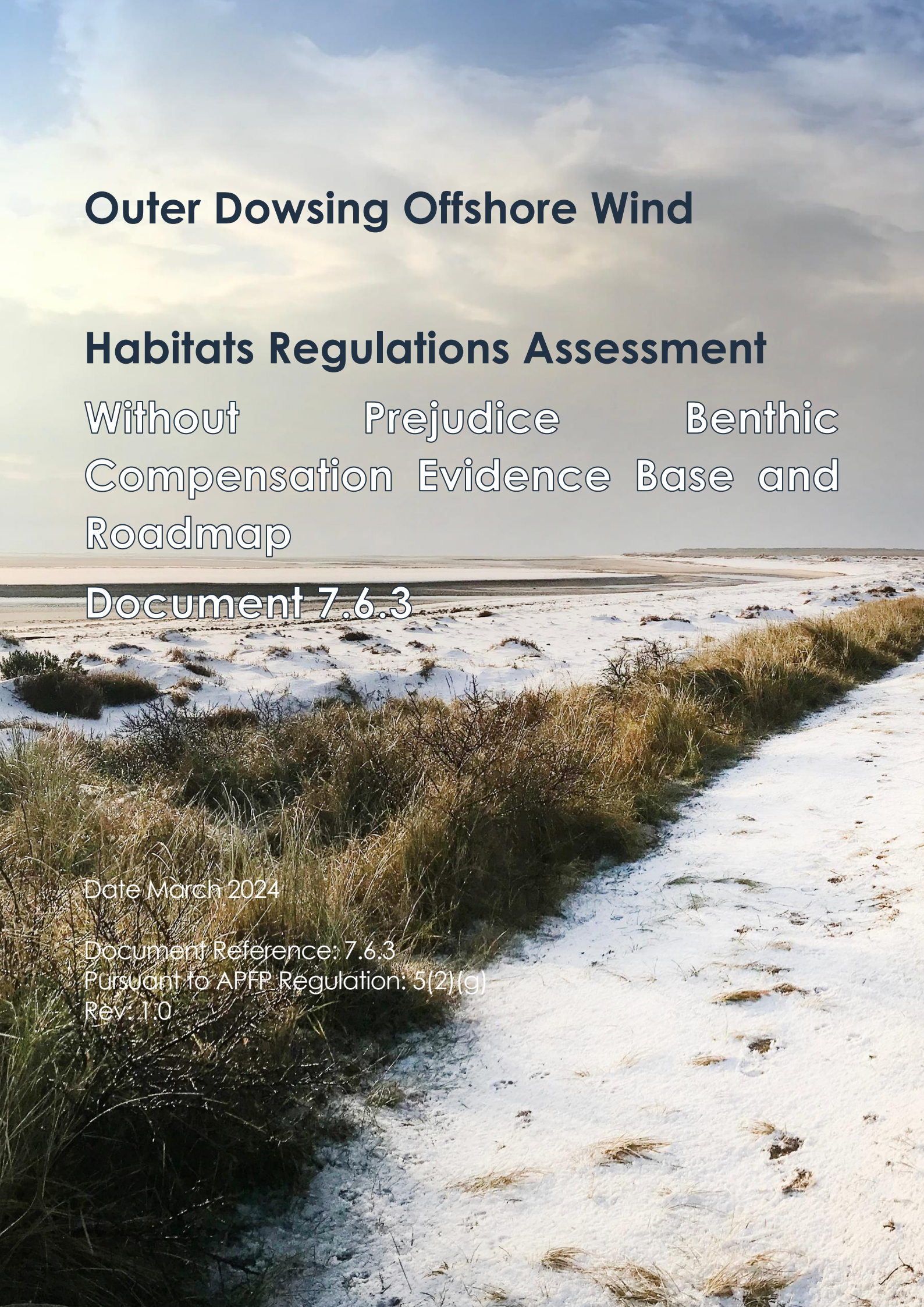
Outer Dowsing Offshore Wind

Habitats Regulations Assessment

Without Prejudice Benthic Compensation Evidence Base and Roadmap

Document 7.6.3



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Acronyms & Definitions

Abbreviations / Acronyms

Abbreviation / Acronym	Description
AEoI	Adverse Effect on Integrity
AfL	Agreement for Lease
BRCSG	Biogenic Reef Compensation Steering Group
BEIS	Department for Business, Energy & Industrial Strategy (now the Department for Energy Security and Net Zero (DESNZ))
BRCIMP	Biogenic Reef Compensation Implementation and Monitoring Plan
BQE	Biological Quality Element
BRUV	Baited Remote Underwater Video
BT	British Telecoms
CBRA	Cable Burial Risk Assessment
Cefas	Centre for Fisheries, Environment and Aquaculture Science
CfD	Contract for Differences
COWSC	Collaboration on Offshore Wind Strategic Compensation
CSCB	Cromer Shoal Chalk Beds
CSG	Compensation Steering Group
DCO	Development Consent Order
DDV	Drop Down Video
Defra	Department for Environment, Food and Rural Affairs
DEP	Dudgeon Extension Project
dSAC	draft SAC
DESNZ	Department for Energy Security and Net Zero (formerly Department of Business, Energy and Industrial Strategy (BEIS))
ECC	Export Cable Corridor
eDNA	Environmental DNA
EIA	Environmental Impact Assessment
EIFCA	Eastern Inshore Fisheries and Conservation Authority
ENORI	Essex Native Oyster Restoration Initiative
ES	Environmental Statement
EU	European Union
EUNIS	European Nature Information System
HHW	Haisborough, Hammond and Winterton
HRA	Habitats Regulations Assessment
IDRBNR	Inner Dowsing, Race Bank and North Ridge
CIMP	Compensation Implementation and Monitoring Plan
INNS	Invasive Non-Native Species
JNCC	Joint Nature Conservation Committee
M&LS	Margate and Long Sands
MCZ	Marine Conservation Zone
MEEB	Measures of Equivalent Environmental Benefit
MMO	Marine Management Organisation
MPA	Marine Protected Area
MoU	Memorandum of Understanding
MRF	Marine Recovery Fund
NERC	Natural Environment and Rural Communities Act

Abbreviation / Acronym	Description
NFFO	National Federation of Fishing Organisations
NGO	Non-Governmental Organisation
NNSSR	North Norfolk Sandbanks and Saturn Reefs
NORA	Native Oyster Restoration Alliance
OBIS	Ocean Biodiversity Information System
OCT	Ocean Conservation Trust
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
OWEC	Offshore Wind Evidence and Change
OWEIP	Offshore Wind Environmental Impact Package
OWF	Offshore Windfarm
OWIC	Offshore Wind Industry Council
pSAC	possible SAC
PSD	Particle Size Distribution
RAG	Red-Amber-Green
RIAA	Report to Inform Appropriate Assessment
SAC	Special Area of Conservation
SDM	Species Distribution Model
SEP	Sheringham Shoal Extension Project
SCIMP	Sandbank Compensation Implementation and Monitoring Plan
SCSG	Sandbank Compensation Steering Group
SNCB	Statutory Nature Conservation Bodies
SoS	Secretary of State
SPA	Special Protected Area
SSS	Side Scan Sonar
SST	Sea Surface Temperature
TCE	The Crown Estate
TMAP	Tri-lateral Monitoring and Assessment Program
WFD	Water Framework Directive
WNNC	Wash and North Norfolk Coast

Terminology

Term	Definition
The Applicant	GT R4 Ltd. The Applicant making the application for a DCO. The Applicant is GT R4 Limited (a joint venture between Corio Generation, TotalEnergies and Gulf Energy Development (GULF)), trading as Outer Dowsing Offshore Wind. The project is being developed by Corio Generation (a wholly owned Green Investment Group portfolio company), TotalEnergies and GULF.
Array area	The area offshore within which the generating stations (including wind turbine generators (WTG) and inter array cables), offshore accommodation platforms, offshore transformer substations and associated cabling are positioned.
Cable Circuit	A number of electrical conductors necessary to transmit electricity between two points bundled as one cable or taking the form of

Term	Definition
	separate cables, and may include one or more auxiliary cables (normally fibre optic cables).
Cable ducts	A duct is a length of underground piping which is used to house the Cable Circuits.
Compensatory Measures	Stage 3 of the Habitats Regulations Assessments (see Derogation) involves the development of compensation measures for any features which the report to inform appropriate assessment was unable to conclude no adverse effect on integrity on.
deemed Marine Licence (dML)	A marine licence set out in a Schedule to the Development Consent Order and deemed to have been granted under Part 4 (marine licensing) of the Marine and Coastal Access Act 2009.
Derogation	Stage 3 of the Habitats Regulations Assessments which is triggered once it is determined that you cannot avoid adversely affecting the integrity of a designated site. Involves assessing if alternative solutions are available to achieve the same goals as the project, if there are imperative reasons of overriding public interest, and if compensatory measures will be required.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for a Nationally Significant Infrastructure Project (NSIP) from the Secretary of State (SoS) for Department for Energy Security and Net Zero (DESNZ).
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of an impact with the sensitivity of a receptor, in accordance with defined significance criteria.
Export cables	High voltage cables which transmit power from the Offshore Substations (OSS) to the Onshore Substation (OnSS) via an Offshore Reactive Compensation Platform (ORCP) if required, which may include one or more auxiliary cables (normally fibre optic cables).
Habitats Regulations Assessment (HRA)	A process which helps determine likely significant effects and (where appropriate) assesses adverse impacts on the integrity of European conservation sites and Ramsar sites. The process consists of up to four stages of assessment: screening, appropriate assessment, assessment of alternative solutions and assessment of imperative reasons of over-riding public interest (IROPI) and compensatory measures.
Maximum Design Scenario	The maximum design parameters of the combined project assets that result in the greatest potential for change in relation to each impact assessed.
Mitigation	Mitigation measures, or commitments, are commitments made by the Project to reduce and/or eliminate the potential for significant effects to arise as a result of the Project. Mitigation measures can be embedded (part of the project design) or secondarily added to reduce impacts in the case of potentially significant effects.

Term	Definition
Offshore Export Cable Corridor (ECC)	The Offshore Export Cable Corridor (Offshore ECC) is the area within the Order Limits within which the export cables running from the array to landfall will be situated.
Offshore Reactive Compensation Station (ORCP)	A structure attached to the seabed by means of a foundation, with one or more decks and a helicopter platform (including bird deterrents) housing electrical reactors and switchgear for the purpose of the efficient transfer of power in the course of HVAC transmission by providing reactive compensation
Offshore Substation (OSS)	A structure attached to the seabed by means of a foundation, with one or more decks and a helicopter platform (including bird deterrents), containing— (a) electrical equipment required to switch, transform, convert electricity generated at the wind turbine generators to a higher voltage and provide reactive power compensation; and (b) housing accommodation, storage, workshop auxiliary equipment, radar and facilities for operating, maintaining and controlling the substation or wind turbine generators
Outer Dowsing Offshore Wind (ODOW)	The Project.
Order Limits	The area subject to the application for development consent, the limits shown on the works plans within which the Project may be carried out.
Pre-construction and post-construction	The phases of the Project before and after construction takes place.
The Project	Outer Dowsing Offshore Wind, an offshore wind generating station together with associated onshore and offshore infrastructure.
Project Design envelope	A description of the range of possible elements that make up the Project's design options under consideration, as set out in detail in the project description. This envelope is used to define the Project for Environmental Impact Assessment (EIA) purposes when the exact engineering parameters are not yet known. This is also often referred to as the "Rochdale Envelope" approach.
Receptor	A distinct part of the environment on which effects could occur and can be the subject of specific assessments. Examples of receptors include species (or groups) of animals or plants, people (often categorised further such as 'residential' or those using areas for amenity or recreation), watercourses etc.
Strategic Compensation	Collaborative approach by developers and/or government departments to secure compensation for adverse effects on the conservation objectives of a protected marine area, where the scale of offshore wind delivery is likely to exceed the ability of developers to provide sufficient compensation on an individual project specific basis.
Study Area	Area(s) within which environmental impact may occur – to be defined on a receptor-by-receptor basis by the relevant technical specialist.

Term	Definition
Subsea	Subsea comprises everything existing or occurring below the surface of the sea.
Wind turbine generator (WTG)	A structure comprising a tower, rotor with three blades connected at the hub, nacelle and ancillary electrical and other equipment which may include J-tube(s), transition piece, access and rest platforms, access ladders, boat access systems, corrosion protection systems, fenders and maintenance equipment, helicopter landing facilities and other associated equipment, fixed to a foundation

Reference Documentation

Document Number	Title
6.1.3	Project Description
6.3.3.1	Confidential Cable Burial Risk Assessment
6.1.4	Site Selection and Consideration of Alternatives
6.1.7	Marine Physical Processes
6.3.7.3	Confidential Sediment Mobility Study
6.1.9	Benthic Subtidal and Intertidal Ecology
6.1.9.2	Benthic Ecology Technical Report (ECC)
6.1.9.5	Envision Data Analysis
6.1.10	Fish and Shellfish Ecology
7.1	Report to Inform Appropriate Assessment
7.5	Derogation Case
7.6	Without Prejudice Benthic Compensation Strategy
7.6.1	Without Prejudice Sandbank Compensation Plan
7.6.2	Without Prejudice Biogenic Reef Compensation Plan
8.22	Outline Biogenic Reef Mitigation Plan

1 Introduction

1. This report reviews the evidence base for the suite of benthic compensation measures proposed by the GT R4 Limited (trading as Outer Dowsing Offshore Wind) hereafter referred to as the 'Applicant'. The focus of this work is delivery of compensation if the Secretary of State (SoS) deems that Outer Dowsing Offshore Wind (the Project) is having an Adverse Effect on Site Integrity (AEoI) at the Inner Dowsing, Race Bank and North Ridge (IDRBNR) Special Area of Conservation (SAC). The Applicant has undertaken a Report to Inform Appropriate Assessment (RIAA) that has concluded no AEoI so the compensation measures are 'without prejudice', and have been developed in the event that the SoS deems compensation necessary.
2. An overview of the compensation measures is provided in the Sandbank Compensation Plan (document reference 7.6.1) and the Biogenic Reef Compensation Plan (document reference 7.6.2). This document provides the evidence and further details of each measure and the delivery process the Applicant will undertake, if required.
3. The 'without prejudice' compensation measures being proposed are in relation to:
   - Potential loss of Annex I 'sandbanks slightly covered by sea water all the time' (hereafter referred to as 'sandbanks') at IDRBNR SAC resulting from the installation of cable protection material on the offshore export cables in those parts of the SAC where they cross the designated sandbank features; and
   - Potential loss of Annex I biogenic reef (specifically *S. spinulosa* reef) at the IDRBNR SAC resulting from cable installation where the offshore Export Cable Corridor (ECC) crosses the SAC.
4. The proposed 'without prejudice' compensation measures for Annex I sandbanks are:
   - SAC extension
     - Alternative protection methodologies
   - Creation of biogenic reef
   - Anthropogenic pressure removal
     - Redundant infrastructure removal
     - Aggregate pressure removal
     - Marine debris removal/ awareness
   - Seagrass bed habitat creation/restoration.
5. The proposed 'without prejudice' compensation measures for Annex I biogenic reef are:
   - SAC extension
     - Alternative protection methodologies
   - Creation of biogenic reef
   - Anthropogenic pressure removal

- Marine debris removal/ awareness

6. Due to the dynamic nature of this topic and the evolution of opinion and strategy that has been developed through consultation (Table 1.1 of Sandbank Compensation Plan (document reference 7.6.1) and Table 1.1 of the Biogenic Reef Compensation Plan (document reference 7.6.2)) and the Project's involvement through working groups, such as Collaboration on Offshore Wind Strategic Compensation (COWSC), some measures have had been developed further than others. However, it is important that flexibility is retained in the compensation options available to the Project.
7. It should be highlighted that the Applicant's preferred option for compensation, if required, is to provide a contribution to a strategic compensation measure, specifically the extension of appropriate SACs. This measure is the most appropriate and robust available, is supported by Natural England and is currently being progressed by the Department for Environment Food and Rural Affairs (Defra).
8. This document provides a review of recent examples of benthic compensation methods proposed by other projects (Section 2); then details the evidence for the compensation options proposed by the Applicant for this Project and provides a roadmap for their delivery (Sections 3 to 10).
9. This document aims to provide the necessary confidence to the SoS that the compensation measures proposed are viable, securable, and deliverable.

