel distribution modelling (Langton *et al.*, 2021) which reveals the Array Area and the ECC have a generally low predicted presence (**Figure 3-11**) and low predicted density (**Figure 3-12**) of sandeel, with the highest densities increasing in inshore areas along the coast at the landfall location. Langton *et al.* (2021) data does have limitations, particularly in the accuracy of lesser sandeel (*Ammodytes marinus*) further offshore in deeper waters as the model is based on shallower depths (30 – 50 m), however due to the identified areas of high use i.e., high intensity spawning and nursery grounds, these data have useful applications for this assessment.

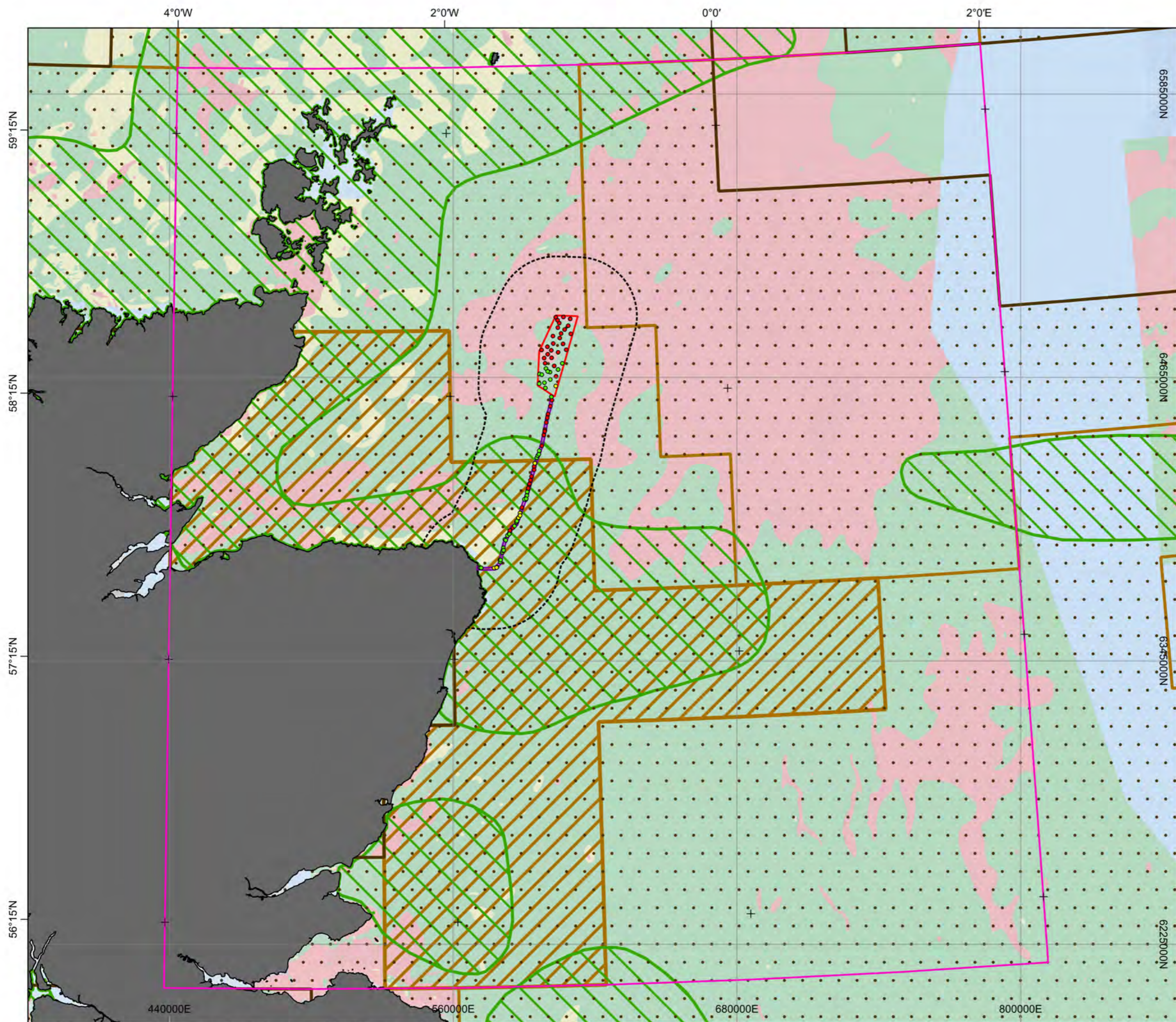
3-292 Sandeel spawning areas represent sandeel presence year-round, due to their largely resident habits, typically remaining close to their spawning grounds. Some discrepancy exists within literature on how far sandeel may move, with Wright *et al.* (2019) reporting sandeel remain within 10 km of their grounds and NatureScot (2003a) reporting sandeel rarely move more than 32 km. Despite this difference, compared to other species, sandeel remain relatively local to

spawning areas, exhibiting site fidelity following initial larval dispersal reflecting the distribution of preferred habitat (Jensen *et al.*, 2011). This fidelity to their spawning grounds leads to highly localised sandeel populations that could be vulnerable to local disturbances or stressors (Latto *et al.*, 2013; Jensen *et al.*, 2011).

- 3-293 Sandeel presence and distribution are driven by substrate suitability. Sandeel have a specific substrate requirement for spawning i.e., sediment with a sandy component (preferred spawning substrate comprises gravelly sand, slightly gravelly sand and sand whilst marginal spawning substrate comprises sandy gravel) (Reach *et al.*, 2024; MarineSpace *et al.*, 2013b).
- 3-294 Sandeel suitable spawning habitat ('preferred' and 'marginal' in line with Reach *et al.* (2024)) is predicted to be present across large areas of the north North Sea (according to EMODnet predictive habitat mapping using the Folk (1954) classification<sup>6</sup>), including within the majority of the Proposed Offshore Development Site (**Figure 3-9**). However, site specific PSA data collected during the benthic baseline survey indicates limited suitable habitat in the Proposed Offshore Development Site (**Figure 3-9**). Only the southern third of the Array Area has suitable ('preferred' and 'marginal') habitat for sandeel spawning (**Figure 3-9**) and the southern half of the ECC (proximal to landfall) has patches of suitable habitat (**Figure 3-9**). Areas of suitable habitat are discrete in nature, representing discrete pockets of suitable habitat overlapping mapped spawning areas (Coull *et al.*, 1998; Ellis *et al.*, 2012) (**Figure 3-9**).
- 3-295 Greatest densities of sandeel are predicted along the coast (**Figure 3-12**) (aligning with the modelled probability of buried sandeel and the predicted density of sandeel (**Figure 3-11** and **Figure 3-12**)).
- 3-296 The Essential Fish Habitat (Franco *et al.* 2022) data for sandeel provide model predictions for lesser sandeel based on inter-annual environmental conditions. Data is restricted to inshore areas across all modelled predictions and the available data demonstrates, for the majority of the available data, that there is a high confidence in absence of sandeel aggregations. There are discrete patches of lower confidence absence. Areas of predicted presence are infrequent.
- 3-297 Sandeel larval abundance has experienced natural fluctuations over time (Marine Scotland, 2023). Historical sandeel data reveals that the relative sandeel larval abundance (between 1950 and 2005) (Lynam *et al.*, 2013) indicates the highest historical relative abundances recorded (> 0.5 individuals per m<sup>3</sup>) do not overlap the Proposed Offshore Development Site. With the Proposed Offshore Development Site, abundance is reduced to moderate relative abundance (between < 0.4 and < 0.6 individuals per m<sup>3</sup>). The historical data (Lynam *et al.*, 2013) are broadly representative of the mapped spawning and nursery areas (Ellis *et al.*, 2012; Coull *et al.*, 1998) and mapped habitat (EMODnet) (**Figure 3-9**), and the probability of lesser sandeel (**Figure 3-11**) and predicted density (**Figure 3-12**) (Langton *et al.*, 2021).

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<sup>6</sup> used to underpin the British Geological Survey surface sediment maps (British Geological Survey, 2020).



Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.9: Sediment suitability for sandeel spawning based on Folk (1954) sediment classification and spawning Ggrounds (Ellis et al., 2012)**

**Key**

- Array Area
- Export Cable Corridor (ECC)
- Local Study Area
- Regional Study Area

**Coull et al. (1998)**

- Nursery and spawning ground - undetermined intensity

**Ellis et al. (2012)**

- Nursery ground - low intensity
- Spawning ground - high intensity
- Spawning ground - low intensity

**Site specific baseline data:**

Sandeel habitat potential (Folk, 1954; Reach et al., 2024)

- Preferred
- Marginal
- Unsuitable

Sandeel habitat suitability (Folk, 1954; Reach et al., 2024)

- Preferred
- Marginal
- Unsuitable

Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland.  
 Folk, R.L. (1954) The distance between grain size and mineral composition in sedimentary rock nomenclature. *Journal of Geology*, 62: 344 – 359.  
 Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters. Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and Nursery Grounds of Selected Fish Species in UK Waters.  
 Reach, I., Kyle-Henney, M., Barr, N., Warner, I., Lowe, S., and Lloyd Jones, D., (2024). Identifying and Mapping Sandeel Potential Supporting Habitat: An Updated Method Statement. Not to be used for Navigation.

**Scale @ A3: 1:1,600,000**  
 Coordinate System: WGS 84 UTM Zone 30N  
 Graticules: WGS84

0 20 40 60 80 km

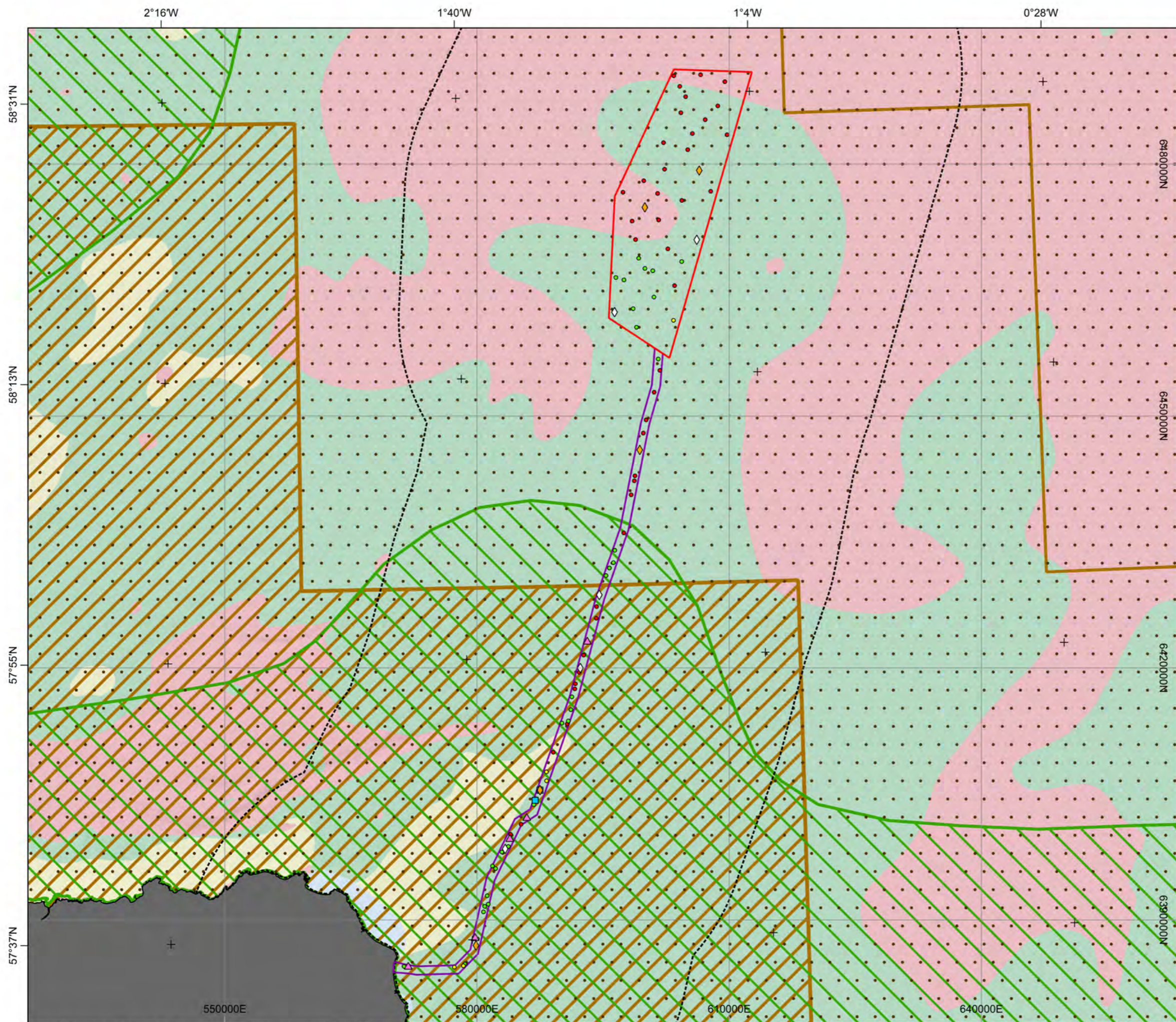
N

Date: 18-06-26    Prepared by: AC    Checked by: ME

EIA Ref No: BUC-C-MP-NP-0367  
 Map Ref: GB204095\_M\_385\_A



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Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.10: Sandeel site specific baseline data gathered for the Project in 2023**

**Key**

- Array Area
- Export Cable Corridor (ECC)
- Local Study Area
- Regional Study Area

**Coull et al. (1998)**

- Nursery and spawning ground - undetermined intensity

**Ellis et al. (2012)**

- Nursery ground - low intensity
- Spawning ground - high intensity
- Spawning ground - low intensity

**Site specific baseline data:**

Sandeel habitat potential (Folk, 1954; Reach et al., 2024)

- Preferred
- Marginal
- Unsuitable

Sandeel habitat suitability (Folk, 1954; Reach et al., 2024)

- Preferred
- Marginal
- Unsuitable

eDNA sampling

- eDNA - Sandeel presence
- eDNA - Lesser sandeel presence
- Benthic grab - Sandeel presence
- DDV - Sandeel presence

Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland.  
 Folk, R.L. (1954) The distance between grain size and mineral composition in sedimentary rock nomenclature. Journal of Geology, 62: 344 – 359.  
 Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters.  
 Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and Nursery Grounds of Selected Fish Species in UK Waters.  
 Reach, L., Kyle-Henney, M., Barr, N., Warner, I., Lowe, S., and Lloyd Jones, D., (2024). Identifying and Mapping Sandeel Potential Supporting Habitat: An Updated Method Statement.  
 Not to be used for Navigation.

**Scale @ A3: 1:450,000**  
 Coordinate System: WGS 84 UTM Zone 30N  
 Graticules: WGS84

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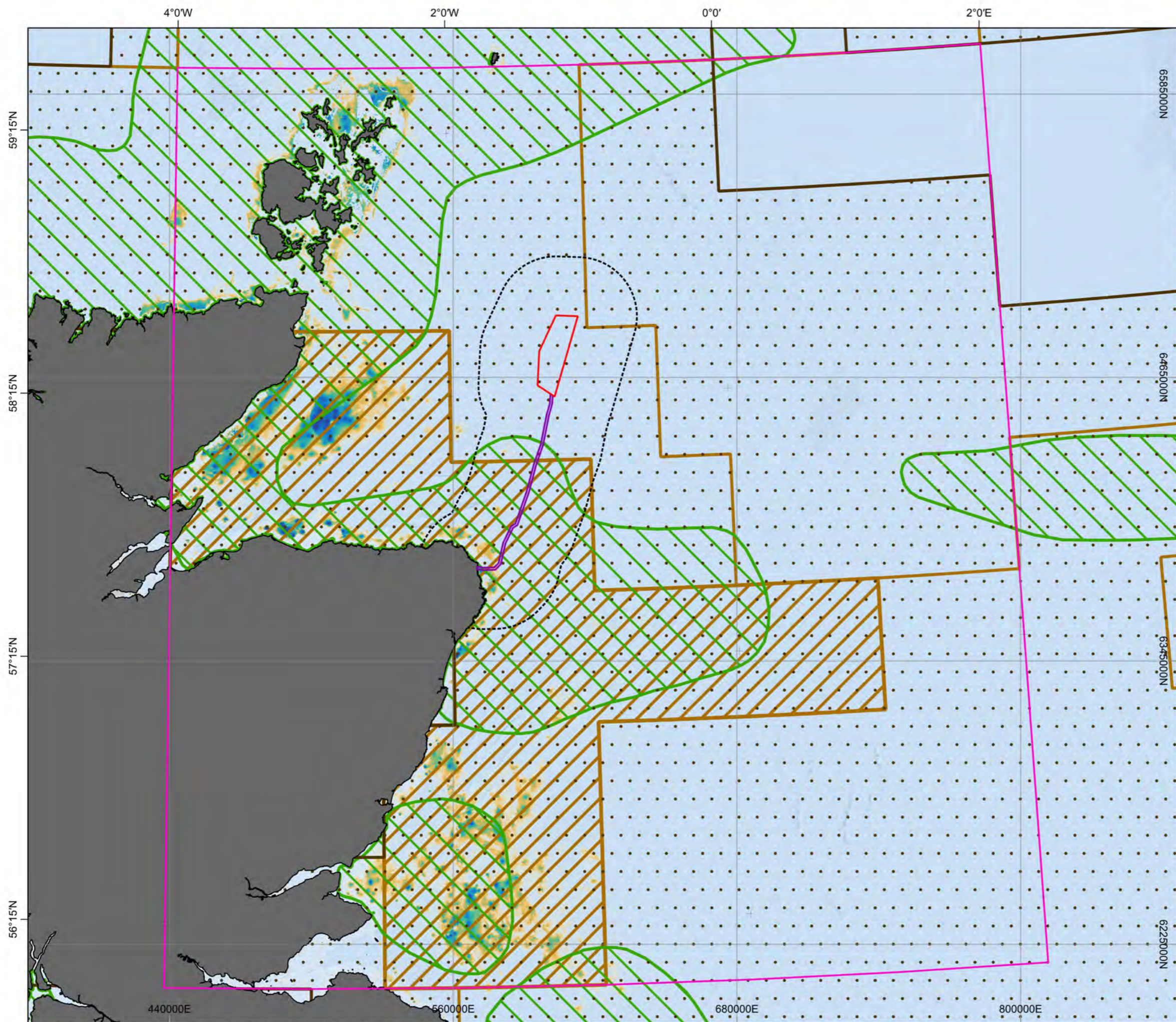
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Date: 18-06-26    Prepared by: AC    Checked by: ME

EIA Ref No: BUC-C-MP-NP-0375  
 Map Ref: GB204095\_M\_393\_A



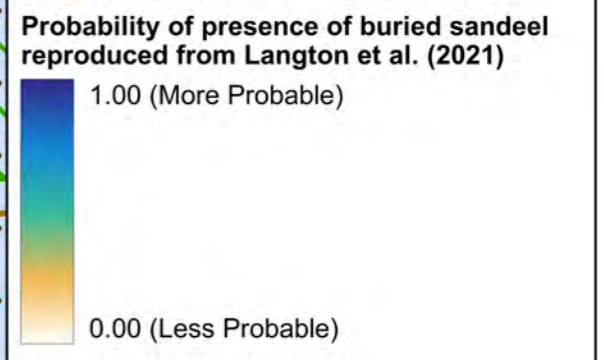
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Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.11: Probability of buried sandeel (*Ammodytes* sp.) presence Langton *et al.* (2021) with modelled spawning and nursery grounds**

- Key**
- Array Area
  - Export Cable Corridor (ECC)
  - Local Study Area
  - Regional Study Area
- Coull *et al.* (1998)**
- Nursery and spawning ground - undetermined intensity
- Ellis *et al.* (2012)**
- Nursery ground - low intensity
  - Spawning ground - high intensity
  - Spawning ground - low intensity



Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland. Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters. Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and Nursery Grounds of Selected Fish Species in UK Waters. Reach, I., Kyle-Henney, M., Barr, N., Warner, I., Lowe, S., and Lloyd Jones, D., (2024). Identifying and Mapping Sandeel Potential Supporting Habitat: An Updated Method Statement. Not to be used for Navigation.

**Scale @ A3: 1:1,600,000**  
 Coordinate System: WGS 84 UTM Zone 30N  
 Graticules: WGS84

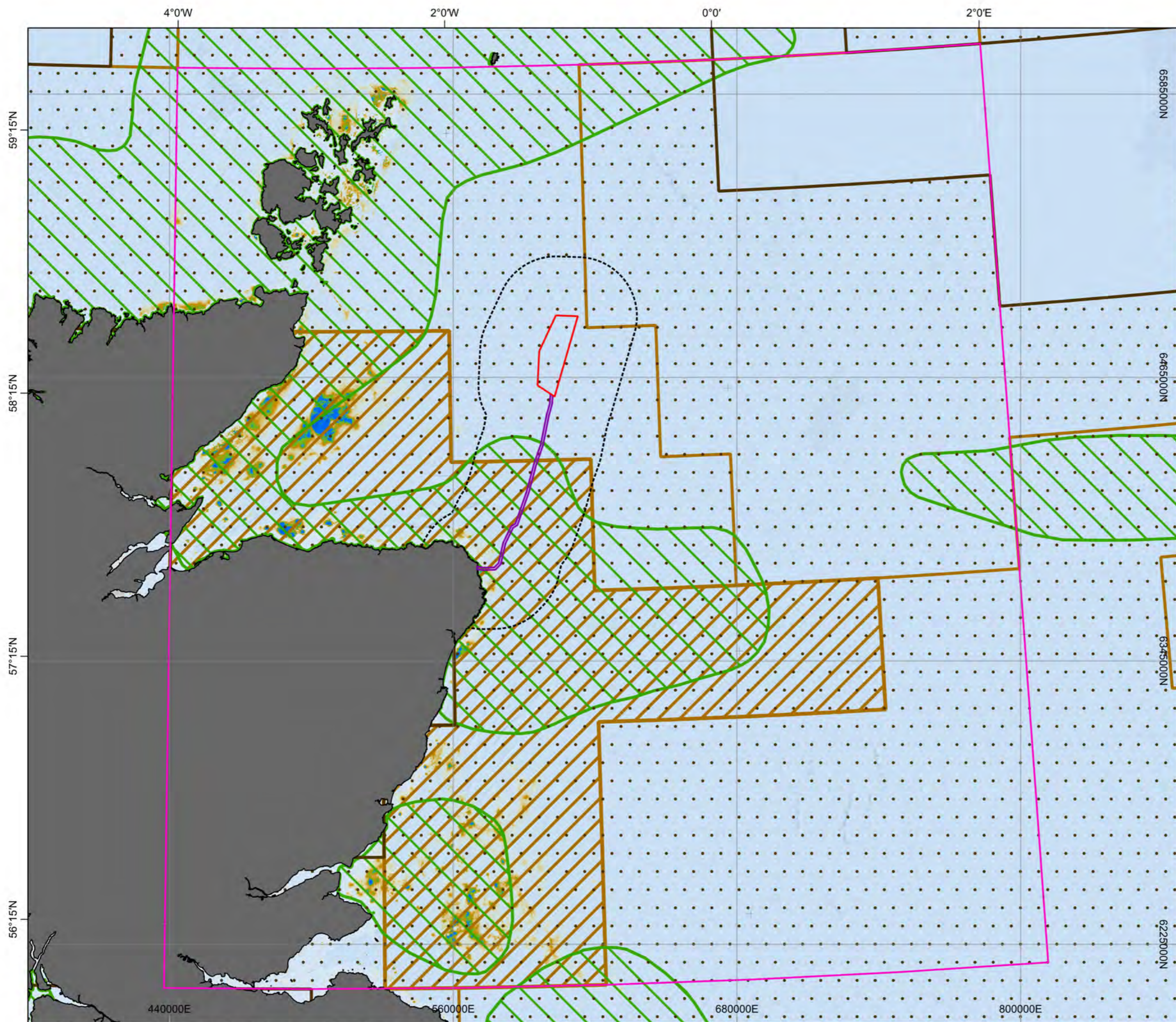
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Date: 18-06-26    Prepared by: AC    Checked by: ME

EIA Ref No: BUC-C-MP-NP-0368  
 Map Ref: GB204095\_M\_386\_A



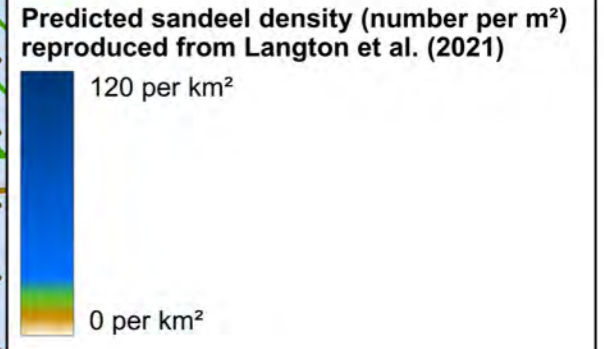
Notes: a) Information on this plan is directly reproduced from digital and other material from different sources. Minor discrepancies may therefore occur. Where further clarification is considered necessary, this is noted through the use of text boxes on the plan itself. b) For the avoidance of doubt and unless otherwise stated: 1. this plan should be used for identification purposes only, unless otherwise stated in accompanying documentation. 2. Buchan Offshore Wind Ltd accepts no responsibility for the accuracy of data supplied by third parties. 3. Buchan Offshore Wind Ltd accepts no liability for any use which is made of this plan by a party other than its client. No third party who gains access to this plan shall have any claim against Buchan Offshore Wind Ltd in respect of its contents.



Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.12: Predicted density of lesser sandeel in the North Sea Langton *et al.* (2021) with modelled spawning and nursery grounds**

- Key**
- Array Area
  - Export Cable Corridor (ECC)
  - Local Study Area
  - Regional Study Area
- Coull *et al.* (1998)**
- Nursery and spawning ground - undetermined intensity
- Ellis *et al.* (2012)**
- Nursery ground - low intensity
  - Spawning ground - high intensity
  - Spawning ground - low intensity



Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland.  
 Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters.  
 Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and Nursery Grounds of Selected Fish Species in UK Waters.  
 Langton, Boulcott & Wright (2021) A verified distribution model for the lesser sandeel *Ammodytes marinus*.  
 Not to be used for Navigation.

Scale @ A3: 1:1,600,000  
 Coordinate System: WGS 84 UTM Zone 30N  
 Graticules: WGS84

N

Date: 18-06-26    Prepared by: AC    Checked by: ME

EIA Ref No: BUC-C-MP-NP-0369  
 Map Ref: GB204095\_M\_387\_A



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### 3.7.1.3 Sandeel Spawning Habitat Suitability Assessment

3-298 In line with the RAEI from MD-LOT in consultation with NatureScot, in order to provide further reassurance in the assessment conclusions reached, a spawning habitat suitability confidence heat map has been produced for sandeel. This follows the methodology in Reach *et al.*, (2024) (i.e., the 2024 updated MarineSpace methodology), updating the MarineSpace (2013b) report.

#### Methodology

3-299 The sandeel habitat suitability assessment methodology and confidence scoring follows the same methodology as herring (**Section 3.6.1.3**), in line with Reach *et al.*, (2024) (i.e., the 2024 updated MarineSpace methodology), updating the MarineSpace (2013b) report.

#### Data Layers

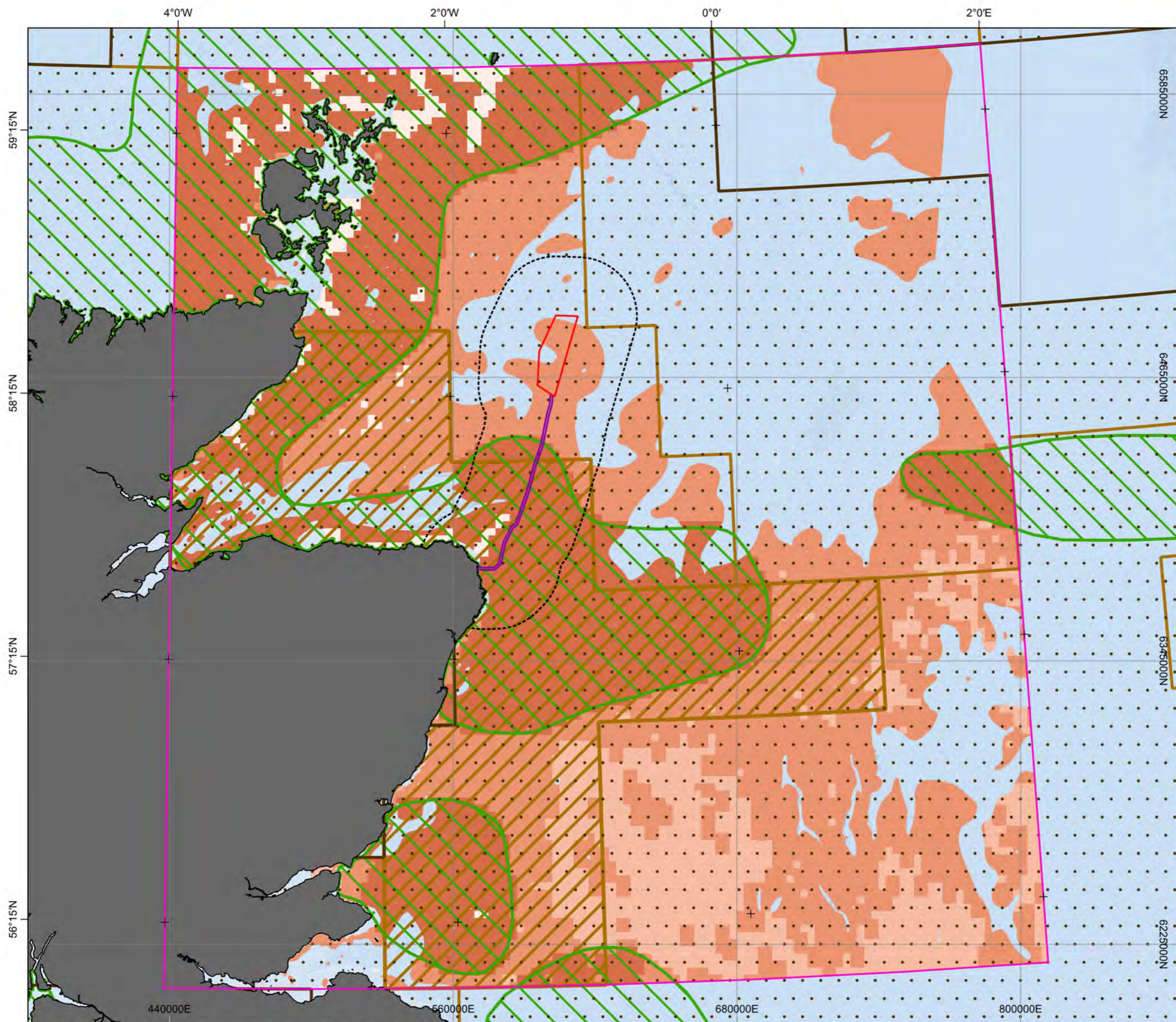
3-300 The data layers used are based on the methodology in Reach *et al.* (2024):

- Sediment data (EMODnet, based on Folk (1954) 16 refinement);
- Coull *et al.* (1998) spawning grounds; and
- Fisheries VMS (demersal).

#### Sandeel Spawning Habitat Suitability

3-301 The heat map (**Figure 3-13**) shows areas of highest heat and therefore potential spawning habitat where the ECC overlaps the spawning area with 'preferred' habitat (**Figure 3-9**).

3-302 Whilst the use of heat maps is a useful way to visualise multiple overlapping data sources, caution is advised based on the modelled nature of the data, and further consideration of individual layers is required to allow overall justification for the conclusions drawn.



Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.13: Sandeel potential spawning habitat heat map (in accordance with Reach *et al.*, 2024)**

**Key**

- Array Area
- Export Cable Corridor (ECC)
- Local Study Area
- Regional Study Area

**Coull *et al.* (1998)**

- Nursery and spawning ground - undetermined intensity

**Ellis *et al.* (2012)**

- Nursery ground - low intensity
- Spawning ground - high intensity
- Spawning ground - low intensity

**Site specific baseline data:**

Sandeel potential spawning habitat (Reach *et al.*, 2024)

- < 0.141
- 0.141 - 0.188
- 0.188 - 0.250
- 0.250 - 0.563

Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland.  
 Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters.  
 Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and Nursery Grounds of Selected Fish Species in UK Waters.  
 Reach, I., Kyle-Henney, M., Barr, N., Warner, I., Lowe, S., and Lloyd Jones, D., (2024). Identifying and Mapping Sandeel Potential Supporting Habitat: An Updated Method Statement.  
 Not to be used for Navigation.

**Scale @ A3: 1:1,600,000**  
 Coordinate System: WGS 84 UTM Zone 30N  
 Graticules: WGS84

0 20 40 60 80 km

N

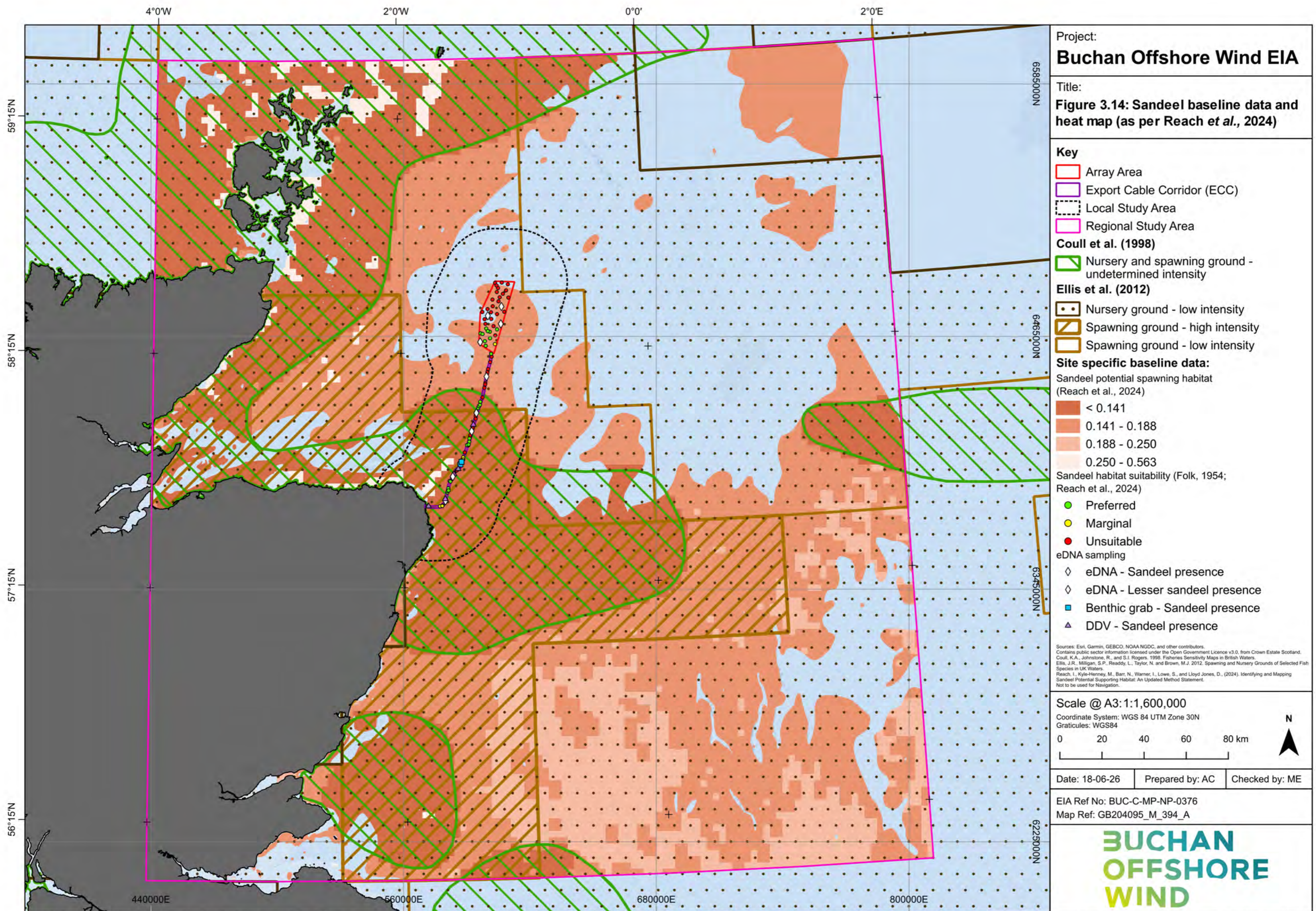
Date: 18-06-26    Prepared by: AC    Checked by: ME

EIA Ref No: BUC-C-MP-NP-0370  
 Map Ref: GB204095\_M\_388\_A



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- 3-303 Preferred and marginal habitats (**Figure 3-9**) (EMODnet) underpin all other layers in the model and therefore it is clear in the heat map (**Figure 3-13**) that this is a large driver in the geographical spread identifying areas with high potential spawning habitat.
- 3-304 The baseline PSA data obtained throughout the Proposed Offshore Development Site indicates that the ECC has areas of suitable habitat to the south, but there are large stretches of unsuitable habitat identified, contradicting the EMODnet habitat (**Figure 3-9**). As previously noted, (**Section 3.7.1.1**), baseline PSA data is a more reliable indicator of true suitable habitat, and have been used in conjunction to draw conclusions.
- 3-305 The model also considers overlap of Coull *et al.* (1998) spawning grounds (as informed by Reach *et al.*, 2024), where areas of mapped 'suitable' (comprising 'preferred' and 'marginal') habitat overlap spawning areas drives the modelling output (**Figure 3-9** and **Figure 3-13**). Despite overlap with the mapped spawning ground (Coull *et al.*, 1998) (**Section 3.7.1.2**, **Figure 3-9**) only a small proportion of the baseline PSA samples coincided with mapped (EMODnet) 'preferred' or 'marginal' habitat. These data drive the area of highest heat (and confidence) (**Figure 3-5**).
- 3-306 The area with the highest confidence covered 41,229.99 km<sup>2</sup> in the regional Study Area, with 69.05 km<sup>2</sup> overlapping with the Proposed Offshore Development Site, equating to the Proposed Offshore Development overlapping 0.17% of the highest potential spawning habitat within the regional area. It is still considered that this represents an over estimation when compared to baseline data available (**Figure 3-6**).
- 3-307 To further provide confidence in the assessment, the heat map is also considered in relation to the baseline data (**Section 3.5.1** and **Figure 3-10**) (eDNA, DDV and grab samples) which identified sandeel throughout the Proposed Offshore Development Site, mostly concentrated along the southern extent of the ECC approaching landfall. This broadly aligns with the mapped 'suitable' habitat for sandeel (**Figure 3-9** and **Figure 3-14**) and is largely consistent with the areas of high heat (**Figure 3-9**) noting the Array Area is considered to have a lower spawning potential due to the lack of overlap of spawning areas, which are a key driver in determining the habitat spawning potential (**Figure 3-9** and **Figure 3-14**).
- 3-308 A combined approach building on the heat map (**Figure 3-13**), and the individual component layers, with consideration of the supporting evidence, concludes that the area of highest spawning potential is conservative due to the areas of unsuitable habitat confirmed (from site specific sediment PSA), particularly within the Array Area (**Figure 3-9**). The map does however, indicate the widespread nature of more suitable alternative spawning habitat in the regional Study Area, including overlap of the spawning areas (Coull *et al.*, 1998) which extend beyond the local Study Area.



Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.14: Sandeel baseline data and heat map (as per Reach et al., 2024)**

**Key**

- Array Area
- Export Cable Corridor (ECC)
- Local Study Area
- Regional Study Area

**Coull et al. (1998)**

- Nursery and spawning ground - undetermined intensity

**Ellis et al. (2012)**

- Nursery ground - low intensity
- Spawning ground - high intensity
- Spawning ground - low intensity

**Site specific baseline data:**

Sandeel potential spawning habitat (Reach et al., 2024)

- < 0.141
- 0.141 - 0.188
- 0.188 - 0.250
- 0.250 - 0.563

Sandeel habitat suitability (Folk, 1954; Reach et al., 2024)

- Preferred
- Marginal
- Unsuitable

eDNA sampling

- ◇ eDNA - Sandeel presence
- ◇ eDNA - Lesser sandeel presence
- Benthic grab - Sandeel presence
- ▲ DDV - Sandeel presence

Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland. Coull, K.A., Johnstone, R., and S.J. Rogers. 1998. Fisheries Sensitivity Maps in British Waters. Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and Nursery Grounds of Selected Fish Species in UK Waters. Reach, I., Kyle-Henney, M., Barr, N., Warner, I., Lowe, S., and Lloyd Jones, D., (2024). Identifying and Mapping Sandeel Potential Spawning Habitat: An Updated Method Statement. Not to be used for Navigation.

**Scale @ A3: 1:1,600,000**

Coordinate System: WGS 84 UTM Zone 30N  
Graticules: WGS84

0 20 40 60 80 km

Date: 18-06-26 | Prepared by: AC | Checked by: ME

EIA Ref No: BUC-C-MP-NP-0376  
Map Ref: GB204095\_M\_394\_A



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### 3.7.2 Direct Temporary Habitat Disturbance (Construction Phase)

- 3-309 See **Section 3.7.1** for a summary of sandeel baseline information and data.
- 3-310 A description of the activities which will lead to direct temporary habitat disturbance can be found in **Section 3.6.2** and **Table 3-3**.
- 3-311 The effects from this impact during operation and decommissioning are considered to be less than during construction.

#### 3.7.2.1 Assessment of Likely Significant Effect

- 3-312 The methodology for assessing direct temporary habitat disturbance on sandeel (**Section 3.7.2.1**) is detailed in **Section 3.3.1**.

##### Direction of change

- 3-313 Direct temporary habitat disturbance may affect individuals directly through the disturbance of key habitat e.g., spawning and nursery habitat, and indirectly through the resultant loss of feeding habitat.

##### Extent and Magnitude

- 3-314 **Section 3.6.2.1** (and **Table 3-3**) detail the parameters for extent and magnitude used in this assessment.
- 3-315 During construction, the area of maximum direct temporary habitat disturbance of the defined sandeel spawning and nursery grounds within the wider regional Study Area (i.e., the area of overlap of the sandeel spawning and nursery grounds within the regional Study Area) are very low (i.e., <0.05%) (**Table 3-9, Figure 3-9**).

**Table 3-9 Direct temporary habitat disturbance of spawning and nursery grounds for sandeel in relation to the regional Study Area**

	<i>Coull et al., 1998</i>		<i>Ellis et al., 2012</i>	
	Area	% Overlap	Area	% Overlap
<b>Spawning</b>	36,408.98 km <sup>2</sup>	0.018%	(H) 31,604.22 km <sup>2</sup> (L) 49,633.43 km <sup>2</sup>	0.02% 0.01%
<b>Nursery</b>	36,408.98 km <sup>2</sup>	0.018%	110,363.89	0.006%

- 3-316 The Proposed Offshore Development Site as a whole is not likely to be important for sandeel because areas of preferred habitat are patchy offshore as demonstrated by the site-specific PSA data, with larger areas of more suitable habitat indicated beyond the local Study Area (**Figure 3-9**). A large proportion of the regional Study Area beyond the local Study Area has high potential sandeel spawning habitat (**Figure 3-13**) within defined sandeel spawning grounds (Coull *et al.*, 1998).

## Duration

- 3-317 See **Section 3.6.2.1** for a summary of the duration of direct temporary habitat disturbance, noting that the potential overlap is highly limited due to the sandeel spawning period (i.e., December to January).

## Timing and Frequency

- 3-318 Sandeel are present in the Proposed Offshore Development Site (and the local Study Area) particularly along the landward half of the ECC (**Figure 3-10** and **Figure 3-11**, and **Section 3.7.1.1**). They are considered to be most sensitive when they are buried or spawning (**Section 3.7.1**). Development from egg is rapid and therefore the potential for interaction with eggs at any one time, is extremely small (**Section 3.7.1.2**).
- 3-319 Although there is overlap in some activities proposed timings, these will be undertaken at different discrete locations i.e., mooring line and cable installation. The multi-year construction programme will mean that there is the potential for repeat disturbance over the approximately six year construction period, incorporating multiple spawning periods, but over limited area and via discrete events.
- 3-320 Most of the construction will occur during summer months due to the location of the Proposed Offshore Development, which will largely be outside of the sandeel spawning season (November to February), noting that construction is not limited to only summer months and would be weather dependent.

## Reversibility

- 3-321 It is known the recoverability of the seabed is linked to substrate type (Newell *et al.*, 1998; Desprez, 2000) with recovery expected between two and five years (Desprez, 2000, (Bonsdorff, 1983).
- 3-322 In areas which will experience direct temporary habitat disturbance, the habitat is expected to recover quickly as sediments are mobile, replenishing quickly through natural processes ensuring the spawning habitat is retained. Features and local processes would not suffer any long term alteration and trenches would typically infill within a matter of weeks, (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes).
- 3-323 Sandeel are prolific spawners rapidly reaching maturity with the ability to rapidly recolonise an area following cessation of construction works (**Section 3.7.1.2**). Following overwintering and spawning, larval recolonisation of suitable habitat following disturbance is likely, considering the potential spawning habitat (**Figure 3-13**) resulting in recovery of adult populations. Recovery is likely to be reliant on the supply of recruits from elsewhere or sufficient numbers remaining for self-recruitment, in line with appropriate environmental conditions (JNCC, 2018).
- 3-324 Sandeel eggs laid directly on the sediment are vulnerable to disturbance activities which occur during spawning resulting in egg mortality and reduced spawning opportunity due to loss of available habitat.

3-325 Existing studies (Stenberg *et al.*, 2011) have found no significant adverse effects on sandeel populations at Horns Rev Offshore Wind Farm, with quick recoverability following construction into operation. A study by van Deurs *et al.*, (2012) and Lindeboom *et al.* (2011) found that the construction of OWFs could have a positive short-term effect on sandeel densities around an offshore wind farm over time with sandeel migrating daily in and around the wind farm with no indication of avoidance. Further, a post construction sandeel survey at Beatrice Offshore Wind Farm (Beatrice Offshore Wind Farm, 2021) showed that sandeel abundance either increased or remained at similar levels when comparing abundance over time from baseline to post construction.

### 3.7.2.2 Conclusion

3-326 Direct temporary habitat loss will be confined to the Proposed Offshore Development Site in the area of construction activities.

3-327 Sandeel are considered sensitive to temporary habitat disturbance, particularly during the spawning window (November to February), and due to their dependence on specific habitat, they are considered sensitive to disturbance and removal of this habitat (FeAST Tool, Wright *et al.*, 2000).

3-328 Following disturbance, sediment is predicted to replenish quickly, and effects are not expected to be long term with the rate of recovery dependent on habitat returning to a suitable composition for sandeel. Any displacement and avoidance of key habitat during construction would be temporary based on limited disturbance to spawning areas and is not considered to affect sandeel at a population level.

3-329 The seabed will return to its existing state due to the hydrodynamics present in the North Sea, replenishing quickly through natural processes. Given that sandeel have been shown to be able to swim short distances, population mixing is possible, increasing the potential for recovery following disturbance events. Although sandeel are considered to have limited mobility they do have the ability to move during and following disturbance events, albeit a limited distance. Any displacement or avoidance during construction would be temporary, with sandeel expected to quickly return following the cessation of work.

3-330 Evidence of sandeel throughout the Proposed Offshore Development Site as a whole is limited (baseline data) with patchy presence in the southern Array Area and along the ECC, confined to overlap with spawning grounds. Considerable alternative potential spawning habitat is available locally and within the regional Study Area.

3-331 Considering the potential for sandeel presence and given the relatively small spatial extent of the construction activities, the temporary intermittent and reversible nature of the work, and relatively short duration of the work, it is considered any likely effect from direct temporary habitat disturbance during construction is Not Significant for sandeel.

3-332 Therefore, the provision of the additional information within **Section 3.7.2** does not alter the original assessment conclusions, i.e., there are no likely significant effects predicted for sandeel as a result of direct temporary habitat disturbance during construction of the Proposed Offshore Development.

### **3.7.2.3 Secondary Mitigation and Residual Effect**

- 3-333 See **Section 3.6.2.3** for the mitigation proposed for direct temporary habitat disturbance.
- 3-334 As the mitigation proposed will already be embedded in the Proposed Offshore Development design and no additional secondary mitigation is proposed, the post-mitigation residual effects of direct temporary habitat disturbance during construction on sandeel receptors is Not Significant.

### **3.7.3 Increases in Suspended Sediment Concentrations (SSC) and Deposition (Construction Phase)**

- 3-335 See **Section 3.7.1** for a summary of sandeel baseline information and data.
- 3-336 A description of the activities which will lead to increases in SSC and deposition can be found in **Section 3.6.3** and **Table 3-3**. The effects from this impact during operation and decommissioning are considered to be less than during construction and therefore the conclusions presented within this section for construction are also applicable and valid for operational and decommissioning effects, noting that, although mooring lines will lead to increases in SSC during operation, this is considered in greater detail within the long term habitat loss assessment (**Section 3.7.5**).

#### **3.7.3.1 Assessment of Likely Significant Effect**

- 3-337 The methodology for assessing increases in SSC and sediment deposition on sandeel (**Section 3.7.3.1**) is detailed in **Section 3.3.1**.

##### **Direction of change**

- 3-338 See **Section 3.6.3.1** for the description of the direction of change relating to increases in SSC and deposition.

##### **Extent and Magnitude**

- 3-339 See **Section 3.6.3.1** for the description of extent of the increases in SSC and deposition .
- 3-340 Sediment transport is modelled to move in a south easterly direction (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes), predicting mobilised sediment to remain within sandeel spawning grounds (Coull *et. al.*, 1998) (**Figure 3-9**).
- 3-341 Finer sediment represents a much lower proportion of the ECC sediment composition and will remain within the mapped spawning ground (Ellis *et al.*, 2012 and Coull *et al.*, 1998) when transported in the predicted south-easterly direction for 15 km. The proportion of fine sediment will be limited and therefore this will not be in sufficient quantities to be distinguishable above background levels (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes).
- 3-342 The Proposed Offshore Development Site as a whole is not likely to be important for sandeel because areas of preferred habitat are patchy offshore as demonstrated by the site specific PSA data, with larger areas of more suitable habitat indicated beyond the local Study Area (**Figure 3-9**). A large proportion of the regional Study Area beyond the local Study Area and the Proposed

Offshore Development Site has high potential sandeel spawning habitat (**Figure 3-13**) within defined sandeel spawning grounds (Coull *et al.*, 1998).

### **Duration**

- 3-343 See **Section 3.6.3.1 - Duration** for the description of the duration relating to increases in SSC and deposition

### **Timing and Frequency**

- 3-344 See **Section 3.6.3.1 – Timing and Frequency** for the description of the timing and frequency relating to increases in SSC and deposition.

### **Reversibility**

- 3-345 See **Section 3.6.3.1 – Reversibility** for general information on the North Sea and recovery of the seabed.
- 3-346 Sandeel spend most of their life buried. An increase in finer sediment could cause avoidance behaviour from sandeel in the short term, until sediment is dispersed. Sandeel have been shown to have the ability to survive in sediment for long periods of time and it has been demonstrated that sandeel can tolerate a degree of sediment deposition by adjusting their depth within the sediment to maintain oxygen availability (Behrens *et al.*, 2007; Latto *et al.*, 2013). Displacement and avoidance would be temporary with species returning quickly following the construction work (SSC declining rapidly within 7 days and maximum sediment thickness predicted at 12 days (EIAR, Volume 2, Chapter 6: Marine and Coastal Physical Processes)).
- 3-347 Despite this, sandeel are considered sensitive to siltation rate changes, demonstrating medium sensitivity to light siltation changes (< 5 cm) and high sensitivity to heavy siltation changes (> 5 cm and < 30 cm) in a single event (or via continuous deposition) (Wright *et al.*, 2000; FeAST, 2025). Siltation has the potential to infill surface burrows and smother individuals leading to hypoxia and the inability to feed (Wright *et al.*, 2000). Sandeel are particularly sensitive during periods of spawning activity (between December and February) (Marine Scotland, 2024). However, as sandeel possess the ability to bury and re-emerge, this reduces the likelihood of immediate death.
- 3-348 Sandeel are prolific spawners rapidly reaching maturity with the ability to rapidly recolonise an area following cessation of construction works (**Section 3.7.1.2**). Sandeel in the North Sea are naturally adapted to survival in areas of increased SSC, particularly within the North Sea.
- 3-349 Sandeel egg development is temperature dependent (Macdonald *et al.*, 2019). Eggs can be covered by sediments to a depth of several centimetres via natural processes and it has been reported that eggs covered with sediment are still capable of developing normally and hatching when they are uncovered again in line with biotic conditions such as increased oxygen concentrations and reduced current flow (Hassel *et al.*, 2003; Winslade, 1971). Therefore, it is considered that SSC and smothering is inconsequential to larval and juvenile sandeels (Pérez-Dominguez & Vogel, 2010; Winslade, 1971).

- 3-350 Existing studies (Stenberg *et al.*, 2011) have found no significant adverse effects on sandeel populations at Horns Rev Offshore Wind Farm, with quick recoverability following construction. A study by Lindeboom *et al.* (2011) found that the construction of OWFs could have a positive short-term effect on sandeel densities around an offshore wind farm over time with sandeel migrating daily in and around the wind farm with no indication of avoidance. Further, a post construction sandeel survey at Beatrice Offshore Wind Farm (Beatrice Offshore Wind Farm, 2021) showed that sandeel abundance either increased or remained at similar levels when comparing abundance over time from baseline to post construction.
- 3-351 The sediment associated with key sandeel functioning is predicted to disperse and settle quickly during Proposed Offshore Development construction activities and sandeel are predicted to recover quickly with populations remaining unaffected due to their relative adaptability and reproductive biology i.e., high fecundity, quick maturation.

### **3.7.3.2 Conclusion**

- 3-352 The increase in SSC and sediment deposition will be confined to the extent of the sediment plume arising from the construction activities at the Proposed Offshore Development within the local Study Area, however the largest impacts will be seen in the immediate vicinity of the works.
- 3-353 The impacts will be temporary over the short term with SSC concentrations rapidly declining within seven days of sediment release and the maximum sediment deposition (of 12 cm) rapidly decreasing after a maximum of 12 days. The greatest area of effect will be restricted to the area proximal to the release point, rapidly declining with increasing distance and time.
- 3-354 Sandeel are sensitive to an increase in SSC and sediment deposition due to their affinity to suitable sediment. Use of the Proposed Offshore Development Site by sandeel is not widespread, with evidence suggesting this is limited to the south of the Array Area and along the ECC, albeit patchy in nature. Although sandeel are considered largely resident and therefore are considered a stationary receptor, they do have the ability to swim short distances outside of key overwintering periods i.e., during spring and summer therefore it is considered that due to the mobile nature of sandeel, they have the ability to avoid localised areas of increased SSC, but certain biological traits and life-history events (such as resident substrate spawning and overwintering), mean that this avoidance may be less likely at certain times.
- 3-355 The exposure of eggs (and adults) to smothering will be limited given the short spawning period and egg development. SSC concentrations are expected to quickly fall to background levels in line with what is experienced as part of the natural system and it is therefore increased deposition is unlikely to affect the development of eggs and larvae.
- 3-356 Considering the limited use of the Proposed Offshore Development, overall and that increases in SSC and deposition is expected to be highly localised and within ranges experienced naturally, and, given the localised, relatively small spatial extent of the construction activities, the temporary intermittent and reversible nature of the work, and relatively short duration of the work, it is considered any likely effect from an increase in SSC and sediment deposition during construction is Not Significant for sandeel.

3-357 Therefore, the provision of the additional information within **Section 3.7.3** does not alter the original assessment conclusions, i.e., there are no likely significant effects predicted for sandeel as a result of increases in SSC and deposition during construction of the Proposed Offshore Development.

### **3.7.3.3 Secondary Mitigation and Residual Effect**

3-358 See **Section 3.6.3.3** for the mitigation proposed for increases in SSC and sediment deposition.

3-359 As the mitigation proposed will already be embedded in the Proposed Offshore Development design and no additional secondary mitigation is proposed, the post-mitigation residual effects of increases in SSC and sediment deposition during construction on sandeel receptors is Not Significant.

### **3.7.4 Increases in Underwater Noise Leading to Mortality, Injury and Behavioural Effects – Sandeel (Group 1) (Construction Phase)**

3-360 The assessment as presented in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.12.1.3 is presented below. Sandeel is assessed as a stationary receptor however both stationary and fleeing values are presented for context.

3-361 See **Section 3.7.1** for a summary of sandeel baseline information and data.

3-362 The information and assessment presented in this chapter is supported by the information presented in EIAR Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment.

3-363 This section should be read alongside the EIAR, Volume 2 Chapter 8: Fish and Shellfish Ecology, Section 8.12.1.3 and EIAR Volume 3, Appendix 8.1: Underwater Noise Modelling Assessment which provides the background on the noise modelling and the full outputs

3-364 The effects from this impact during operation and decommissioning are considered to be less than during construction and therefore the conclusions presented within this section for construction are also applicable and valid for operational and decommissioning effects.

#### **3.7.4.1 Assessment of Likely Significant Effect**

3-365 The methodology for assessing increases in underwater noise on sandeel (**Section 3.7.4.1**, below) is detailed in **Section 3.3.1**.

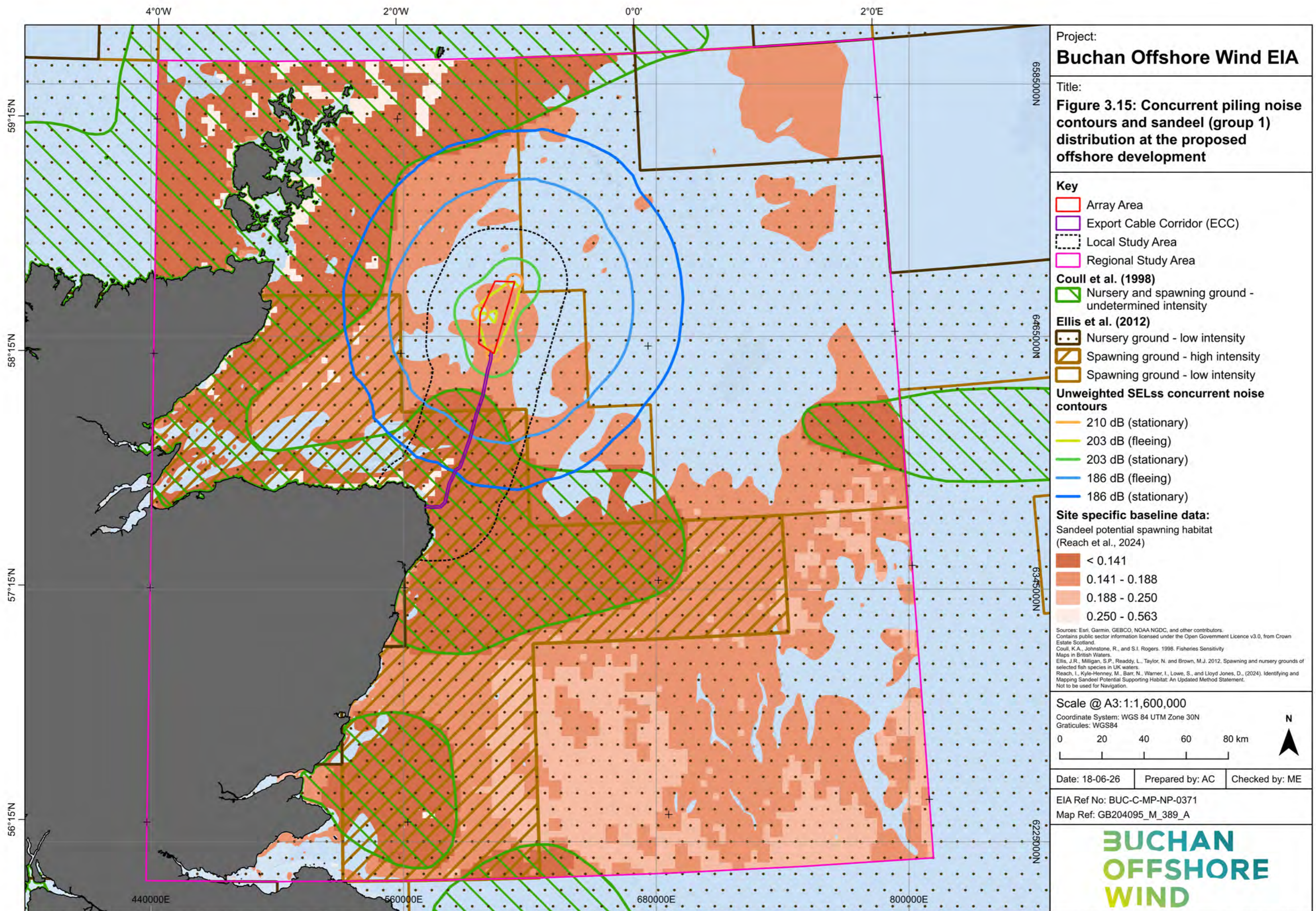
##### **Direction of change**

3-366 During noise generating activities, particularly piling, fish species sensitive to noise will be affected by the impulsive noise generated. Sandeel (a Group 1 fish) are considered the least sensitive to noise effects (Popper *et al.*, 2014 and RWE, 2024) (as defined in **Table 3-2**).

3-367 As a species which remain within or close to the seabed, sandeel are thought to be affected by vibration through the seabed, particularly when they are buried, and as such are considered to be a stationary receptor and thus the modelled stationary outputs are the most relevant for sandeel.

## Extent and Magnitude

- 3-368 During noise producing activities, the potential for sandeel (and other Group 1 fish) individuals to be impacted is dependent on the level of exposure to noise (defined based on mortality, recoverable injury and TTS (behavioural) modelled contours). The greatest impact will arise from the overlap of noise with sandeel within spawning and nursery grounds, potentially affecting congregating and use of the areas for key life events i.e., spawning and overwintering.
- 3-369 Sandeel rely on the seabed for overwintering and spawning and the predicted noise (TTS) contours extend into the mapped sandeel grounds (Coull *et al.*, 1998) (**Figure 3-15**) to the west of the Array Area. Sandeel are considered more sensitive than other Group 1 fish due to their substrate affinity and habitat dependence.
- 3-370 The maximum area of impact for concurrent piling noise arises from TTS (21,000 km<sup>2</sup>) for stationary fish, with injury and mortality considerably less (EIAR, Volume 2, Chapter 8: Fish and Shellfish Ecology, Table 8-27). Full breakdown of the areas of impact are presented in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Group 1 Noise Assessment, Section 8.12.1.3.



Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.15: Concurrent piling noise contours and sandeel (group 1) distribution at the proposed offshore development**

**Key**

- Array Area
- Export Cable Corridor (ECC)
- Local Study Area
- Regional Study Area

**Coull et al. (1998)**

- Nursery and spawning ground - undetermined intensity

**Ellis et al. (2012)**

- Nursery ground - low intensity
- Spawning ground - high intensity
- Spawning ground - low intensity

**Unweighted SELs concurrent noise contours**

- 210 dB (stationary)
- 203 dB (fleeing)
- 203 dB (stationary)
- 186 dB (fleeing)
- 186 dB (stationary)

**Site specific baseline data:**  
 Sandeel potential spawning habitat (Reach et al., 2024)

- < 0.141
- 0.141 - 0.188
- 0.188 - 0.250
- 0.250 - 0.563

Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information licensed under the Open Government Licence v3.0, from Crown Estate Scotland. Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters. Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. 2012. Spawning and nursery grounds of selected fish species in UK waters. Reach, I., Kyle-Hemmy, M., Barr, N., Warner, I., Lowe, S., and Lloyd Jones, D., (2024). Identifying and Mapping Sandeel Potential Supporting Habitat: An Updated Method Statement. Not to be used for Navigation.