2 Recent Examples of Benthic Compensation

10. A number of recent consent decisions have required the delivery of compensation measures for benthic features (primarily sandbank features) due to the potential need for cable protection on the sandbank features of various SACs in the southern North Sea. This includes Hornsea Three, Norfolk Vanguard and Norfolk Boreas, with details of the measures required provided below. Dudgeon Extension and Sheringham Extension have considered the need to provide Measures of Equivalent Environmental Benefit (MEEB) for impacts from cable protection through the Cromer Shoals Chalk Beds (CSCB) Marine Conservation Zone (MCZ).
11. These projects evaluated a range of compensation measures throughout the pre-application, examination and post-examination phases, providing evidence on the feasibility and effectiveness of the measures to the SoS, however, to date, only measures relating to the recovery of marine debris and marine debris reduction, awareness and education have been taken forward within the determined consents. However, the Applicant acknowledges Natural England's position that these measures are insufficient to compensate for the predicted impacts of cable protection (discussed further in paragraph 15).
12. The measures initially proposed by those projects align with those considered for this Project; those measures included on the short-list for Hornsea Three, Norfolk Vanguard and Norfolk Boreas include:
    - Removal of, and awareness raising in relation to, marine debris;
    - Establishment of a new biogenic reef;
    - Extending the boundary of SACs to incorporate currently unprotected Annex I habitats; and
    - Fisheries management – reduction in intrusive fishing methods.

2.1.1 Hornsea Three

13. When the SoS granted consent for Hornsea Three Offshore Windfarm (OWF) on the 31 December 2020, this was the first project in UK waters to be granted a Development Consent Order (DCO) that contained within it a condition to secure compensation for AEoI on a fully marine SAC. The Appropriate Assessment completed by the former Department for Business, Energy & Industrial Strategy (BEIS) (2020) (now Department for Energy Security and Net Zero (DESNZ)) as part of the Habitat Regulations Assessment (HRA) could not rule out AEoI to the North Norfolk Sandbanks and Saturn Reefs (NNSSR) SAC, and therefore the consent was issued on the basis of a derogation case being required. As is the case for the IDRBNR SAC, the NNSSR SAC is also designated for the Annex 1 habitats 'sandbanks which are slightly covered by sea water all of the time' and biogenic 'reefs'. The Appropriate Assessment for Hornsea Three also concluded that an AEoI could not be ruled out for the Wash and North Norfolk Coast (WNNC) SAC, which is also designated for, amongst other features, 'sandbanks which are slightly covered by sea water all of the time'.

4.6.5 Compensation measures required for Hornsea Three were:

- Marine litter removal within a specified area within the WNNC and NNSSR SACs; and

- Marine debris reduction and awareness campaign measures in relation to the WNNC and NNSSR SACs.

2.1.2 Norfolk Boreas and Vanguard

14. During the Norfolk Boreas and Norfolk Vanguard Examinations, a number of compensation measures were proposed that would address the potential effects of offshore export cable protection material on the Haisborough, Hammond and Winterton (HHW) SAC. The HHW SAC is also designated for sandbanks which are slightly covered by sea water all of the time, as well as *S. spinulosa* reefs. A range of different compensatory measures were developed should the SoS conclude that AEoI on the HHW SAC could not be ruled out as a result of its Appropriate Assessment. The DCOs granted for these projects stipulated the following compensation measures:
    - A quantum of marine debris removal from within the HHW SAC; and
    - Marine debris reduction and awareness campaign measures in relation to the HHW SAC.
15. The SoS's response on the projects' Benthic Implementation and Monitoring Plan (BIMP) from 30th October 2023 states that the Plan in its current form cannot be approved[1]. The reason for not approving the plan included the lack of evidence and programming as to how 8.3 hectares of marine debris could be removed prior to the commencement of cable installation works.
16. The Applicant also notes Natural England's position that these measures are insufficient to compensate for the predicted impacts of cable protection. Natural England's response to the Norfolk Boreas BIMP[2] also cites the results of the Hornsea Project Three Benthic Compensation, Marine Debris Removal Campaign Summary Report which indicated a low recovery of debris in the Wash and North Norfolk Coast and North Norfolk (WNNC SAC) Sandbanks and Saturn Reef (NNSSR SAC) when compared to the predicted area of habitat loss/change (less than 0.5% in both cases). Natural England also note that adaptive management was triggered for both designated sites as insufficient debris was located in the original area of searches. This evidence could suggest that, dependent on the quantum of debris required for removal, delivery of such a measure could prove challenging.

[1] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-004594-Norfolk%20Projects%20-%20BIMP%20response%20-%2031%20Oct%202023.pdf
[2] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-003028-Natural%20England%2026.5.2023.pdf

2.1.3 Sheringham Shoal and Dudgeon Extension Projects

17. As the Sheringham Shoal and Dudgeon Extension Projects (SEP and DEP) Offshore ECC passes through the CSCB MCZ, a 'without prejudice' MEEB Implementation and Monitoring Plan for the CSCB MCZ has been proposed, to be finalised and approved prior to the commencement of construction works. The primary MEEB put forward by the Applicant is the restoration of a native oyster bed within the CSCB MCZ (noting that a proposal for the creation of sediment habitat (which is the impacted feature) was not considered possible given the potential for existing marine conditions to rapidly erode any artificially created banks).
18. The compensatory measure proposed involves deploying and maintaining a native oyster bed of 10,000m^2 with an average density of five live oysters per m^2.
19. At the time of writing, the SEP and DEP projects have completed the Examination phase, with a decision on the consent, and the required compensation, expected from the SoS in April 2024.
20. Sections 3 to 10 below provide the evidence and roadmap for each of the compensation measures proposed for this Project.

3 SAC Extension

21. SAC extension could provide compensation for an AEoI to the IDRBNR SAC, both in relation to Annex I biogenic reefs and Annex I sandbanks.

3.1 Overview

22. This option refers to changing the boundary (extending the area) of an existing SAC designated for sandbanks (and potentially also *S. spinulosa* reef) to include an additional area of qualifying sandbank habitat and supporting features, including areas suitable for *S. spinulosa* reef development. The protection of currently unprotected Annex 1 sandbank and supporting habitat or areas suitable for *S. spinulosa* reef anywhere in the UK could potentially deliver compensation for the Project. However, there are a few extension areas that have been discussed with Natural England as having ecological merit due to the quality of the sandbank and the supporting features.
23. SAC extensions with a currently identified ecological merit include an extension to the IDRBNR SAC boundary to encompass the sandbank system (Docking Shoal) and supporting habitats outside but next to the current boundary (Figure 3.1) and a westerly extension of the HHW SAC (Figure 3.2). Further information on the ecological merit of this extension is presented in the section below.
24. Fundamentally, however, this is a strategic measure that must be delivered by Defra in conjunction with Natural England and the Joint Nature Conservation Committee (JNCC) and is not considered a project alone measure. Therefore, the development and implementation of this measure to a large degree is outside the Project's control, however, there are specific areas within the development of the measure and the ongoing monitoring of the efficacy of the measure where the Project (and other developments) can provide support.
25. Natural England advised that an extension area must demonstrate ecosystem functionality. Furthermore, Natural England stated that any possible time lag between the impact occurring, and the implementation of compensation, must demonstrate overall ecological gain over the lifetime of the development. This is discussed further within the following sections.
26. The current consultation (Defra, 2024) held as part of Defra's Offshore Wind Environmental Improvement Package (OWEIP) focusses on 'ecological effectiveness' and 'local circumstances' as the primary considerations when identifying compensatory measures, with measures that benefit the specific feature at risk being encouraged over measures that would benefit different qualifying features at risk but which could provide 'functional equivalence'.
27. This measure would demonstrate that any sandbank or *S. spinulosa* reef habitat loss is offset, or compensated for, by increasing the area of designated sandbanks or habitat suitable for *S. spinulosa* within the region, and would ensure that legal protection is afforded to the newly designated area thereby maintaining the ecological coherence of the Marine Protected Area (MPA) network in the region.

28. The Applicant recognises that this is a complex and rigorous process that is outside of the Project's control. However, the Applicant maintains that due to the level of existing data (see below for information on existing data), the fact that appropriate Annex I habitat has been identified in the proposed area to be extended, and that the proposed area is not currently widely used by other marine industries (Figure 3.5 and Figure 3.6), these particular extensions would have a very good chance of being designated.
29. It should be noted that this is not an exhaustive list of possible extension areas, however, those highlighted in this document are recognised as ecologically important, as per consultation with Natural England (Table 1.1 of Sandbank Compensation Plan (document reference 7.6.1) and Table 1.1 of the Biogenic Reef Compensation Plan (document reference 7.6.2)). It is understood that the strategic extension areas will be identified by Defra in collaboration with Natural England and the JNCC, and so are outside the Project's control, albeit that this does not imply that the areas identified through the Government process would be unsuitable as compensation for the impacts arising from the Project should they be different to those proposed by the Project. As noted in paragraph 22 the protection of currently unprotected Annex 1 sandbank and supporting habitat or areas suitable for *S. spinulosa* reef anywhere in the UK could potentially deliver compensation for the Project.
30. The Applicant notes that Defra's preference is to undertake the SAC extension process once to account for all projects anticipating the need to use the measure as strategic compensation. To support this strategic approach, the Applicant has commenced discussions with other developers, who may have to deliver compensation for the same features at other sites, to coordinate activities and share information, including data availability and potential scale of impacts. To facilitate ongoing discussions and demonstrate the willingness of multiple developers to collaborate on this measure, the Applicant has commenced the process of agreeing a Memorandum of Understanding (MoU) with the Five Estuaries Offshore Wind Farm (Five Estuaries) and is seeking to agree a similar approach with other relevant developers.
31. The mechanism for delivering this measure strategically does not currently exist, although it is expected to be in place by the time the Project is seeking to deliver compensation. Natural England advised that the Project drafts the DCO in such a way that the Project would be able to access strategic compensation to discharge its compensation requirements at a strategic level if required. The Applicant has drafted the DCO to facilitate the discharge of compensation in this manner.

3.2 Evidence Base

3.2.1 Value and Function

32. This measure will ensure that any sandbank or biogenic reef habitat loss is offset, or compensated for, by increasing the area of designated features and supporting habitats within the region, which will in turn ensure that legal protection is afforded to the newly designated area, thereby maintaining the ecological coherence of the MPA network in the region. It is also considered to be of high environmental value to other species of conservation importance, including biogenic reef forming species such as *S. spinulosa*.

33. Natural England believes that 'Extending SAC and/or protecting a new area for benthic habitats' could be a suitable compensation option for the Project proposals due to the ecological merit.
34. As detailed above the two extension areas that the Project has presented (in consultation with Natural England (although not an exhaustive list)), include:
    - An extension to the IDRBNR SAC to encompass the sandbank system (Docking Shoal) and supporting habitats/features outside but next to the current boundary (Figure 3.1); and
    - And extension to the HHW SAC to encompass the sandbank system and supporting habitats/features outside but next to the current boundary (Figure 3.3).
35. Although this is considered to be a feasible option as European Marine Site extensions have taken place in the past, such as for the Outer Thames Estuary Special Protected Area (SPA) extension (Natural England and JNCC, 2016), Defra are yet to confirm which sites are most suitable for extension and the relevant administrative/legal processes to initiate following the UK's Exit from the European Union (EU). However, this is outside the Project's control.
36. As detailed in the Sandbank Compensation Plan (document reference 7.6.1) and the Biogenic Reef Compensation Plan (document reference 7.6.2), through the consultation responses it is understood that suitable areas will be identified based on ecological benefit to ensure that the overall coherence of the MPA network is maintained, and that Defra will use advice from Natural England and the JNCC. However, initial identification of data shows suitable sandbank and supporting habitats (i.e. areas available for biogenic reef) are available outside the IDRBNR SAC and HHW SAC which supports the proposal of the extension of these sites as a strategic compensation measure. Furthermore, the Project has been engaging with stakeholders, regulators and other developers on these options.
37. It has now been confirmed that designation of MPA extensions for the purpose of strategic compensation will be led by Defra. However, many of the preceding steps – site selection, data collection/collation/analysis, early phase consultation – can be undertaken by non-governmental organisations, such as a developer, as well as providing funding where required to facilitate other activities (e.g. advertisement, consultation support, etc.), which would then ensure that the ecological benefits of this measure can be attributed, in part, to the Project.