Scale @ A3: 1:1,600,000  
 Coordinate System: WGS 84 UTM Zone 30N  
 Graticules: WGS84

0 20 40 60 80 km

Date: 18-06-26 | Prepared by: AC | Checked by: ME

EIA Ref No: BUC-C-MP-NP-0371  
 Map Ref: GB204095\_M\_389\_A



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- 3-371 The greatest areas of impact of the Proposed Offshore Development (concurrent WTG piling and the IRC) which overlaps sandeel spawning and nursery grounds were calculated (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Table 8-21). The areas and percentages presented are based on reasonable worst case values i.e., stationary where both stationary and fleeing values have been calculated.
- 3-372 The percentage overlap of modelled noise contours with spawning and nursery grounds reveals universally low (i.e., <0.08%) overlap for mortality and recoverable injury, respectively, based on stationary receptors. The potential for TTS and behavioural effects is larger (up to 22.3%), based on the larger area of impact, however considered fully recoverable in a short period of time following cessation of noise (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Table 8-21).
- 3-373 The spawning grounds in the area which overlap the Proposed Offshore Development are vast in nature and there is considerable alternative spawning habitat available (**Figure 3-13**).
- 3-374 The use of the Proposed Offshore Development Site (determined through baseline data) overlapping with mortality and recoverable injury noise contours is restricted to the southern extent of the Array Area (**Figure 3-9** and **Figure 3-15**). The TTS (186 dB) noise contours extend into the spawning and nursery grounds and areas representing high potential sandeel spawning which is also widespread throughout the regional Study Area (**Figure 3-9** and **Figure 3-15**).
- 3-375 Despite the high overlap of the TTS noise contour with mapped spawning and nursery areas (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Table 8-21), potential behavioural impacts are considered minimal with rapid recovery documented immediately upon cessation of noise generating activities (Hassel *et al.*, 2023). Furthermore, the data indicates that the Proposed Offshore Development area is unlikely to be of key importance to sandeel considering the lack of suitable sediments confirmed through PSA data, and large areas of highly suitable habitat located elsewhere in the regional Study Area.
- 3-376 Sandeel spawning and nursery grounds overlapping the Proposed Offshore Development Site, increase the potential for the presence of eggs and larvae to be affected by Project related noise.
- 3-377 Eggs and larvae are considered organisms of concern by Popper *et al.* (2014), due to their vulnerability, reduced mobility and small size.
- 3-378 Eggs and larvae are susceptible to mortality in the immediate vicinity of piling operations representing a relatively small proportion of the overall spawning and nursery areas, eggs and larvae are considered a critical stage of fish life history.

### **Duration**

- 3-379 See **Section 3.6.4.1 -Duration** for information on the duration of increases in underwater noise leading to mortality, injury and behavioural effects.

### **Timing and Frequency**

- 3-380 See **Section 3.6.4.1 – Timing and Frequency** for the general detail on timing and frequency of increases in underwater noise leading to mortality, injury and behavioural effects.

## Reversibility

- 3-381 The values for mortality are considered negligible. Although the noise impact areas are larger for injury and for behavioural (TTS) effects, it is considered sandeel are able to fully recover quickly from such non-injurious effects (recovery will commence on cessation of the impact) (Hassel *et al.*, 2003). However, due to the high substrate affinity of sandeel, there is greater potential for impacts on individuals.
- 3-382 Nevertheless, it has been suggested (via simulated models) (Marine Directorate, 2023; Wright *et al.*, 2019) that that recovery after local depletion (following cessation of the impacting factor) in an area of 50 km<sup>2</sup> indicates that replenishment of larvae from neighbouring grounds may lead to recovery within one to three years i.e., short term (Tyler-Walters *et al.*, 2023). Additionally, studies on Horns Rev Offshore Wind Farm (Stenberg *et al.*, 2011) and Beatrice Offshore Wind farm (Beatrice Offshore Wind Farm, 2021) infer a high degree of recovery following construction, with no population level effects evident.

### 3.7.4.2 Conclusion

- 3-383 Underwater noise will be relatively localised and of short duration in terms of construction timings, with rapid recovery predicted for the furthest reaching effects (TTS).
- 3-384 The updated baseline (**Section 3.7.1**) provides additional certainty in characterising the relative importance of the Proposed Offshore Development Site for sandeel, through the provision of additional information strengthening the baseline, including the heat map for spawning potential (**Figure 3-13**). This demonstrates the areas of highest spawning potential only overlap the ECC within the Proposed Offshore Development Site, however baseline data suggests that this presence is sporadic with patchy areas of suitable habitat present (**Figure 3-14**).
- 3-385 Sandeel are reliant on sediment for overwintering and spawning, and when considering the baseline evidence of presence in the area (**Figure 3-9** and **Figure 3-14**), the availability of alternative suitable habitat (**Figure 3-9**) and areas of high spawning potential (**Figure 3-13**) to move to, during and following any noise disturbance events. and it is considered any likely effect from increases in underwater noise during construction is Not Significant for sandeel.
- 3-386 Although eggs and larvae from a number of species could be present at the Proposed Offshore Development Site, the maximum area affected is considered to be negligible in size in comparison to the spawning and nursery areas in the wider regional Study Area. Mortality from noise is expected to occur to a maximum of 7.4 km from source (OSP) for eggs and larvae (based on stationary fish). Underwater noise will be relatively localised and of short duration in terms of construction timings and it is considered any likely effect from increases in underwater noise during construction is Not Significant for eggs and larvae.
- 3-387 Therefore, the provision of the additional information within **Section 3.7.4** does not alter the original assessment conclusions, i.e., there are no likely significant effects predicted for sandeel as a result of increases in underwater noise leading to mortality, injury and behavioural effects arising during construction of the Proposed Offshore Development.

### 3.7.4.3 Secondary Mitigation and Residual Effect

- 3-388 See **Section 3.6.4.3** for the mitigation proposed for direct temporary habitat disturbance.
- 3-389 As the mitigation proposed will already be embedded in the Proposed Offshore Development design and no secondary mitigation is proposed, the post-mitigation residual effects of increases in underwater noise during construction on Group 1 sandeel receptors is Not Significant.

### 3.7.5 Long Term Habitat Loss (Operation Phase)

- 3-390 In line with the RAEI from MD-LOT (including NatureScot's response), the long term habitat loss now includes the addition of mooring chains and is assessed accordingly (which were previously assessed for direct temporary habitat disturbance during operation).
- 3-391 See **Section 3.7.1** for a summary of sandeel baseline information and data.

#### 3.7.5.1 Assessment of Likely Significant Effect

- 3-392 The methodology for assessing long term habitat loss on sandeel (**Section 3.7.5.1**. below) is detailed in **Section 3.3.1**.

##### Direction of change

- 3-393 Long term habitat loss will result from anchors, mooring lines, cable protection, foundations of the substation and IRC, and all associated scour protection being placed directly over the existing habitat.
- 3-394 Sandeel rely on specific sediment to bury and spawn, and therefore are sensitive to the loss of this habitat (**Section 3.7.1**).

##### Extent and Magnitude

- 3-395 See **Section 3.6.5.1 – Extent and Magnitude** and **Table 3-3** for details on the worst case for long term habitat loss.
- 3-396 Long term habitat loss is confined to the physical area of infrastructure within the Proposed Offshore Development Site, at locations where sandeel are present and where there is a high potential of spawning habitat (**Figure 3-13**).
- 3-397 The southern extent of the ECC overlaps with a refined spawning area as presented by Coull *et al.* (1998) and high intensity spawning ground as presented by Ellis *et al.* (2012) (**Figure 3-9**).
- 3-398 In addition to the permanent static infrastructure, mooring chains have the potential to be intermittently in contact with the seabed during tidal cycles thereby resulting in the inability for the area to be used resulting in habitat loss. . A total of 800 m<sup>2</sup> per mooring chain totalling 0.50 km<sup>2</sup> (**Table 3-3**) will be causing the sediment to be disturbed and suspended. Although this will produce localised increased in SSC, SSC levels are not expected to be above those experienced naturally, with limited deposition expected outside the direct footprint of the disturbance.
- 3-399 The worst case for long term habitat loss will result in disturbance to 1.68 km<sup>2</sup> (**Table 3-3**) representing 0.4 % of the total Proposed Offshore Development Site. Values are provided for the

maximum habitat loss in terms of sandeel habitat, which are very low (i.e., <0.005%) (**Table 3-10**) These values are considered highly conservative, given that potential spawning habitat (**Figure 3-13**) overlapping defined spawning and nursery areas is limited.

**Table 3-10 Long term habitat loss of spawning and nursery grounds for sandeel in relation to the regional Study Area**

	<i>Coull et al., 1998</i>		<i>Ellis et al., 2012</i>	
	Area	% Overlap	Area	% Overlap
<b>Spawning</b>	36,408.98 km <sup>2</sup>	0.005%	(H) 31,604.22 km <sup>2</sup> (L) 49,633.43 km <sup>2</sup>	0.005% 0.003%
<b>Nursery</b>	36,408.98 km <sup>2</sup>	0.005%	110,363.89 km <sup>2</sup>	0.002%

3-400 The habitat overlapped by the Proposed Offshore Development Site as a whole, is not likely to be important for sandeel because areas of ‘preferred’ habitat are patchy offshore, with increased suitable habitat inshore (**Figure 3-9**). A considerable proportion of the regional Study Area has alternative high potential sandeel spawning habitat (**Figure 3-9**), including within defined sandeel spawning areas (Coull *et al.*, 1998).

#### **Duration and Timing**

3-401 See **Section 3.6.5.1 – Duration and Timing** for detail on duration and timing relating to long term habitat loss.

#### **Frequency**

3-402 See **Section 3.6.5.1 – Frequency** for detail on frequency relating to long term habitat loss.

#### **Reversibility**

3-403 See **Section 3.6.5.1 – Reversibility** for detail on reversibility relating to long term habitat loss.

### **3.7.5.2 Conclusion**

3-404 The impacts seen will be localised and habitat loss will be limited to the footprint of the Proposed Offshore Development infrastructure (including cable protection) and the immediate vicinity (e.g., for mooring chains) for 35 years of operation in the marine environment.

3-405 The regional Study Area provides considerable alternative potential spawning habitat within the maximum distance travelled by sandeel (i.e., 35 km) and therefore it is considered that long term habitat loss will not impact the sandeel population overall.

3-406 Although these impacts will be long term in duration, it is considered that given the relatively small area of seabed lost to long term habitat loss (including the relatively limited sandeel habitat), and the wide distribution of sandeel habitat in the regional Study Areas, it is considered any likely effects of long term habitat loss during operation and maintenance are Not Significant for sandeel.

3-407 Therefore, the provision of the additional information within **Section 3.7.5** does not alter the original assessment conclusions, i.e., there are no likely significant effects predicted for sandeel as a result of long term habitat loss during operation of the Proposed Offshore Development.

### **3.7.5.3 Secondary Mitigation and Residual Effect**

3-408 See **Section 3.6.5.3** for the mitigation proposed for long term habitat loss.

3-409 Given that the mitigation proposed will already be embedded in the Proposed Offshore Development design and no additional secondary mitigation is proposed, the post-mitigation residual effects of long term habitat loss during operation on sandeel receptors is therefore Not Significant.

### **3.7.6 Sandeel Cumulative Effects Assessment**

3-410 This part of the CEA builds on that presented in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13.3 and the two should be read in conjunction.

3-411 The sandeel CEA follows the CEA methodology presented in **Section 3.3.2** and has been updated in line with RAEI from MD-LOT (including NatureScot's response), building on that provided in the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13). The updated sandeel baseline (**Section 3.7.1**) has been used for this assessment.

3-412 Where the export cable route (or corridor) is considered for other plans or projects, in the assessment, this is stated, noting that this information is not publicly available for all sites.

3-413 Within this section, the assessment is presented for only the impacts forming the basis of the AEIR relating to sandeel. The impacts where additional information is presented are:

- Direct temporary habitat disturbance;
- Increases in SSC and deposition; and
- Increases in underwater noise leading to mortality, injury and behavioural effects.

3-414 **Section 3.9**, provides the additional information requested as part of the CEA for all receptors for the following remaining impacts:

- Colonisation of structures and infrastructure;
- EMF and thermal effects; and
- Secondary entanglement.

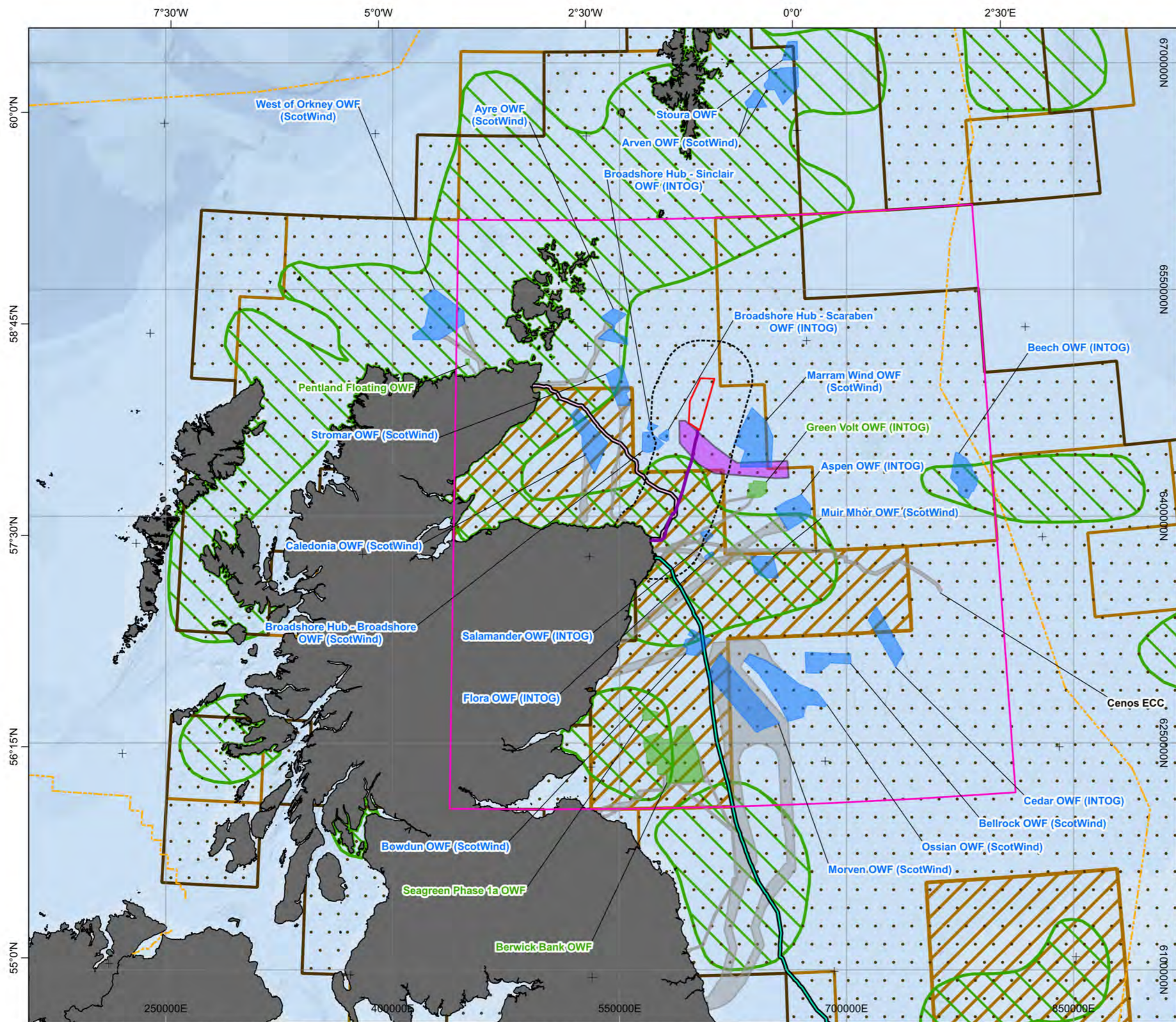
#### **3.7.6.1 Direct Temporary Habitat Disturbance**

3-415 A number of offshore developments fall within the cumulative assessment Study Area (**Figure 3-16**). Direct temporary habitat disturbance can only occur within the footprints of the proposed plans and projects.

3-416 Accordingly, Plans and Projects have been further refined (from the full list) to those projects which fall within the potential range sandeel may travel. Sandeel are largely resident and the maximum reported distance travelled is 32 km (NatureScot, 2003a), therefore a 35 km buffer is

deemed appropriate for the assessment for plans and projects overlapping spawning and nursery grounds (Coull *et al.*, 1998). The following plans and projects are therefore considered for the CEA for sandeel for the impact of direct temporary habitat disturbance:

- Broadshore Hub - Sinclair OWF;
- Broadshore Hub - Scaraben OWF;
- Broadshore Hub - Broadshore OWF;
- Marram Wind OWF;
- Muir Mhòr export cable;
- Cenos export cable;
- GreenVolt export cable;
- Flora OWF;
- Salamander (including export cable);
- EGL2; and
- Spittal – Peterhead Subsea Cable Link;



Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.16: Projects screened into the cumulative assessment for sandeel**

**Key**

- Array Area
- Export Cable Corridor (ECC)
- Local Study Area
- Regional Study Area
- Exclusive Economic Zone (EEZ) UK limit

**Offshore wind farms**

- Consented
- Planned

**Subsea cables and utilities**

- Eastern GreenLink 2
- Spittal to Peterhead

**Carbon Capture, Utilisation and Storage (CCUS)**

- Acorn South and East stores

**Coull et al. (1998)**

- Nursery and spawning ground - undetermined intensity

**Ellis et al. (2012)**

- Nursery ground - low intensity
- Spawning ground - high intensity
- Spawning ground - low intensity

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Scale @ A3: 1:2,500,000  
 Coordinate System: WGS 84 UTM Zone 30N  
 Graticules: WGS84

Date: 18-06-26 | Prepared by: AC | Checked by: ME

EIA Ref No: BUC-C-MP-NP-0378  
 Map Ref: GB204095\_M\_396\_A



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## Construction

- 3-417 It is considered that the predominant impact to sandeel with respect to direct temporary habitat disturbance is impact to the spawning habitat, and areas where sandeel may be overwintering. As sandeel are mostly resident, there is the potential for impacts over all phases of their lifecycle.
- 3-418 Despite the Proposed Offshore Development Site appearing to be situated in an area of high sandeel potential spawning habitat (**Figure 3-13**), the habitat present within the Proposed Offshore Development Site is not universally suitable and includes areas of both suitable and unsuitable habitat (**Section 3.7.1** and **Figure 3-9**), noting there is limited overlap of the Proposed Offshore Development with spawning grounds (Ellis *et al.*, 2012; Coull *et al.*, 1998). Therefore, the Proposed Offshore Development Site as a whole is not considered likely to represent particularly important habitat for sandeel because areas of preferred habitat as demonstrated by the site-specific PSA data are patchy, with larger areas of more suitable habitat indicated beyond the local Study Area (**Figure 3-9**). A large proportion of the regional Study Area, beyond the Proposed Offshore Development has high potential sandeel spawning habitat (**Figure 3-13**) within the defined sandeel spawning grounds (Coull *et al.*, 1998). Predicted sandeel density and probability of buried sandeel are highest inshore (**Figure 3-11** and **Figure 3-12**).
- 3-419 The maximum area of habitat disturbance at the Proposed Offshore Development Site is <0.02% of the sandeel spawning ground (**Table 3-9** and **Section 3.7.2**) and was considered negligible (**Section 3.7.2**) and Not Significant for sandeel for the Proposed Offshore Development alone.
- 3-420 The worst case for temporary habitat disturbance for the other plans and projects (alone) (**Appendix 3.3**) ranges between 1.76 km<sup>2</sup> (Spittal to Peterhead Subsea Cable Link) and 49.1 km<sup>2</sup> (Marram Wind OWF) (**Appendix 3.3**) which were similarly assessed as Not Significant.
- 3-421 The total cumulative area of habitat disturbance, including the Proposed Offshore Development Site (6.413 km<sup>2</sup>) is 92.97 km<sup>2</sup> <sup>7</sup> (**Appendix 3.3**). equating to a negligible proportion (i.e., 0.26 %) of the overall available sandeel spawning habitat (Coull *et al.*, 1998) in the regional Study Area (36,409 km<sup>2</sup>). Furthermore, the areas with greatest potential for sandeel are outside areas of development.
- 3-422 The conclusions for the CEAs for these other plans and projects was that the impact of direct temporary habitat disturbance on sandeel was Not Significant following the implementation of embedded mitigation (similar to those proposed for the Proposed Offshore Development). This conclusion was based on the overall area or be potentially impacted, the short term and temporary nature of the work, and the natural dynamics of the North Sea leading to rapid recovery of habitats. The mitigation measures for the Proposed Offshore Development are presented in the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.11).

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<sup>7</sup> Marram Wind OWF (49.11 km<sup>2</sup>), Muir Mhor OWF (7.73 km<sup>2</sup>), Cenos OWF (10.63 km<sup>2</sup>), Green Volt OWF (4.55 k km<sup>2</sup>), Salamander OWF (5.18 km<sup>2</sup>), EGL2 (7.6 k km<sup>2</sup>), Spittal – Peterhead Subsea Cable Link (1.76 km<sup>2</sup>) Proposed Offshore Development (6.413 km<sup>2</sup>). **Totalling 92.97 km<sup>2</sup>**

Common proposed mitigation for other projects include (noting that not all of the below are recommended for each project):

- The production of suitable Plans e.g., CaP, Piling Strategy, MMMP, EMP;
- Sensitive engineering considerations for design and placement of infrastructure;
- FMPs are also included as mitigation (Muir Mhor OWF) to present specific mitigation for fish and shellfish where e.g., the In Principle FMP shows how likely significant effects on behaviour from underwater noise during spawning can be reduced to levels which are Not Significant.

- 3-423 As direct temporary habitat disturbance impacts on sandeel spawning are only present within the footprint of the construction work, effects will be highly localised and the cumulative area will be a product of discrete localised areas within each project's development areas, noting that the area of spawning and nursery ground impacted by the Proposed Offshore Development, has limited areas suitable for sandeel due to sediment types.
- 3-424 Sandeel spawning is predicted to occur during two months over winter (December – January (Scottish Government, 2023)) within the spawning period (November – February (Coull *et al.*, 1998)). As such, impacts from each project will only partially overlap with the overall spawning window and will not constitute the full impact area for any one project. It is therefore considered that the overall areas presented are an overestimation of the impact area at any one time. It is recognised that this will be a multi-year impact depending on the project's construction schedules, however in each year, the area of impact will be small and discrete, and considerably less than that described above.
- 3-425 Furthermore, seabed recovery is expected to be rapid with recoverability of the seabed for the Proposed Offshore Development Site considered in the order of months to years (EIAR, Volume 2, Chapter 6: Marine and Coastal Physical Processes) (**Figure 3-9** and **Figure 3-13**). This is comparable to all other projects considered that may act cumulatively (National Grid and SSENT, 2022; Desperes, 2000, Dernie *et al.*, 2003). As such, though the impact may present over multiple years, recovery of areas where work is complete will ensure that the full area is never fully impacted in any one year.
- 3-426 All of the projects assessed this impact alone and cumulatively as Not Significant and it is considered that no additional mitigation was required, outside of embedded / in-built mitigation proposed (**Appendix 3.3**). Although not specifically stated as an embedded mitigation measure for direct temporary habitat disturbance, the production and implementation of an FMP will be produced, following consent, ensuring the confirmed design parameters are assessed for sensitive species, including sandeel.
- 3-427 Considering the baseline which describes the availability of suitable habitat within the Proposed Offshore Development, and the areas of alternative potential for sandeel, the localised, small extent and temporary intermittent nature of the construction activities for each plan or project, and the fact the overall cumulative footprints are very small and discrete in comparison with the wider extent of sandeel spawning grounds, the Proposed Offshore Development's negligible contribution cumulatively with that of other plans and projects remains Not Significant for direct temporary habitat disturbance for sandeel.

## Operation and Maintenance

- 3-428 It is considered, based on **Appendix 3.2**, that when the Buchan OWF is operational, so will all other listed projects and therefore the same plans and projects are considered for the operation and maintenance cumulative assessment, as for construction for direct temporary habitat disturbance.
- 3-429 The impacts of direct temporary habitat disturbance during operation and maintenance for all plans and projects are expected to be less than those predicted for the construction phase as the activities are lesser in nature and scale (**Section 3.7.6.1**) and the spatial extent disturbed is small in comparison, considering the temporary nature of the impact. Although sandeel have limited mobility, there is considerable alternative suitable habitat available.
- 3-430 Therefore, the Proposed Offshore Development's negligible contribution cumulatively with the contribution to others is Not Significant for direct temporary habitat loss for sandeel during operation and maintenance.

## Decommissioning

- 3-431 The effects of direct temporary habitat disturbance during decommissioning will be less than those predicted for the construction phase, with conclusions therefore remaining as presented in the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13) i.e., Not Significant for sandeel.

### 3.7.6.2 Increases in Suspended Sediments and Deposition

- 3-432 A number of neighbouring offshore plans and projects fall within the cumulative assessment Study Area (**Figure 3-16**). Increases in SSC and deposition can occur within the footprints of the proposed plans or projects as well as outside through sediment transport pathways.
- 3-433 Plans and projects considered for this cumulative impact assessment have been refined from the full list to those projects which fall within 35 km of the Proposed Offshore Development, overlapping the same spawning grounds (Coull *et al.*, 1998) which is within the range of sediment transport (25 km based on a precautionary sediment transport maximum (**Figure 3-16**)).
- 3-434 The plans and projects screened in for increases in SSC and deposition for sandeel are the same as those in **Section 3.7.6.1**.
- 3-435 Adult sandeel are largely resident, remaining within 32 km of their location, with burial into the sand forming part of their natural adaptation to their environment. Sandeel in the North Sea are naturally adapted to survival in areas of increased SSC. Increases in SSC and sediment deposition is predicted to disperse and settle quickly during Proposed Offshore Development construction activities (Volume 2, Chapter 6: Marine and Coastal Physical Processes) and it is expected this is the case for projects in the wider area.

## Construction

- 3-436 It is considered that the predominant impact to sandeel with respect to increases in SSC and sediment deposition is the impact to the spawning habitat, and the area where sandeel may be overwintering. As sandeel are mostly resident, there is the potential for impacts over all phases of their lifecycle.
- 3-437 The sediment composition throughout the Proposed Offshore Development Site is mainly silty sand to gravelly sand, with finer sediment present in the Array Area, changing to coarser sediment (i.e., gravel) and bedrock approaching landfall, with patches of finer sediment present (**Section 3.6.1**) (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes).
- 3-438 For the Proposed Offshore Development, impacts arising from the worst case parameters (i.e., maximum distance travelled by SSC is 15 km ( south easterly direction), maximum SSC up to 270 mg/l rapidly declining after seven days, and the maximum level of deposition estimated at 12 cm (**Table 3-3**) were considered to be Not Significant for the Proposed Offshore Development alone.
- 3-439 The worst case for increases in SSC for the other plans and projects (alone) (**Appendix 3.3**) provides a maximum range of SSC from 0.0025 km (Marram Wind OWF) to 20 km (Muir Mhor OWF), with the majority of other considered projects predicting SSC effects extending up to between approximately 1.5 km and 17 km (**Appendix 3.3**).
- 3-440 Maximum concentrations for the other plans and projects range from hundreds of thousands of mg/l in the immediate vicinity (Cenos OWF and Salamander OWF) to 200 mg/l at Muir Mhor OWF, rapidly decreasing in less than one week (maximum six days for Muir Mhor OWF), however for the majority of projects SSC returns to background levels typically less than one to three days following cessation of the activity (e.g., Cenos OWF, Salamander OWF, and Marram Wind OWF) (**Appendix 3.3**).
- 3-441 Sediment deposition across the plans and projects varies, ranging (where data are available) between > 10 mm (Muir Mhor OWF) to 100 cm (Salamander OWF) linked to direct disposal mounds resulting from release of sediment from a dredger (resulting in the disaggregation of finer material and potentially forming an armoured seabed layer of coarser sediment) (**Appendix 3.3**). The other plans and projects similarly assessed increases in SSC and deposition as Not Significant, alone.
- 3-442 The conclusions of the CEA for these other projects were that the impact of increases in SSC and sediment deposition on sandeel was Not Significant following the implementation of embedded mitigation (similar to those proposed for the Proposed Offshore Development). This conclusion was based on the overall area to be potentially impacted, the short term and temporary nature of the work, and the natural dynamics of the North Sea leading to rapid recovery of habitats. The mitigation measures for the Proposed Offshore Development are presented in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.11) and listed above (**Section 3.7.6.2**).
- 3-443 It is acknowledged that if the Proposed Offshore Development is constructing alongside one or more of the other plans or projects, and to a similar programme, that multiple sources of elevated SSC are probable. However, given the generally low levels once at a distance from the

source, and the rapid dispersion of SSC in the water column, and limited deposition away from the relevant projects, any potential impacts would be very small and short lived.

- 3-444 Considering the baseline which describes the availability of suitable habitat within the Proposed offshore Development, and the areas of alternative potential for sandeel spawning, and considering that the potential area of effect is limited at each project location with SSC and deposition decreasing rapidly with distance from the source at all projects, and the intermittent nature of the construction activities, the Proposed Offshore Development's negligible contribution cumulatively with the contribution to other plans and projects is therefore Not Significant for SSC and sediment deposition on sandeel.

### **Operation and Maintenance**

- 3-445 It is considered, that when Proposed Offshore Development is operational, so will all other listed projects and therefore the same plans and projects are considered for the operation and maintenance cumulative assessment, as for construction for increases in SSC and deposition.
- 3-446 The assessment for the Proposed Offshore Development alone, identified no likely significant effects on all fish and shellfish receptors from increases in SSC and sediment deposition from operation and maintenance activities. This was due to the dynamic nature of the North Sea, the limited plume distance, the temporary nature of the impact and the small spatial extent disturbed in comparison with the alternative available habitat (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13.3.2).
- 3-447 The effects of an increase in SSC and sediment deposition during operation and maintenance is expected to be less than those predicted for the construction phase (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13.3.1). The associated operation and maintenance activities are less in nature and scale. Therefore, the Proposed Offshore Development's negligible contribution cumulatively with the contribution to others is Not Significant for increases in SSC and sediment deposition for sandeel during operation and maintenance.

### **Decommissioning**

- 3-448 The effects of increases in SSC and sediment deposition during decommissioning will be less than those predicted for the construction phase with conclusions remaining as per the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13) i.e., Not Significant for sandeel.

### **3.7.6.3 Increases in Underwater Noise**

- 3-449 A number of neighbouring offshore developments fall within the cumulative assessment Study Area (**Figure 3-16**). Increases in underwater noise can occur within the footprints of the proposed plans or projects as well as outside through propagation.
- 3-450 Accordingly, plans and projects considered for this cumulative impact assessment have been refined from the full list to those projects which are within double the maximum range of TTS (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes), 178 km (double the 89 km predicted TTS range for the Proposed Offshore Development Site) as this represents the

maximum potential for noise contours to overlap between projects (**Figure 3-15** and **Figure 3-17**) and due to sandeel limited movement, plans and projects which fall within the same spawning grounds as the Proposed Offshore Development are only considered if they are also within the maximum predicted noise impact range. .

3-451 For the purposes of the CEA, and to take a precautionary approach, it is considered that the plans and projects screened in are constructing at the same time as the Proposed Offshore Development. The following plans and projects are screened in for the cumulative assessment of increases in underwater noise on sandeel:

- Marram Wind OWF;
- Spittal – Peterhead Subsea Cable Link
- Green Volt OWF (including export cable);
- Ayre OWF (including export cable);
- Caledonia OWF (including export cable);
- Salamander OWF (including export cable);
- Aspen OWF (including export cable);
- Muir Mhòr OWF (including export cable);
- EGL2;
- Bowdun OWF;
- Pentland OWF (including export cable);
- Ossian OWF;
- Morven OWF (including export cable);
- West of Orkney OWF (including export cable);
- Bellrock OWF;
- Cenos export cable route (not OWF);
- Seagreen 1a;
- Berwick and Marr Bank (including export cable);
- Broadshore Hub - Sinclair OWF;
- Broadshore Hub - Scaraben OWF;
- Broadshore Hub - Broadshore OWF;
- Stromar OWF (including export cable);

- Flora OWF;
- Cedar OWF;
- Beech OWF;

3-452 The assessment is based on receptors being stationary, which, given the limited movement of sandeel, ensures a precautionary approach. The assessments for these other plans and projects concluded impacts were Not Significant following the implementation of embedded mitigation (similar to those proposed for the Proposed Offshore Development). These are presented in the EIA Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.11) and listed above (**Section 3.7.6.1**).

3-453 The predominant noise source that may act cumulatively on sandeel is from impact piling. Sandeel fall within the least sensitive hearing group, but are considered to be susceptible to TTS impact, despite their relative lack of hearing ability. Though it is recognised that cable laying and other construction activities other than piling can generate underwater noise and contribute to a cumulative underwater noise impact, the noise arising from such activities as cable installation and rock placement is non-impulsive, of low magnitude, and is unlikely to have any potential to act cumulatively when considering the distances between projects and the low levels of noise emitted from such non-impulsive sources. As such it is considered that it is only piling impacts that have the potential to lead to a significant cumulative likely effect and is therefore the subject of the assessment text below.

### **Construction**

3-454 The effects of underwater noise on sandeel were assessed as Not Significant for the Proposed Offshore Development, alone (**Section 3.7.4**). Impacts arising from impact piling range from mortality and recoverable injury at close range, and TTS over potentially larger distances.

3-455 There is limited possibility that individuals would be cumulatively impacted by mortality or recoverable injury as impact ranges at these thresholds are small for each development, typically affecting approximately 1-2% of the sandeel spawning ground at any one time from each project which overlaps the spawning ground.

3-456 It is acknowledged any fish in the immediate vicinity of piling operations would be subject to mortality and recoverable injury, however it is not considered that there is potential for any significant cumulative impacts from mortality and recoverable injury (including on eggs and larvae which are subject to these impacts ) due to the small overall area of impact arising from each development relative to the availability of habitat located outside of the Proposed Offshore Development Site (**Figure 3-9, Figure 3-13 and Figure 3-15**).

3-457 The greatest potential for cumulative effects from underwater noise arises from the impact of TTS, with the maximum range for the Proposed Offshore Development calculated at 66 km (21,000 km<sup>2</sup>) for concurrent piling. The worst case for increases in underwater noise for the other plans and projects (**Appendix 3.3**) provides TTS impact ranges between 25 km (Bowdun O WF) and 110 km (Muir Mhòr OWF), and areas between 47 km<sup>2</sup> (Bellrock OWF) and 20,000 km<sup>2</sup>( Muir Mhòr OWF), which were all assessed as Not Significant at a project level (**Appendix 3.3**),

noting that not all projects report equivalent parameters, and models used varied between projects (**Appendix 3.3**).

- 3-458 Though potentially large areas may be affected, due to the intermittent nature of the impacts, and the location of the spawning grounds for sandeel, it is considered the impact to spawning potential for any one project is very small. It is not possible to sum the impact areas for each development for TTS as overlapping areas would generate an overestimate of the full picture, and not be representative of the actual impact which, due to the general availability of piling vessels, will not all be able to install at the same points in time. TTS recovery is also very rapid (within 24 hours (Popper *et al.*, 2014)) and it has been reported (McCauley *et al.*, 2000) that fish have been shown to return to normal behaviour patterns between noise generating events within 30 minutes following cessation of the noise generating activity. Sandeel spawning period is during winter months when construction weather constraints will be greatest. As such, though it is recognised that multiple disturbance events may arise, the impact to the spawning potential from each development is small when the duration of spawning periods is considered along with the considerable alternative habitat with high potential for sandeel spawning, and as recovery from each event will be quick allowing reestablishment of any activities, the overall potential to impact sandeel cumulatively will be limited.
- 3-459 Therefore, it is considered that the Proposed Offshore Development's contribution cumulatively with all other projects considered is Not Significant for increases in underwater noise for sandeel.

### **Operation and Maintenance**

- 3-460 The effects of increases in underwater noise during operation and maintenance are expected to be less than those predicted for the construction phase and therefore Not Significant for sandeel (**Section 3.7.6.3**). See the EIAR, (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.12.2.4).

### **Decommissioning**

- 3-461 The effects of increases in underwater noise during decommissioning will be less than those predicted for the construction phase with conclusions remaining as per the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13 i.e., Not Significant for sandeel).

#### **3.7.6.4 Long Term Habitat Loss**

- 3-462 A number of neighbouring offshore developments fall within the cumulative assessment Study Area (**Figure 3-16**). Plans and projects have been further refined (based on those in **Appendix 3.2** for sandeel based on a 35 km buffered area around the Proposed Offshore Development Site (**Figure 3-8**)).
- 3-463 The plans and projects screened in for long term habitat loss for sandeel are the same as those in **Section 3.7.6.1**.

## Operation and Maintenance

- 3-464 It is considered that the operation and maintenance phase will give rise to the greatest impact of long term habitat loss. The maximum area of long term habitat loss at the Proposed Offshore Development Site is 1.68 km<sup>2</sup> (**Table 3-3** and **Section 3.7.5**), and the overlap of the Proposed Offshore Development with sandeel spawning and nursery grounds is negligible in terms of the wider available habitat (< 0.005 % (**Section 3.7.5**)) and areas of high spawning potential (**Figure 3-13** and **Figure 3-14**). This was assessed as Not Significant for sandeel for the Proposed Offshore Development alone (**Section 3.7.5.2**).
- 3-465 The worst case for long term habitat loss for the other plans and projects (alone) (**Appendix 3.3**) provides a range of values between 0.31 km<sup>2</sup> (Spittal – Peterhead subsea cable link) and 13.14 km<sup>2</sup> (Marram Wind OWF), which were similarly assessed as Not Significant. This conclusion was based on the limited extent of long term habitat loss and the considerable alternative habitat available.
- 3-466 The total area of long term habitat loss (based on the refined plans and projects (for sandeel) and available data<sup>8</sup>) including the Proposed Offshore Development is 31.28 km<sup>2</sup> (**Appendix 3.3**) equating to a small proportion (i.e., 0.09 %) of the overall available sandeel spawning habitat (Coull *et al.*, 1998) in the regional Study Area (36,409 km<sup>2</sup>).
- 3-467 The conclusions of the CEAs for these other projects was that the impact of long term habitat loss was Not Significant following the implementation of embedded mitigation (similar to those proposed for the Proposed Offshore Development). This conclusion was based on the overall area to be potentially impacted, the local spatial extent over time and the reversible nature of the impact. The mitigation measures for the Proposed Offshore Development are presented in the EIA Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.11 and listed above (**Section 3.7.6.1**).
- 3-468 The majority of the plans and projects screened into the CEA for long term habitat loss have limited overlap of the defined areas of high sandeel spawning potential (**Figure 3-9**, **Figure 3-13** and **Figure 3-14**). Areas of long term habitat loss will be highly localised and restricted to the footprint of the plans and projects infrastructure only and therefore the cumulative area will be made up of discrete localised areas at each plan or project, instead of one continuous area. It is further considered that given the locations, each of the plans and projects are likely to impact different habitats, in discrete areas, and therefore unlikely to affect either the same receptors or sensitive areas such as spawning and nursery grounds.
- 3-469 Cumulatively it is considered the temporary disturbance to the sandeel spawning and nursery habitat overlapping the Proposed Offshore Development is very small, based on the very small

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<sup>8</sup> Marram Wind (13.14 km<sup>2</sup>), Muir Mhor (2.76 km<sup>2</sup>), Cenos OWF (1.9 km<sup>2</sup>), Green Volt OWF (4.55 km<sup>2</sup>), Salamander OWF (6.95 km<sup>2</sup>), Spittal – Peterhead Subsea Cable Link (0.31 km<sup>2</sup>) and the Proposed Offshore Development (1.68 km<sup>2</sup>) **totalling 31.28 km<sup>2</sup>**

overlap with suitable habitat and habitat with high spawning potential (**Section 3.7.5, Figure 3-13 and Figure 3-14**).

- 3-470 Furthermore, sandeel will only be impacted during the time they remain resident in the sediment i.e., during overwintering or during spawning. The values presented are highly precautionary and assume all loss is within the spawning area. Long term, it is also considered there are vast other areas of high spawning potential (**Figure 3-13**) within the cumulative assessment Study Area, including within defined spawning grounds (Coull *et al.*, 1998) (**Section 3.7.1.2**).
- 3-471 Despite this, the overall cumulative project footprints are very small (**Appendix 3.3**) in comparison with the wider extent of spawning grounds and the long term loss of habitat is not expected to affect sandeel thus the Proposed Offshore Development's contribution is Not Significant cumulatively with other plans and projects for long term habitat loss for sandeel during operation and maintenance.

### **Decommissioning**

- 3-472 The effects of long term habitat loss during decommissioning will be less than those predicted for the construction phase with conclusions remaining as per the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13) i.e., Not Significant for sandeel.

## **3.8 ALL OTHER SPECIES - LONG TERM HABITAT LOSS (INCLUDING MOORING CHAINS)**

- 3-473 In line with the RAEI from MD-LOT (informed by NatureScot's response to the EIAR), the long term habitat loss assessment presented within this section now includes consideration of the mooring chains and is assessed accordingly (noting mooring chains were previously assessed in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, for direct temporary habitat disturbance during operation).
- 3-474 The update to the long term habitat loss calculations to include mooring chains during operation, are described within **Section 3.6.5** (area of potential habitat loss now totalling 1.68 km<sup>2</sup>) (as calculated in **Table 3-3**).
- 3-475 As habitat loss for herring and sandeel is presented **Section 3.6.5** and **Section 3.7.5**, respectively and within the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.12.2.2), all other fish and shellfish species are considered together within this section in line with the VER approach as outlined in Section 3.3 following CIEEM guidance (2022) to ensure the most important ecological features (i.e., species) are assessed. Updated values arising mooring chain area calculations considered as part of long term habitat loss are presented below, noting these are only possible for species which have defined spawning and nursery grounds overlapping the Project (Ellis *et al.*, 2012; Coull *et al.*, 1998).
- 3-476 This section presents the species with the largest potential for long term habitat loss i.e., the greatest percentage of habitat (both spawning and nursery areas within the regional Study Area) which has the potential to be lost from the footprint of the constructed Project, in order to

strengthen the assessment presented in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.12.2.2).

### 3.8.1 Mobile Fish with Spawning and Nursery Grounds Overlapping the Proposed Offshore Development Site

3-477 The maximum percentage habitat loss for species with defined spawning and nursery grounds is between 0.133 % and 0.055 % (mackerel , spurdog and plaice) (Table 3-11) (Ellis *et al.*, 2010; Coull *et al.*, 1998) resulting in a negligible increase in the area calculated to be lost from the Project footprint during operation. The remainder of long term habitat loss calculated for key habitat is < 0.05 for all other species, displaying a negligible increase from the values presented in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.12.2.2.

**Table 3-11 Maximum Percentage (%) habitat loss of spawning and nursery grounds in the regional Study Area**

Species	Spawning Ground		Nursery Ground	
	Coull <i>et al.</i> , 1998	Ellis <i>et al.</i> , 2012	Coull <i>et al.</i> , 1998	Ellis <i>et al.</i> , 2012
Anglerfish (H)				0.004
Anglerfish (L)				0.002
Blue whiting			0.004	
Blue Whiting (H)				0.033
Blue whiting (L)				0.002
Cod	0.011		0.038	
Cod (H)				0.005
Cod (L)		0.002		0.002
Common skate				0.009
European hake				0.001
Haddock	0.020		0.003	
Lemon sole	0.002		0.003	
Ling (L)				0.001
Mackerel			0.112	
Mackerel (H)	0.055			0.106
Mackerel (L)	0.010			0.001
<i>Nephrops</i>	0.003		0.003	
Norway pout			0.002	
Norway pout (H)	0.010			
Norway pout (L)	0.003			
Plaice	0.023			
Plaice (L)		0.004		0.003
Saithe	0.029		0.009	
Spotted ray (L)				0.002
Sprat	0.003		0.003	
Spurdog (H)				0.058
Spurdog (L)				0.002
Thornback ray (L)				0.017
Tope shark (L)				0.008
Whiting	0.005		0.004	

Species	Spawning Ground		Nursery Ground	
	Coull <i>et al.</i> , 1998	Ellis <i>et al.</i> , 2012	Coull <i>et al.</i> , 1998	Ellis <i>et al.</i> , 2012
Whiting (H)				0.004
Whiting (L)		0.003		0.002
<i>Note values presented are highly conservative as it assumes the entire area of habitat loss is within individual habitats</i>				

3-478 It is considered that and the conclusions presented in the EIAR remain valid i.e., Not Significant for mobile fish with spawning and nursery grounds overlapping the Proposed Offshore Development Site.

### 3.8.2 Mobile Fish and Squid with No Spawning and Nursery Grounds (Including Migratory Species) Overlapping the Proposed Offshore Development Site

3-479 Given that the updated increase in habitat loss is considered small, and the mobile nature of the species which do not have spawning or nursery grounds defined overlapping the Proposed Offshore Development Site, the conclusions presented in the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.12.2.2) remain valid i.e., impacts are long term, however, given the relatively small area of seabed affected by long term habitat loss, and the extent of alternative habitats for mobile fish, it is considered any effects of long term habitat loss during operation and maintenance are Not Significant for other mobile species and squid with no spawning or nursery grounds overlapping the Proposed Offshore Development Site.

### 3.8.3 Shellfish

3-480 The long term loss of *Nephrops* spawning and nursery habitat, represents 0.016% of the local Study Area spawning and nursery habitat, and 0.0026% of the total spawning and nursery area (Coull *et al.*, 1998) within the regional Study Area. Although impacts are long term, given the relatively small area of habitat loss, it is considered any effects of long term habitat loss during operation and maintenance are therefore Not Significant for *Nephrops*.

3-481 For all other species where the potential habitat loss cannot be calculated (i.e., no mapped spawning and nursery grounds) the assessments and conclusions reached within the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, remain valid based on the nominal increase in long term habitat loss, accounting for the addition of the mooring chains within the habitat loss assessment.

3-482 It is considered that and the conclusions presented in the EIAR remain valid i.e., Not Significant for shellfish at the Proposed Offshore Development Site.

### 3.8.4 Conclusion

3-483 The consideration of the mooring chains as contributing to long term habitat loss (totalling 1.68 km<sup>2</sup>) does not represent a significant increase in potential loss of key fish habitat (i.e., spawning and nursery grounds, as mapped) when compared to the area of overall habitat (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.12.2.2; **Table 3-3**).

3-484 Therefore, **Section 3.8** satisfies the RAEI through the provision of the additional information and updated calculations pertaining to the increase in long term habitat loss. The original conclusions of the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.12.2.2) remain valid and any likely significant effects arising from long term habitat loss at the Project are Not Significant for fish and shellfish.

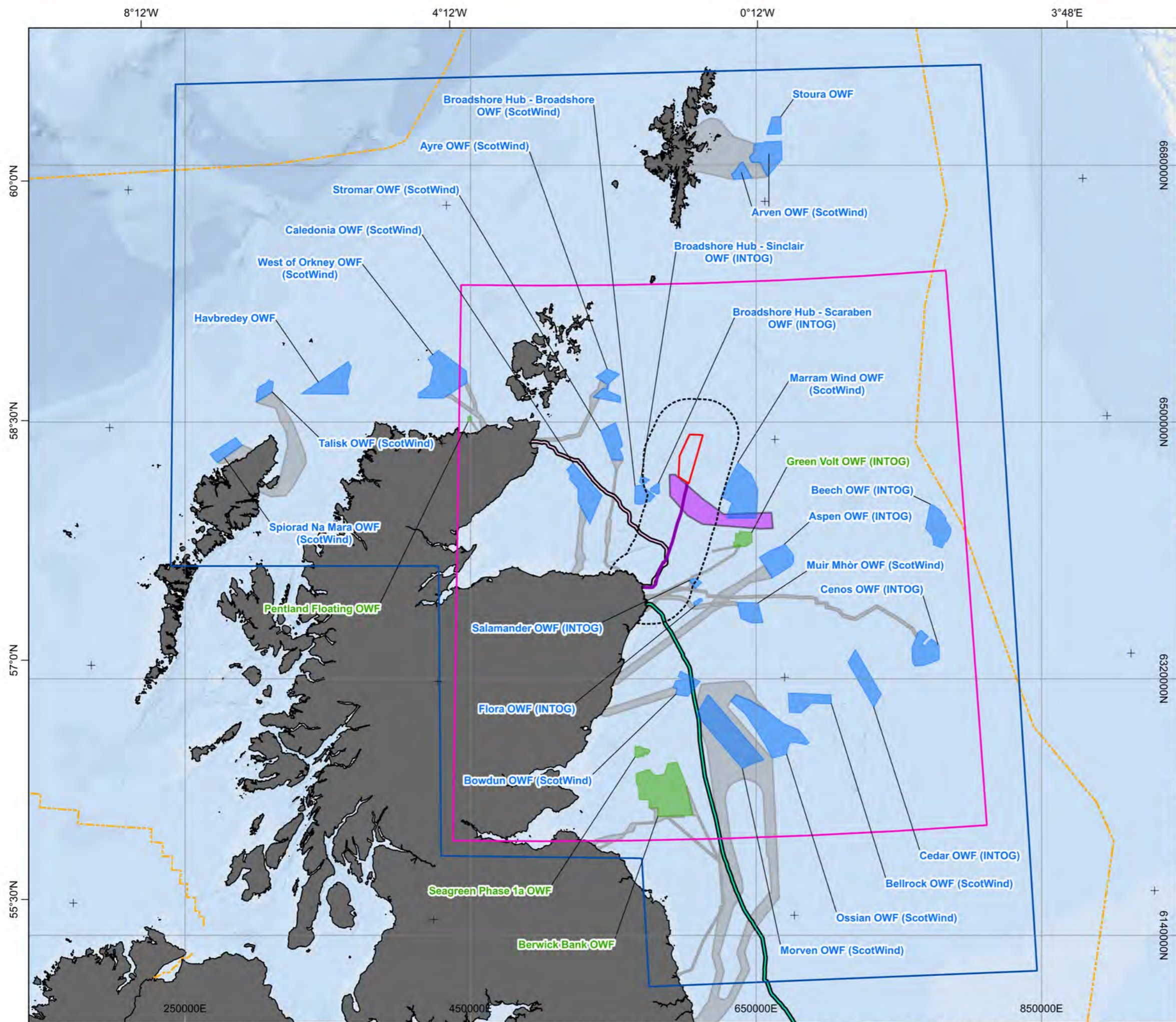
### **3.9 CUMULATIVE EFFECTS ASSESSMENT**

3-485 This cumulative effects assessment (CEA) builds on the approach presented in the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13.3), incorporating updated worst case parameters, refined project screening, and adds additional assessment narrative to provide further justification and robustness of the conclusions presented. The additional information presented within this AEIR is intended to provide greater confidence in the assessments undertaken through consideration of additional contextual information relating to the wider baseline environment and the characteristics and maximum design scenarios of relevant plans and projects, together with the magnitude of the Proposed Offshore Development's contribution to cumulative effects. Where data are available, effects have been quantified to support the assessment conclusions.

3-486 Herring and sandeel are not included within this Section and are instead considered separately within **Section 3.6** and **Section 3.7**, respectively, reflecting the specific nature of MD-LOTs REAI, reflecting NatureScot's comments relating to these key prey species.

3-487 The cumulative assessment Study Area is defined in **Section 3.3.2** and presented in **Figure 3-17** and accounts for known and predicted migration routes for migratory fish species, including Atlantic salmon, together with the maximum predicted spatial extent of impacts arising from the Proposed Offshore Development and other relevant plans and projects within the cumulative assessment Study Area.

3-488 The updated assessments presented within this AEIR do not alter the conclusions presented in the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.12) for the Proposed Offshore Development alone, which concluded that effects were Not Significant for all receptors. In addition, review of the available assessments for other relevant plans and projects (**Appendix 3.3**) indicates that the effects were similarly assessed as negligible to minor and Not Significant, both alone and cumulatively. Accordingly, the Proposed Offshore Development's contribution to cumulative effects is considered to be relatively small in the context of the wider cumulative scenario, existing baseline environment and available habitat, with conclusions remaining unchanged from those presented within the EIAR.



Project:  
**Buchan Offshore Wind EIA**

Title:  
**Figure 3.17: Projects screened into the cumulative assessment for fish and shellfish receptors**

- Key**
- Array Area
  - Export Cable Corridor (ECC)
  - Local Study Area
  - Regional Study Area
  - Cumulative Assessment Study Area
  - Exclusive Economic Zone (EEZ) UK limit
- Offshore wind farms**
- Consented
  - Planned
- Subsea cables and utilities**
- Eastern GreenLink 2
  - Spittal to Peterhead
  - CEA Export Cable Corridor (ECC)
- Carbon Capture, Utilisation and Storage (CCUS)**
- Acorn South and East stores

Sources: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors. Contains public sector information, licensed under the Open Government Licence v3.0. European Marine Observation Network (EMODnet) Human Activities, Offshore Wind Farms in European Seas. This dataset is licensed under the Creative Commons Attribution 4.0 International (CC-BY-4.0) licence. Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters. Ellis, J.R., Milligan, S.P., Ready, L., Taylor, N. and Brown, M.J. 2012. Spawning and Nursery Grounds of Selected Fish Species in UK Waters. © UKHO. Not to be used for Navigation.

Scale @ A3: 1:2,650,000  
 Coordinate System: WGS 84 UTM Zone 30N  
 Graticules: WGS84

Date: 18-06-26 | Prepared by: AC | Checked by: ME

EIA Ref No: BUC-C-MP-NP-0379  
 Map Ref: GB204095\_M\_397\_A



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### 3.9.1 Direct Temporary Habitat Disturbance

3-490 A number of offshore developments fall within the cumulative assessment Study Area (**Figure 3-17**). Direct temporary habitat disturbance can only occur within the footprints of the proposed plans or projects.

3-491 Accordingly, the list has been refined to include only projects with directly overlapping infrastructure, accounting for mobile receptors and located within a precautionary 25 km cumulative assessment Study Area of the project, as set out in **Section 3.3.2**. As established in the EIA Volume 2, Chapter 8: Fish and Shellfish Ecology, it is considered mobile diadromous species (Atlantic salmon) will not be impacted due to the lack of reliance on specific marine habitat and therefore only concerns marine fish and shellfish.

3-492 The following plans and projects are therefore considered in the CEA for other fish and shellfish for the impact of direct temporary habitat disturbance:

- Broadshore Hub - Sinclair OWF;
- Broadshore Hub - Scaraben OWF;
- Broadshore Hub - Broadshore OWF;
- Muir Mhòr (including export cable);
- GreenVolt export cable;
- Cenos export cable route (not array area);
- EGL2;
- Stromar OWF (including export cable);
- Salamander OWF (including export cable);
- Spittal – Peterhead Subsea Cable Link; and
- Carbon capture, compression energy infrastructure installation.

#### Construction

3-493 It is considered that the predominant impact to marine fish and shellfish with respect to direct temporary habitat disturbance is an impact on the habitat utilised for key life history stages such as spawning. With the exception of a number of elasmobranchs and a few teleost fish species, the majority of fish species are pelagic spawners, lacking dependency on specific spawning success and are not therefore subject to this impact in a manner which could lead to likely significant effects at a cumulative level.

3-494 The habitat within the Proposed Offshore Development Site is varied, and where spawning and nursery grounds are recorded, considerable alternative habitat exists (EIA Volume 2, Chapter 8: Fish and Shellfish, Section 8.12.1.1). Although specific reliance on the spawning habitat is limited for those species with mapped spawning grounds, it is considered that the largest potential for

effect will be during construction where 6.413 km<sup>2</sup> (**Table 3-3**) of the seabed has the potential to be disturbed by the Proposed Offshore Development. For species with spawning and nursery areas that overlap the Proposed Offshore Development Site (Ellis *et al.*, 2012; Coull *et al.*, 1998) the overlap is very small (< 0.5% (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Table 8-14)) in relation to the overall available habitat as detailed in the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.7.2), and is therefore considered negligible and Not Significant.

- 3-495 The worst case for temporary habitat disturbance for the other Plans and projects (alone) (**Appendix 3.3**) provides a range of values (between 1.76 km<sup>2</sup> (Spittal to Peterhead Subsea Cable Link) and 10.63 km<sup>2</sup> Cenos OWF) (**Appendix 3.3**) which were similarly assessed as Not Significant.
- 3-496 The total cumulative area of habitat disturbance across all projects considered, including the Proposed Offshore Development Site (6.413 km<sup>2</sup>) is 43.86 km<sup>2</sup><sup>9</sup> (**Appendix 3.3**), equating to a small proportion of the overall available spawning habitat (Coull *et al.*, 1998) in the cumulative assessment Study Area for all species (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Figure 8-3) .
- 3-497 The CEAs for these other projects concluded that the impact of direct temporary habitat disturbance on fish and shellfish was Not Significant following the implementation of embedded mitigation (similar to those proposed for the Proposed Offshore Development). This conclusion was based on the overall area to be potentially impacted, the short term and temporary nature of the work, and the natural dynamics of the North Sea leading to rapid recovery of habitats. The mitigation measures for the Proposed Offshore Development are presented in the EIAR, EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.11). Common proposed mitigation for other projects include:
- The production of suitable management plans e.g., CaP, PS, MMMP, EMP; and
  - Sensitive engineering considerations for design and placement of infrastructure.
- 3-498 As direct temporary habitat disturbance impacts on mobile fish with (and without) spawning grounds, and shellfish, are only present within the footprint of construction work, effects will be highly localised and the cumulative area will be a product of discrete localised areas within each project's development areas, noting the general overall lack of benthic habitat reliance for these mobile species.
- 3-499 Spawning for other fish and shellfish will be ongoing throughout the year (EIAR Volume 2, Chapter 8: Fish and Shellfish, Table 8-7), however largely refined to a small window and as such, impacts from each project during that small window will not constitute the full impact area for

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<sup>9</sup> Spittal to Peterhead Subsea Cable Link (1.76 km<sup>2</sup>), Green Volt OWF (4.55 km<sup>2</sup>), Salamander OWF (5.18 km<sup>2</sup>), EGL2 (7.6 km<sup>2</sup>), Muir Mhòr OWF (7.73 km<sup>2</sup>), Cenos OWF (10.63 km<sup>2</sup> for the whole Project) Proposed Offshore Development (6.413 km<sup>2</sup>) **totalling 43.86 km<sup>2</sup>**

any one project, and as such the overall areas presented (EIAR Volume 2, Chapter 8: Fish and Shellfish, Table 8-14) are an overestimation of the impacted area at any one time. It is recognised that this will be a multi-year impact depending on the projects' construction schedules, however in each year, the area of impact will be small and discrete and considerably less than that described above.

- 3-500 Adult fish (including elasmobranchs, shellfish and squid) are considered not sensitive to direct temporary habitat disturbance, possessing escape mechanisms and features enabling avoidance of disturbance (EIAR Volume 2, Chapter 8: Fish and Shellfish, Section 8.12.1.1).
- 3-501 Furthermore, seabed recovery is expected to be rapid with recoverability of the seabed for the Proposed Offshore Development Site considered in the order of months to years (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes). This is comparable to all other projects considered that may act cumulatively (National Grid and SSENT, 2022; Desperes, 2000, Dornie *et al.*, 2003). As such, though the impact may present over multiple years, recovery of areas where work is complete will ensure that the full area is never fully impacted in any one year.
- 3-502 All of the projects assessed this impact alone and cumulatively as Not Significant and it is considered that no additional mitigation was required, outside of embedded / in-built mitigation proposed (**Appendix 3.3**).
- 3-503 Considering the baseline (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.7) which describes widespread habitat over much of the Proposed Offshore Development Site, the localised, small extent and temporary intermittent nature of the construction activities for each plan or project, and the fact the overall cumulative footprints are very small and discrete in comparison with the wider extent of the mapped spawning grounds or considered migratory routes in the case of Atlantic salmon, the Proposed Offshore Development's negligible contribution cumulatively with that of other plans and projects remains Not Significant for direct temporary habitat disturbance for fish and shellfish.

### **Operation and Maintenance**

- 3-504 It is considered, based on **Appendix 3.2**, that when Buchan OWF is operational, so will all other listed projects and therefore the same projects are considered for the operation and maintenance cumulative assessment, as for construction for direct temporary habitat disturbance.
- 3-505 The effects of direct temporary habitat disturbance during operation and maintenance for all plans and projects are expected to be less than those predicted for the construction phase as the activities are lesser in nature and scale (**Section 3.9.1**) and due to the mobile nature of the receptor, the alternative available habitat, the temporary nature of the impact and the small spatial extent disturbed in comparison.
- 3-506 Therefore, the Proposed Offshore Development's negligible contribution cumulatively with the contribution to others is Not Significant for direct temporary habitat loss for fish and shellfish during operation and maintenance.

## Decommissioning

- 3-507 The effects of direct temporary habitat disturbance during decommissioning will be less than those predicted for the construction phase with conclusions remaining as per the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13) i.e., Not Significant for fish and shellfish.

### 3.9.2 Increases in SSC and Deposition

- 3-508 A number of neighbouring offshore plans and projects fall within the cumulative assessment Study Area (**Figure 3-17**). increases in SSC and deposition can occur within the footprints of the proposed plans or projects, as well as outside through sediment transport pathways.
- 3-509 Accordingly plans and projects considered for the cumulative impact assessment include those on the full list (**Appendix 3.2**). This includes those plans and projects which fall within the predicted precautionary impact range (25 km (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology; EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes)). It also includes other plans and project to account for the migratory nature of Atlantic salmon, where there is the potential for multiple exposures during migration, when they are considered more vulnerable.

## Construction

- 3-510 It is considered the predominant impact to fish and shellfish with respect to increases in SSC and deposition, arises from increases in SSC in the water column and to the habitat through deposition.
- 3-511 The sediment composition throughout the Proposed Offshore Development Site is mainly silty sand to gravelly sand, with finer sediment present in the Array Area, changing to coarser sediment (i.e., gravel) and bedrock approaching landfall, with patches of finer sediment present (**Section 3.6.1**) (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes).
- 3-512 For the Proposed Offshore Development, impacts arising from the worst case parameters (i.e., maximum distance travelled by SSC is 15 km ( south easterly direction), maximum SSC up to 270 mg/l rapidly declining after seven days, and the maximum level of deposition estimated at 12 cm (**Table 3-3**) were considered to be Not Significant for the Proposed Offshore Development alone.
- 3-513 The worst case for increases in SSC for the other plans and projects (alone) (**Appendix 3.3**) provides a maximum range of SSC from 0.0025 km (Marram Wind OWF) to 20 km (Muir Mhòr OWF), with the majority of other considered projects predicting SSC effects extending up to between approximately 1.5 km and 17 km (**Appendix 3.3**).
- 3-514 Maximum concentrations for the other plans and projects range from hundreds of thousands of mg/l in the immediate vicinity (Cenos OWF, Bowdun OWF and Salamander OWF) to > 50 mg/l at Caledonia OWF, rapidly decreasing in less than two weeks (maximum 13 days for Spiorad na Mara OWF), however for the majority of projects SSC returns to background levels typically between one to three days following cessation of the activity (**Appendix 3.3**).