3.2.2 Ecosystem Functionality

38. Whilst current monitoring data do not exist for these extensions, Figure 3.2 and Figure 3.4 demonstrate that broadscale habitats data (EMODnet, 2022) highlight the predominance of sandy substrates at both proposed SAC extension sites with area of sandbanks likely in southern half of the Docking Shoal and the majority of the area adjacent to HHW SAC.
39. High energy areas such as subtidal mobile sandbanks are characterised by a biota of low diversity, lack of sedentary forms especially bivalve molluscs, and the numerical dominance of agile swimmers such as haustoriid amphipods and isopods. These species have a short life span and are characterised by their ability to withstand sediment disturbance (Elliott, 1998).

40. Species diversity as well as overall community structure, is influenced by the habitat stability and sediment type. Coarse sediments, which are unstable and difficult to burrow into, are dominated by epifauna, while fine sediments are increasingly dominated by infauna (Elliott, 1998).
41. Subtidal mobile sandbanks provide prey for demersal fishes, especially the mobile small crustaceans which migrate from the sediment and thus become available for predation (Costa and Elliott, 1991; Marshall and Elliott, 1997). These areas are often important as fish nursery areas, e.g. plaice (Gibson, 1973).
42. Sandbanks are also often important areas for crab populations, for example the Docking Shoal (proposed extension area, Figure 3.1) and Race Bank off the Norfolk coast support a large crab population as well as numerous other epifauna, particularly echinoderms. The epifaunal component may represent a large proportion of the biomass of the sand bank fauna with large numbers of echinoderms such as the common starfish *Asterias rubens* and brittle stars such as *Ophiura albida*. Predatory fauna such as hermit crabs e.g. *Eupagurus bernhardus*, harbour crab *Liocarcinus depurator* and the edible crab *Cancer pagurus* may also be present.
43. Sandeels (*Ammodytes* spp.) have a close association with the sandy substrates into which they bury to protect themselves from predators. Once settled, studies have shown that sandeels are mostly resident, rarely travelling over 20 miles from their home areas and they rarely emerge from the seabed between September and March, except to spawn.
44. Birds such as the guillemot, razorbill, puffin and the terns will feed on the fish such as sandeels (Batten *et al*., 1990). Both the arctic tern and the puffin rely on populations of sandeel as their predominant food source. The sandeel is also an important food source for wintering birds such as scoters, little terns and the red-throated diver (Gibbons *et al.*, 1993). Guillemots and razorbills although not as selective as puffins and terns will also predate sandeels.
45. *S. spinulosa* often occurs in sandbank troughs, where food and suspended sediment needed to build their tubes are sufficiently present (van der Reijden *et al*., 2019; Van Lancker *et al.*, 2012). The presence of these reefs induces high local biodiversity, sustained by increased local habitat heterogeneity, physical shelter and better food supply (Dubois *et al*., 2002; Gravina *et al*., 2018; Rabaut *et al*., 2007).
46. The extension of SACs to encompass and therefore protect areas of sandbanks and associated features and species would benefit wider ecosystem functionality.

3.2.3 Review of existing data - IDRBNR SAC extension area

47. The area identified in Figure 3.1 has been subject to environmental surveys aimed at identifying and characterising Annex I sandbank and supporting habitats within the southern North Sea. Relevant surveys include the following:
    - Inner Dowsing, Race Bank and North Ridge, Haisborough, Hammond and Winterton Special Areas of Conservation (SACs) Joint Wash Baseline Survey (2011): JNCC, Natural England and the Centre for Fisheries, Environment and Aquaculture Science (Cefas) worked together to identify the location, extent and condition of Annex I habitat features at these two sites;
    - OneBenthic (Cefas) data;

- Special Area of Conservation (SAC): Inner Dowsing, Race Bank and North Ridge SAC Selection Assessment;
- Centrica, 2008. Docking Shoal Offshore Wind Farm, Environmental Statement. Volume I: Offshore Works; and
- EMODnet (2022) broad scale seabed habitat map for Europe.

48. EMODnet (2022) data indicate that the area of Docking Shoal proposed as an extension to the IDRBNR SAC is characterised primarily by sand and muddy sands with some coarser mixed sediments evident in the eastern third of the area (Figure 3.1). Surveys undertaken in relation to the proposed Docking Shoal OWF in the northern half of the proposed extension area reported that sediments were predominantly sandy with variable proportions of gravel (Centrica, 2008).
49. Information from OneBenthic indicates that benthic communities throughout the area are generally polychaete dominated with the most common faunal grouping characterised by species typical of sandy habitats such as Nephtydae, Spionidae and Ophelidae.
50. Biotopes identified from Docking Shoal during OWF related surveys included:
    - Sparse fauna in Atlantic infralittoral mobile clean sand (European Nature Information System (EUNIS) biotope MB5231; UK biotope SSa.IFiSa.IMoSa)
    - Dense *Lanice conchilega* and other polychaetes in Atlantic tide-swept (EUNIS biotope MB3237; UK biotope SS.SCS.ICS.Slan)
    - *Moerella* spp. with venerid bivalves in Atlantic infralittoral gravelly sand (EUNIS biotope MB233; UK biotope SS.SCS.ICS.MoeVen
    - Atlantic circalittoral mixed sediment (EUNIS biotope MC42; UK biotope SS.SMx.CMx)
    - *Hesionura elongata* and *Microphthalmus similis* with other interstitial polychaetes in Atlantic infralittoral mobile coarse sand (EUNIS biotopeMB3234; UK biotope SS.SCS.ICS.HeloMsim)
    - *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed (EUNIS biotope MC4241; UK biotope SS.SMx.CMx.FluHyd)
    - *S. spinulosa* on stable Atlantic circalittoral mixed sediment (EUNIS biotope MC2211; UK biotope SS.SBR.PoR.SspiMx)
51. The Ross worm *S. spinulosa* was found on mixed sediments throughout the northern area of Docking Shoal surveyed in relation to the OWF. However, abundances were generally low to moderate in encrusting form or forming aggregation of tubes amid shells and stone which were not considered to constitute a biogenic reef. Other reef building species present included mussels, although the population did not constitute a reef.

52. *S. spinulosa* reefs have been recorded in the southern half of the proposed extension area and appear to be typical for the region rising from the surrounding coarse sandy seabed to heights of between 5cm to 10cm (Limpenny *et al.*, 2010). The reefs were reported as being consolidated structures of sand tubes showing seafloor coverage of between 30% to areas where reef occupied 100% of the sediment. Some parts of the reefs appeared to be acting as sediment traps, with exposed tube height accordingly reduced within the core parts of reefs. It was reported that whilst the positions of core reef may temporally shift location, this area of sandbank had supported stable reef mosaics for a significant number of years, although temporal variability in reef dynamics was evident (Foster-Smith *et al.*, 1997; Foster-Smith and Hendrick, 2003; Limpenny *et al.*, 2010).

3.2.4 Review of existing data – HHW SAC extension area

53. The area identified in Figure 3.3 has been subject to several environmental surveys aimed at identifying and characterising Annex I sandbank and supporting habitats within the southern North Sea. Relevant surveys include the following:
    - OneBenthic (Cefas) data;
    - Unicomarine (1999) - Likely changes to the benthic fauna following development of the proposed Sarah Jane Windfarm on Middle Scroby Sands;
    - EMODnet (2022) broad scale seabed habitat map for Europe; and
    - Cefas (2006) - Scroby Sands Offshore Wind Farm – Coastal Processes Monitoring. Final Report for the Department of Trade and Industry.
54. EMODnet (2022) data indicates that the area to the west of the HWW SAC proposed as an extension to the SAC is characterised primarily by sand and muddy sands with some coarser mixed sediments evident in the nearshore extent of the area; areas of biogenic reef are evident overlapping between the SAC and the proposed extension area (Figure 3.4). Surveys undertaken in relation to the Scroby Sands OWF which is located in the middle of the proposed extension area reported that sediments were predominantly sandy with variable proportions of gravel (Cefas, 2006).
55. Information from OneBenthic indicates that benthic communities throughout the area are generally polychaete dominated with the most common faunal grouping characterised by species typical of sandy habitats such as Nephtydae, Spionidae and Ophelidae.
56. Benthic surveys undertaken in the vicinity of the Scroby Bank OWF indicated that the fauna was relatively poor, with species typical of mobile sands such as polychaete worms and amphipod crustaceans; no sessile epifauna was recorded (Unicomarine, 1999). The study area was characterised by one biotope: *Nephtys cirrosa* and *Bathyporeia* spp. in Atlantic infralittoral sand (EUNIS biotope MB5233; UK biotope SS.SSa.IFiSa.NcirBat).

3.3 Delivery Process

57. An extension to an SAC and/or designation of Annex 1 sandbank and supporting habitats outside the boundary of the SAC would be protected by law following implementation. The designation process will be delivered by Defra in consultation with Natural England and the JNCC. As outlined above and below, there are, however, specific elements where the Applicant could provide support and assistance to the process in a form determined by the DCO decision, in order to assist in the timely delivery of the required compensation for the Project. As detailed within Table 1.1 of Sandbank Compensation Plan (document reference 7.6.1) and Table 1.1 of the Biogenic Reef Compensation Plan (document reference 7.6.2), Defra envisage that this process will be undertaken once to account for all projects anticipating the need to use MPA designation as strategic compensation.
58. Figure 3.7 sets out the process of designating an offshore SAC in UK waters.
59. To assist the process outlined in (Figure 3.7) the steps that could be undertaken by the Applicant to promote an extension to the SAC are as follows:

- Agreement of the proposal to promote an extension to the SAC with Natural England, the JNCC and Defra.
- Provision of assistance in the development of an Area of Search in accordance with the JNCC Marine SAC Selection Process and Guidance. This may be undertaken either by the Applicant or by a third party (e.g. Natural England, Defra or JNCC) with financial support from the Applicant.
- Data gathering: Statutory Nature Conservation Bodies (SNCBs) have already identified areas qualifying as Annex I sandbanks, and data used in this identification (see further information on surveys below) is understood to be sufficient to support the designation of the SAC extensions. This would be supplemented with any further information available to prepare for a consultation.
- Support to Defra in preparing for the formal consultation based on the proposed SAC extensions.
- It is anticipated that the approved strategy would include provision of ongoing support to Natural England, Defra (and JNCC as required) to progress agreement of an extension boundary (including confirmation of the size of the extension), which would be formally submitted to the UK Government as a draft SAC (dSAC).
- Once the proposal is accepted and progressed to a possible SAC (pSAC) by the UK Government, the compensation would be deemed to be effective for the Project. However, the Applicant would provide ongoing support to progress the formal public consultation required for the site to reach full SAC status. This is likely to take the form of funding for an appropriate person(s) in Natural England or JNCC for approximately two to three years.

60. It has been confirmed by Defra that MPA designation/SAC extension will be available as a strategic compensation measure and that the process will be led by Defra with guidance from Natural England and the JNCC. Whilst the locations of the sites to deliver the measure have not yet been determined, the Applicant currently considers that an extension to the IDRBNR SAC and HHW SAC would represent a securable and deliverable solution.
61. The precise size and location of the extension would be approved by the SoS, in consultation with the Marine Management Organisation (MMO), Natural England, JNCC and Defra and would depend on the conclusions of the Appropriate Assessment regarding the area of any adverse effect, as well as confirmation of an appropriate scale of extension. However, at the scale and locations proposed, it is noted that these extensions would provide adequate compensation for multiple projects.
62. Accepting that the ultimate delivery of the proposed SAC extension(s) as a compensation measure is beyond the control of the Project, the Applicant is exploring the possibility of working with other developers to explore how this measure could be delivered collaboratively (if not available through Defra, strategically). As noted previously, the Applicant has signed an MoU with Five Estuaries and is exploring similar MoUs and Cooperation Agreements with other developers, and these agreements will serve as a platform to secure collaboration on strategic measures and associated cost sharing exercises where possible and appropriate.
63. The Applicant will continue to collaborate with other developers who could require benthic compensation for sandbank features through the development of MoU and Cooperation Agreements and through engagement with the Offshore Wind Industry Council (OWIC) Offshore Wind Evidence and Change (OWEC) Strategic Compensation Project.

3.3.1 Site Selection and Scale

64. This measure is a strategic measure and will be Defra/government led. As such, it is possible that delivery of the measure could occur either prior to (or after the impact). The latest Defa guidance, which is out for consultation (Defra, 2024) states that: "*On rare occasions, time lags between a negative effect arising and compensatory measures becoming fully functional may be unavoidable. As a clarification to the paragraph 58 of the 2021 draft guidance, a greater ratio of measures may be required under such circumstances where it is not possible for the measure to be fully implemented before harm takes place*." Any time lags as a result of the implementation of a strategic measure would be outside the Projects control and if a greater ratio is required this would be determined in consultation with Defra, JNCC and Natural England. In any case it is expected that any strategic extension would be sufficiently large to accommodate any requirement for spatial overcompensation, as described below.

65. The extent of the area to be designated must provide ecosystem functionality and network benefits and therefore the area for extension would need to encompass a whole sandbank system and the supporting habitats (including those available for biogenic reef). Natural England advised that any extension must demonstrate ecosystem functionality and consider both the uncertainty around delivering this proposal and any possible time lag between the impact occurring and the implementation of compensation such that the Project provides overall ecological gain over the lifetime of the development. The Project has identified extension areas, although these would not be delivered by the Project alone and would need to form part of a package with other developers also requiring compensation.
66. The extension areas identified are:
    - IDRBNR SAC Extension Area = 408km^2
    - HHW SAC Extension Area = 253km^2
67. These extension areas are ambitious when considering the scale of the features for compensation and would only be deliverable strategically and proportionate to the Project's requirements (as detailed below and within the Sandbank Compensation Plan (document reference 7.6.1) and the Biogenic Reef Compensation Plan (document reference 7.6.2).
68. Ambitious extension areas also add additional compensation for uncertainty around delivering this proposal and any possible time lag between the impact occurring and the implementation of compensation. This will also ensure that the Project provides overall ecological benefit over the lifetime of the development.

3.3.2 Project Alone Spatial Scale

69. The area required to offset the worst-case cable protection on Annex I sandbanks within the IDRBNR SAC would be 5,760m^2 (assuming a 1:1 ratio). Further details of this are presented within document reference 6.1.3 and within the Sandbank Compensation Plan (document reference 7.6.1).
70. The Applicant has found no evidence for the presence of *S. spinulosa* reef within the areas of the SAC that the ECC intersects. However, Natural England are still reviewing further evidence that supports this conclusion. In the absence of an agreed position on this point it is necessary for the Applicant to assign a theoretical worst case upon which to demonstrate the availability of sufficient compensation as part of its without prejudice derogation case. The area for the worst case scenario for installation of export cables within the IDRBNR SAC (excluding the sandbank features) would be 4.63km^2. This value has been used for the current purpose of demonstrating that the Applicant can deliver sufficient compensation in the event that and AEoI for reef is concluded. However, in reality it is wholly unrealistic for any assumption to be made that *S. spinulosa* reef would be present within the entirety of this area. Further details of this are presented within document reference 6.1.3 and within the Biogenic Reef Compensation Plan (document reference 7.6.2).