- 3-515 Sediment deposition across the plans and projects varies, ranging (where data are available) between 10 mm (Ossian OWF) to 100 cm (Salamander OWF) linked to direct disposal mounds resulting from release of sediment from a dredger (resulting in the disaggregation of finer material with the potential to form an armoured seabed layer of coarser sediment) (**Appendix 3.3**).
- 3-516 The other plans and projects similarly all assessed increases in SSC and deposition as Not Significant (alone).
- 3-517 The conclusions of the CEA for these other projects was that the impact of increases in SSC and sediment deposition on fish and shellfish was Not Significant following the implementation of embedded mitigation (similar to those proposed for the Proposed Offshore Development). This conclusion was based on the high mobility of species, along with the overall area to be potentially impacted, the short term and temporary nature of the work, and the natural dynamics of the North Sea leading to rapid recovery of habitats. The mitigation measures for the Proposed Offshore Development are presented in the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.11) and listed above (**Section 3.9.2**).
- 3-518 It is acknowledged that if the Proposed Offshore Development is constructing alongside one or more of the other plans or projects, and to a similar programme, that multiple sources of elevated SSC are probable. However, given the generally low levels once at a distance from the source, and the rapid dispersion of SSC in the water column, and limited deposition away from the relevant projects, any potential impacts would be very small and short lived.
- 3-519 Considering the baseline which describes the availability of suitable habitat within the Proposed Offshore Development, and the areas of alternative potential for spawning, and considering that the potential area of effect is limited at each project location with SSC and deposition decreasing rapidly with distance from the source at all projects, and the intermittent nature of the construction activities, the Proposed Offshore Development's negligible contribution cumulatively with the contribution to other plans and projects is therefore Not Significant for SSC and sediment deposition on fish and shellfish ecology.

### **Operation and Maintenance**

- 3-520 It is considered, that when the Proposed Offshore Development is operational, so will all other listed projects and therefore the same plans and projects are considered for the operation and maintenance cumulative assessment, as for construction for increases in SSC and deposition.
- 3-521 The assessment for the Proposed Offshore Development alone, identified no likely significant effects on all fish and shellfish receptors from increases in SSC and sediment deposition from operation and maintenance activities. This was due to the dynamic nature of the North Sea, the limited plume distance, the temporary nature of the impact and the small spatial extent disturbed in comparison with the alternative available habitat (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13.3.2).
- 3-522 The effects of an increase in SSC and sediment deposition during operation and maintenance is expected to be less than those predicted for the construction phase (**Section 3.9.3, Section 3.6.3. and Section 3.7.3**). The associated operation and maintenance activities are less in nature

and scale. Therefore, the Proposed Offshore Development's negligible contribution cumulatively with the contribution to others is Not Significant for increases in SSC and sediment deposition for fish and shellfish during operation and maintenance.

### **Decommissioning**

- 3-523 The effects of increases in SSC and sediment deposition during decommissioning will be less than those predicted for the construction phase with conclusions remaining as per the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13) i.e., Not Significant for fish and shellfish.

### **3.9.3 Increases in Underwater Noise**

- 3-524 Increases in underwater noise has the greatest potential for cumulative effects due to the relatively large impact ranges associated with piling activities and the potential for both temporal and spatial overlap between concurrent offshore construction activities. However, impacts associated with underwater noise are predicted to remain temporary and intermittent in nature, with extensive alternative habitat available throughout the wider cumulative assessment Study Area.
- 3-525 The plans and projects assessed include those listed for herring and sandeel (**Section 3.6.4** and **Section 3.7.4**) to account for plans and projects which are within double the maximum range of TTS (EIAR Volume 2, Chapter 6: Marine and Coastal Physical Processes), 178 km (double the 89 km predicted TTS range for the Proposed Offshore Development Site) as this represents the maximum potential for noise contours to overlap between projects (**Figure 3-7**, **Figure 3-15**, and **Figure 3-17**).

### **Construction**

- 3-526 For the purposes of the CEA, and to take a precautionary approach, it is considered Fish Hearing Group 3 species are considered the most sensitive fish receptors to underwater noise effects and have therefore been assessed as the worst case receptor group within the cumulative assessment. The cumulative assessment presented within **Section 3.6.6.4** for herring is therefore also considered applicable to other Group 3 fish species. Similarly, the cumulative assessment presented for sandeel (Group 1 species) is therefore also considered applicable to other Group 1 fish species (**Section 3.7.6.3**).
- 3-527 As outlined within the EIAR (EIAR Volume 2 Chapter 8: Fish and Shellfish Ecology, Section 8.8), the predicted temporary threshold shift (TTS) impact ranges (for stationary fish) are the same for all fish hearing groups and therefore assessment of Group 3 species is considered suitably precautionary (**Section 3.6.6.4**).
- 3-528 The majority of fish receptors considered within the assessment are mobile and are therefore expected to demonstrate behavioural avoidance responses to active piling operations. Less mobile receptors, including shellfish species, are not considered particularly sensitive to underwater noise effects in comparison to mobile fish receptors.

3-529 The assessments for other relevant plans and projects (**Appendix 3.3**) similarly concluded effects from underwater noise to be Not Significant both alone and cumulatively following implementation of embedded mitigation measures. Although temporary overlap of piling activities may occur under a worst case scenario, the temporary nature of the activities, the availability of alternative habitat, behavioural avoidance responses and recoverability, and the relatively small contribution of the Proposed Offshore Development to the wider cumulative scenario mean that cumulative underwater noise effects are considered Not Significant for marine fish and shellfish receptors.

### **Operation and Maintenance**

3-530 The effects of increases in underwater noise during operation and maintenance are expected to be less than those predicted for the construction phase, and therefore Not Significant for fish and shellfish (**Section 3.6.4, Section 3.7.4 and Section 3.9.3**). See the EIAR, (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.12.2.4).

### **Decommissioning**

3-531 The effects of increases in underwater noise during decommissioning will be less than those predicted for the construction phase as there will be no impact piling, with conclusions remaining as per the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13 i.e., Not Significant for fish and shellfish).

## **3.9.4 Long Term Habitat Loss**

3-532 Long-term habitat loss during operation is only considered likely to be important for species with a strong benthic association and limited mobility. The assessment of long-term habitat loss therefore builds on the receptor-specific assessments presented within the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13.3.2) and the updated herring and sandeel assessments presented within **Section 3.6.5** and **Section 3.7.5**, respectively.

3-533 The plans and projects screened in for long term habitat loss for herring are the same as those in **Section 3.9.1**.

3-534 It is considered that long term habitat loss is an impact that presents after the completion of construction work and during the lifetime of the Proposed Offshore Development and as such the assessment is undertaken based on the footprint of infrastructure only, during the operation and maintenance and decommissioning phases only.

### **Operation and Maintenance**

3-535 It is considered that the predominant impact to fish and shellfish with respect to long term habitat loss is an impact on the potential spawning habitat for this species, or areas of refuge / feeding area. Most of the fish species assessed (including those with mapped spawning and nursery grounds) are demersal or pelagic in nature, without strict affinity to the seabed, and therefore not subject to this impact in a manner that could lead to likely significant effects at a cumulative level.

- 3-536 The footprint of permanent habitat loss associated with the Proposed Offshore Development represents a very small proportion of the wider available habitat within the cumulative assessment Study Area (up to 0.13 % for mackerel) (**Section 3.9.4**). In addition, the majority of fish species considered within the assessment are mobile and are therefore not expected to be significantly affected by the relatively localised areas of habitat loss.
- 3-537 The conclusions for the CEAs for other projects was that the impact of direct temporary habitat disturbance on fish and shellfish was Not Significant following the implementation of embedded mitigation (similar to those proposed for the Proposed Offshore Development) including the production and adherence to a CaP. This conclusion was based on the overall area to be potentially impacted, the local spatial extent over time and the reversible nature of the impact.
- 3-538 Despite the impacts occurring throughout the operational lifetime of the plans and projects, these are of limited scale, at discrete locations. Fish and shellfish would rapidly adapt to the presence of the infrastructure (which would take time to install and it is assumed a degree of habituation exists by the end of construction) and due to a specific lack of sediment affinity for many of these species or mobile nature (e.g., *Nephrops* which bury into the sediment), the Proposed Offshore Development's negligible contribution cumulatively with that of other plans and projects remains Not Significant for long term habitat loss for fish and shellfish.

### **Decommissioning**

- 3-539 The effects of long term habitat loss during decommissioning will be less than those predicted for the operation and maintenance phase with conclusions remaining as per the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13) i.e., Not Significant for fish and shellfish.

### **3.9.5 Colonisation of Structures and Infrastructure**

- 3-540 The cumulative effects assessment for colonisation of structures and infrastructure builds on that presented within in the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13.3.2). The updated assessment considers plans and projects included since the original EIA application submission based on updates to project status.
- 3-541 The effects of the colonisation of structures and infrastructure are considered localised at the Proposed Offshore Development; therefore, the cumulative assessment considers offshore projects within the cumulative assessment Study Area (considered highly conservative) to the Proposed Offshore Development, and developments which will be constructed at the same time (**Appendix 3.2**).
- 3-542 The effects remain localised and within the boundary of the Proposed Offshore Development therefore it is considered that the area outside the red line boundary with the potential to be affected is negligible. Other developments may also experience colonisation of sub-structures and infrastructure, however it is considered the distance between individual sub-structures or infrastructure within or between OWFs is large enough that the effects on fish are considered negligible.

- 3-543 The colonisation of structures can potentially have a positive impact on fish and shellfish ecology as it can lead to increased biodiversity, in turn attracting fish and shellfish due to an increased provision of shelter, refugia and foraging opportunities (Linley *et al.* 2007; Orsted, 2021; BioConsult, 2006).
- 3-544 The cumulative effects assessment for colonisation of structures and infrastructure presented within in the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13.3.2) concluded the cumulative likely effect to be Not Significant. The updated assessment for other relevant plans and projects similarly concluded effects from colonisation of structures and infrastructure (during operation and maintenance) to be Not Significant cumulatively, with some assessments identifying the potential for minor beneficial effects associated with the introduction of additional hard substrate habitat (**Appendix 3.3**).
- 3-545 Given the localised nature of these effects and the relatively small contribution of the Proposed Offshore Development to the wider cumulative scenario, cumulative effects associated with colonisation of structures and infrastructure are considered Not Significant for marine fish and shellfish receptors.

### **3.9.6 EMF and Thermal Effects**

- 3-546 The cumulative effects assessment for electromagnetic fields (EMF) and thermal effects builds on that presented within the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13.3.2). Only species capable of detecting EMF are considered sensitive to this pathway.
- 3-547 The cumulative assessment includes only those plans and projects with offshore export or interconnector cabling located within the relevant cumulative assessment Study Area, where offshore cable infrastructure falls within a 25 km buffer of the Proposed Offshore Development ECC. These include:
- Marram Wind,
  - Salamander,
  - Easten Greenlink 2,
  - Spittal – Peterhead,
  - Cenos,
  - Stromar,
  - Green Volt and
  - Muir Mhòr (**Appendix 3.3**).
- 3-548 Operational projects already present within the cumulative assessment Study Area are considered to form part of the existing baseline environment and are therefore not anticipated to contribute cumulatively to construction-related EMF effects.
- 3-549 Though considerable amounts of cable will be installed across all the projects considered, EMF effects are highly localised around the cables themselves and rapidly attenuate with distance (i.e., within metres both vertically and horizontally). Furthermore, the majority of cable

infrastructure will be buried beneath the seabed (or with appropriate protection) further reducing potential exposure.

- 3-550 The assessments for other relevant plans and projects similarly concluded effects from EMF and thermal impacts to be Not Significant both alone and cumulatively (**Appendix 3.3**). Given the highly localised nature of EMF effects, and the widespread availability of available habitat, cumulative EMF and thermal effects are considered Not Significant for marine fish and shellfish receptors.

### **3.9.7 Secondary Entanglement**

- 3-551 The cumulative effects assessment for secondary entanglement remains unchanged from that presented within the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology, Section 8.13.3.2). The assessments for other relevant plans and projects similarly concluded effects of secondary entanglement to be Not Significant cumulatively, reflecting the low likelihood of significant debris accumulation together with the implementation of embedded mitigation measures, monitoring and regular maintenance activities designed to reduce the potential for entanglement risk.
- 3-552 Given the limited likelihood of occurrence and the relatively small contribution of the Proposed Offshore Development to the wider cumulative scenario, cumulative effects associated with secondary entanglement are considered Not Significant for marine fish and shellfish receptors.

### **3.10 DRAFT FISH MITIGATION PLAN**

- 3-553 A Fish Mitigation Plan (FMP) will be produced for approval by Scottish Ministers post-consent (prior to construction).
- 3-554 The plan will be developed in consultation with NatureScot and MD-LOT (and any other consultees, as required) following confirmation of finalised project design and allowing the incorporation of any updated parameters (including design, schedule, methods and footprint), in line with guidance and industry best practice, and additional survey data.
- 3-555 A thorough baseline for herring and sandeel receptors will be provided with the ecological importance of these fish species (both in their own right, and as a key prey item within the wider North Sea food web) described alongside conservation status and any specific factors that make them vulnerable to potential impacts.
- 3-556 An outline of the effects requiring mitigation and proposed mitigation measures to reduce the potential for significant disturbance on herring and sandeel will be provided, along with general Project commitments including the due care and consideration when scheduling the works to account for sensitivity of receptors. The residual effects will also be detailed.
- 3-557 As per the EIAR (EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology) and this supporting AEIR, the FMP will confirm detailed mitigation.
- 3-558 The FMP will also seek to address monitoring requirements including a post construction monitoring plan to validate assessments in terms of temporary and long term loss of habitat, underwater noise, SSC and deposition with respect to herring and sandeel.
- 3-559 The methods to measure and monitor the effectiveness of the proposed mitigation measures will be defined through agreement with MD-LOT and NatureScot. This will include any potential parameters to be assessed (e.g. fish presence, habitat condition), the method and frequency of surveys and reporting procedures.

### **3.11 SUMMARY OF CONCLUSIONS**

- 3-560 This AEIR has provided targeted additional information relating to Fish and Shellfish Ecology specifically relating to herring and sandeel sensitivities, in line with the consultation feedback.
- 3-561 This AEIR has considered the RAEI from MD-LOT (including NatureScot’s response) and the NatureScot Post-Workshop Memo (28.02.2026). Considering the additional evidence and the information presented within this AEIR it is concluded that the assessment undertaken within the EIAR Volume 2, Chapter 8: Fish and Shellfish Ecology remains suitable and the conclusions are retained.
- 3-562 A baseline update and additional heat modelling were undertaken to provide an overview of the potential spawning habitat for both herring and sandeel. This has indicated that for both species, there is considerable and preferential alternative spawning habitat in the regional Study Area outside the areas impacted by the Proposed Offshore Development, providing the confidence in the maintenance of population dynamics for both species within the regional Study Area.
- 3-563 Where required, assessments were undertaken for the following impacts:
- direct temporary habitat disturbance;
  - increases in SSC and deposition;
  - increases in underwater noise leading to mortality, injury and behavioural effects; and
  - long term habitat loss.
- 3-564 The assessment concluded likely effects on fish and shellfish receptors as Not Significant, in line with the EIAR.
- 3-565 An updated CEA has been undertaken, with an updated list of plans and projects (following discussion with NatureScot). All impacts have been assessed as Not Significant for fish and shellfish.
- 3-566 Considering the effect pathways, the low receptor availability and presence, and the mitigation in place, it can be concluded that likely significant effects are not predicted for fish and shellfish receptors alone or cumulatively.

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### APPENDIX 3.1 – CONSULTATION LOG

This appendix provides a comprehensive record of consultation undertaken with NatureScot during the determination phase relevant to the fish and shellfish ecology AEIR.

Consultee's response	Response from applicant
<p><i>For example, Table 8-12 of the Fish and Shellfish Chapter states that 800m of mooring chain will be laid on the seafloor prior to installation but does not appear to consider the potential 100-800m (per anchor) of mooring chain that will interact with the seabed during the operation and maintenance (O&amp;M) phase (Table 4-4, Project Description). The calculations provided within Table 8-12 for long term habitat loss do not show the necessary breakdown within each category of infrastructure to inform our assessment, and therefore we cannot be confident in the maximum area of seabed take.</i></p>	<p>In response, additional detail has been provided within the AEIR to clarify the breakdown of seabed take by infrastructure type and to explain the assumptions used in the Maximum Design Scenario (MDS) calculations. As noted within the AEIR, the assessment approach has been refined following consultation with NatureScot such that mooring chain interaction with the seabed during operation is now considered within the long term habitat loss assessment, rather than temporary habitat disturbance. The updated assessment includes consideration of the potential extent of mooring chain touchdown and movement associated with operational conditions, alongside anchors, inter-array cables and export cables. Consequently, the conclusions of the EIA remain unchanged, with effects on fish and shellfish receptors continuing to be assessed as not significant in EIA terms. BOW also notes that the final mooring configuration and infrastructure layout will continue to be refined through detailed design, with opportunities to further minimise seabed interaction considered through the project design process and subsequent Fish Mitigation Plan.</p>
<p><i>The EIA assessment for fish and shellfish ecology concludes no significant impacts, both alone and cumulatively – we broadly support most of the conclusions reached, except in respect of impacts to sandeel and herring, where we do not support conclusions on predicted impacts from underwater noise and increase in suspended sediment concentration (SSC). We provide advice on how this could be addressed through the development of a Fish Mitigation Plan. Further advice is provided in Appendix C</i></p>	<p>Responses requested will be provided in the AEIR.</p>

Consultee's response	Response from applicant
<p><i>Fish and shellfish ecology is considered in Chapter 8 (Volume 2) of the Buchan EIA Report and the following supporting appendices: • Buchan Environmental Survey Report, Volume 3, Appendix 7.1 • Under Water Noise Assessment Report, Volume 3, Appendix 8.1 • Electro Magnetic Field Assessment, Volume 3, Appendix 8.2 • Marine and Coastal Physical Processes Modelling Technical Report, Volume 3, Appendix 6.1 • Report to Inform Appropriate Assessment</i></p>	<p>Noted.</p>
<p><i>The assessment for fish and shellfish ecology predicted the significance of effect to be Not Significant in EIA terms across all impact pathways, both alone and cumulatively. Although we broadly support most of the conclusions reached regarding significance in EIA terms, we note the following exceptions</i></p>	<p>Noted.</p>
<p><i>We do not accept the conclusion of Not Significant for sandeel and herring for injury and behaviour changes (TTS) on the basis of the information provided.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>We do not consider predicted increases in SSC for herring and sandeel to be Not Significant on the basis of the information provided.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>Our interest in fish species and the conclusions being reached relate to the importance of these species as both prey species but also as fundamental building blocks in the food web chain and therefore marine ecosystem resilience. We do not consider the overall approach to assessing this receptor to be robust and identify that there are still gaps in knowledge around the impacts on fish species from the development of a floating wind farm with a broad project envelope design.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>The advice we provide within this Appendix addresses specific elements of the assessment that we do not agree with and specifies where further work will be required to verify assessment conclusions with requirements for mitigation and monitoring.</i></p>	<p>Noted.</p>

Consultee's response	Response from applicant
<p><i>The study areas as presented in Section 8.5 and Figure 8-1 are appropriate and have been informed by ICES rectangles as well as sediment transport modelling and maximum spring tidal excursion.</i></p>	<p>Noted.</p>
<p><i>A desk-based literature review of existing fish and shellfish ecological data and site-specific data has been used to inform the fish and shellfish baseline (Section 8.6 and 8.7). Table 8-4 details the data sources used for the desk-based review, and we are pleased to see the addition of Langton et al. (2021) but note that FeAST11 and Essential Fish Habitat maps<sup>12</sup> have been omitted.</i></p>	<p>Noted. The AEIR provides a substantially updated baseline characterisation which brings together the various evidence sources used within the assessment and includes the FeAST and Essential Fish Habitat map datasets. In addition, the revised baseline includes spawning and nursery ground datasets (Coull et al., 1998; Ellis et al., 2012), site-specific Particle Size Analysis (PSA) data, eDNA survey results, DDV observations, sediment suitability mapping and modelled habitat suitability assessments. The additional information does not alter the overall conclusions of the assessment, and predicted effects on fish and shellfish receptors remain not significant in EIA terms.</p>
<p><i>Project specific surveys are detailed in Table 8-5, and include offshore geophysical and geotechnical surveys, Particle Size Analysis (PSA) surveys and environmental DNA (eDNA) surveys. The geophysical and geotechnical surveys cover the entire Array Area and ECC, whilst the PSA (93 locations) and eDNA surveys (12 locations at 3 depths) represent specific sample locations. Available datasets have been layered together on the same map (e.g. Figure 8-7) which is confusing in determining the relative importance of the proposed Development area for certain species and to also understand the relationship between site-specific data and existing broad scale habitat mapping.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>

Consultee's response	Response from applicant
<p><i>In general, the eDNA and other site-specific environmental data (PSA and DDV footage) has not been sufficiently considered in characterising the baseline environment, noting especially that drop down video (DDV) data has not been incorporated within Table 8-5. We note identification of 34 different taxa - of which herring appear in 97% of all water samples and represent the most abundant taxa, that eight individual species were consistently present in ≥61% of all samples and that sandeel were identified as an abundantly occurring taxa from still imagery and video recordings (Table 42, Appendix 7.1 Buchan Environmental Survey Report).</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>Appropriate data sets (e.g. Ellis et al. (2012) and Coull et al. (1998)) have been used to consider spawning and nursery areas and where possible supplemented by supporting datasets (e.g. historical catch data, sediment type and predicted distribution of species) however the narrative presented in Section 8.7 does not build a coherent picture to accurately characterise the proposed Development area. This is especially notable for those with substrate affinity and habitat dependence for key life history stages and likely to be impacted by the proposed Development during different phases (especially sandeel). This is discussed further in comments below.</i></p>	<p>The EIAR baseline drew upon a range of established and site-specific datasets, including spawning and nursery ground data (Coull et al., 1998; Ellis et al., 2012), historical fisheries records, sediment characterisation, habitat suitability assessments and species distribution information. The AEIR provides an expanded and more integrated baseline narrative to better explain the relationship between sediment characteristics, habitat suitability, observed species occurrence and the ecological function of the Proposed Development.</p>

Consultee's response	Response from applicant
<p><i>We note that herring spawning grounds overlap parts of the proposed Development (covering parts of both the Array Area and ECC), as shown in Figure 8-2a, however we disagree that there are no nursery grounds overlapping the proposed Development. Figure 8-3b shows low intensity nursery grounds (Ellis et al., 2012) throughout the Regional Study Area and within the entire proposed Development. Whilst these may present areas of lower intensity use, they still constitute potential nursery grounds for herring and should not be omitted. High intensity nursery grounds (Ellis et al., 2012) are correctly identified in the south and west of the Local Study Area, with high intensity nursery grounds to the west of the Array Area also overlapping with a nursery ground area identified in Coull et al. (1998).</i></p>	<p>BOW acknowledges NatureScot’s comments regarding the interpretation of herring nursery ground data within the EIAR baseline characterisation. BOW recognises that low intensity nursery grounds identified by Ellis et al. (2012) extend across parts of the Regional Study Area and overlap the Proposed Development Area. The AEIR provides additional clarification regarding the interpretation of herring nursery ground datasets, including further explanation of the distinction between low and high intensity nursery areas identified by Ellis et al. (2012) and Coull et al. (1998). The AEIR also incorporates additional site-specific evidence. BOW therefore remains satisfied that the baseline characterisation and assessment conclusions are robust and that predicted effects on herring receptors remain not significant in EIA terms.</p>
<p><i>Figure 8-4 details potential habitat suitability for herring spawning using data from Folk (1954) and Marine Space et al. (2013a). To note, there is an updated 2024 MarineSpace13 methodology which ideally should have been used for the EIA, rather than the 2013a version. As it stands, unsuitable spawning habitat makes up the majority of the Regional Study Area, however there are areas of prime and sub-prime herring habitat suitability within the south of the Local Study Area and ECC. The northwest of the Regional Study Area also hosts large pockets of prime and sub-prime suitability, and there are small areas of sub-prime habitat scattered across the Regional Study Area.</i></p>	<p>BOW acknowledges NatureScot’s comments regarding the use of the MarineSpace et al. (2013a) herring habitat suitability methodology within the EIAR. BOW notes the publication of the updated 2024 MarineSpace methodology, however, it is considered that the approach adopted within the EIAR was appropriate and proportionate based on the best available evidence and methodologies available during preparation of the assessment. The AEIR includes additional clarification and interpretation of herring habitat suitability, including updated narrative regarding the distribution of prime and sub-prime habitat within the Local and Regional Study Areas, supported by site-specific sediment and habitat data. BOW remains satisfied that the assessment appropriately characterised herring habitat suitability and that the conclusions of the assessment remain robust and not significant in EIA terms.</p>

Consultee's response	Response from applicant
<p><i>Figure 8-5 shows low predicted abundances of group 0 herring (fish ≤ 12 months of age) across the proposed Development area (Aries et al., 2024; Scottish Government (Marine Directorate), 2015). At the southwest of the Local Study Area and partially overlapping the ECC, there are areas of higher probability, but no overlap with the Array Area. IHLS herring larvae densities are shown in Figure 86 and similarly show high average densities of herring larvae around the south of the Local Study Area, and the northeast of the Regional Study Area. In contrast to Figure 8-5, the Array Area and much of the ECC overlaps with an anticipated average larval density of 0-250, with only a small portion of the ECC showing an anticipated average density of 0.</i></p>	<p>Noted.</p>
<p><i>These Figures are helpful in describing the baseline for herring and show areas such as the south and northwest of the Local Study Area having habitat suitable for herring spawning, and likely higher average densities of herring larvae. They show clearly that the southern part of the ECC overlaps with a herring spawning ground and has a combination of prime and sub-prime sediment suitability, and that the Array Area overlaps with a herring spawning ground (Coull et al., 1998) and may have average herring larval densities of between 0-250. This has not been accurately reflected in the supporting narrative.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>Whilst we agree that Figure 8-5 predicts a modelled probability of zero Group 0 Herring within the Array Area and most of the ECC, Figures 8-4 and 8-6 show that the Array Area may still support herring spawning, and therefore we do not consider Figure 8-4 sufficient to rule out the potential use of the Array Area by herring. Whilst we agree that the Array Area does represent an area of low habitat suitability and low larval densities, and that the highest densities and habitat suitability are found along the inshore regions of the Regional Study Area, we are mindful that the eDNA data indicates a consistent presence of herring throughout the Array Area and ECC. The narrative presented does not synthesise the available baseline information</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>

Consultee's response	Response from applicant
<p><i>sufficiently clearly to understand the relative importance of the proposed Development Area for herring across key life history stages. This has implications for the assessment.</i></p>	
<p><i>Sandeel are key ecological species within the North Sea food web and provide a prey source for marine mammals and birds. They exhibit high habitat fidelity and typically remain local to their spawning grounds. This fidelity is driven by substrate suitability and means that sandeel are not likely to relocate/move away when experiencing stress.</i></p>	<p>Noted.</p>
<p><i>Figure 8-2c and 8-3d show that the Array Area and ECC overlap with predicted sandeel spawning and nursery grounds (Ellis et al., 2012; Coull et al., 1998). The Array Area is mostly prime potential sandeel spawning habitat (Folk, 1954; MarineSpace et al., 2013a), with PSA indicating the southern part of the Array Area having the most suitable sediment. The entire Array Area and ECC is within the Coull et al. (1998) predicated spawning ground for sandeel (Figures 8-7 and 8-8), as well as a low intensity spawning ground (Ellis et al., 2012). The ECC overlaps with both the sandeel spawning and nursery grounds and constitutes prime potential sandeel spawning habitat. To note, Figure 8-2c appears to model the Coull et al. (1998) nursery ground, however this has incorrectly been labelled as the Coull et al. (1998) spawning ground</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>

Consultee's response	Response from applicant
<p><i>While site-specific PSA benthic surveys have identified that some of the proposed Offshore Development is unsuitable for sandeel, there are distinct areas to the south of the Array Area and along the ECC that are suitable (PSA - Sandeel Habitat Suitability (Folk, 1954; Marine Space et al., 2013a) (Figure 8-7). Whilst we agree that the southern part of the Array Area appears to have the most suitable sandeel habitat (as indicated by site-specific PSA data), Figure 8-7 also indicates that the majority of the Array Area and ECC is prime sandeel spawning habitat (Potential Sandeel Spawning Habitat, (Folk (1954); Marine Space et al., 2013a)). eDNA data for sandeel indicates the presence of sandeel in 61% of samples taken throughout the Array Area and ECC, suggesting that sandeel are present throughout the Local Study Area. It would be helpful if eDNA and DDV data was displayed alongside the PSA and EMODnet data rather than multiple overlapping datasets with similar colouring in the same Figure. The narrative presented does not synthesise the available baseline information sufficiently, both from literature and site-specific surveys to clearly understand the relative importance of the proposed Development area for sandeels across key life history stages. This has implications for the assessment.</i></p>	<p>BOW acknowledges NatureScot’s comments regarding the presentation and synthesis of baseline information for sandeel within the EIAR. The AEIR provides a substantially expanded and more integrated baseline narrative for sandeel, including additional interpretation of the relationship between sediment suitability, potential spawning habitat, eDNA detections and DDV observations across the Array Area and ECC. The AEIR also includes revised figures and updated mapping to improve transparency and interpretation of the various overlapping datasets. The updated narrative clarifies that, while suitable and potentially important sandeel habitat occurs within parts of the southern Array Area and along sections of the ECC, habitat suitability and likely ecological importance vary spatially across the Proposed Development Area. Site-specific PSA and survey data were also given greater weighting within the assessment where available. The conclusions of the assessment remain unchanged, with predicted effects on sandeel receptors assessed as not significant in EIA terms.</p>
<p><i>A valued ecological receptor approach has been used to determine which species are most appropriate to take through to the impact assessment as outlined in Section 8.7.6. However, it is not entirely clear which species have been taken through to assessment, partly as each sub-section describing species groups refers to example species, and no narrative is provided on the criteria used to select VERs or how this links to the baseline characterisation. While this was discussed in part at Scoping, we had anticipated the narrative to build on what was previously outlined. We have assumed that the named example species are those that have been selected.</i></p>	<p>BOW acknowledges NatureScot’s comments regarding the clarity of the Valued Ecological Receptor (VER) approach and the identification of species taken forward to assessment within Chapter 8. The AEIR provides additional clarification regarding the rationale for VER selection and the relationship between baseline characterisation and receptors taken forward to assessment. The updated text clarifies which species and receptor groups were assessed in detail, including representative species used for key impact pathways, and explains how these were identified based on sensitivity, habitat association and ecological relevance to the Proposed Development Area. BOW considers that the additional clarification provided within the AEIR improves transparency of the assessment methodology and receptor selection process while not altering the</p>

Consultee's response	Response from applicant
	conclusions of the assessment, which remain not significant in EIA terms.
<p><i>A maximum design scenario (MDS) has been selected for each impact, which would lead to the greatest impact for that particular receptor. However there appears to be a disconnect between the narrative within Table 8-12 and that of Chapter 4 Project Description particularly in relation to temporary and long-term habitat loss / disturbance. We have found it difficult to understand and replicate calculations between these documents to fully understand the footprints associated with mooring chains connected to each anchor design including storage of chain prior to installation, as well as movement of chains when installed that result in intermittent contact both below and on the seabed. We note from Table 4-7 that scour protection is only required for driven or suction pile options, but it is unclear from the schematics provided (i.e. Figure 4-14, Figure 4.9 and 4.10) whether movement of chains below the sediment surface has been evaluated and if so to what degree.</i></p>	<p>BOW confirms that mooring chains were included in the impact for temporary habitat disturbance during operation in the EIAR. BOW has considered NatureScots comments and presents further information on how the Maximum Design Scenario has been reached, including additional detail on mooring chains. The assessment for long term habitat loss has been updated to include impacts from mooring chains within the AEIR Chapter 3: Fish and Shellfish Ecology</p>
<p><i>As the final project design envelope is selected, we expect further consideration to be given to choices which minimise the loss of habitat both temporary and long-term including how the mooring chains will interact with the seabed to reduce the amount of suspended sediment concentrations</i></p>	<p>Noted. BOW will endeavour to reduce any habitat loss through refinement of the PDE.</p>