3.3.3 Project in-Combination Spatial Scale

71. Table 3.1 details the worst-case quantum of effect from cable protection associated with projects that might require compensation in the form of SAC extension. This includes the Project, Norfolk Vanguard, Norfolk Boreas, Five Estuaries, Dogger Bank South East, Dogger Bank South West and Dogger Bank D. This exercise demonstrates which projects could require compensation for impacts to Annex I sandbanks and the potential scale required to deliver this. It can be seen that the scale of the proposed SAC extensions (total of 66km^2, see section 3.3.1) would comfortably cover the predicted impact to sandbank features including any overcompensation that might be deemed necessary.

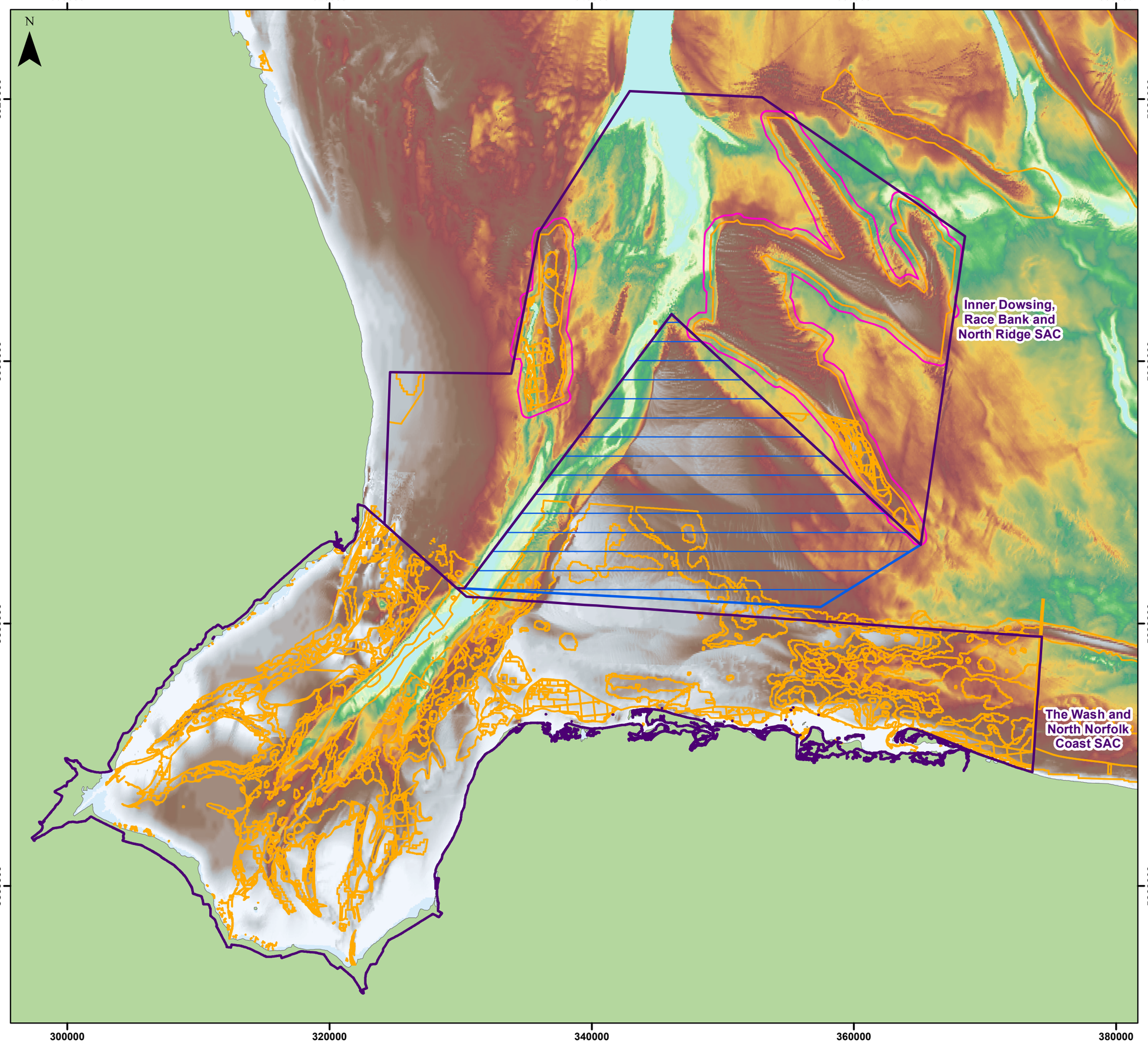
72. This exercise cannot be undertaken in relation to impacts on Annex I biogenic reef at this stage. However, given the scale of the proposed SAC extensions, any compensation required for reef could easily be accommodated.

Table 3.1. Project in-combination impacts to protected sandbank within southern North Sea[3].

OWF Project	Status	Impact to Sandbank from Cable Protection Material (m^2)
Norfolk Vanguard	Consented	24,000m^2
Norfolk Boreas	Consented	24,000m^2
The Project	Submitted	5,760m^2
Five Estuaries	Pre-application	5,400m^2
R4 Dogger Bank[3]	Pre-application	7,926,938m^2
Dogger Bank D[4]	Pre-application	2,300,000m^2
Total		**10,286,098m^2**

[3] Where projects are not consented, the latest available information is used herein, either from the respective PEIRs, DCO or direct information sharing with the relevant developer.

[4] Indicative project value, based on worst case assumptions which are subject to project refinement through detailed engineering studies and further assessment



Legend

- Special Areas of Conservation
- Proposed IDRBNR SAC Extension Area

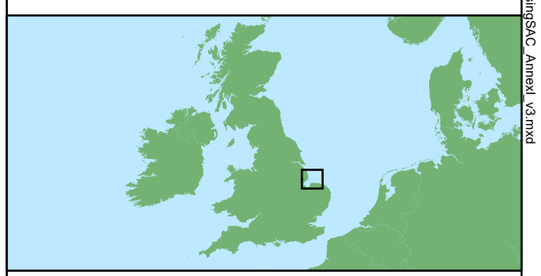
Annex I Sandbanks (Confidence)

- High
- Potential

Depth (m)

0

30



Coordinate System: WGS 1984 UTM Zone 31N

0 5 10 km

Scale: 1:275,000

A3 Page Size

Proposed SAC extension area adjacent to the Inner Dowsing, Race Bank and North Ridge SAC

Figure 3.1

OUTER DOWSING OFFSHORE WIND

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320000
340000
360000
5920000
5900000
5880000
N
Inner Dowsing, Race Bank and North Ridge SAC

Legend

- Array Area
- Offshore Export Cable Corridor
- Special Areas of Conservation
- Proposed IDRBNR SAC Extension

EUSeaMap 2021 (EMODnet, 2021)

- A5.13: Infralittoral coarse sediment
- A5.14: Circalittoral coarse sediment
- A5.15: Deep circalittoral coarse sediment
- A5.23 or A5.24: Infralittoral fine sand or Infralittoral muddy sand
- A5.25 or A5.26: Circalittoral fine sand or Circalittoral muddy sand
- A5.27: Deep circalittoral sand
- A5.33: Infralittoral sandy mud
- A5.35: Circalittoral sandy mud
- A5.37: Deep circalittoral mud
- A5.43: Infralittoral mixed sediments
- A5.44: Circalittoral mixed sediments
- A5.45: Deep circalittoral mixed sediments
- A5.6: Sublittoral biogenic reefs
- A5.61: Sublittoral polychaete worm reefs on sediment
- A5.611: [Sabellaria spinulosa] on stable circalittoral mixed sediment
- No EUNIS habitat assigned

OneBenthic Faunal Data Points (Cefas)

A1, A2a, A2b, C1a, C1b, D2a, D2b, D2c, D2d

Coordinate System: WGS 1984 UTM Zone 31N

0 5 10 km

Scale: 1:200,000

A3 Page Size

Proposed SAC extension area adjacent to the IDRBNR SAC with EUSeaMap broadscale habitat data (EUSeaMap, 2021) and OneBenthic faunal data points

Figure 3.2

OUTER DOWSING OFFSHORE WIND

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Revision: 0.1

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Contains ESRI Basemapping; EMDOnet 2020 bathymetry

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380000
400000
420000
440000
5860000
5840000
5820000
N
North Norfolk Sandbanks and Saturn Reef SAC
Haisborough, Hammond and Winterton SAC

Legend

- Special Areas of Conservation
- Proposed HHW SAC Extension Area

Annex I Reef Points (Subtype)

- Bedrock
- Bedrock/Stony
- Biogenic
- Stony

Annex I Reefs (Subtype)

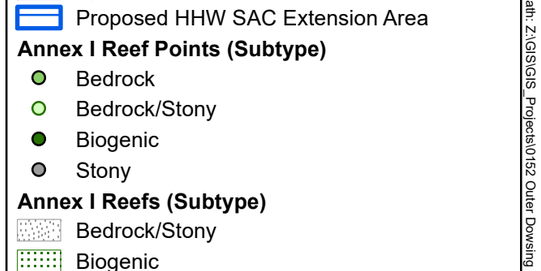
- Bedrock/Stony
- Biogenic

Managed As Reefs (Confidence)

- High
- Potential

Annex I Sandbanks (Confidence)

- High
- Potential



Coordinate System: WGS 1984 UTM Zone 31N

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Scale: 1:250,000

A3 Page Size

Proposed SAC extension area adjacent to the Haisborough, Hammond and Winterton SAC

Figure 3.3

OUTER DOWSING OFFSHORE WIND

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400000
420000
440000
460000
5880000
5860000
5840000
5820000
N
Haisborough, Hammond and Winterton SAC

Legend

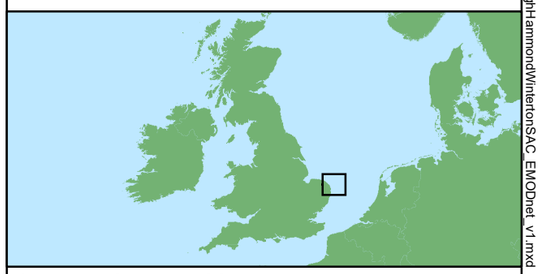
Special Areas of Conservation
Proposed HHW SAC Extension

EUSeaMap 2021 (EMODnet, 2021)

- A4.27: Faunal communities on deep moderate energy circalittoral rock
- A5.13: Infralittoral coarse sediment
- A5.14: Circalittoral coarse sediment
- A5.15: Deep circalittoral coarse sediment
- A5.23 or A5.24: Infralittoral fine sand or Infralittoral muddy sand
- A5.25 or A5.26: Circalittoral fine sand or Circalittoral muddy sand
- A5.27: Deep circalittoral sand
- A5.37: Deep circalittoral mud
- A5.44: Circalittoral mixed sediments
- A5.45: Deep circalittoral mixed sediments
- A5.6: Sublittoral biogenic reefs
- A5.611: [Sabellaria spinulosa] on stable circalittoral mixed sediment
- No EUNIS habitat assigned

OneBenthic Faunal Data Points (Cefas)

A1, A2a, A2b, C1a, C1b, D1, D2a, D2b, D2c, D2d



Coordinate System: WGS 1984 UTM Zone 31N

0 10 20 km

Scale: 1:300,000

A3 Page Size

Proposed SAC extension area adjacent to the HHW SAC with EUSeaMap broadscale habitat data (EUSeaMap, 2021) and OneBenthic faunal data points

Figure 3.4

OUTER DOWSING OFFSHORE WIND

Date: 06/03/2024
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Revision: 0.1

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Contains ESRI Basemapping; EMDOnet 2020 bathymetry

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3.3.4 Review of Other Users

3.3.4.1 IDRBNR SAC Extension Area

Fishing

73. As presented within Annex 1 – Commercial fisheries activity review within the IDRBNR SAC and proposed extension areas (NiMa, 2024), the reports conclude that the IDRBNR SAC and proposed extension area is utilised by UK fishing vessels using potting gears. Data indicate the potential for potting activity throughout the SAC and proposed extension area, with larger vessels active further offshore in the northern and eastern portions of the SAC and smaller vessels active inshore. Within the SAC some areas of reef are closed to static gear as a result of implementation of an MMO byelaw from 2022 onwards.
74. Data indicate the potential presence of beam trawlers targeting brown shrimp in the nearshore portion of the SAC, inside of the 6 nm limit. Data indicates the potential for other fishing gear types to be deployed within the SAC and extension area, though not with high frequency.
75. It should be noted that patterns of fishing practices and target fisheries can change over time.

Other Seabed Users

76. Figure 3.5 presents the range of activities currently within the proposed IDRBNR SAC extension area. These include:
    - Race Bank OWF subsea cables (operational) and associated designated disposal area;
    - Lincs OWF subsea cables (operational);
    - Aggregate dredging area 481/2 (active); and
    - Provisional aggregates area 2103.

3.3.4.2 HHW SAC extension area

Fishing

77. The HHW SAC and proposed extension area is utilised by UK fishing vessels using potting gears. Data indicate the potential for potting activity throughout the SAC and proposed extension area though across more spatially limited areas than within the IDRBNR SAC.
78. Within the HHW SAC, data indicate the potential presence of smaller inshore beam trawlers targeting brown shrimp, and netting vessels seasonally targeting bass and herring, in the nearshore portion of the SAC, inside of the 6 nm limit.
79. Data indicate the presence of demersal and beam trawl activity by larger vessels targeting sole, plaice and other demersal species, with landings and spatial data indicating that this activity is focused offshore and in the far south-eastern portion of the SAC.

Other Seabed Users

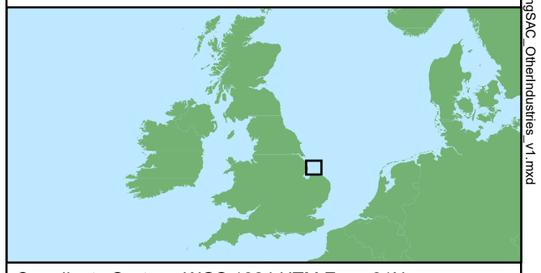
80. Figure 3.6 presents the range of activities currently within the proposed HHW SAC extension area. These include:
    - Aggregate dredging area 511 (active); and

- Subsea power cable (active).