Consultee's response	Response from applicant
<p><i>Prior to construction and as part of the final design envelope selection, further assessment is made on the potential impacts on sandeel and herring, what mitigation will be provided (this could including timing of activity to avoid key biological sensitive periods), alongside the provision of a construction and post construction monitoring plan to assess impacts in terms of temporary and long term loss of habitat, underwater noise, suspended sediment concentration and changes in productivity for both sandeel and herring. This could be achieved through the development of a Fish Mitigation Plan.</i></p> <p><i>This plan should consider disturbance during key life history stages for sandeel (spawning / winter hibernation) and herring spawning and with reduction / finalisation of the project design envelope, sensitive siting and whether sensitive scheduling of works in key areas could be of benefit in minimising impacts.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>The assessment methodology for fish and shellfish deviates from the standard significance matrix methodology and the method described in the EIA Methodology Chapter (Volume 1, Chapter 5) and instead follows the CIEEM (2022) approach of qualitatively describing each impact following a set of criteria. This includes characterising the impact as described in Section 8.9.2 and then determining the significance of effect as described in Section 8.9.3. Both approaches can be useful, each have their own merits / weaknesses, however, in reviewing the assessment set out in Section 8.12 we have largely found that the justification provided is very high level, lacks logical structure and appears to downplay or omit consideration of impacts. It relies consistently on the mobile nature of key species and the short-term duration of the development activities, which is not always appropriate.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>Our comments below focus on those species / groups and impact pathways where we consider the assessment provided has not sufficiently considered the level of potential impact. These</i></p>	<p>Noted.</p>

Consultee's response	Response from applicant
<p><i>relate to our request for a Fish Mitigation Plan, as discussed above.</i></p>	
<p><i>For herring, a conclusion of Not Significant has been reached for direct temporary habitat disturbance during construction. The proposed Development overlaps with defined spawning and nursery grounds for herring as discussed above. The Applicant has identified potential for temporary habitat disturbance across 6.413km<sup>2</sup> (which equates to 1.5% of the proposed Development area) and 0.021% of the herring spawning ground defined in the wider Regional Study Area). No calculations are provided to outline how these values have been derived or allow for any recalculation.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>Herring are reliant on specific substrate conditions to complete their lifecycle, and whilst it is possible for herring to be displaced and utilise suitable sediment in a different area of the Regional Study Area, it cannot be assumed that all herring will do this, or that they will return following the cessation of construction. Paragraph 8-135 states a notable absence of herring from eDNA data in defined spawning areas, yet herring appeared in 97% of all water samples (Paragraph 8-34) and represented the most abundant taxa (Appendix J, eDNA Results, Buchan Environmental Survey Report, Appendix 7.1).</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>Although temporary short-term disturbance is generally considered as not significant for fish receptors, disturbance during key life history stages such as spawning should be appropriately considered particularly as potential impacts could be minimised through sensitive scheduling of works.</i></p>	<p>Noted.</p>

Consultee's response	Response from applicant
<p><i>For sandeel, a conclusion of Not Significant has also been reached for direct temporary habitat disturbance during construction. Similar to herring, the Applicant has identified the potential for temporary habitat disturbance across 6.413km<sup>2</sup> (which equates to 1.5% of the proposed Development area) and 0.018% of the sandeel spawning ground defined in the wider Regional Study Area. No calculations are provided to outline how these values have been derived or allow for any recalculation.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>Sandeel are dependent on specific habitats due to their substrate fidelity and life history and consequently are less likely to leave their habitat in search for similarly suitable sediment than herring. Sandeel are particularly vulnerable to disturbance and habitat loss in the winter hibernation months, and in general there is a lack of post-construction research on sandeel habitat use. Therefore, we do not consider displacement to be appropriate justification in assessing this impact. Habitat fidelity means that sandeels are sensitive to the temporary removal of substrate, and particularly sensitive during the spawning window (November – February) when eggs are buried in the substrate. Figure 8-7 show the Array Area, ECC and Local Study Area to largely be prime potential sandeel spawning habitat, with the southern section of the Array Area constituting both prime spawning habitat and prime sandeel habitat suitability (PSA). Both Figures 8-8 and 8-9 model the predicted densities of sandeel to be highest in the nearshore areas of the regional Study Area, but both show predicted densities for sandeel within the ECC.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>Although we accept the conclusion of Not Significant in EIA terms, we do not consider the likely impact has been suitability described.</i></p>	<p>BOW has considered NatureScot's comments and presents additional information providing an updated baseline and assessment of all relevant impacts for sandeel in AEIR Chapter 3: Fish and Shellfish Ecology.</p>

Consultee's response	Response from applicant
<p><i>Overall, we accept the conclusion of Not Significant (in EIA terms) for fish and shellfish receptors for direct temporary habitat disturbance. However, as above we request the development of a Fish Mitigation Plan to validate assessment of the final project design envelope and to monitor the impacts through construction and operation.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>Herring demonstrate habitat fidelity and lay their eggs directly onto the substrate. Increases in SSC and deposition during construction activities can smother eggs and disrupt the development of larvae. SSC can reduce the availability of oxygen for eggs, and the sediment granules can damage developing larvae, making herring eggs and larvae particularly sensitive to this impact. Whilst adult herring are mobile, eggs and larvae are susceptible to smothering.</i></p>	<p>Noted.</p>
<p><i>Modelling for three representative scenarios is provided in Table 8-15 with the ECC trenching scenario (number 3) predicting the highest maximum sediment deposition (12cm) and maximum SSC value of 270mg/l, with sediment predicted to travel 10km south-east from the modelled location (KP64 -74). Although the narrative is unclear, we surmise from review of the scenario selection justification provided in Appendix 6.01 that these scenarios are indicative of discrete activities which have been modelled using various indicative sediment type and current velocities. While we accept that remobilise to natural background levels is likely in 12 days, the narrative provided does not place the results in the context of all construction activities likely to increase SSC or what this may mean for areas of suitable habitat.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>

Consultee's response	Response from applicant
<p><i>To the south of the Local Study Area and overlapping the ECC, high densities of herring larvae are modelled (Figure 8-6). The Figure legend does not indicate what the darkest coloured ICES squares represent for herring larvae, but we have assumed that these squares indicate a density higher than 1000 larvae per m<sup>2</sup>. To note, a similar herring larval abundance model using IHLS data was modelled for another Offshore Windfarm recently and shows considerably higher densities of herring larvae in the same ICES squares. Considering the high prevalence of herring in site specific eDNA surveys, the overlap of herring spawning grounds (Coull et al., 1998) and the predicted sediment deposition of ≤12cm and uncertainty around construction timing, we do not consider the impacts to be Not Significant, on the basis of the information provided.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>Sandeel demonstrate higher substrate specificity than herring and spend the winter months buried in the sediment. Figure 8-7 shows the overlap of both sandeel spawning (low intensity and high intensity) and nursery grounds within the Local Study Area, and the ECC. Site specific data (PSA and eDNA) confirm that sandeel are very likely to utilise the habitats within the Array Area and SSC, and therefore the impact of ≤12cm deposition and 270mg/L of SSC are likely to have a significant effect on sandeel. As for herring above, we do not consider the impacts to be Not Significant, on the basis of the information provided. We are also unclear how much the movement of mooring chains will contribute to sediment resuspension and how this will affect sediment type and suitability for sandeel. This should be addressed as discussed above.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>In considering the potential for significant underwater noise effects we acknowledge the associated uncertainty and precaution inherent within underwater noise models. We focus our advice where we have not been able to reach the same conclusion as the Applicant.</i></p>	<p>Noted.</p>

Consultee's response	Response from applicant
<p><i>Group 1 (Popper et al., 2014) are species that remain close to the seabed, and include sandeel, lemon sole, dab, plaice, mackerel, elasmobranchs, river and sea lamprey. Sandeel is the only species considered as stationary which we support. A conclusion of Not Significant has been reached on the basis that underwater noise will be relatively localised and short in duration. We are content with this conclusion for all species within this category on the basis that most fish and elasmobranch species can flee localised underwater noise and utilise areas outside of the impact zone.</i></p>	<p>Noted.</p>
<p><i>However, the impact on sandeel will be greater due to their substrate affinity and habitat dependence. Table 8-21 models the predicted mortality, recoverable injury, and behavioural effects for concurrent piling and the Intermediate Reactive Compensation (IRC) Platform. Whilst mortality (<math>\leq 0.01\%</math> from nursery and spawning area overlap) and recoverable injury (<math>\leq 0.02\%</math> from nursery and spawning area overlap) is predicted to be low for sandeel, behavioural effects from concurrent piling are anticipated to be notable (<math>\leq 7.8\%</math> of spawning and nursery overlap (Coull et al., 1998) and <math>\leq 10\%</math> overlap with high intensity, 22.3% overlap with low intensity spawning areas (Ellis et al., 2012) and <math>\leq 19.1\%</math> overlap with low intensity nursery grounds (Ellis et al., 2012). Similarly for IRC platforms, mortality and recoverable injury is low, whilst behavioural effects for sandeel are greater. <math>\leq 18.2\%</math> of sandeel spawning areas and nursery areas (Coull et al., 1998) overlap with underwater noise contours. For high intensity spawning areas there is a <math>\leq 21.7\%</math> overlap and 15.2% low intensity and <math>\leq 14.1\%</math> low intensity overlaps for nursery areas (Ellis et al., 2012)</i></p>	<p>Noted.</p>
<p><i>Table 8-20 shows the predicted TTS impact zone for fleeing (1100km) and stationary (21,000km) Group 1 species during concurrent piling. With sandeel considered as static receptors, a scenario where piling occurs concurrently across the Array Area could have a significant impact on sandeel,</i></p>	<p>Noted.</p>

Consultee's response	Response from applicant
<p><i>especially if concurrent piling occurs when sandeel are buried.</i></p>	
<p><i>We consider the overlap with sandeel nursery and spawning grounds could be significant when considering the static nature of sandeels and in light of the uncertainty discussed above in characterising the relative importance of the proposed Development area. The presence of 'alternate suitable habitat' to relocate to does not minimise the impacts to sandeel spawning and nursery grounds within the Array Area and ECC. No evidence that sandeel from outside of the Array Area will potentially replenish lost sandeel densities within the Array Area has been provided, and therefore this shouldn't be considered. Additionally, there is no mention of the proposed piling times (other than the anticipated start year), and therefore it is difficult to assess with certainty whether piling operations will interact with the burrowed period of sandeel between September and February (emerging in November – February to spawn). As such we cannot accept the conclusion of Not Significant for sandeel for injury and behaviour changes (TTS) on the basis of the information provided.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>

Consultee's response	Response from applicant
<p><i>Group 3 (as per Popper et al. 2014) fish represent the most sensitive species to underwater noise, as they possess swim bladders. All species within this group are pelagic spawners, other than herring which lay eggs on the seabed. Similarly to our comments above, our concerns are around the potential concurrent piling of 8 Wind Turbine Generators (WTG) at each location (NE, E and SE) totalling 24 piles simultaneously being installed and an impact area of 21,000km<sup>2</sup> for TTS (stationary fish). Herring are demersal and spawn on specific substrates and should be considered as stationary receptors for this impact. As no indication of when piling will take place is provided, we have assumed that piling will overlap with herring spawning season (August – September). If concurrent piling takes place during the herring spawning season, then a potential mortality area of 370km<sup>2</sup> occurs for herring, increasing to an area of 1,500km<sup>2</sup> (recoverable injury). Herring is the only species in Table 8-29 that is substrate dependent, and therefore more susceptible to impact. 1.9% of spawning in sub-prime habitats and 2% in prime habitats is predicted for Herring, which we agree does not represent a large proportion of the spawning areas. However, we are mindful of the uncertainty discussed above in characterising the relative importance of the proposed development area for herring. As such we cannot accept the conclusion of Not Significant for herring for injury and TTS and on the basis of the information provided. This should be addressed as discussed above.</i></p>	<p>BOW has considered NatureScot's comments and presents additional information providing an updated baseline and assessment of all relevant impacts for herring in AEIR Chapter 3: Fish and Shellfish Ecology. BOW considers that the additional information provided within the AEIR does not alter the conclusions of the assessment, which remain not significant in EIA terms.</p>
<p><i>Particle motion has been identified as a key evidence gap by ScotMER and as such we request that:</i></p> <ul style="list-style-type: none"> <li>• <i>The proposed development, if consented, explores opportunities to contribute to emerging research in this field, especially given the potential for suitable habitat across the proposed development area for Nephrops (Coull et al., 1998).</i></li> </ul>	<p>BOW is aware of ongoing and emerging ScotMER research and will support research wherever possible and practicable.</p>

Consultee's response	Response from applicant
<p><i>The assessment of EMF effects considers research publications and predictive modelling outputs generated from a range of cable scenarios and a burial depth of 2m which we note is 0.5m lower than the target burial depth described in Chapter 4. Our collective understanding of EMF effects remains poor, particularly in relation to in-field measurements of EMF and potential impacts to sensitive receptors, such as elasmobranchs including basking sharks. ScotMER currently have a research contract let on this subject matter, due to report in 2026 and any outputs from this work should be considered in the final project design.</i></p>	<p>Noted. BOW will consider ScotMER outputs on EMF.</p>
<p><i>We support the commitment (Table 8-13) to develop an Entanglement Management Plan (EM14).</i></p>	<p>Noted.</p>
<p><i>The assessment presented for underwater noise effects from clearance of unexploded ordnance (UXOs) is especially high level. We welcome the commitment to use low order deflagration and note the potential for further assessment associated with separate Marine Licence requirements through which a worst-case scenario, high order detonation assessment, would be necessary. Our comments above in respect of the need to revisit the baseline characterisation will be important to inform any future assessment, noting that we have not supported a conclusion on Not Significant elsewhere for mortality impact area of <math>\leq 0.43\text{km}</math> (234dB) and <math>\leq 0.72\text{km}</math> (229dB) for mortal injury particularly in relation to herring.</i></p>	<p>Noted. BOW will take NS comments into account for future UXO clearance.</p>

Consultee's response	Response from applicant
<p><i>The review of long-term habitat loss is very high-level, making it difficult to have confidence in the assessment provided. Paragraph 8-313 states the total footprint of the cable along the ECC and IAC to be 0.58km<sup>2</sup>. Table 8-12 details the maximum design scenario for long term habitat loss, however as discussed above, it appears that the value for mooring lines differs from those presented in Chapter 4 (Project Description). Table 4-4 of the Project Description (Chapter 4) states that each WTG will have 9 mooring lines, with 100 - 800m of each mooring line touching the seabed at any one time, totalling a potential impact area for the Array Area of 63 – 504km every tidal cycle. Mooring lines that regularly pick-up and set-down on the seafloor, and from our understanding, move below the mudline, will therefore prevent settlement of species in the direct area of contact - this should be considered as long-term habitat loss.</i></p>	<p>BOW acknowledges NatureScot’s comments regarding the treatment of mooring line interaction with the seabed within the long term habitat loss assessment. Following consultation and Requests for Additional Information, the assessment approach presented within the AEIR was updated to explicitly include operational mooring line touchdown interaction within the long term habitat loss impact pathway, rather than temporary habitat disturbance. The revised assessment recognises that mooring chains may intermittently contact and move across the seabed throughout the operational lifetime of the Proposed Development, including localised pick-up and set-down behaviour associated with tidal and metocean conditions. The AEIR provides additional clarification regarding the assumptions used in the Maximum Design Scenario (MDS) calculations, including the extent of mooring chain interaction with the seabed and the resulting long term habitat loss footprint. Infrastructure-specific breakdowns have also been provided to improve transparency of the seabed take calculations. BOW also notes that detailed mooring configuration and infrastructure layout will continue to be refined through the project design process.</p>
<p><i>Paragraph 8-320 states the worst-case scenario for long term habitat loss (herring) to be 1.18km<sup>2</sup> but doesn’t explain what infrastructure have been considered and doesn’t appear to include the potential impact of mooring lines. We also note that only spawning ground habitat loss has been considered for herring (0.0038%) and sandeel (0.003%). Perhaps this is because the location of structures is considered to be outside of nursery grounds for both species?</i></p>	<p>BOW acknowledges NatureScot’s comments regarding the presentation of the worst-case scenario for long term habitat loss for herring and the apparent omission of operational mooring line interaction from the assessment calculations. Following consultation and Requests for Additional Information, the AEIR updated the Maximum Design Scenario (MDS) calculations and long term habitat loss assessment to explicitly include operational mooring line seabed interaction within the assessed footprint. While some lower intensity nursery habitat overlaps parts of the Proposed Development Area, predicted habitat loss effects remain highly localised and not significant in EIA terms.</p>

Consultee's response	Response from applicant
<p><i>A tiered approach to the cumulative effects assessment (CEA) has been detailed in Paragraph 8-457 which is the only part of the CEA that we support. We consider that the assessment is not sufficient for a number of reasons including, but not limited, too: • It does not consider operational wind farms, wave/tidal developments or relevant coastal / harbour works including dredge disposal sites. Export cable routes are not illustrated in Figure 8-13 so it is unclear if these are included although we note the reference to the Peterhead area in Paragraph 8-476 / Paragraph 8-580 yet can see no actual assessment of this.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>No quantification of cumulative impacts for any of the impact pathways is provided instead the maximum design scenario assumes that the impact (and mitigation) from other wind farms is broadly similar to that of the proposed Development, which we do not support.</i></p>	<p>Noted. Additional information will be included in AEIR Chapter 3: Fish &amp; Shellfish Ecology.</p>
<p><i>Each assessment relies on impacts being negligible when considered against total available regional habitat (e.g. Paragraph 8-481) which, without any quantification, cannot be substantiated.</i></p>	<p>BOW acknowledges NatureScot’s comments regarding the quantification of available habitat within the cumulative effects assessment (CEA) and the basis on which habitat loss impacts were considered negligible relative to the wider regional resource. The AEIR provides additional clarification and supporting quantification regarding the extent of suitable habitat available regionally for key receptors including herring and sandeel, together with revised Maximum Design Scenario calculations and updated habitat overlap assessments. The AEIR further clarifies the proportional extent of predicted habitat disturbance and long term habitat loss relative to the wider availability of suitable habitat within the Regional Study Area.</p>

Consultee's response	Response from applicant
<p><i>The narrative is high level and relies on statements e.g. localised, small extent and temporary intermittent nature of the construction as well as the mobile and migratory nature (Paragraph 8-485).</i></p>	<p>BOW acknowledges NatureScot’s comments regarding the level of detail presented within the cumulative effects assessment narrative. The AEIR provides additional clarification and supporting narrative regarding the basis for the cumulative assessment conclusions, including further explanation of the proportional extent of predicted habitat disturbance relative to available regional habitat and the spatially limited nature of impacts associated with the Proposed Development. The AEIR also expands the assessment narrative where applicable. BOW considers that the additional information provided within the AEIR improves transparency of the assessment rationale and supports the conclusion that cumulative effects on fish and shellfish receptors remain not significant in EIA terms.</p>
<p><i>There are inconsistencies between which developments have been screened in for assessment across receptors e.g. Figure 8-14 and Figure 8-15.</i></p>	<p>BOW acknowledges NatureScot’s comments regarding apparent inconsistencies in the developments screened into the cumulative effects assessment across different receptor groups and figures within Chapter 8. The cumulative assessment screening process was undertaken on a receptor-specific basis, taking account of the relevant impact pathways, spatial overlap, temporal overlap, ecological connectivity and sensitivity of each receptor group to the impacts being assessed. Consequently, different projects may have been screened into or out of specific assessments depending on their relevance to individual receptor-impact pathways. Following consultation and Requests for Additional Information, the AEIR provides additional clarification regarding the cumulative screening methodology.</p>

Consultee's response	Response from applicant
<p><i>Conclusions are reached based on the Project's negligible contribution cumulatively with the contribution of the other plans and projects but is not evidenced (e.g. Paragraph 8-512 &amp; 8566)</i></p>	<p>BOW acknowledges NatureScot's comments regarding the presentation of evidence supporting conclusions on the Proposed Development's cumulative contribution alongside other plans and projects. The cumulative effects assessment presented within the EIAR were informed by review of publicly available project information, project-specific parameters where available, and consideration of the proportion of suitable habitat potentially affected within the wider regional context. The AEIR provides additional clarification and supporting narrative regarding the basis for the cumulative assessment conclusions, including further explanation of the scale and proportional contribution of the Proposed Development relative to the wider cumulative scenario.</p>
<p><i>The underwater noise assessment relies on highly localised, low level noise which will not impact fish and distance between projects rather than considering the temporal overlap in noise emitting activities and what this might mean cumulatively across the Study Area (Paragraphs 8-570 &amp; 8-571).</i></p>	<p>BOW acknowledges NatureScot's comments regarding consideration of temporal overlap within the cumulative underwater noise assessment for fish and shellfish receptors. The AEIR provides additional clarification regarding the cumulative assessment rationale, including further explanation of assumptions relating to temporal overlap and the proportional contribution of the Proposed Development within the cumulative scenario. relevant spatial and temporal overlap scenarios and that cumulative effects on fish and shellfish receptors remain not significant in EIA terms.</p>

Consultee's response	Response from applicant
<p><i>Arbitrary buffers have been used to screen out relevant projects (Paragraph 8-589).</i></p>	<p>BOW acknowledges NatureScot’s comments regarding the use of spatial buffers within the cumulative effects assessment screening process. The screening approach adopted within the EIAR used spatial boundaries and buffers proportionate to the relevant impact pathways, receptor mobility, predicted zone of influence and the scale of potential effects associated with the Proposed Development. The purpose of the screening criteria was to identify projects with a realistic potential for cumulative interaction with the relevant fish and shellfish receptors, while avoiding inclusion of projects with no credible pathway for cumulative effect. The AEIR provides additional clarification regarding the cumulative screening methodology and rationale for project inclusion or exclusion.</p>
<p><i>These points together with the issues identified above in respect of the project alone assessment are such that we do not have any confidence in the cumulative assessment provided. Given the uncertainty associated with consent / build out timelines, we request that:</i></p> <ul style="list-style-type: none"> <li><i>• An updated cumulative effects assessment is carried out pre-construction, if consented, to identify any significant cumulative effects to fish and shellfish receptors and to inform any mitigation requirements as part of the Fish Mitigation Plan.</i></li> </ul>	<p>BOW acknowledges NatureScot’s request for an updated cumulative effects assessment (CEA) to be undertaken prior to construction in light of evolving consent and build-out timelines for other projects. The cumulative assessment presented within the EIAR and subsequently clarified and updated within the AEIR was based on the best available information at the time of assessment and considered relevant plans and projects with realistic potential for cumulative interaction with fish and shellfish receptors. BOW agrees that an updated review of the cumulative scenario for fish and shellfish receptors can be undertaken pre-construction, where appropriate, as part of the Fish Mitigation Plan process and in consultation with relevant stakeholders.</p>

Consultee's response	Response from applicant
<p><i>Embedded mitigation has been proposed to reduce potential impacts on environmental receptors. Table 8-13 detail the embedded mitigation measures relevant to Fish and Shellfish Ecology. Excluding EM4 (micro siting of infrastructure) and EM13 (low order deflagration), all embedded measures are plans. The commitment to produce a plan (and follow this plan post-consent) does not technically constitute mitigation, and whilst these plans are positive, we do not consider these to be mitigation. Advice is provided above in relation to the request for a Fish Mitigation Plan above.</i></p>	<p>Noted. Mitigation measures will be refined once plans are fully developed.</p>
<p><i>Advice is provided above in relation to specific monitoring requirements within the Fish Mitigation Plan comments as above.</i></p>	<p>Noted.</p>
<p><i>At the EIA Scoping stage, we provided our position on diadromous fish whereby impacts should be assessed through the EIA process and not through HRA. This position reflects: • Current limited knowledge of spatial and temporal distribution and behaviour of these species in the marine environment, • Current lack of evidence to inform impact pathways, and, • Lack of reference population figures which prevents impact apportioning to SACs. We note that diadromous fish have been considered through the EIA process as recommended and are content with the assessment conclusions reached. We have not reviewed the assessment provided in the RIAA.</i></p>	<p>Noted.</p>

### APPENDIX 3.2 – LIST OF OTHER DEVELOPMENTS CONSIDERED WITHIN THE CEA FOR FISH AND SHELLFISH ECOLOGY

Plan/Project	Summary	Status	Distance from array area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
<b>Tier 1</b>							
<i>None</i>							
<b>Tier 2</b>							
Marram Wind OWF (ScotWind)	Planned floating OWF  3000 MW  126-225 turbines	Planned, EIA submitted	24.2	25	2030	2041	Potential overlap with construction activities due to project programmes.  Located within 25 km of the Proposed Offshore Development.
Spittal – Peterhead Subsea Cable Link10	HVDC cable route	Construction phase	40	-	2026	2030	Due to lack of project timeline information, assume temporal overlap with construction activities.  Located within the wider cumulative assessment Study Area and there will be overlap with the Proposed Offshore Development export cable route.

<sup>10</sup> It is understood that the Marine Licence Application for this project was submitted in January 2025. Details have been requested from MD-LOT and the applicant, but have not been able to be provided to allow a more detailed consideration of the assessment of cumulative effects at the time of finalising the assessment, and this therefore remains as Tier 3 for assessment purposes.

Plan/Project	Summary	Status	Distance from array area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
Green Volt OWF (INTOG)  (including ECC)	Consented floating OWF  490-560 MW  35 turbines	Consented April 2024	43.8	6.6	2025	2029	Potential overlap with construction activities due to project programmes, and potential proximity to Proposed Offshore Development Site.  Located within the wider cumulative assessment Study Area.
Ayre OWF (ScotWind)  (including ECC)	Planned floating OWF  1008 MW  40-67 turbines	Planned, EIA submitted November 2025	53.1	72.3	2029	2033	Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area.
Caledonia OWF (ScotWind)  (including ECC)	Planned fixed/floating OWF 2000 MW  84-140 turbines  One quarter of the turbines in deeper water may require floating foundations	Planned, submitted EIA December 2024	55.1	40.8	2028	2032	Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area.

Plan/Project	Summary	Status	Distance from array area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
Salamander OWF (INTOG)  (including ECC)	Planned floating OWF  100 MW  5-7 turbines	Consented July 2025	66.3	4.7	2026	End of 2029	Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area.
Aspen OWF (INTOG)  (including ECC)	Planned floating OWF  1008 MW  70 - 100 turbines	Planned, awarded INTOG March 2023, Scoping report submitted January 2025, EIA submitted	71.5	61.1	2028	2031	INTOG projects with construction periods close, temporally.  Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area.
Muir Mhòr OWF (ScotWind)  (including ECC)	Planned floating OWF 798 MW  40 turbines	Planned, EIA submitted December 2024	84.8	5	2028	2033	Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area.
Eastern GreenLink 2	Consented  Subsea cable connecting two convertor stations	Construction in progress	88.9	11	October 2024	2029	Potential overlap with construction activities due to project programmes and any potential overrun.  Located within the wider cumulative assessment Study Area and in the absence of specific locational data, overlap is expected.

Plan/Project	Summary	Status	Distance from array area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
Bowdun OWF (ScotWind)  (including ECC)	Planned fixed/floating OWF  1008 MW  50-60 turbines	Planned, Scoping Opinion received November 2024, EIA submitted May 2026	131.7	61.4	2029	2033	Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area.
Pentland Floating OWF  (including ECC)	Consented Demo floating OWF  Up to 100 MW  6 turbines	Consented, variation application submitted March 2023, CfD secured Jan 2026.	147.6	156.2	2027	2030	Due to lack of project timeline information, assume temporal overlap with construction activities.  Located within the wider cumulative assessment Study Area.
Ossian OWF (ScotWind)  (including ECC)	Planned floating OWF  2600-3600 MW  270 turbines	EIA submitted June 2024, AI submitted October 2025	151.6	94.6	2031	2038	Due to lack of project timeline information, assume temporal overlap with construction activities.  Located within the wider cumulative assessment Study Area.
West of Orkney Wind Farm (ScotWind)  (including ECC)	Planned OWF  2000 MW  125 turbines	Consented June 2025	157.3	168.5	2028	2031	Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area.

Plan/Project	Summary	Status	Distance from array area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
Bellrock OWF (ScotWind)	Planned floating/fixed OWF  1200 MW  42-80 turbines	Planned, scoping opinion received August 2024. EIA submitted	162.6	119.6	2031	2037	Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area.
Cenos OWF (INTOG)  (including ECC)	Planned floating OWF  1350 MW  68 - 90 turbines	Planned, submitted EIA February 2025	185.7	182.5	2030	2035	Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area.
Seagreen 1a Windfarm (including ECC)	Consented OWF  500 MW  36 turbines	Consented August 2023	187.9	110.9	2030	2031	Due to lack of project timeline information, assume temporal overlap with construction activities.  Located within the wider cumulative assessment Study Area.
Berwick and Marr Bank Wind Farm (OWF)  (including ECC)	Planned OWF  1400 – 4100 MW  307 turbines	Planned, submitted EIA May 2023	193.3	118.7	2026	2031	Due to lack of project timeline information, assume temporal overlap with some construction activities.  Located within the wider cumulative assessment Study Area.
Spiorad na Mara OWF	Consented Demo OWF	Consented, March 2023	306.3	297.1	2027	2031	Potential overlap with construction activities due to project programmes.

Plan/Project	Summary	Status	Distance from array area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
(ScotWind)  (including ECC)	20 MW  1 turbine						Located within the wider cumulative assessment Study Area. Potential for cumulative effects on migrating salmon.
<b>Tier 3</b>							
Broadshore Hub - Scaraben OWF (INTOG)	Planned floating OWF  99.45 MW  Between 3 – 6 turbines	Planned, Scoping Opinion received May 2024	14.2	17.1	2028	2031	Potential overlap with construction activities due to project programmes.  Located within 25 km of the Proposed Offshore Development.
Broadshore Hub - Sinclair OWF (INTOG)	Planned floating OWF  99.45 MW  Between 3 – 6 turbines	Planned, Scoping Opinion received May 2024	16.9	20.9	2028	2031	Potential overlap with construction activities due to project programmes.  Located within 25 km of the Proposed Offshore Development.
Broadshore Hub - Broadshore OWF (ScotWind)	Planned floating OWF  900 MW  Between 32 – 60 turbines	Planned, Scoping Opinion received May 2024	21.2	22.4	2029	2032	Potential overlap with construction activities due to project programmes.  Located within 25 km of the Proposed Offshore Development.

Plan/Project	Summary	Status	Distance from array area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
Stromar OWF (ScotWind)  (including ECC)	Planned floating OWF  1000 MW  71 turbines	Planned, Scoping Opinion received April 2024	39.6	47.1	2027	2033	Due to lack of project timeline information, assume temporal overlap with construction activities.  Located within the wider cumulative assessment Study Area.
Carbon Capture, Compression and Conditioning Plant, electricity cables (Shell UK)	Approved	Approved, Jul 2015	90.5	11.7	-	-	Due to lack of project timeline information, assume temporal overlap with construction activities.  Located in close proximity to ECC.
Morven OWF (ScotWind)  (including ECC)	Planned OWF  2907 MW  191 turbines	Planned, Scoping submitted July 2023	148.9	84.2	2030	2037	Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area.
Arven OWF (including Arven South) (ScotWind)  (including ECC)	Planned floating OWF  2300 MW  161 turbines	Planned, Scoping submitted May 2024 (Arven) and 2023 (Arven South)	183.5	217.7	2030	2033	Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area. Potential for cumulative effects on migrating salmon.

Plan/Project	Summary	Status	Distance from array area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
Stoura OWF (ScotWind)	Planned floating OWF  500 mW	Planned, awarded ScotWind 2022  Scoping report submitted July, 2025	218.2	252.9	2030	2035	Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area. Potential for cumulative effects on migrating salmon.
Havbredey OWF (ScotWind)	Planned floating OWF  1,500 MW  108 turbines	Planned, awarded ScotWind Apr 2022	236.1	244.7	-	2034 - 2055	Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area. Potential for cumulative effects on migrating salmon.
Talisk OWF (Scotwind)  (including ECC)	Planned floating OWF  495 MW 33 turbines	Planned, awarded ScotWind 2022	288.8	292.8		2030	Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area. Located within the wider cumulative assessment Study Area. Potential for cumulative effects on migrating salmon.
<b>Tier 4</b>							
Flora OWF (INTOG)	Planned floating OWF  50 MW	Planned, awarded INTOG March 2023	80.8	28.9	-	-	Due to lack of project timeline information, assume temporal overlap with construction activities.

Plan/Project	Summary	Status	Distance from array area (km)	Distance from ECC (km)	Construction Dates (if relevant)	Operational by (if relevant)	Summary of Interaction with Proposed Offshore Development
	50 turbines						Located within the wider cumulative assessment Study Area.
Cedar OWF (INTOG)	Planned floating OWF  1008 MW  100 turbines	Planned, awarded INTOG March 2023	164.7	144.8	2026 - 2027	2031	INTOG projects with construction periods close, temporally.  Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area.
Beech OWF (INTOG)	Planned floating OWF  1008 MW  100 turbines	Planned, awarded INTOG March 2023	168.1	169.3	2026 - 2027	2031	INTOG projects with construction periods close, temporally.  Potential overlap with construction activities due to project programmes.  Located within the wider cumulative assessment Study Area.

### APPENDIX 3.3 – LIST OF OTHER TIER 2 PLANS AND PROJECTS MDS AND IMPACT ASSESSMENT CONCLUSIONS RELEVANT TO FISH AND SHELLFISH ECOLOGY

The table below presents the parameters assessed, along with the assessment conclusions for the phase (i.e., construction, operation and maintenance, and decommissioning) which will give rise to the greatest impact. Any secondary / additional mitigation suggested is provided along with the cumulative assessment conclusions. In line with the request from MD-LOT informed by NatureScot (see **Table 3-1**) the maximum design scenario has been updated in consideration of direct temporary habitat disturbance, increase in SSC and sediment deposition, increase in underwater noise, long term habitat loss, colonisation of structures / infrastructure, EMF and thermal effects of cables and secondary entanglement.

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
Marram Wind OWF	Direct temporary habitat disturbance	Total temporary habitat disturbance = 49,110,010 m <sup>2</sup> (49.11 km <sup>2</sup> ) representing approximately 3.9% of the site area	Magnitude of impact – low Sensitivity – low to medium Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None identified beyond embedded mitigation	<a href="https://marine.gov.scot/sites/default/files/chapter_13_-_fish_ecology.pdf">https://marine.gov.scot/sites/default/files/chapter_13_-_fish_ecology.pdf</a>
	Increase in SSC and sediment deposition	Immediate SSC (hundreds to low thousands of mg/l) lasting for the duration of active disturbance plus up to 30 minutes following the end of disturbance. Local thicknesses of tens of centimetres to metres depending on the degree of seabed intervention. Fine sediment is unlikely to deposit in measurable thickness. More than one hour after the end of active disturbance, SSC will no longer be elevated and with no measurable ongoing deposition.	Magnitude of impact – very low Sensitivity – low to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None identified beyond embedded mitigation	
	Increase in underwater noise	Construction window of up to 12 years, including up to 1,856 piling days associated with WTG anchors, offshore substations and RCP foundations. Up to two concurrent piling locations assessed. UXO clearance assessed using low-order clearance as the primary method, with high-order clearance considered as the worst-case scenario.  Concurrent piling for stationary fish:  Group 1 <ul style="list-style-type: none"> <li>Mortality – 0.36 km<sup>2</sup> (range - 350m)</li> <li>Recoverable injury – 0.99 km<sup>2</sup> (range – 580 m)</li> </ul> Group 2 <ul style="list-style-type: none"> <li>Mortality - 7.6km<sup>2</sup> (range – 1.6 km)</li> <li>Recoverable injury – 75 km<sup>2</sup> (range – 4.9 km)</li> </ul> Group 3 and 4 <ul style="list-style-type: none"> <li>Mortality – 21 km<sup>2</sup> (range – 2.6 km)</li> <li>Recoverable injury – 75 km<sup>2</sup> (range – 4.9 km)</li> </ul> TTS = 5,500 km <sup>2</sup> (maximum range 44 km)	Magnitude of impact – very low to low Sensitivity – very low to low Negligible to minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	Embedded mitigation measures applied during piling and UXO clearance activities	
	Long term habitat loss	<u>Operation Phase:</u>  Maximum long-term habitat loss of 13,136,930 m <sup>2</sup> (13.137 km <sup>2</sup> ).	Magnitude of impact – low Sensitivity – low to medium Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None identified beyond embedded mitigation	

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
	Colonisation of structures / infrastructure	Total volume of hard substrate introduced = 2,399,000 m <sup>3</sup>	Magnitude of impact – low Sensitivity – low Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None required	
	EMF and thermal effects of cables	Total cable length = 1,230 km 140 km export cable corridor length x 5 530 km inter-array cables	Magnitude of impact – low Sensitivity – low to medium Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	Cable burial and routing embedded within project design	
	Secondary entanglement	Presence of floating infrastructure, mooring lines and dynamic cables within the water column during operation.	Magnitude of impact – low Sensitivity – low to medium Minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	Embedded mitigation including monitoring and fisheries liaison	
Spittal – Peterhead Subsea Cable Link	Direct temporary habitat disturbance	Total temporary habitat disturbance = 1,755,126 m <sup>2</sup> (1.76 km <sup>2</sup> )	Magnitude of impact – low Sensitivity – low to medium Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	Embedded mitigation and standard industry practice	<a href="https://www.ssen-transmission.co.uk/globalassets/projects/spittal-to-peterhead/marine-licence-application---cables/marine-environment-assessment.pdf">https://www.ssen-transmission.co.uk/globalassets/projects/spittal-to-peterhead/marine-licence-application---cables/marine-environment-assessment.pdf</a>
	Increase in SSC and sediment deposition	Temporary and localised increases in SSC and sediment deposition associated with seabed preparation, cable installation and cable protection activities.	Magnitude of impact – very low Sensitivity – low to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	Embedded mitigation and standard industry practice	
	Long term habitat loss	Maximum long-term habitat loss of 308,374 m <sup>2</sup> (0.308 km <sup>2</sup> )	Magnitude of impact – low Sensitivity – low Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	Embedded mitigation through cable routing and minimisation of cable protection where practicable	
	EMF and thermal effects of cables	EMFs generated from operation of buried HVDC subsea export cables. EMF levels expected to attenuate rapidly with distance from the cable.	Magnitude of impact – low Sensitivity – low Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	Embedded cable burial and cable protection measures	
	Colonisation of structures / infrastructure	Total surface area of hard substrate introduction = 308,374 m <sup>2</sup>	Magnitude – low Sensitivity – low Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None required	
	EMF and thermal effects of cables	Bundled HVDC cable design proposed to minimise electric and magnetic fields generated during operation. EMF reduced through engineering measures including cable	Magnitude – negligible Sensitivity – low to medium	Negligible adverse <b>Not Significant</b>	None required	

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
		sheaths, burial and cable protection to achieve target depth of lowering (DoL). EMF effects predicted to be highly localised and undetectable within a few metres of the cable.	Negligible adverse <b>Not Significant</b>			
Green Volt OWF	Direct temporary habitat disturbance	Total temporary habitat disturbance = 4.55 km <sup>2</sup>	Magnitude – negligible Sensitivity – low to high Minor adverse <b>Not Significant</b>	No potential for cumulative impact identified		
	Increase in SSC and sediment deposition	Total area of sediment disturbed = 4.55 km <sup>2</sup>	Magnitude – negligible Sensitivity – low to high Negligible to minor adverse <b>Not Significant</b>	No potential for cumulative impact identified		
	Long term habitat loss	Maximum long-term habitat loss of 4.55 km <sup>2</sup>	Magnitude – negligible Sensitivity low to very high Negligible to minor adverse <b>Not Significant</b>	No potential for cumulative impact identified		
	Increase in underwater noise	Only impact pile the OSP. Maximum range for impact piling – first hammer strike (values for mortality and recoverable injury)  Group 1 - 85 km Group 2 – 147 km Group 3 – 147 km.  TTS – 4,500 km <sup>2</sup>	Magnitude– negligible Sensitivity low to medium Negligible adverse <b>Not Significant</b>	No significant cumulative impact identified		
	EMF and thermal effects of cables	Inter-array cabling 134 km Export cable length – 300 km Total cable length = 434 km  The modelled EMF produced by both cable routes 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 µT at a distance of 5.5 m for the 275kV cables.	Magnitude of impact – negligible to low Sensitivity low to medium Negligible adverse <b>Not Significant</b>	No significant cumulative impact identified	Embedded cable burial and cable protection measures incorporated into project design	
	Colonisation of structures / infrastructure	Total surface area of hard substrate addition = 0.132 km <sup>2</sup>	Magnitude – negligible / beneficial Sensitivity – low to high Negligible / beneficial <b>Not Significant</b>	Negligible / beneficial <b>Not Significant</b>	No additional mitigation proposed	
	Ayre OWF	Direct temporary habitat disturbance	<u>Construction and Decommissioning Phases:</u>	Magnitude - low	Minor adverse <b>Not Significant</b>	None required

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
		<ul style="list-style-type: none"> <li>Total temporary habitat disturbance = 18,000,341.50 m<sup>2</sup> (18 km<sup>2</sup>)</li> <li>Representing approximately 4.64% of the total area of the Site Boundary</li> </ul> <p><u>O&amp;M Phase:</u></p> <ul style="list-style-type: none"> <li>Total temporary habitat disturbance = 2,632,500 m<sup>2</sup> (2.63 km<sup>2</sup>)</li> </ul>	Sensitivity – low (medium for sandeel) Minor adverse <b>Not Significant</b>			2_-_chapter_9_-_fish_and_shellfish.pdf  <a href="https://marine.gov.scot/sites/default/files/vol_3_-_technical_appendix_7.3_-_physical_processes_technical_assessment.pdf">https://marine.gov.scot/sites/default/files/vol_3_-_technical_appendix_7.3_-_physical_processes_technical_assessment.pdf</a>
	Increase in SSC and sediment deposition	Maximum plume distance is 17 km (4 km in array area). Plumes were expected to be vertically and horizontally dispersed to less than 1,000 mg/l within tens of metres with SSCs were expected to reach less than 5 mg/l in all locations within three days of the cessation of excavation. Maximum deposited thickness is 10 mm to 50 mm.	Magnitude - low Sensitivity - low (medium for sandeel and herring) Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None required	
	Increase in underwater noise	<p><u>Construction</u> Based on worst case single anchor pile installation for stationary fish (range)</p> <p>Group 1</p> <ul style="list-style-type: none"> <li>Mortality – 1,390 m</li> <li>Recoverable injury – 2,000 m</li> </ul> <p>Group 2</p> <ul style="list-style-type: none"> <li>Mortality – 4,060 m</li> <li>Recoverable injury – 8,860 m</li> </ul> <p>Group 3 and 4</p> <ul style="list-style-type: none"> <li>Mortality – 5,700 m</li> <li>Recoverable injury – 8,860 m</li> </ul> <p>TTS – 40,600 m</p> <p>Concurrent piling scenario:</p> <p>Group 1</p> <ul style="list-style-type: none"> <li>Mortality – 1,025 m</li> <li>Recoverable injury – 1,480 m</li> </ul> <p>Group 2</p> <ul style="list-style-type: none"> <li>Mortality – 3,040m</li> <li>Recoverable injury – 6,780 m</li> </ul> <p>Group 3 and 4</p> <ul style="list-style-type: none"> <li>Mortality – 4,280 m</li> <li>Recoverable injury – 6,780 m</li> </ul> <p>TTS – 33,700 m</p>	<p><u>Construction Phase</u></p> <p>Magnitude – low Sensitivity – low to medium Minor adverse (moderate for herring, piling only) <b>Not significant</b></p> <p><u>O&amp;M and Decommissioning Phase</u></p> <p>Magnitude- low Sensitivity – low to medium Minor adverse <b>Not significant</b></p>	Minor adverse <b>Not Significant</b>	A Piling Strategy would be agreed post-consent with stakeholders to reduce piling noise impacts on herring to minor adverse and therefore <b>Not Significant</b> in EIA terms.	

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
	Long term habitat loss	<u>All Phases:</u> Maximum long-term habitat loss of 3,042,840 m <sup>2</sup> (3.04 km <sup>2</sup> )	Magnitude - low Sensitivity - low (medium for sandeel and herring) Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	Embedded Mitigation - drafting and implementation of a Decommissioning Programme	
	EMF and thermal effects of cables	Total cable length = 605 km EMF levels are expected to return to baseline within a few metres to tens of metres from the cable.	Magnitude – low Sensitivity – low Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None required	
	Colonisation of structures / infrastructure	Total surface area of hard substrate introduced = 3,412,840 m <sup>2</sup>	Magnitude – low Sensitivity – low Minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None required	
	Secondary entanglement	There will be a total of 135,816 m (135.82 km) of mooring lines and dynamic IACs within the water column.	Magnitude - low Sensitivity – low (marine fish) to medium (shellfish) Minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None	
Caledonia OWF	Direct temporary habitat disturbance	<u>Construction Phase:</u> Total temporary habitat disturbance = 17,603,592 m <sup>2</sup> (17.60 km <sup>2</sup> ) representing approximately 3.3% of the offshore development area.  <u>Construction and O&amp;M Phases:</u> Total temporary habitat disturbance = 815,800 m <sup>2</sup>	Magnitude – low Sensitivity – low to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None required beyond embedded mitigation	<a href="https://digital-eia.cloud/ayre/offshore-eia/vol2/ch9-fish-and-shellfish-ecology/part-3.html#9-12-cumulative-effects-assessment">https://digital-eia.cloud/ayre/offshore-eia/vol2/ch9-fish-and-shellfish-ecology/part-3.html#9-12-cumulative-effects-assessment</a>
	Long term habitat loss	<u>Construction and O&amp;M Phases:</u> Maximum long-term habitat loss of 9,366,000 m <sup>2</sup> (9.37 km <sup>2</sup> ).	Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None required beyond embedded mitigation	
	Increase in underwater noise	<u>Construction Phase:</u> Maximum predicted impact areas for stationary receptors concurrent piling:  Mortality – 6.9 km <sup>2</sup> Recoverable injury - 16 km <sup>2</sup> TTS – 17,000 km <sup>2</sup>	Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None required beyond embedded mitigation	

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
	EMF and thermal effects of cables	<p><u>Operation and Maintenance Phase:</u></p> <p>655 km inter-array length  60 km combined (x2) interconnector cables  F182.5 km floating inter Array cables  330 km combined (x4) export cables  Total cable length = 1,227.5km</p> <p>EMF levels predicted to return to baseline within meters to tens of metres from the cable infrastructure.</p>	<p>Magnitude - low  Sensitivity - low to medium  Negligible to minor adverse  <b>Not Significant</b></p>	<p>Negligible to minor adverse  <b>Not Significant</b></p>	<p>Embedded cable burial and cable protection measures incorporated into project design</p>	
	Colonisation of structures / infrastructure	<p><u>Operation and Maintenance Phase:</u></p> <p>Total surface area of introduced hard substrates = 10,162,205 m<sup>2</sup>.</p>	<p>Magnitude - low  Sensitivity - low  Negligible  <b>Not Significant</b></p>	<p>Not assessed</p>	<p>No additional mitigation proposed</p>	
	Secondary entanglement	<p><u>Operation and Maintenance Phase:</u></p> <p>Total cross sectional area of mooring lines within the water column = 45,000m<sup>2</sup> for semi-submersible foundations.</p>	<p>Magnitude - low  Sensitivity - medium  Negligible to minor adverse  <b>Not Significant</b></p>	<p>Negligible to minor adverse  <b>Not Significant</b></p>	<p>Embedded mitigation including fisheries liaison and navigational controls</p>	
	Increase in SSC and sediment deposition	<p><u>Construction Phase:</u></p> <p>Sediment plumes with SSC up to thousands of mg/l, however these concentrations will be spatially restricted and short-lived.  Elevated SSC may be advected by tidal currents up to 10km away, although these concentrations will be low.  In the vast majority of cases, elevated SSC will be indistinguishable from background levels after 20 hours from the start of activities and can therefore be considered temporary and localised  Sediment deposition following MFE activities of up to 50mm is expected in the immediate vicinity of the active disturbance. With thicknesses between 5 and 20mm deposited up to 600m away from the active disturbance area, reducing to low tens of mm Sediment deposition is generally not measurable beyond 3km to 5km away.</p> <p>Maximum SSC plume predicted to be:</p> <ul style="list-style-type: none"> <li>• Up to 6 km in length and 2.5 km in width</li> <li>• SSC concentrations &gt;50 mg/l &lt; 1 km long and 500 m wide; and</li> </ul>	<p>Magnitude – low  Sensitivity – low to medium  Negligible to minor adverse  <b>Not Significant</b></p>	<p><b>Not Significant</b></p>	<p>None beyond embedded mitigation</p>	

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
		SSC reduces to 15mg/l within 3km east to west and approximately 700m north to south within 3.6 hours.				
Salamander OWF	Direct temporary habitat disturbance	<p><u>Construction and Decommissioning Phases:</u></p> <ul style="list-style-type: none"> <li>Total temporary habitat disturbance = 5,177,340 m<sup>2</sup> (5.18 km<sup>2</sup>) representing approximately 6.4 % of the offshore array area and ECC.</li> </ul>	Magnitude - low Sensitivity - negligible to medium Negligible to minor adverse <b>Not Significant</b>	Not assessed	None beyond embedded mitigation	<a href="https://marine.gov.scot/sites/default/files/3.10_fish_and_shellfish_ecology.pdf">https://marine.gov.scot/sites/default/files/3.10_fish_and_shellfish_ecology.pdf</a>  <a href="https://marine.gov.scot/sites/default/files/marine_physical_processes_0.pdf">https://marine.gov.scot/sites/default/files/marine_physical_processes_0.pdf</a>
	Increase in SSC and sediment deposition	<p>Maximum extent of tidally aligned sediment plume predicted to be approximately 17 km.</p> <p>At the time of active disturbance - very high SSC increase (tens to hundreds of thousands of mg/l) lasting for the duration of active disturbance plus up to 30 minutes following end of disturbance; sands and gravels may deposit in local thicknesses of tens of centimetres to several metres; fine sediment is unlikely to deposit in measurable thickness.</p> <p>One to six hours after end of active disturbance - decreasing to low SSC increase (tens of mg/l); fine sediment is unlikely to deposit in measurable thickness.</p> <p>Six to 24 hours after end of active disturbance - decreasing gradually through dispersion to background SSC (no measurable local increase); fine sediment is unlikely to deposit in measurable thickness. No measurable change from baseline SSC after 24 to 48 hours following cessation of activities.</p>	Magnitude - low Sensitivity - negligible to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None beyond embedded mitigation	<a href="https://marine.gov.scot/sites/default/files/marine_physical_processes_0.pdf">https://marine.gov.scot/sites/default/files/marine_physical_processes_0.pdf</a> <a href="https://marine.gov.scot/sites/default/files/3.10_fish_and_shellfish_ecology.pdf">https://marine.gov.scot/sites/default/files/3.10_fish_and_shellfish_ecology.pdf</a>  <a href="https://marine.gov.scot/sites/default/files/marine_physical_processes_0.pdf">https://marine.gov.scot/sites/default/files/marine_physical_processes_0.pdf</a>
	Increase in underwater noise	<p><u>Construction Phase:</u></p> <p>Stationary impact range for four piles:</p> <p>Group 1 Mortality – 1.2 km<sup>2</sup> (range 0.63 km) Recoverable injury – 2.9 km<sup>2</sup> (range 0.98 km)</p> <p>Group 2 Mortality – 19 km<sup>2</sup> (range 2.5 km) Recoverable injury – 160 km<sup>2</sup> (range 7.2 km)</p> <p>Group 3 Mortality – 49 km<sup>2</sup> (range 4 km) Recoverable injury – 160 km<sup>2</sup> (range 7.2 km)</p> <p>TTS – 8,200 km<sup>2</sup></p>	Magnitude – low (piling) to negligible (UXO) Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b>	Significant without mitigation <b>Not Significant</b> with mitigation	The Salamander Project would work collaboratively with other regional developers, where reasonably practicable, to minimise overlap of piling activities and reduce cumulative underwater noise impacts (Co58).	

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
	Long term habitat loss	Maximum long-term habitat loss of 6,950,460 m <sup>2</sup>	Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b>	Not assessed	None beyond embedded mitigation	
	EMF and thermal effects of cables	Detectable EMF volumes assessed for dynamic array cables, static array cables and export cables.  Length of inter-array cabling (dynamic) - 3,500 m Length of static array cable – 31,500 m Length of export cable – 85,000 m Total length of cabling = 120,000 m (120 km)	Magnitude - low Sensitivity - negligible to low Negligible adverse <b>Not Significant</b>	Not assessed	Embedded cable burial and cable protection measures incorporated into project design	
	Colonisation of structures / infrastructure	Total volume of hard substrate introduced = 6,585,600 m <sup>3</sup>	Magnitude - negligible Sensitivity - negligible to low Negligible beneficial <b>Not Significant</b>	Not assessed	None beyond embedded mitigation	
	Secondary entanglement	Presence of floating infrastructure and associated mooring systems during operation.	Magnitude - negligible Sensitivity - medium Negligible adverse <b>Not Significant</b>	Negligible adverse <b>Not Significant</b>	Embedded mitigation including fisheries liaison and navigational controls	
Aspen OWF	Increase in underwater noise	<u>Construction Phase:</u>  Noise modelling for stationary receptors sequential piling:  Group 1 <ul style="list-style-type: none"> <li>Mortality – 1,200 m</li> <li>Recoverable Injury – 1,900 m</li> </ul> Group 2 <ul style="list-style-type: none"> <li>Mortality – 5,000 m</li> <li>Recoverable Injury – 14,000 m</li> </ul> Group 3 <ul style="list-style-type: none"> <li>Mortality – 7,800 m</li> <li>Recoverable Injury – 14,000 m</li> </ul> TTS – 78,000 m	Magnitude – negligible to low Sensitivity - low to high (group 3) Minor adverse (moderate without mitigation) <b>Not Significant</b>	Minor adverse (moderate without mitigation) <b>Not Significant</b>	Implementation of a Fisheries Mitigation Plan (FMP) and embedded piling mitigation measures	<a href="https://aspen.ceruleanwinds.com/wp-content/uploads/2025/09/Chapter-10-Fish-and-Shellfish-Ecology.pdf">https://aspen.ceruleanwinds.com/wp-content/uploads/2025/09/Chapter-10-Fish-and-Shellfish-Ecology.pdf</a>
	Increase in SSC and sediment deposition	Total SSC released during construction = 11,040,639m <sup>3</sup>  Maximum increases in SSC occurs in relation to disposal events within the identified disposal events, up to 800 mg/l, although this is short lived and localised, with these	Magnitude - low Sensitivity - low to medium Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
		concentrations occurring during and immediately following the works. Sediment plumes extend up to approximately 8 km, SSC will return to levels consistent with naturally variable background concentrations within several tidal cycles.				
	Direct temporary habitat disturbance	Total temporary habitat disturbance = 23,944,200 m <sup>2</sup> (23.94 km <sup>2</sup> )	Magnitude - low Sensitivity - negligible to medium Negligible to minor adverse <b>Not Significant</b>	Not assessed	None beyond embedded mitigation	
	Long term habitat loss	Maximum long-term habitat loss of 1,364,653 m <sup>2</sup>	Magnitude - low Sensitivity - negligible to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
	Colonisation of structures / infrastructure	Total surface area of introduced hard substrates = 2,426,846 m <sup>2</sup>	Magnitude - low Sensitivity - low Minor adverse <b>Not Significant</b>	Not assessed	None beyond embedded mitigation	
	EMF and thermal effects of cables	<u>Operation and maintenance Phase:</u>  IAC and Inter-link Cable length up to 300 km; OTCs length up to 620 km;  Total Length of Cables: 920 km	Magnitude - low Sensitivity - low to medium Minor adverse <b>Not Significant</b>	Not assessed	Embedded cable burial and cable protection measures incorporated into project design	
Muir Mhor OWF	Increase in SSC and sediment deposition	Total SSC released during construction activities = 12,718,023 m <sup>3</sup>  SSC increases above 20 mg/l predicted to be short term (< 7.2 hours), with concentrations generally reducing to <5 mg/l within one tidal cycle following cessation of activities.  Peaks of SSC up to 200 mg/l are anticipated in proximity to the interconnector cable installation works, with elevations expected to remain very localised to the activity, with very limited transport of the suspended sediment predicted  SSC quickly reduces to background concentrations with no increases in background concentrations within six days of the end of the installation activity.  Sediment plumes predicted to remain largely localised to installation activities and the offshore ECC, but may extend up to 20 km south of the ECC	Magnitude –low to medium Sensitivity – low to medium Negligible to minor adverse Reduced from moderate through implementation of the FMP <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	Implementation of the FMP	<a href="https://marine.gov.scot/sites/default/files/eia_ch10_fish_and_ecology.pdf">https://marine.gov.scot/sites/default/files/eia_ch10_fish_and_ecology.pdf</a>

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
		Sedimentation thicknesses generally predicted to be: <ul style="list-style-type: none"> <li>• 4-6 mm along the jet trencher path;</li> <li>• &gt;10 mm in small localised areas; and</li> <li>• &lt;3 mm outside the Array Area.</li> </ul>				
	Direct temporary habitat disturbance	<u>Construction Phase:</u>  Total temporary habitat disturbance = 7,731,870 m <sup>2</sup> (7.73 km <sup>2</sup> )	Magnitude – low Sensitivity – negligible to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
	Increase in underwater noise (mortality and mortal injury)	<u>Construction Phase:</u>  Sequential piling for static receptors:  Group 1 <ul style="list-style-type: none"> <li>• Mortality – 2,300 m</li> <li>• Recoverable Injury – 3,600 m</li> </ul>	Magnitude - low Sensitivity – negligible to medium Negligible to minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
	Increase in underwater noise (recoverable injury)	Group 2 <ul style="list-style-type: none"> <li>• Mortality - 8,600 m</li> <li>• Recoverable Injury – 22,000 m</li> </ul> Group 3 <ul style="list-style-type: none"> <li>• Mortality – 13,000 m</li> <li>• Recoverable Injury – 22,000 m</li> </ul>	Magnitude - low (medium for herring) Sensitivity – medium to negligible Negligible to moderate adverse Reduced through implementation of the FMP <b>Not Significant</b>		Implementation of the FMP	
	Increase in underwater noise (TTS)	TTS – 110,000 m  Concurrent piling:  Group 1 <ul style="list-style-type: none"> <li>• Mortality – 7 km<sup>2</sup></li> <li>• Recoverable Injury – 18 km<sup>2</sup></li> </ul> Group 2 <ul style="list-style-type: none"> <li>• Mortality - 120 km<sup>2</sup></li> <li>• Recoverable Injury – 980 km<sup>2</sup></li> </ul>	Magnitude - low to medium (high for herring) Sensitivity - negligible to medium Negligible to moderate adverse Reduced through implementation of the FMP <b>Not Significant</b>			
	Increase in underwater noise (behavioural impacts)	Group 3 <ul style="list-style-type: none"> <li>• Mortality – 370 km<sup>2</sup></li> <li>• Recoverable Injury – 980 km<sup>2</sup></li> </ul> TTS – 20,000 km <sup>2</sup>	Magnitude- low to medium (high for herring) Sensitivity - negligible to medium Negligible to moderate adverse			

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
			Reduced through implementation of the FMP <b>Not Significant</b>			
	Increase in underwater noise (from other sources)		Magnitude - low to medium Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b>	Not assessed	None beyond embedded mitigation	
	Increase in underwater noise (UXO clearance)	<u>Construction Phase:</u>  Maximum 910 m	Magnitude - medium Sensitivity - low to medium Minor to moderate adverse Reduced through mitigation determined through UXO licencing <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	UXO mitigation measures to be determined through licencing	
	Long term habitat loss	Maximum long-term habitat loss of 2,757,400 m <sup>2</sup>	Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
	EMF and thermal effects of cables	Total length inter-array cables = 250 km Total length of up to three interconnector cables = 3 km Total length of up to three export cables = 270 km  Total length of cables: 523 km	Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	Embedded cable burial and cable protection measures incorporated into project design	
	Secondary entanglement	Total cross section in water column = 777,585 m <sup>2</sup>	Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b>	Not assessed	Embedded mitigation including fisheries liaison and navigational controls	
	Colonisation of structures / infrastructure	Total surface area hard substrate introduced = 5,530,120 m <sup>2</sup>	Magnitude - low Sensitivity - low to high Negligible to minor beneficial <b>Not Significant</b>	Negligible to minor beneficial <b>Not Significant</b>	None beyond embedded mitigation	
Eastern Greenlink 2	Direct temporary habitat disturbance	<u>Installation Phase:</u>  Total temporary habitat disturbance = 7.6 km <sup>2</sup> per cable (15.2 km <sup>2</sup> for separate cable lay). Includes 106.0 km of boulder clearance plough (25 m swath); and 340 km of mechanical trenching (15 m swath).	Magnitude - low Sensitivity: low to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None beyond embedded mitigation	<a href="https://marine.gov.scot/sites/default/files/c9_environmental_appraisal_report_-_fish_and_shellfish_ecology_0.pdf">https://marine.gov.scot/sites/default/files/c9_environmental_appraisal_report_-_fish_and_shellfish_ecology_0.pdf</a>

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
	Increase in SSC and sediment deposition	<p>Construction Phase:</p> <ul style="list-style-type: none"> <li>106 km of boulder clearance ploughing (25 m swath); and</li> <li>340 km of mechanical trenching (15 m swath), with associated temporary and localised sediment disturbance and plume generation. SSC increases associated with boulder clearance, ploughing and trenching activities during cable installation. Sediment plumes predicted to be temporary and localised in nature.</li> </ul> <p>Coarse sand typical of the majority of the sediments affected, is expected to be approximately 247 m, fine sediment 1.5 km but negligible at that distance.</p>	<p>Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b></p>	<p>Negligible to minor adverse <b>Not Significant</b></p>	None beyond embedded mitigation	
	Long term habitat loss	Maximum long-term habitat loss of 308.6 km	<p>Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b></p>	<p>Negligible to minor adverse <b>Not Significant</b></p>	None beyond embedded mitigation	
	EMF and thermal effects of cables	<p>HVDC subsea cables assessed under separated and bundled cable configurations – maximum length 436 km.</p> <p>Separated cables:</p> <ul style="list-style-type: none"> <li>maximum magnetic field strength = 404 <math>\mu</math>T at seabed;</li> <li>EMF reduced to background levels within approximately 20 m.</li> </ul> <p>Bundled cables:</p> <ul style="list-style-type: none"> <li>EMF reduced to background levels within approximately 5–10 m.</li> </ul> <p>Induced electric fields:</p> <ul style="list-style-type: none"> <li>maximum iE field strength = 303 <math>\mu</math>V/m at seabed;</li> <li>reduced to background levels within approximately 20 m</li> </ul>	<p>Magnitude - negligible to low Sensitivity: low to medium Negligible to minor adverse <b>Not Significant</b></p>	<p>Negligible to minor adverse <b>Not Significant</b></p>	Embedded cable burial and cable protection measures incorporated into project design.	
	Colonisation of structures / infrastructure	<p>Total length of hard substrate introduced:</p> <ul style="list-style-type: none"> <li>approximately 154.3 km per cable; and</li> <li>approximately 308.6 km if cables laid separately.</li> </ul>	<p>Magnitude - low Sensitivity - low Minor beneficial to negligible adverse <b>Not Significant</b></p>	<p>Negligible to minor adverse <b>Not Significant</b></p>	None beyond embedded mitigation	
Bowdun OWF	Direct temporary habitat disturbance	<p><u>Construction Phase:</u></p> <p>Total temporary habitat disturbance = 19,414,805 m<sup>2</sup> Representing approximately 0.66% of the total area of the Site Boundary.</p>	<p>Magnitude - low Sensitivity - medium (sandeel, herring and Nephrops) to low Minor adverse <b>Not Significant</b></p>	<p>Minor adverse <b>Not Significant</b></p>	None beyond embedded mitigation	<a href="https://marine.gov.scot/sites/default/files/chapter_9_-_fish_and_shellfish_ecology.pdf">https://marine.gov.scot/sites/default/files/chapter_9_-_fish_and_shellfish_ecology.pdf</a>