320000
340000
360000
5920000
5900000
5880000
N
Triton Knoll
515/2
493
106/1
106/2
197
106/3
400
515/1
1805
481/1
481/2
Race Bank
Inner Dowsing,
Race Bank and
North Ridge SAC
Lincs
Inner Dowsing
Lincs
Lynn
Sheringham
Shoal
Extension
Sheringham
Shoal

Legend

- Array Area
- Offshor... Expor... Cabl... Corrido...
- Special Areas of Conservation
- Propose... IDRBN... SA... Extensio... Are...
- Offshor... Win... Far... Site...
- Open Disposal Area
- Aggregat... Are...
- Provisional Aggregates Area (2103)
- Militar... Practic... Are...
- Power Cable - Active
- Pipeline - Active
- Pipeline - Not In Use



Coordinate System: WGS 1984 UTM Zone 31N

0 5 10 km

Scale: 1:200,000

A3 Page Size

Other seabed users identified within and surrounding the IDRBNR SAC, including the proposed extension area

Figure 3.5

OUTER DOWSING OFFSHORE WIND

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Revision: 0.1

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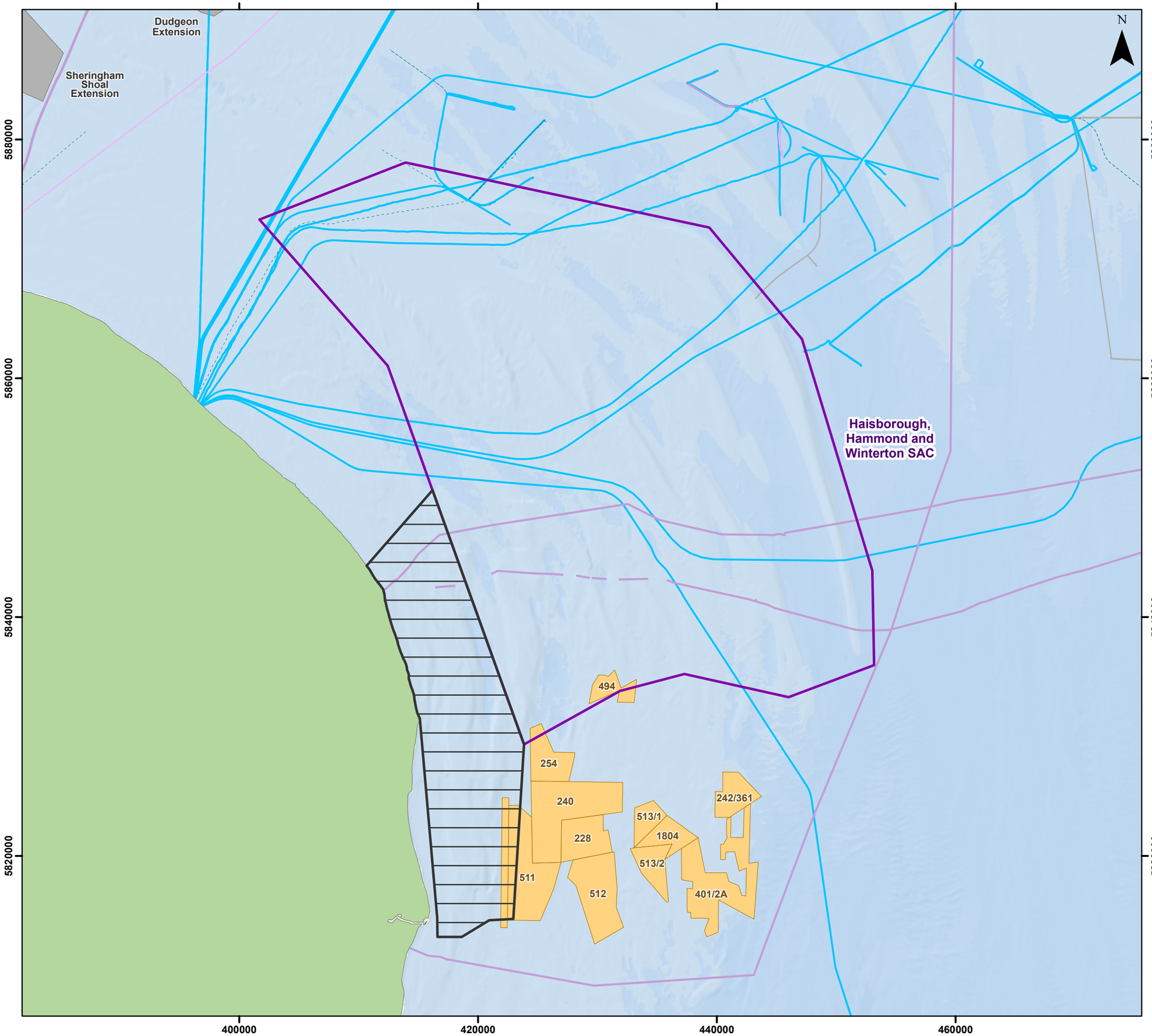

Legend

- Special Areas of Conservation
- Proposed HHW SAC Extension Area
- Offshore Wind Farm Sites
- Aggregate Area
- Power Cable - Active
- Cable - Not In Use
- Pipeline - Abandoned
- Pipeline - Active
- Pipeline - Not In Use

Coordinate System: WGS 1984 UTM Zone 31N

0 10 20 km

Scale: 1:300,000

A3 Page Size

Other seabed users identified within and surrounding the HHW SAC, including the proposed extension area

Figure 3.6

OUTER DOWSING OFFSHORE WIND

Date: 06/03/2024
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Revision: 0.1

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3.3.5 Delivery Timeframe

81. The aim of this potential compensatory measure would be to designate the site extension as soon as possible, if required, for either or both features (Annex I sandbank and Annex I biogenic reef). The expected scenario is that the measure becomes available to the Project as part of a strategic compensation package (or through the Marine Recovery Fund (MRF)), in the timescales relevant to the Project, if required.
82. However, once an area is notified as a pSAC, it is treated as if it has been formally designated or classified, consequently it is considered that it would be sufficient for the extension area to reach pSAC status for it to be considered as constituting compensation. The Applicant would expect to continue to support the measures beyond this point to ensure that the compensation continued to function throughout the Project lifetime.
83. Promoting an extension to the IDRBNR SAC and/or the HHW SAC is considered to have significant advantages over identifying a new site for designation elsewhere, given that they could be brought forward on a shorter timescale. The SACs have clear areas for potential extensions where the Annex I sandbank habitat and supporting features extend beyond the existing site boundaries. It should be noted that this is not an exhaustive list of possible extension areas, however, these are the ones highlighted as ecologically important as per consultation s with Natural England. It is understood that the strategic extension areas will be identified by Defra in collaboration with Natural England and the JNCC.
84. The process of delivering the SAC extension as a compensatory measure could be enhanced by the early collection of the evidence required (as advised by stakeholders) and preparing for consultation on any proposed extension, as well developing a better understanding of any consequential effects on the commercial fisheries industry and other relevant marine users. Defra has advised that the likely minimum timescales for an SAC extension designation is 3 years.
85. An indicative timeline for the proposed SAC extensions in relation to the Project's delivery programme is provided in Table 3.2. It is anticipated, that if granted consent, the Project will be operational by 2030, with offshore construction potentially commencing in 2027 and preparatory works undertaken from 2026 at the earliest. An indicative construction programme is provided in document 6.1.3 of the Environmental Statement which has been used to inform the detailed assessments as required (including in-combination and cumulative assessments). The delivery of compensation measures and associated activities could commence prior to the start of the construction phase of other offshore elements of the Project. Note that these dates are indicative at this stage.

86. Figure 3.7 illustrates the likely stages required for the formal designation of the SAC extension. This figure is based on UK guidelines produced to show the pre-Brexit Offshore SAC Designation Process and has been updated to include the requirements of The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019[5].

[5] https://www.gov.uk/government/publications/changes-to-the-habitats-regulations-2017/changes-to-the-habitats-regulations-2017

Table 3.2 Project Indicative timeline for the extension of an SAC

Year from consent	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Project milestones												
Consent	Q3/Q4 2025	Anticipated consent award										
	Q4 2028 onwards	Cable installation works										
Extension of an SAC												
Phase 1	Q3 2024	Agreement to include extension to an SAC on the list of approved MRF measures										
	Q4 2024 / Q1 2025	Provision of assistance in the development of an Area of Search										
	2025 / Q1 2026	Data gathering (dependent on whether sufficient survey data are already available)										
Phase 2	Early 2026	Support to Defra in preparing the formal consultation										
	Early 2026	Ongoing support to Natural England, Defra (and JNCC as required) to progress agreement on extension boundary (including confirmation of extension size)										
	Q3 2026	Extension boundary proposal submitted to UK Government (dSAC status)										
	Q4 2026 / Q1 2027	Consideration of proposal										

Year from consent	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
	Q2 2027	Proposal accepted (pSAC status) and therefore **compensation delivered**										
	2027 / 2028	Ongoing support to Defra to achieve full designation status including formal consultation										
Phase 3	2028 onwards	Ongoing support to the management of the site, including site condition monitoring										

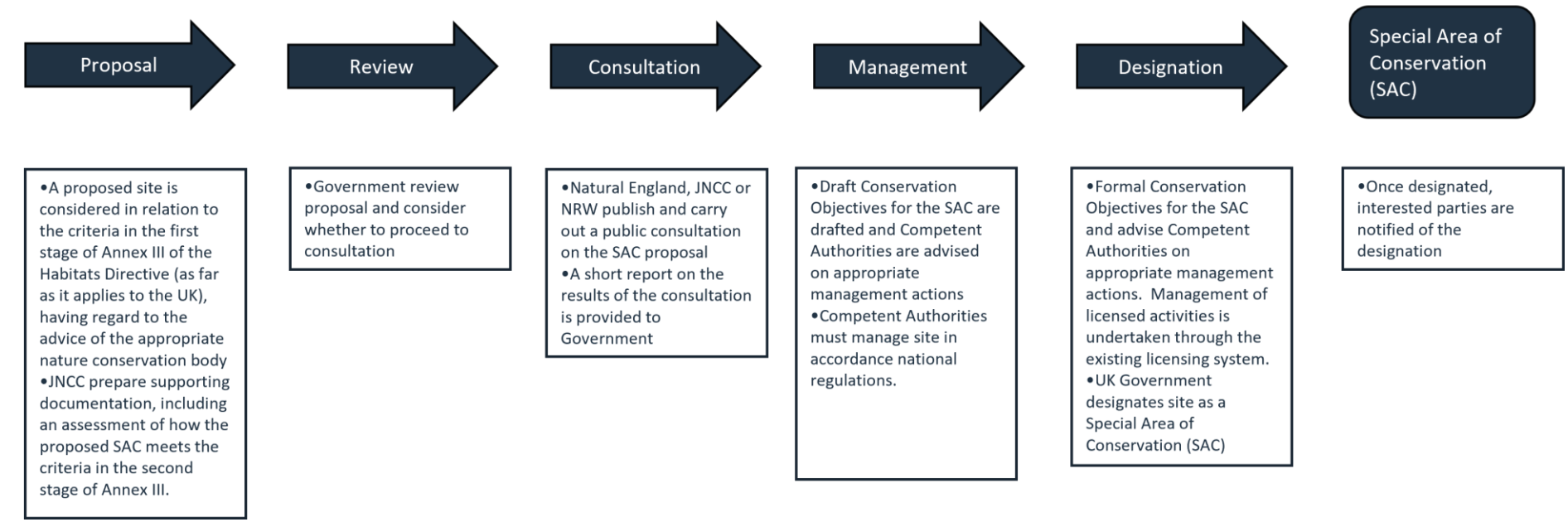


Figure 3.7 Indicative offshore SAC designation process (based on https://www.gov.uk/government/publications/changes-to-the-habitats-regulations-2017/changes-to-the-habitats-regulations-2017).

3.3.6 Monitoring and Adaptive Management

87. Once designated, the site extension would require monitoring with the clear aim of demonstrating how the extra protection delivered through this compensation measure is sufficiently offsetting impacts to aid understanding that management measures are working and maintaining the coherence of the designated site network.
88. It is currently unclear whether monitoring would be delivered by Defra and/or Natural England, and what role, if any, developers will play in defining and delivering the monitoring. Natural England have advised that any monitoring related to the extension of an SAC delivered as a compensation measure would likely need to be linked to the demonstration of the efficacy of the management measures, rather than necessarily comprising "standard" site condition monitoring.
89. As with the provision of the measures to promote the extension, should a consortium of developers be required to provide compensation, the monitoring requirements and costs would be undertaken strategically.
90. Other mechanisms for monitoring, once designated, could be aligned with the existing management of the SAC. The Applicant (or consortium of developers) could provide funding for a proportion of the Common Standards Monitoring (Common Standards Monitoring was developed to provide an agreed approach to the assessment of condition on statutory sites designated through UK legislation and international agreements[6]).
91. Once designated, the adaptive management of the extension could be aligned with the existing management measures that are already established for the SAC's.
92. In the event that an extension of an SAC does not proceed, the Project would implement an alternative measure, to be approved by the SoS.

3.4 Funding

93. An SAC extension would require the Applicant to provide either support or provide funding for staff time to Natural England, Defra and possibly the JNCC. This support would not be required on a full-time basis as there would be peaks and troughs in activity. Therefore, an assumption has been made that an equivalent of two full time members of staff would be required up until the point of full designation. Once the extension had been designated further support for ongoing site management and site condition monitoring would be provided.

[6] https://jncc.gov.uk/our-work/common-standards-monitoring/

94. Estimated costs are provided in Table 3.3 below. Note that these are the total costs for the SAC extension. As the mechanism and share that each project could be required to pay as a contribution to a strategic measure has not yet been established, a conservative assumption that the Project could fund the SAC extension measure in its entirety has been assumed. These costs are also included within the Compensation Funding Statement (document reference 7.9) which outlines how the Applicant and its ultimate parent companies would fund compensation measures should they be required.

Table 3.3 Indicative costs for extension of an SAC (project alone).

Cost estimate subcategories	Project Costs
DEVEX	£87,000
CAPEX	N/A
OPEX	£7,000,000
Total	£7,087,000

4 Alternative Protection Methodologies

95. This measure could provide compensation for an AEoI to the IDRBNR SAC, both in relation to Annex I biogenic reefs and Annex I sandbanks.

4.1 Overview

96. The Project has been exploring other options for the protection of sandbank and biogenic reef habitat, outside an SAC, where an extension to an SAC is not possible or feasible in the timescales required.
97. The justification for the site selection, scale, and ecological and site network benefits are as outlined for the SAC extension and as such are not repeated here. High level information on the delivery process is outlined below.
98. The primary method of protection for a sandbank outside an SAC, is expected to be through the designation of a byelaw to manage fishing activities, similar to those enacted by the MMO and the Eastern Inshore Fisheries and Conservation Authority (EIFCA) within the IDRBNR SAC. However, there will be a need to ensure that the area could not be developed by other industries in the future, which would not necessarily be precluded by a byelaw. This is most likely to be managed through a lease with The Crown Estate (TCE) to give the Applicant exclusive seabed rights to that area, which would then preclude the installation of cables or aggregate extraction over that area.
99. As noted in Table 1.1 of Sandbank Compensation Plan (document reference 7.6.1) and Table 1.1 of the Biogenic Reef Compensation Plan (document reference 7.6.2), although Natural England acknowledge the potential for this to represent a compensation measure in the future, they consider further legislative changes would also be required to make it viable and to ensure that an area set aside for compensation could not be impacted by any other marine plans/projects. Therefore, Natural England do not consider this as a viable option for the Project at this time.
100. The Applicant acknowledges Natural England's position and also notes that the implementation of necessary byelaw (or byelaws) would require a formal consultation process prior to being submitted to the SoS for subsequent confirmation7 (MMO, 2014). To this extent the implementation of such a measure is beyond the control of the Applicant. Given the expected availability of SAC extensions as a strategic compensation measure (see section 3) it is considered unlikely that this measure will be progressed in a similar timeframe. However, the Project has included the measure in the event that an SAC extension does not materialise.

[7] https://www.gov.uk/guidance/marine-conservation-byelaws#byelaw

5 Creation of Biogenic Reef

101. The creation of biogenic reef, either in the form of blue mussel *Mytilus edulis* beds or reefs of the native oyster *Ostrea edulis*, could provide compensation for an AEoI to the IDRBNR SAC, both in relation to Annex I biogenic reefs and Annex I sandbanks.

5.1 Overview

102. The conservation objectives of the IDRBNR SAC include ensuring that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring their structure and function (including typical species). Creation of new and additional sandbank habitat is not considered possible, as artificially created banks can be easily eroded by natural hydrodynamics. Therefore, as well as providing compensatory habitat for *S. spinulosa* reef, the creation of biogenic reef should also be considered as a suitable measure for sandbanks, providing benefits to ecological function of the overall MPA network.

103. Best practice guidance from Defra (Defra 2021) for developing compensatory measures in relation to MPAs sets out that, if providing the same ecological function for the species or habitat that the activity is damaging is not technically possible, then compensatory measures should provide functions and properties that are comparable to those that originally justified designation of the SAC (Defra, 2021).

104. As stated in Section 3, Defra is currently consulting on draft policies to update this guidance. The new proposals prioritise 'Ecological Effectiveness' when considering compensation, i.e. the ecological outcome and the confidence that the measures will be effective. As outlined below, the Applicant considers that this proposed measure will provide benefits to ecological function of the overall MPA if delivered for either biogenic reef or sandbank features.

105. Although blue mussel and native oyster reefs are not currently known to be present within the IDRBNR SAC, they are known to have been widely present historically throughout the southern North Sea, including along the Lincolnshire and Norfolk coastlines. As such, these species are considered to have been naturally present within the SAC historically. Since the 1800's there has been a 95% decline in shellfish populations around the UK and across the Lincolnshire coast (Baden *et al.*, 2021; Harding *et al.*, 2016; Laing *et al.*, 2006; Smyth *et al.*, 2009). This is due to a combination of factors from overexploitation through destructive fishing methods, pollution, and habitat loss (EIFCA, 2023).

106. The creation of these biogenic reefs would provide equivalent ecosystem services to the component communities of the existing *S. spinulosa* reef and would be regarded as 'like-for-like' compensation for *S. spinulosa* reef, taking key consideration of 'ecological effectiveness' and 'local circumstances' (Defra, 2024). As natural components of the wider ecosystem, with demonstrable historical presence, this measure would be complementary to the existing conservation measures for biogenic reef within the SAC.

107. Whilst this would comprise a non-like-for-like measure for Annex I sandbanks, within the IDRBNR SAC, sandbanks and biogenic reef features are often co-located and provide complementary ecosystem services. As such, this measure would support the integrity of the wider National Site Network through supporting the key component communities associated with a combination of sandbank and reef habitats.

108. The creation of biogenic reefs would follow established standards and best practice guidelines and would be conducted in close collaboration with stakeholders and restoration experts. The following sections outline the proposed road map and strategy towards developing the compensation options to support the 'without prejudice' derogation case.

5.2 Delivery Timeframe

109. An indicative timeframe for the delivery of both compensation options in relation to key Project milestones is presented in Figure 5.1. It is anticipated, that if granted consent, the Project will be operational by 2030, with offshore construction potentially commencing in 2027 and preparatory works undertaken from 2026 at the earliest. An indicative construction programme is provided in document 6.1.3 of the Environmental Statement which has been used to inform the detailed assessments as required (including in-combination and cumulative assessments). The delivery of compensation measures and associated activities could commence prior to the start of the construction phase of other offshore elements of the Project. Note that these dates are indicative at this stage.

110. The timeline utilises the Indicative Project Construction Programme provided in Section 11 of the Project Description (6.1.3), with Year -1 as the year of the consent application, Year 0 as the year of consent, construction during Years 1 – 5, and offshore cable installation during Years 3 and 4.

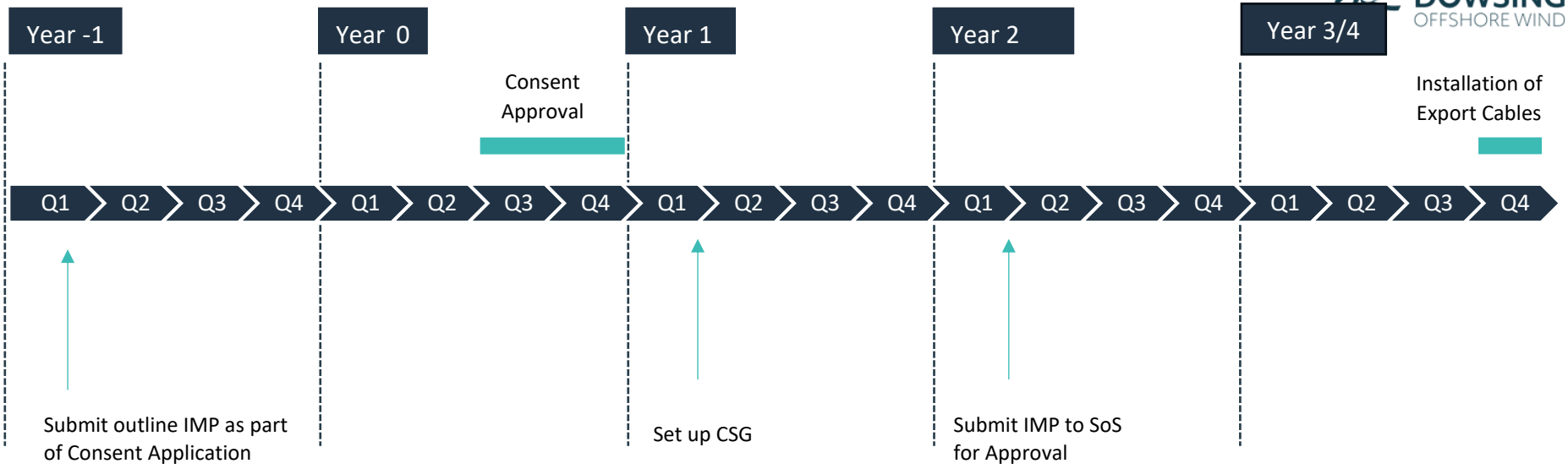
111. The implementation of both compensation options is expected to follow broadly similar timelines and would include the establishment of a Compensation Steering Group (CSG) for the relevant feature following consent approval. A Sandbank Implementation and Monitoring Plan (SCIMP) and/or Biogenic Reef Implementation Monitoring Plan (BRCIMP) would then be developed for the chosen compensation option in consultation with the Sandbank CSG (SCSG) or Biogenic Reef CSG (BRCSG).

112. It is the Applicant's position that, were the Secretary of State to determine that at this stage, the potential for and AEoI to the IDBRNR SAC from the deployment of removable cable protection over the sandbank features or potential cable installation works through the remainder of the SAC (for theoretical impacts to *S. spinulosa* reef), could not be excluded then the timing of delivery of compensation should be deferred. This is because the final need for, or quantity of, that compensation would not be able to be determined until it is established that cable protection is required over the sandbanks (which would be immediately post cable installation) or that *S. spinulosa* reef is identified within the offshore ECC which would be during the pre-construction surveys. This would mean that it would make more sense to defer the compensation delivery until these matters were established.

113. The Applicant does recognise that, if possible, compensation should be in place prior to the placement of cable protection over the qualifying features. However, Defra guidance (Defra, 2021) also makes allowance for situations where it is not possible to fully implement the compensation measure before the impact takes place, stating that "*Defra recognises that in some cases and for certain habitats and species [compensation] could take several years and therefore it may not be feasible for the compensatory measures to be complete before the impact takes place. Where this is not possible, it is important that necessary licences are in place, finances are secured, and realistic implementation plans have been agreed with the appropriate bodies to demonstrate that the compensatory measure is secured*".

114. The latest Defra guidance, which is out for consultation (Defra, 2024) states that: "*On rare occasions, time lags between a negative effect arising and compensatory measures becoming fully functional may be unavoidable. As a clarification to the paragraph 58 of the 2021 draft guidance, a greater ratio of measures may be required under such circumstances where it is not possible for the measure to be fully implemented before harm takes place*."

115. Whilst the Applicant maintains that compensation should only be required if it determined following cable installation that cable protection is needed over the sandbanks, or if the pre-construction surveys showed that it was not possible to microsite around *S. spinulosa* reef, in acknowledgement of the guidance as stated above, the below programme demonstrates how the measure could be delivered prior to impact, were the SoS to require this.



Phase 1: Planning phase

Finalise feasibility study; consult with stakeholders and restoration experts; draft implementation framework including targets, reef construction methods and monitoring protocols; identify contractors and costings

Phase 2: Design phase

Conduct baseline survey and analyse data; finalise IMP including targets, reef construction methods and monitoring protocols; obtain permits and consents

Phase 3: Reef creation phase

Construct reef; conduct initial monitoring and report results; as needed refine monitoring protocols

Phase 4: Monitoring and adaptive management

Implement monitoring and reporting protocols; note that monitoring and adaptive management will continue beyond year 3/4.

Figure 5.1 Indicative reef creation timeline

5.3 Option 1: Creation of Native Oyster Beds

116. As detailed above, the Applicants position is that the Project will not have AEoI on either the sandbank or reef features of the IDRBNR SAC. However, in the event that the SoS concludes that it does, it is proposed that the creation of native oyster beds could provide compensation for an AEoI to the IDRBNR SAC, both in relation to Annex I biogenic reefs and Annex I sandbanks.

5.3.1 Evidence Base

117. The native oyster is a reef-building suspension-feeding bivalve, which is found in shallow subtidal estuarine, coastal and offshore waters down to about 80m water depth (Bennema *et al.*, 2020; Hayward and Ryland, 2017). It typically occurs on firm substrates of mud, rocks, muddy sand, muddy gravel and sandy mud mixed sediments with shells, and hard silts (Connor *et al.*, 2004; Perry *et al.*, 2023; Pogoda *et al.*, 2020). Individuals can grow up to 15cm in size and typically live between 5-10 years (Preston *et al.*, 2020).

118. The recruitment success of native oysters can be highly variable, making it an important consideration in any oyster restoration/creation project (Preston *et al.*, 2020). Part of this variation is explained by their reproductive cycle, which relies on internal fertilisation. Native oysters are protandrous hermaphrodites, who begin their life as males but later alternate between genders as they grow older (Preston *et al.*, 2020; Smaal *et al.*, 2017). Sexually mature males release packages of sperms, which are drawn in by close-by females. Eggs are then fertilised internally in brood chambers and incubated for about 7-15 days until they have developed into shelled veliger larvae, at which point they are released into the water column (Preston *et al.*, 2020).

119. Oyster larvae float in the water column for about 7-14 days before settling onto the seabed (Smaal *et al.*, 2017). They can only settle once as they cement themselves to the substratum as soon as a suitable surface has been found (Smaal *et al.*, 2017). Research has shown that oyster preferably settle on other living oyster shells or suitable nearby substrates (e.g., Kennedy, 1999). This behaviour promotes the development of oyster aggregations, which under favourable conditions may develop into biogenic reefs (Gercken and Schmidt, 2014).

120. Beds of native oysters increase habitat complexity and support a diverse and productive community of animals and plants (Pogoda *et al.*, 2019). They are known to support a large number of sponges, hydroids and sea squirts and also attract juvenile fish and other mobile species, which use the beds for feeding and as nursery grounds (e.g., Coen *et al.*, 2007; Connor *et al.*, 2004). Commercially important shellfish, and several conspicuously large polychaete species and turf of seaweeds may also be present (Conner *et al.*, 2004). Moreover, as active suspension feeders, oysters filter large amounts of water, and thereby may improve water quality by removing pollutants from the water column (Preston *et al.*, 2020). The faeces and pseudofaeces produced by *O. edulis* enrich the surrounding sediment and contribute to organic nitrate and organic carbon fixation (Fodrie *et al.*, 2017). Oyster beds have also been shown to stabilise the sediment, and recent studies suggest that they have the capacity to deliver carbon sequestration (Fodrie *et al.*, 2017).

121. Natural oyster beds were once widespread throughout European waters before they experienced substantial declines, mainly due to overfishing and more recently as a result of habitat degradation, pollution and the spread of diseases (e.g., Pogoda *et al.*, 2019). Former oyster grounds in UK waters covered parts of the English Channel, the Bristol Channel, the central North Sea and many shallow sublittoral areas along the western and eastern English and Scottish coasts (Bennema *et al.*, 2020; Preston *et al.*, 2020). Olsen's Piscatorial Atlas (1883) indicates that native oysters have historically been widely distributed along the Norfolk and Lincolnshire coasts. Records from the Ocean Biodiversity Information System (OBIS) and Natural England's Marine Evidence databases show that in the past native oysters were present in the inner and other Wash, the outer Humber Estuary and offshore within the central North Sea (Johnson *et al.*, 2023). Data from historic research surveys conducted in the late 19th and early 20th centuries show similar results, with records of oyster shells in the outer Wash, off the Norfolk coast and off the Lincolnshire coast between Skegness and Grimsby (Bennema *et al.*, 2020). Today, remnant populations of native oyster are sparsely distributed in the south-east and south-west of England, Milford Haven in Wales and along the west coast of Scotland (Johnson *et al.*, 2023; Preston *et al.*, 2020).