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
	Long term habitat loss	<u>Operation and Maintenance Phase:</u> Maximum long-term habitat loss of 2,251,000 m <sup>2</sup>	Magnitude - low Sensitivity - medium (sandeel, herring and Nephrops) to low Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	<a href="https://marine.gov.scot/sites/default/files/chapter_7_-_physical_processes.pdf">https://marine.gov.scot/sites/default/files/chapter_7_-_physical_processes.pdf</a>
	Colonisation of structures / infrastructure	<u>Operation and Maintenance Phase:</u> Total volume of hard substrates introduced = 2,705,020 m <sup>2</sup>	Magnitude - low Sensitivity - low Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
	Increase in SSC and sediment deposition	<u>Construction Phase:</u> Up to 318,086 m <sup>3</sup> of drill arising associated with the 40 x 25 MW fixed monopile WTG layout SSC concentrations: <ul style="list-style-type: none"> <li>• Predicted to return to background levels within a few tidal cycles</li> <li>• Concentrations &gt;1,000 mg/l predicted only within tens of metres of activities</li> <li>• Concentrations &lt;5 mg/l predicted within three days of cessation works; and</li> <li>• Plume extents for finer sediments predicted up to 3.9 km</li> </ul>	Magnitude - low Sensitivity - medium (sandeel and herring) to low Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
	Increase in underwater noise	<u>Construction Phase:</u> Worst case arises from concurrent monopile installations:  Group 1 <ul style="list-style-type: none"> <li>• Mortality – 1,993 m</li> <li>• Recoverable Injury – 2,813 m</li> </ul> Group 2 <ul style="list-style-type: none"> <li>• Mortality – 5,860 m</li> <li>• Recoverable Injury – 15,235 m</li> </ul> Group 3 <ul style="list-style-type: none"> <li>• Mortality – 9,141 m</li> <li>• Recoverable Injury – 15,235 m</li> </ul> TTS – 25,000 m	Magnitude - low Sensitivity - high (herring) to low Moderate adverse for herring (piling only) and minor adverse for all other receptors Reduced to minor adverse following mitigation <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	Additional mitigation measures to be agreed with stakeholders and secured through the Piling Strategy. Measures may include noise abatement systems and/or site-specific surveys to identify herring spawning periods	
	EMF and thermal effects of cables	Total cable length = 397 km	Magnitude - low Sensitivity - low Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	Embedded cable burial and cable protection measures incorporated into project design	
Pentland Floating OWF	Direct temporary habitat disturbance	Maximum seabed preparation footprint = 375,000 m <sup>2</sup> Maximum remedial cable protection footprint = 87,500 m <sup>2</sup>	Magnitude - low Sensitivity - low to medium	Minor adverse <b>Not Significant</b>	Embedded mitigation measures including	<a href="#">GBPNTD-ENV-XOD-RP-00005-Chapter-10-Fish-</a>

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
		Total temporary habitat disturbance = 2,205,000 m <sup>2</sup>	Minor adverse <b>Not Significant</b>		micrositing and cable routing measures where practicable.	<a href="#">and-Shellfish-Ecology.pdf</a>
	Increase in SSC and sediment deposition	Temporary increases in suspended sediment concentrations and associated sediment deposition arising from seabed preparation, cable installation and anchor installation activities. Offshore export cables: <ul style="list-style-type: none"> <li>maximum seabed preparation footprint = 375,000 m<sup>2</sup>.</li> </ul> Inter-array cables: <ul style="list-style-type: none"> <li>maximum seabed preparation footprint = 300,000 m<sup>2</sup>.</li> </ul>	Magnitude - low Sensitivity - low to medium Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
	Increase in underwater noise	<u>Construction Phase:</u> Noise modelling for stationary receptors:  Group 1 <ul style="list-style-type: none"> <li>Mortality – 1.8 km</li> <li>Recoverable Injury – 2.8 km</li> </ul> Group 2 <ul style="list-style-type: none"> <li>Mortality – 6.6 km</li> <li>Recoverable Injury – 14 km</li> </ul> Group 3 <ul style="list-style-type: none"> <li>Mortality – 9.5 km</li> <li>Recoverable Injury – 14 km</li> </ul> TTS – 34 km	Magnitude - low Sensitivity - low to medium Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	Embedded mitigation and standard industry practice measures	
	Direct temporary habitat disturbance	Drilled pile cuttings mound predicted to have: <ul style="list-style-type: none"> <li>radius of approximately 21 m; and</li> <li>footprint area of approximately 1,424 m<sup>2</sup>.</li> </ul>	Magnitude - low Sensitivity - low to medium Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
	Long term habitat loss	Maximum long-term habitat loss of 306,810 m <sup>2</sup>	Magnitude - low Sensitivity - low to medium Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	Embedded mitigation measures including cable routing and minimisation of seabed footprint where practicable	
	EMF and thermal effects of cables	Offshore export and inter-array cables: <ul style="list-style-type: none"> <li>maximum export cable length = 25 km; and</li> <li>maximum inter-array cable seabed length = 20 km.</li> </ul> total cable length – 45 km.	Magnitude - low Sensitivity - low to medium Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	Embedded mitigation measures including cable burial where practicable.	
	Colonisation of structures / infrastructure	<u>Operational Phase:</u>  Total volume of hard substrates introduced = 258,125 m <sup>3</sup>	Magnitude - low Sensitivity - low to medium	Minor beneficial <b>Not Significant</b>	None beyond embedded mitigation	

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
			Minor adverse <b>Not Significant</b>			
Ossian OWF	Direct temporary habitat loss	<p><u>Construction Phase:</u></p> <ul style="list-style-type: none"> <li>Total temporary habitat disturbance = 49,948,548 m<sup>2</sup> (49.95 km<sup>2</sup>)</li> <li>Representing approximately 5.82% of the total site boundary;</li> <li>Assessed disturbance footprint = 40.41 km<sup>2</sup> (4.71%)</li> </ul> <p>Additional temporary habitat loss of up to 5,190 m<sup>2</sup> of temporary habitat loss may occur due to crater formation from the clearance of UXO.</p> <p><u>Operation and Maintenance Phase:</u></p> <ul style="list-style-type: none"> <li>Total temporary habitat disturbance = 51,411,500 m<sup>2</sup> (51.41 km<sup>2</sup>);</li> <li>Representing approximately 5.99% of the total site boundary.</li> </ul>	Magnitude - negligible to low Sensitivity - low to medium Minor adverse during construction and negligible adverse for O&M and decommissioning <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	<a href="https://ossian-eia.com/offshore-eia/vol2/ch9-fish-and-shellfish-ecology/part-12.html#9.16.-Summary-of-Impacts-Mitigation-Likely-Significant-Effects-and-Monitoring">https://ossian-eia.com/offshore-eia/vol2/ch9-fish-and-shellfish-ecology/part-12.html#9.16.-Summary-of-Impacts-Mitigation-Likely-Significant-Effects-and-Monitoring</a>
	Long term habitat loss	<p><u>Construction and Operation and Maintenance Phase:</u></p> <ul style="list-style-type: none"> <li>Long term habitat loss/disturbance = 19,270,958 m<sup>2</sup> (19.27 km<sup>2</sup>);</li> <li>Approximately 2.25% of the total Site Boundary</li> </ul> <p>Up to 778,464 m<sup>2</sup> of additional long term seabed disturbance may occur due to mooring line movement.</p>	Magnitude - low Sensitivity - low to medium Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
	Colonisation of structures / infrastructure	<p><u>Operation and Maintenance Phase:</u></p> <p>Total volume of hard substrates introduced = 19,270,958 m<sup>3</sup></p>	Magnitude - low Sensitivity - low Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
	Increase in underwater noise	<p><u>Construction Phase:</u></p> <p>Concurrent piling scenario assessed for stationary fish receptors:</p> <p>Group 1</p> <ul style="list-style-type: none"> <li>Mortality – 1,680 m</li> <li>Recoverable Injury – 2,360 m</li> </ul> <p>Group 2</p> <ul style="list-style-type: none"> <li>Mortality -4,460 m</li> <li>Recoverable Injury – 9,060 m</li> </ul> <p>Group 3</p> <ul style="list-style-type: none"> <li>Mortality – 6,120 m</li> </ul>	Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
		<ul style="list-style-type: none"> <li>Recoverable Injury – 9,060 m</li> </ul> <p>TTS – 45,100 m</p> <p>UXO clearance assessed as part of the construction phase worst-case scenario.</p>				
	Increased SSCs and associated deposition	<p>Peak SSC concentrations:</p> <ul style="list-style-type: none"> <li>up to 2,500 mg/l at release locations associated with sandwave clearance;</li> <li>100–250 mg/l predicted over one tidal excursion;</li> <li>concentrations up to 500 mg/l following sediment re-suspension on subsequent tides.</li> </ul> <p>Sedimentation:</p> <ul style="list-style-type: none"> <li>deposition focused within 100 m of release locations;</li> <li>maximum deposition depth = 0.5–0.75 m;</li> <li>finer sediment deposition generally 5–10 mm.</li> </ul> <p>Cable installation:</p> <ul style="list-style-type: none"> <li>peak SSC increases of approximately 100 mg/l in the immediate vicinity of installation activities.</li> </ul>	<p>Magnitude - low</p> <p>Sensitivity - low</p> <p>Negligible to minor adverse</p> <p><b>Not Significant</b></p>	Not assessed	None beyond embedded mitigation	
	EMF and thermal effects of cables	<p>Total cable length = 1,497 km</p> <ul style="list-style-type: none"> <li>up to 1,261 km of 66 kV or 132 kV inter-array cables;</li> <li>up to 116 km within the water column;</li> <li>remaining inter-array cables buried to a minimum target depth of 0.4 m (subject to CBRA);</li> <li>up to 236 km of 275 kV AC or 525 kV DC interconnector cables;</li> <li>minimum target burial depth of 0.4 m where feasible, with cable protection where target burial depth cannot be achieved.</li> </ul>	<p>Magnitude - low</p> <p>Sensitivity - low</p> <p>Negligible to minor adverse</p> <p><b>Not Significant</b></p>	Negligible to minor adverse <b>Not Significant</b>	Embedded cable burial and cable protection measures incorporated into project design	
West of Orkney OWF	Direct temporary habitat disturbance	<p><u>Construction and Decommissioning Phase:</u></p> <p>Total temporary habitat disturbance = 69.1 km<sup>2</sup> Representing approximately 8.8% of the offshore project area.</p>	<p>Magnitude - low</p> <p>Sensitivity - high (sandeel, flapper skate) to low</p> <p>Negligible to minor adverse</p> <p><b>Not Significant</b></p>	Negligible to minor adverse <b>Not Significant</b>	None beyond embedded mitigation.	<a href="https://marine.gov.scot/sites/default/files/west_of_orkney_windfarm_offshore_eia_report_-_chapter_11_-_fish_and_shellfish_ecology_1.pdf">https://marine.gov.scot/sites/default/files/west_of_orkney_windfarm_offshore_eia_report_-_chapter_11_-_fish_and_shellfish_ecology_1.pdf</a>
	Increase in underwater noise	<p><u>Construction Phase:</u></p> <p>Impact piling at single location for stationary fish – WTG monopiles SELcum:</p> <p>Group 1</p> <ul style="list-style-type: none"> <li>Mortality – 41 km<sup>2</sup> (range 3,600 m)</li> <li>Recoverable Injury – 93 km<sup>2</sup> (range 5,400 m)</li> </ul> <p>Group 2</p>	<p>Magnitude - low</p> <p>Sensitivity - low to medium</p> <p>Negligible to minor adverse</p> <p><b>Not Significant</b></p>	Negligible to minor adverse <b>Not Significant</b>	None beyond embedded mitigation.	

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
		<ul style="list-style-type: none"> <li>Mortality – 400 km<sup>2</sup> (range 11,000 km)</li> <li>Recoverable Injury – 1,600 km<sup>2</sup> (range 22,000 m)</li> </ul> <p>Group 3</p> <ul style="list-style-type: none"> <li>Mortality – 760 km<sup>2</sup> (range 16,000 m)</li> <li>Recoverable Injury – 1,600 km<sup>2</sup> (range 22,000)</li> </ul> <p>TTS – 9,000 km<sup>2</sup> (range 52,000 m)</p> <p>Concurrent piling scenario assessed for stationary fish receptors: TTS - 11,000 km<sup>2</sup></p> <p>Group 1</p> <ul style="list-style-type: none"> <li>Mortality = 44 km<sup>2</sup></li> <li>Recoverable injury = 100 km<sup>2</sup></li> </ul> <p>Group 2</p> <ul style="list-style-type: none"> <li>Mortality = 480 km<sup>2</sup></li> <li>Recoverable injury = 2,300 km<sup>2</sup></li> </ul> <p>Group 3</p> <ul style="list-style-type: none"> <li>Mortality = 970 km<sup>2</sup></li> <li>Recoverable injury = 2,300 km<sup>2</sup></li> </ul>				
	Long term habitat loss	<p><u>Operation and Maintenance Phase:</u></p> <p>Maximum long-term habitat loss of 7.34 km<sup>2</sup></p>	Magnitude - low Sensitivity - high (sandeel) to low Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None beyond embedded mitigation.	
	EMF and thermal effects of cables	<ul style="list-style-type: none"> <li>Up to 140 145 kV inter-array HVAC cables (500 km),</li> <li>six 420 kV interconnector HVAC cables (150 km); and</li> <li>five 420 kV offshore export cables (320 km)</li> </ul> <p>Total cable length = 970 km</p>	Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant.</b>	Negligible to minor adverse <b>Not Significant</b>	Embedded cable burial and cable protection measures incorporated into project design	
Bellrock OWF – Development Area	Direct temporary habitat disturbance	<p><u>Construction Phase:</u></p> <p>Total temporary habitat disturbance = 3.64 km<sup>2</sup> (3,635,158 m<sup>2</sup>)</p> <p>O&amp;M:</p> <p>Total temporary habitat disturbance = 47.46 km<sup>2</sup> (47,461,080 m<sup>2</sup>)</p>	Magnitude - negligible Sensitivity - low to high (herring and sandeel spawning) Negligible to minor adverse  Not Significant	Negligible adverse <b>Not Significant</b>	None beyond embedded mitigation	<a href="https://marine.gov.scot/sites/default/files/bellrock_eia_-_volume_2_-_chapter_8_-_fish_shellfish_ecology_0.pdf">https://marine.gov.scot/sites/default/files/bellrock_eia_-_volume_2_-_chapter_8_-_fish_shellfish_ecology_0.pdf</a> <a href="https://d1ssu070pg2v9i.cloudfront.net/bellrock/2026/04/16152842/Chapter-6-Marine-Geology-">https://d1ssu070pg2v9i.cloudfront.net/bellrock/2026/04/16152842/Chapter-6-Marine-Geology-</a>

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
	Increase in SSC and sediment deposition	<p><u>Construction Phase:</u></p> <p>SSC modelling predicted:</p> <ul style="list-style-type: none"> <li>• increases generally ≤5 mg/l at disturbance locations</li> <li>• plume extents up to 12 km (associated with anchor installation with drilling).</li> <li>• SSC concentrations typically &lt;50 mg/l within 5 km of activities;</li> <li>• Peak SSC increases up to 200 mg/l are observed immediately adjacent to the point of disturbance</li> </ul> <p><u>Operation and Maintenance Phase:</u></p> <p>SSC increases predicted to be lower than during construction.</p>	<p>Magnitude - negligible</p> <p>Sensitivity - low to high (herring and sandeel spawning)</p> <p>Negligible to minor adverse</p> <p>Not Significant</p>	<p>Minor adverse</p> <p><b>Not Significant</b></p>	<p>None beyond embedded mitigation</p>	<p><a href="#">Oceanography-and-Physical-Processes.pdf</a></p>
	Increase in underwater noise	<p><u>Construction Phase:</u></p> <p>three sequentially installed piles (stationary):</p> <p>Group 1</p> <ul style="list-style-type: none"> <li>• Mortality – 0.65 km<sup>2</sup></li> <li>• Recoverable injury – 1.1 km<sup>2</sup></li> </ul> <p>Group 2</p> <ul style="list-style-type: none"> <li>• Mortality – 2.8 km<sup>2</sup></li> <li>• Recoverable injury 8.1 km<sup>2</sup></li> </ul> <p>Group 3</p> <ul style="list-style-type: none"> <li>• Mortality – 1.46 km<sup>2</sup></li> <li>• Recoverable injury – 8.1 km<sup>2</sup></li> </ul> <p>TTS – 47 km<sup>2</sup></p>	<p>Magnitude - minor adverse</p> <p>Sensitivity - low to high (herring spawning)</p> <p>Minor adverse</p> <p>Not Significant</p>	<p>Minor adverse</p> <p><b>Not Significant</b></p>	<p>None beyond embedded mitigation</p>	
	Long term habitat loss	<p>Operation and Maintenance Phase:</p> <p>Total Area of permanent habitat loss = 2.93 km<sup>2</sup> (2,926,659 m<sup>2</sup>)</p>	<p>Magnitude - negligible</p> <p>Sensitivity - low to high</p> <p>Minor adverse</p> <p>Not Significant</p>	<p>Minor adverse</p> <p><b>Not Significant</b></p>	<p>None beyond embedded mitigation</p>	
	EMF and thermal effects of cables (only development area)	<p>Operation and Maintenance Phase:</p> <p>Up to 300 km of IAC cabling and 92.4 km dynamic IAC cable associated with the offshore project. EMFs associated with inter-array and offshore export cables assessed during operational conditions.</p>	<p>Magnitude - negligible</p> <p>Sensitivity - low to medium</p> <p>Negligible adverse</p> <p>Not Significant</p>	<p>Minor adverse</p> <p><b>Not Significant</b></p>	<p>Embedded cable burial and cable protection measures incorporated into project design.</p>	
	Colonisation of structures / infrastructure	<p>Operation and Maintenance</p> <p>Total area of permanent habitat loss = 2.93 km<sup>2</sup>.</p>	<p>Magnitude - low</p> <p>Sensitivity - low</p>	<p>N/A</p>		

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
			Negligible to minor beneficial Not Significant			
	Secondary entanglement	Secondary entanglement risk associated SKSs and associated offshore infrastructure.	Magnitude - low Sensitivity - low Minor adverse Not Significant	N/A	None beyond embedded mitigation	
Cenos OWF	Direct temporary habitat disturbance	<u>Construction Phase:</u>  Total temporary habitat disturbance = 10.63 km <sup>2</sup> <u>Operation and Maintenance Phase:</u>  Impacts predicted to be less than during construction	Magnitude - negligible  Sensitivity - low to high (sandeel and common skate)  Negligible adverse Not Significant	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation.	<a href="https://marine.gov.scot/sites/default/files/cenos_eia_vol.3_-_chapter_13_-_fish_and_shellfish_ecology_redacted.pdf">https://marine.gov.scot/sites/default/files/cenos_eia_vol.3_-_chapter_13_-_fish_and_shellfish_ecology_redacted.pdf</a>
	Increase in underwater noise	<u>Construction Phase:</u>  Impact distances (SELcum) for static fish receptors:  Group 1 <ul style="list-style-type: none"> <li>• Mortality = 378 m</li> <li>• Recoverable injury = 571 m</li> </ul> Group 2 <ul style="list-style-type: none"> <li>• Mortality = 1,340 m</li> <li>• Recoverable injury = 3,620 m</li> </ul> Group 3 and 4 <ul style="list-style-type: none"> <li>• Mortality = 1,570 m</li> <li>• Recoverable injury = 3,620 m</li> </ul> TTS - 39,500 m  UXO clearance assessed as part of the construction phase worst case scenario.	Magnitude - low Sensitivity - low to medium (high for UXO) Minor adverse Not Significant	Negligible <b>Not Significant</b>	None beyond embedded mitigation.	
	Increase in SSC and sediment deposition	<u>Construction Phase:</u>  SSC plume extents predicted between 4.5 - 12 km. Maximum SSC concentrations: <ul style="list-style-type: none"> <li>• hundreds of thousands of mg/l immediately adjacent to trenching activities;</li> <li>• reducing to low thousands of mg/l between 50 m and 500 m from disturbance.</li> <li>• tens of mg/l. predicted at tidal excursion extents approximately 4.5 km from disturbance.</li> </ul>	Magnitude - low Sensitivity - low to high (Turbot Bank NCMPS) Minor adverse Not Significant	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
		<ul style="list-style-type: none"> <li>Background levels predicted approximately 24 hours following cessation of activities.</li> <li>No measurable sediment deposition beyond 500 m from disturbance</li> </ul>				
	Long term habitat loss	<u>Operation and Maintenance Phase:</u> Maximum long-term habitat loss of 1.90 km <sup>2</sup>	Magnitude - negligible Sensitivity - low to high (sandeel) Negligible adverse Not Significant	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
	EMF and thermal effects of cables	<u>Operation and Maintenance Phase:</u> Total cable length = 580 km <ul style="list-style-type: none"> <li>350 km inter-array cables and</li> <li>230 km export cables</li> </ul>	Magnitude - negligible Sensitivity - low to medium Negligible adverse Not Significant	Minor adverse <b>Not Significant</b>	Embedded cable burial and cable protection measures incorporated into project design	
	Secondary entanglement	<u>Operation and Maintenance Phase:</u> All subsea infrastructure contributing to potential secondary entanglement risk	Magnitude - negligible Sensitivity - medium Minor adverse Not Significant	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
	Colonisation of structures / infrastructure	<u>Operation and Maintenance Phase:</u> Total volume of hard substrates introduced = 538,000 m <sup>3</sup>	Magnitude - low Sensitivity - medium Minor adverse Not Significant	Minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
Seagreen 1A	Increase in underwater noise	<u>Construction Phase:</u> Project Alpha simultaneous monopile and jacket (4 pin piles): <ul style="list-style-type: none"> <li>mortality = 1.5 km<sup>2</sup>.</li> <li>recoverable injury = 6.55 km<sup>2</sup>;</li> </ul> Project Alpha jacket foundations (4 pin piles): <ul style="list-style-type: none"> <li>recoverable injury = 5.21 km<sup>2</sup> (1,354 m);</li> <li>mortality = 1.64 km<sup>2</sup> (726 m).</li> </ul>	Magnitude - negligible Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None beyond embedded mitigation	<a href="https://marine.gov.scot/sites/default/files/chapter_12_-_natural_fish_and_shellfish_resource.pdf">https://marine.gov.scot/sites/default/files/chapter_12_-_natural_fish_and_shellfish_resource.pdf</a>  <a href="https://marine.gov.scot/sites/default/files/chapter_9_natural_fish_and_shellfish_resource.pdf">https://marine.gov.scot/sites/default/files/chapter_9_natural_fish_and_shellfish_resource.pdf</a>
	Direct temporary habitat disturbance	Total temporary habitat disturbance = 3.75 km <sup>2</sup> Representing approximately 1.9% of the total consent envelope.	Magnitude - negligible Sensitivity - low to medium Negligible adverse <b>Not Significant</b>	Negligible adverse <b>Not Significant</b>	None beyond embedded mitigation	<a href="https://marine.gov.scot/sites/default/files/chapter_07_-_physical_environment.pdf">https://marine.gov.scot/sites/default/files/chapter_07_-_physical_environment.pdf</a>
	Long term habitat loss	Total maximum habitat loss = 0.088 km <sup>2</sup>	Magnitude - negligible Sensitivity - low to high (sandeel) Negligible adverse	Negligible adverse <b>Not Significant</b>	Avoidance and minimisation of impacts to prime sandeel habitat where practicable, including consideration of	

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
			<b>Not Significant</b>		jacket foundations where appropriate.	<a href="https://marine.gov.scot/sites/default/files/appendix_e1.pdf">https://marine.gov.scot/sites/default/files/appendix_e1.pdf</a>
	Increase in SSC and sediment deposition	Release of up to 695,700 m <sup>3</sup> of seabed material during seabed preparation and installation activities and 2,236,500 m <sup>3</sup> for cabling.  Sediment plumes predicted to disperse naturally following cessation of activities, becoming indistinguishable within days (short period of time).	Magnitude - negligible Sensitivity - low to medium Negligible adverse <b>Not Significant</b>	Negligible adverse <b>Not Significant</b>	None beyond embedded mitigation	
	EMF and thermal effects of cables	The worst case scenario for EMF has been calculated as 88.8 ha over the array footprint and a total cable length of 530 km	Magnitude - low Sensitivity - low to medium Minor adverse <b>Not Significant</b>	Minor adverse <b>Not Significant</b>	Embedded cable burial and cable protection measures incorporated into project design	
	Colonisation of structures / infrastructure	Total maximum habitat loss = 0.088 km <sup>2</sup> .	Magnitude - negligible to low Sensitivity - low Negligible to minor beneficial <b>Not Significant</b>	Negligible to minor beneficial <b>Not Significant</b>	None beyond embedded mitigation	
Berwick Bank OWF	Direct temporary habitat disturbance	<u>Construction Phase:</u>  <ul style="list-style-type: none"> <li>Total temporary habitat disturbance = 113,974,700 m<sup>2</sup>;</li> <li>Representing approximately 9.7% of the Proposed Development area</li> </ul>	Magnitude – negligible to low Sensitivity – low to medium Negligible to minor adverse <b>Not Significant.</b>	Cumulative significance of effect – negligible to minor adverse and therefore <b>Not Significant</b>	None beyond embedded mitigation.  The Applicant has committed to engaging with Marine Scotland and SNCBs post-consent regarding proportionate strategic monitoring opportunities for diadromous fish species.	<a href="https://berwickbank-eia.com/offshore-eia/vol2-ch09-fish-and-shellfish-ecology/part-6.html#9.15.-Summary-of-Impacts-Mitigation-Measures-Likely-Significant-Effects-and-Monitoring">https://berwickbank-eia.com/offshore-eia/vol2-ch09-fish-and-shellfish-ecology/part-6.html#9.15.-Summary-of-Impacts-Mitigation-Measures-Likely-Significant-Effects-and-Monitoring</a>
	Increase in SSC and sediment deposition	<u>Construction Phase:</u>  <ul style="list-style-type: none"> <li>predicted plume extent up to approximately 10 km;</li> <li>SSC concentrations generally &lt;100 mg/l across the wider plume;</li> <li>localised SSC concentrations up to 2,500 mg/l at release locations.</li> </ul> SSC concentrations predicted to reduce rapidly due to tidal dispersion and currents.	Magnitude - negligible to low Sensitivity - low to medium Negligible to minor <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>		
	Increase in underwater noise	<u>Construction Phase:</u>  Maximum stationary injury ranges for piling:  Group 1 <ul style="list-style-type: none"> <li>thresholds not exceeded</li> </ul> Group 2 <ul style="list-style-type: none"> <li>Mortality – 19 m</li> <li>Recoverable injury – 67 m</li> <li>TTS – 4,161 m</li> </ul> Group 3 and 4	Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>		

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
		<ul style="list-style-type: none"> <li>Mortality – 33 m</li> <li>Recoverable injury – 67 m</li> <li>TTS – 4,161 m</li> </ul> <p>Concurrent piling cumulative SEL for stationary fish:</p> <ul style="list-style-type: none"> <li>TTS all – 7.1 km</li> </ul>				
	Long term habitat loss	<p><u>All phases:</u></p> <p>Maximum long-term habitat loss of = 7,798,856 m<sup>2</sup>Study Area.</p>	<p>Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b></p>	<p>Negligible to minor adverse <b>Not Significant</b></p>	<p>Embedded cable burial and cable protection measures incorporated into project design.</p>	
	EMF and thermal effects of cables	<p><u>Operation and Maintenance Phase:</u></p> <ul style="list-style-type: none"> <li>up to 1,225 km of inter-array cables;</li> <li>up to 94 km of interconnector cable; and</li> <li>up to 872 km of offshore export cables.</li> </ul> <p>Total cable length = 2,191 km.</p> <p>Magnetic fields predicted to reduce to between 10 mG and &lt;0.1 mG between 3–7.5 m from array cables at seabed level.</p>	<p>Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b></p>	<p>Negligible to minor adverse <b>Not Significant</b></p>		
	Colonisation of structures / infrastructure	<p><u>Operation and Maintenance Phase:</u></p> <p>Total volume of hard substrates introduced =: 10,198,971 m<sup>3</sup></p>	<p>Magnitude - low Sensitivity - low Negligible to minor beneficial <b>Not Significant</b></p>	<p>Negligible to minor beneficial <b>Not Significant</b></p>		
Spiorad na Mara OWF	Direct temporary habitat disturbance	<p><u>Construction Phase:</u></p> <p>Total temporary habitat disturbance = 12,480,875 m<sup>2</sup> (12.481 km<sup>2</sup>), representing approximately 6.00% of the Offshore Project Boundary.</p> <p><u>Operation Phase:</u></p> <p>Total temporary habitat disturbance = = 27,610,800 m<sup>2</sup> (27.610 km<sup>2</sup>)</p>	<p>Magnitude - low Sensitivity - low to high (common skate complex) Negligible to minor adverse <b>Not Significant</b></p>	<p>Negligible to minor adverse <b>Not Significant</b></p>		<p>None beyond embedded mitigation</p>
	Increase in SSC and sediment deposition	<p><u>Construction Phase:</u></p> <ul style="list-style-type: none"> <li>maximum plume distance = 15 km;</li> <li>SSC concentrations up to 450 mg/l for less than one hour within 500 m of activities;</li> <li>concentrations predicted to exceed background levels for approximately 13 days within 500 m.</li> </ul>	<p>Magnitude - low Sensitivity - low to high (common skate and spotted ray) Negligible to minor adverse <b>Not Significant</b></p>	<p>Negligible to minor adverse <b>Not Significant</b></p>	<p>None beyond embedded mitigation</p>	
	Increase in underwater noise	<p><u>Construction Phase:</u></p> <p>Cumulative SEL ranges for stationary fish:</p>	<p>Magnitude - low Sensitivity - low to medium</p>	<p>Negligible to minor adverse <b>Not Significant</b> Except for Atlantic Salmon, Moderate (potentially</p>	<p>Development and implementation of a Piling Strategy</p>	

Project	Impact	MDS and / or WCS	Assessment Conclusions (project alone)	Assessment Conclusions (residual cumulative assessment)	Secondary / Additional Mitigation	Reference
		Group 1 <ul style="list-style-type: none"> <li>Mortality – 100 m</li> <li>Recoverable injury – 200 m</li> </ul> Group 2 <ul style="list-style-type: none"> <li>Mortality – 400 m</li> <li>Recoverable injury – 1,200 m</li> </ul> Group 3 <ul style="list-style-type: none"> <li>Mortality – 700 m</li> <li>Recoverable injury – 1,200 m</li> </ul> TTS - 15 km	Negligible to minor adverse Atlantic salmon effects reduced from moderate adverse to minor adverse through mitigation. <b>Not Significant</b>	significant) reduced to minor, <b>Not Significant</b> through mitigation		
	Long term habitat loss	<u>Operation and Maintenance Phase:</u>  Maximum long-term habitat loss = 2,411,500 m <sup>2</sup> (2.411 km <sup>2</sup> ).	Magnitude - low Sensitivity - low to high (common skate, sandeel) Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	None beyond embedded mitigation	
	EMF and thermal effects of cables	<u>Operation and Maintenance Phase:</u> <ul style="list-style-type: none"> <li>maximum length of cables = 350 km</li> <li>magnetic field predicted to extend approximately 2.32 m horizontally and 95 cm vertically before attenuating to background levels</li> </ul>	Magnitude - low Sensitivity - low to medium Negligible to minor adverse <b>Not Significant</b>	Negligible to minor adverse <b>Not Significant</b>	Embedded cable burial and cable protection measures incorporated into project design.	
	Colonisation of structures / infrastructure	<u>Operation and Maintenance Phase</u> Total volume of hard substrates introduced = 10,877,500 m <sup>3</sup>	Magnitude - low Sensitivity - low to high (Atlantic salmon, European eel) Negligible to minor beneficial <b>Not Significant</b>	Negligible to minor beneficial <b>Not Significant</b>	None beyond embedded mitigation	