122. The number of projects aimed at restoring native oyster beds has substantially increased in recent years; nevertheless, oyster restoration in Europe is still considered in its infancy (zu Ermgassen *et al.*, 2020a). The oyster reef creation project would therefore be developed and delivered in close collaboration with stakeholders, regulators and oyster restoration practitioners.

123. Should this compensation measure be adopted, the overall aim of the measure would be to create a self-sustaining oyster bed with an average minimum density of 5 live oysters per m^2 within the IDRBNR SAC (The Convention for the Protection of the Marine Environment of the North-Atlantic (OSPAR) define a native oyster bed as occurring at densities of 5 or more per m^2 (OSPAR, 2009)). The delivery process would be developed considering the following elements pertaining to oyster restoration/creation:

- Reef creation strategy (e.g., goals, stocking densities, deployment methods);
- Project logistics and permit requirements; and
- Monitoring and adaptive management.

5.3.2 Delivery Process

124. Clear objectives and targets will be set during the planning phase to describe what the reef creation project seeks to achieve and how its progress will be measured and evaluated (Fitzsimons *et al.*, 2019; Howie and Bishop, 2021). Part of the programme of delivery including aims and objectives would be agreed through the relevant CSG post-consent and secured through the CIMP. This would include key strategies and activities, expected outcomes, and risks and challenges in relation to both ecological and societal goals (Fitzsimons *et al.*, 2019). In general, objectives and targets for oyster reef creation may be set around the following aspects:

- Target oyster population structure (e.g., mortality, growth rates; sex ratio);
- Target structural reef attributes (e.g., size, complexity, fragmentation, vertical relief);

- Associated reef communities (e.g., diversity, biomass) and functions;
- Target timelines to achieve creation goals;
- Target monitoring programme;
- Reporting and communication framework; and
- Project partners and stakeholder engagement strategy.

125. Further consultation with delivery partners and stakeholders would be required to determine and agree appropriate objectives and targets, and this would form part of the CIMP post-consent.

5.3.3 Site Selection and Scale

126. One of the principal challenges for oyster creation projects is identifying locations suitable to support self-sustaining oyster populations (e.g., Kamermans *et al.*, 2018; Preston *et al.*, 2020). The first step of the oyster creation project was therefore an initial feasibility analysis to evaluate the suitability of the IDRBNR SAC for the occurrence and survival of native oysters. This assessment in the first instance focussed on providing information about the existing environmental conditions within the SAC, including its structural components, benthic communities and physio-chemical characteristics. Potential suitable locations for oyster reef development were then identified through habitat suitability modelling based on the known habitat requirements of native oyster and available environmental data within the SAC.

127. Table 5.1 shows the environmental variables important for oyster bed development. Crucial factors for the survival and growth of native oysters are seabed dynamics (e.g., seabed mobility and bed sheer stress), oxygen content, salinity and predation pressure. The reproduction of oysters is strongly influenced by water temperature and the size and age class distribution of the parent population, while successful recruitment is mainly dependent on substrate availability and local hydrodynamic conditions (e.g., Kamermans *et al.*, 2018; Preston *et al.*, 2020; Smaal *et al.*, 2017).

Table 5.1 Key environmental factors for the development of native oyster beds, associated environmental tolerances, and their deemed importance in oyster habitat restoration/creation projects. Based on information in Hughes *et al.* (2023), Kamermans *et al.* (2018), Preston *et al.* (2020) and Smaal *et al.* (2017). Parameters included in the habitat suitability analysis are identified below (those not considered further at this stage are typically associated with lack of resolution/ data at this stage).

Environmental factor	Range	Importance	Mapped
Abiotic			
Minimum dissolved oxygen concentration	Optimum >3.5mg/l; unsuitable < 0.5mg/l	Essential	No, but all areas likely to be suitable
Substrate suitability for settlement	Fine sand (>63µm) and firm silty sand or silty gravel. All with shells and stones.	Essential	Yes, using EUSeaMap (2021); higher resolution maps needed to refine areas of search
Summer water temperature maximum	Maximum summer temperature threshold 28-30°C	Essential	No; water temperature is consistent for the whole SAC
Low seabed mobility (average change in seabed height)	Optimum <0.8cm/day	Essential	No; factor not yet considered
Salinity minimum	>20PSU	Essential	No; salinity is >20PSU across the whole SAC
Salinity range	Optimum 25-35PSU; moderately suitable 20-25PSU	Essential	No; salinity is consistent for the whole SAC
Seabed sheer stress	Average <1N/m^2; optimum <0.6N/m^2	Essential?	No; factor not yet considered
Water depth	1-80m below sea level	Essential	Yes

Environmental factor	Range	Importance	Mapped
Low turbidity	Suspended sediments optimum <60mg/l; unsuitable >180mg/l	Desirable	No; turbidity is consistent for the whole SAC
Wave exposure	Low to moderate	Desirable	No; lack of data
Water temperature minimum in winter	> 3-5°C	Desirable	No; water temperature is consistent for the whole SAC
Current velocity	Low to moderate; 0.25-0.8m/s; Tolerance limits depend on the type of substrate available, with tolerance levels of oysters attached to hard substrate typically being higher than those found on soft substrate. Linked to tolerance levels for sedimentation.	Desirable	Yes; but may need to be revisited comparing different threshold levels
Sedimentation rate	Low	Desirable	No; factor not yet considered
Volume of freshwater inputs	Low	Desirable	No; not relevant
Tidal currents	Low to moderate	Desirable	No
Water pH range	>6.9	Desirable	No
Water quality	Low pollution levels; minimal sewage outflow within close proximity to the site, inorganic nutrient concentrations (nitrates and phosphates) below harmful thresholds	Desirable	No; not relevant
Biotic			
Historic distribution	Restoration site lies within historical species range; evidence of historical occurrence at creation site	Desirable	Yes
Low predator abundance	High numbers of predators can decimate a population. Particularly important for the survival of young oysters < 3 cm in size. Main oyster predators are starfish (e.g., *A. rubens*, *Astropecten irregularis*), large crabs (e.g., *C. pagurus*), whelks (e.g., *Buccinum undatum*) and predatory snails.	Desirable	No; lack of data

Environmental factor	Range	Importance	Mapped
Food concentration (Chlorophyll a)	Growth > 0.5 µg/l; gonad development > 1.68 µg/l	Desirable	No; lack of data
Connectivity with naturally occurring larval broodstock	Size and proximity of existing oyster beds; larval retention rates and dispersal pathways	Desirable	No; no known naturally occurring larval broodstook present
Absence of OIE/EC listed diseases	E.g., *Bonamia* spp., *Marteilia refringens*, *Mikrocytos mackini* and Herpes virus OsHV-1-µVAr	Desirable	No; factor not yet considered
Absence of high impact invasive non-native species (INNS)	E.g., carpet sea squirt (*Didemnum vexillum*), American slipper limpet (*Crepidula fornicata*); prevalence, density and distribution of the Pacific oyster (*Crassostrea gigas*)	Desirable	No; factor not yet considered
Potential for biodiversity enhancement of the site	Assess whether some sites are more likely to support higher diversity of associated species than others.	Desirable	No; factor not yet considered
Balanced food web	Competition for food can reduce growth and reproduction.	Desirable	No; factor not yet considered
Risks of competition	Low abundance of species that compete for settlement; balanced food web - high numbers of predators can decimate a population, while competition for food can reduce growth and reproduction	Desirable	No; factor not yet considered
Ecosystem health indicators	Low levels of harmful algae; absence of biotoxins	Desirable	No; factor not yet considered
Presence, abundance, and relative location of non-oyster habitats	Ensure existing non-oyster habitats will not be negatively impacted by creation activities.	Desirable	No; not yet assessed

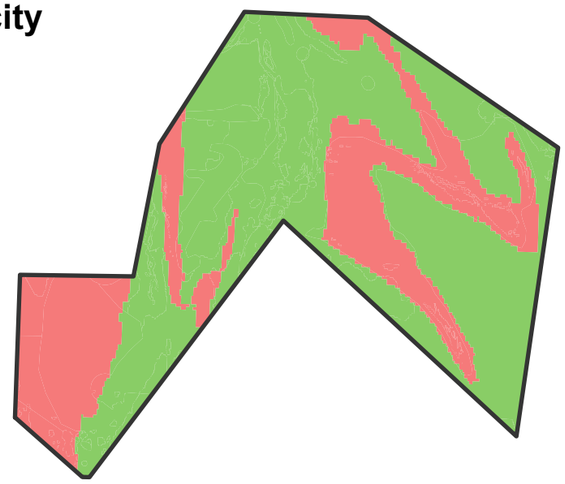
128. The results of the habitat suitability assessment based on a subset of key environmental variables are presented in Figure 5.2 to Figure 5.4; the methodology adopted is detailed in Appendix 2. Considering concerns from Natural England regarding avoidance of areas that would impact habitat availability for *S. spinulosa*, the area for the delivery of a biogenic reef has been drawn to exclude any known areas of *S. spinulosa* reef, or the "areas to be managed as reef" within the SAC.

129. Exclusion areas also include the location of other existing infrastructure and licenced aggregate dredging sites as these are regarded as areas that would need to be avoided (Figure 5.4). Human activities, in particular those that impact the seabed, are a significant threat to native oysters and their habitats (Hughes *et al.*, 2023). Therefore, any reef creation work would be undertaken outside the influence of seabed-modifying activities. Figure 5.3 also depicts the historic (1154-2009) distribution of *O. edulis* records within and adjacent to the SAC (Johnson *et al.,* 2023).

130. Based on the evidence combined, oyster reef creation search areas have been identified (Figure 5.4). As detailed within the review of commercial fisheries activity within the IDRBNR SAC (Appendix 1), the SAC is mainly targeted by UK fishing vessels using potting gear, with potting likely to occur throughout the SAC. Beam trawling is likely to take place in the nearshore portion of the SAC, inside the 6nm limit. The Applicant would commence discussions with the MMO to explore options to protect any created reef from fishing pressures, should that be considered necessary.

131. A targeted site-survey (undertaken post-consent) would likely be required prior to any creation activities to ground-truth the habitat suitability modelling and to inform deployment decisions. In addition, potential recruitment limitations will need to be assessed, preferably through model simulation, to provide information on the dispersal pathways of oyster larvae within the region and to assess the potential of any planted oyster beds to sustain themselves in the long-term (e.g., Kamermans *et al.*, 2018).

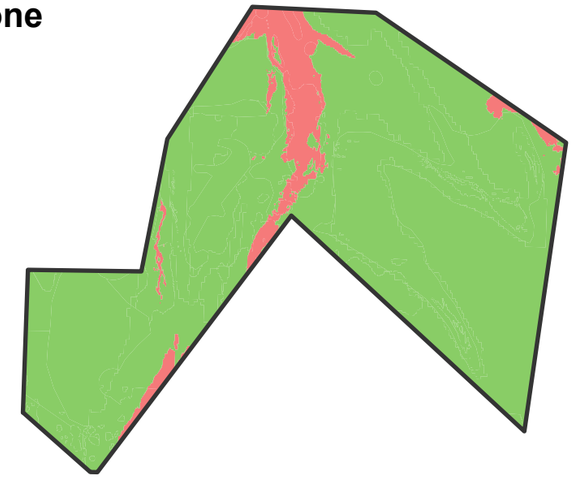
Current Velocity (Energy)



Preferred (Moderate Energy)
Nonpreferred (High Energy)

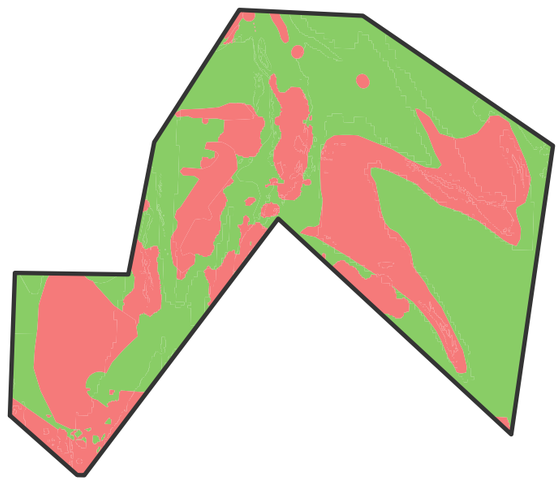
Biological Zone

N



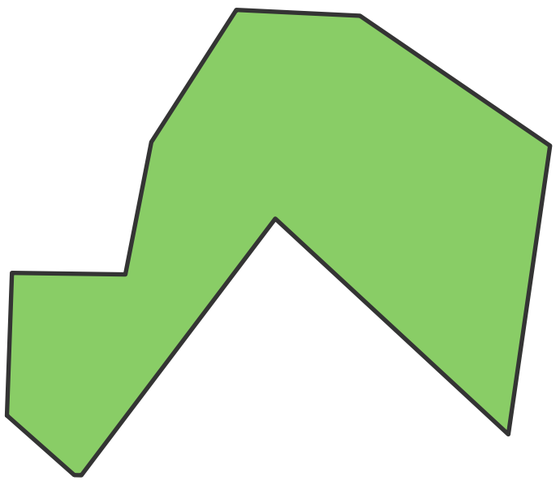
Preferred (Lower eulittoral, Sublittoral fringe, Lower / Upper circalittoral, Lower / Upper infralittoral)
Nonpreferred (Other)

Substratum / Habitat



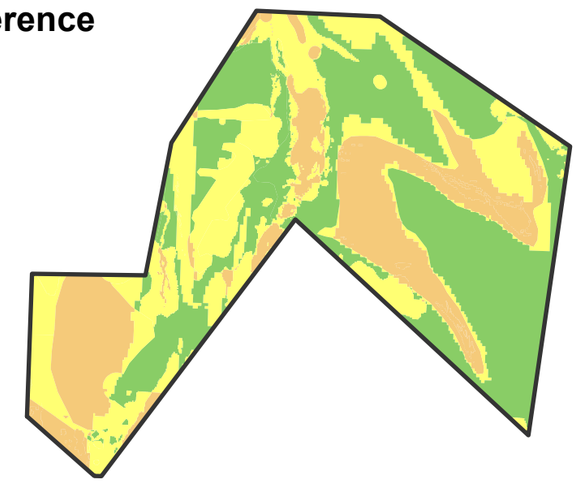
Preferred (Firm substrates including silty sand, silty gravel with shells and stones, cobbles, pebbles and small boulders)
Nonpreferred (Other)

Water Depth



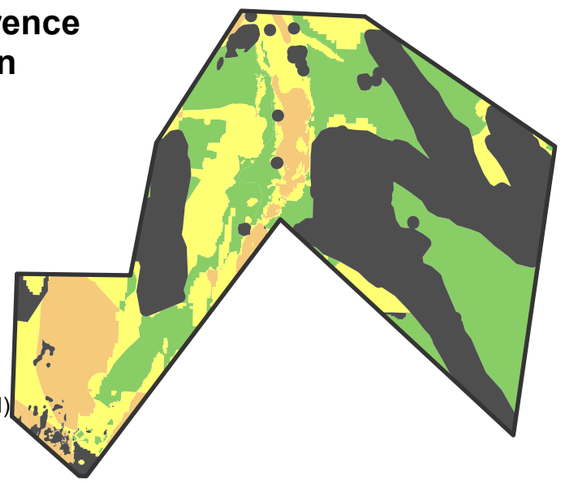
Preferred (0 - 80m)
Nonpreferred (80m+)

Habitat Preference



Least Preferred
Most Preferred

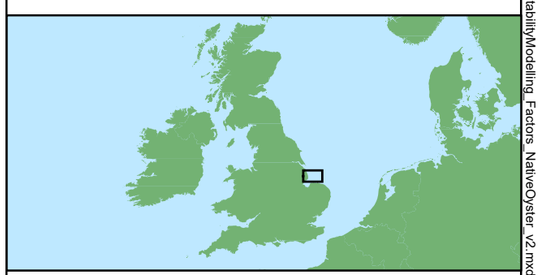
Habitat Preference with Exclusion



Excluded (Annex I)
Least Preferred
Most Preferred

Legend

Inner Dowsing, Race Bank and North Ridge SAC



Coordinate System: WGS 1984 UTM Zone 31N

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Results of native oyster habitat suitability modelling for the Inner Dowsing, Race Bank and North Ridge SAC

Figure 5.2

OUTER DOWSING OFFSHORE WIND

Date: 06/03/2024
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Document Path: Z:\GIS\GIS_Projects\0152 Outer Dowsing EIA\GIS\Figures\GeneralBenthic Compensation Strategy Roadmap\ODOW_0152_Fig5.2_HabitatSuitability\HabitatSuitabilityModelling_Factors_NativeOyster_v2.mxd

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Legend

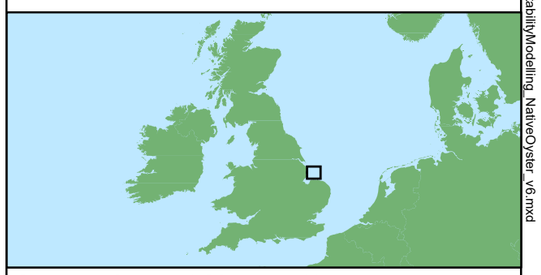
- Offshore Export Cable Corridor
- Inner Dowsing, Race Bank and North Ridge SAC
- 6nm Limit
- Historic Oyster Distribution Presence

Aggregate Areas

- Production Agreement Area
- Exploration and Option Area

Native Oyster Habitat

- Excluded
- Least Preferred
- Most Preferred



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Habitat suitability model for native oyster in the IDRBNR SAC, including exclusions areas (Annex I protected features and aggregate industries) and historic oyster presence (Johnson *et al.*, 2023)

Figure 5.3

OUTER DOWSING OFFSHORE WIND

Date: 06/03/2024
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Revision: 0.1

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Triton Knoll
Race Bank
Inner Dowsing
Lincs
Lynn
Sheringham Shoal Extension
Sheringham Shoal

Legend

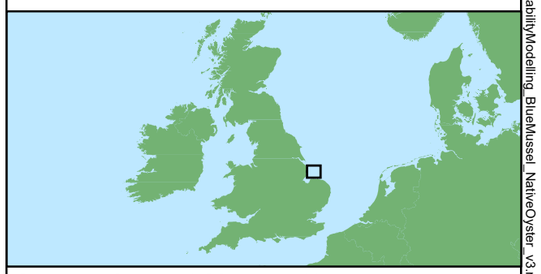
- Offshore Export Cable Corridor
- Inner Dowsing, Race Bank and North Ridge SAC
- 6nm Limit
- Offshore Wind Farm Sites
- Offshore Wind Farm Cable Agreements
- Open Disposal Area
- Power Cable - Active
- Pipeline - Active
- Pipeline - Not In Use

Aggregate Areas

- Production Agreement Area
- Exploration and Option Area

Blue Mussel and Native Oyster Habitat

- Most Preferred



Coordinate System: WGS 1984 UTM Zone 31N

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Preferred habitat in the Inner Dowsing, Race Bank and North Ridge SAC with exclusion zones for protected habitat and includes existing infrastructure

Figure 5.4

OUTER DOWSING OFFSHORE WIND

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Revision: 0.1

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132. The biogenic reef creation project would aim to create a self-sustaining oyster reef that provides ecological functions and ecosystem services similar to the *S. spinulosa* reef and sandbank habitat that is potentially lost. The reef should be of sufficient size and complexity to support long-term oyster survival, growth, reproduction and reef accretion.

133. The target size of the oyster bed(s) to be created would be determined based on the predicted magnitude of long-term habitat loss from cable protection measures, acceptable habitat compensation ratios, and the size required to establish a healthy and viable oyster reef.

134. As detailed within the Sandbank Compensation Plan (document reference 7.6.1), the predicted worst-case footprint of cable protection on sandbanks is 2,880m^2 for each of the two sandbank features to be affected within the IDRBNR SAC, leading to a total impact area of 5,760m^2.

135. As detailed within the Biogenic Reef Compensation Plan (document reference 7.6.2), an absolute worst case scenario could assume that *S. spinulosa* reef is present across the entire offshore ECC so would be impacted by the installation of export cables. The maximum total area within the SAC that is expected to be disturbed by sandwave clearance is approximately 4.63km^2.

136. Information on the extent, shape and density of healthy European oyster reefs is extremely sparse due to the lack of studies conducted prior to the widespread decline in oyster populations (Preston *et al.*, 2020). OSPAR define a native oyster bed as "*O. edulis* occurring at densities of 5 or more per m^2 on shallow mostly sheltered sediments (typically 0-10 m, but occasionally down to 30 m). There may also be considerable quantities of dead oyster shell making up a substantial portion of the substratum (OSPAR, 2009)". Experts of the Native Oyster Restoration Alliance (NORA) do not provide a threshold density for oyster reefs and instead have defined oyster beds "as a substrate with a veneer of living oyster, providing a habitat with high surface complexity, on a substrate which may be dominated by dead oyster shell" (Preston *et al.*, 2020).

137. In the absence of a comprehensive definition of a native oyster reef, the Applicant proposes to follow the OSPAR definition and develop an oyster reef with a minimum of 5 live oysters per m^2.

138. For the compensation of *S. spinulosa* reef the Applicant is committed to providing habitat compensation at a ratio of 1:1 as the compensation measure is regarded as 'like for like' or '*taking full account of local circumstances where the risk to the feature is predicted to occur, delivered within or adjacent to the area affected by the plan or project'* (Defra, 2024).

139. For the compensation of Annex I sandbank, this is lower on the compensation hierarchy (i.e., comparable ecological function, different location and not like-for-like). The application of a compensation ratio of 3:1 would mean that an oyster reef of 17,280m^2 would need to be created to compensate for the loss of sandbank habitat.

140. However, any created reef will have to be a certain size to be self-sustaining, and therefore to successfully deliver the compensation measure and limit repeated seeding, the size of the reef may by necessity have to exceed any agreed ratio. Work on identifying adequate stocking densities to create a viable reef is ongoing and will be progressed by the Applicant in consultation with oyster reef restoration experts.

5.3.4 Creation Process

141. No natural native oyster reefs are currently present within or near the IDRBNR SAC, and consequently there is likely to be a lack of sufficient oyster broodstocks for long-term oyster bed development. Therefore, reproductive individuals would need to be introduced, either by seeding juvenile oysters (spat) settled onto suitable substrate (e.g., shell), and/or by adding mature (adult) oysters (Howie and Bishop, 2021; Preston *et al.*, 2020). Adult oysters may be sourced from hatcheries or natural wild stocks, while juvenile oysters may be obtained from hatcheries, spatting ponds or shellfish farms (Preston *et al.*, 2020).

142. Identifying the number of oysters required to establish diverse, self-sustaining reefs over the long term would be a key step during the planning phase. Information on the density (and extent and shape) of healthy oyster beds is extremely sparse due to the lack of studies conducted prior to the widespread decline in European oyster populations (Preston *et al.*, 2020). This paucity of data has made it difficult to identify thresholds for stocking densities with certainty. Factors that will need to be considered to determine the number of oysters to be deployed include target densities, natural mortality rates, potential for bonamiosis infection, predation pressure and retention rates (Preston *et al.*, 2020). For example, high initial stocking densities will likely be required to ensure an appropriate age structure and sex ratio is achieved that would maximise fertilisation success (Gercken and Schmidt, 2014). Furthermore, survival rates may be affected by predators, and deployed oysters may be redistributed by currents and tides (Preston *et al.*, 2020). Data to assess the potential for oyster loss due to predation and hydrodynamic process will be collated as part of the ongoing feasibility analysis post-consent (via the CIMP) and during subsequent site-surveys and monitoring. In addition, experiences from oyster creation projects elsewhere (Annex 3 - Examples of bivalve reef restoration projects) will be incorporated into the decision-making process.

143. Based on experience from previous oyster restoration projects (Annex 3 - Examples of bivalve reef restoration projects), it is likely that cultch would need to be deployed to provide substrate suitable for oyster bed planting and reef accretion. The amount of cultch required would be determined following final site selection and analysis of sediment data collected during the site-specific seabed survey. Suitable materials include a mixture of aggregate pebbles purchased from onshore or offshore suppliers and waste oyster shell from local markets. Alternatively, waste shell from the mussel and scallop industry could be used (Preston *et al.*, 2020). Natural England have previously recommended working with local fishermen to source the cultch. Cultch material would be selected on the basis of their suitability to support oyster settlement and reef development under local conditions and considering their potential impacts on the qualifying features of the IDRBNR SAC.

144. A shellfish biosecurity plan would be established during the planning phase to ensure no pathogens or INNS are spread when deploying cultch and oysters. For example, protozoans of the genus *Bonamia* are known to cause bonamiosis, a disease that infects the immune cells of oysters (zu Ermgassen *et al.*, 2020). The presence of *Bonamia* has been shown to cause substantial mortality in wild oyster stocks and is considered a key risk that may impede oyster bed creation (Laing *et al.*, 2006). Other limiting factors in oyster bed development are INNS, such as the slipper limpet *C. fornicata*, which can outcompete native oysters for food and space (Laing *et al.*, 2006). The development of a biosecurity plan would be based on recommendations and requirements set out in the "European Guidelines on Biosecurity in Native Oyster Restoration" (zu Ermgassen *et al.*, 2020b) and advice from local oyster restoration specialists. Details would be finalised post-consent and following decisions on how to source cultch and oysters.

145. Other important points for considerations are the timing of oyster and cultch deployment and suitable methods for preparing and seeding the beds. Given the location of the IDRBNR SAC, oysters will likely be deployed by vessels using fallpipe/chute systems or cranes to lower seeds to the seabed. Oysters may be deposited on the seabed without protection or within on-bottom cages or nets to reduce the risk of predation (Preston *et al.*, 2020). The need for oyster protection during the seeding phases would be evaluated during the design phase in consultation with oyster restoration practitioners.

5.3.5 Project Logistics

5.3.5.1 Availability of cultch and oysters

146. Seed oysters would be sourced from recognised oyster farms or hatcheries. The Project would aim, where possible, to use suppliers from within the Norfolk and Lincolnshire regions to maintain the local gene pool and to provide benefits to local communities (Howie and Bishop, 2021; Preston *et al.*, 2020). The current production of native oyster seed is considered to be insufficient to meet the increasing demands by restoration activities (NORA, 2021). Therefore, partnerships with seed suppliers would need to be established early at the planning phase to ensure sufficient amounts of seed oysters can be produced within the Project timelines. **Error! R eference source not found.** lists examples of existing native oyster farms and nurseries in the UK.

Table 5.2 Examples of native oyster hatcheries and farms (adapted from Native Oyster Network UK & Ireland, 2023a)

Organisation / Company	Location
University of Portsmouth and Blue Marine Foundation Hatchery	Langstone Harbour, Portsmouth
Blakeney Harbour Oyster Farm	North Norfolk, England
Exmouth Mussels & Aquafish Solutions Ltd.	River Exe, England
River Roach Oyster Farm	River Roach, England
Fal Oyster Ltd.	River Fal, England
Helford River Oysters Ltd.	Helford River, England
Angle Bay Oyster Farm	Milford Haven, Wales

Organisation / Company	Location
Mumbles Oyster Company	Mumbles, Wales
Maorach Beag	Western Ross, Scotland
Loch Craignish Restoration Project	Loch Craignish, Scotland
Loch Ryan Oyster Fishery Company Ltd.	Loch Ryan, Scotland
The Oyster Restoration Company	Orkney, Scotland
Atlantic Shellfish Ltd.	Cork Harbour, Ireland
Jersey Sea Farms	Jersey

5.3.5.2 Licensing and regulation

147. The Applicant is proposing to consent the development of a biogenic reef through the DCO for the Project, with details of the methodologies proposed for deployment, if required, presented within the Project Description (document reference 6.1.3) and relevant impacts assessed within the technical chapters of the Environmental Statement (ES) and within the RIAA. Final details of the proposed deployments, if required, would be discussed with stakeholders through consultation and subject to sign off by the SoS.

148. To ensure the protection of the created reef, the Project is exploring multiple options, including extensions of existing, or sponsoring the development of new, byelaws to restrict other marine activities (fishing, cables, pipelines, etc.) over the reef. The Applicant has commenced discussions with the MMO to understand the byelaw process. The MMO stated in a response to the Applicant "*that a byelaw could feasibly be extended/a new byelaw put in place, in principle. If the new reef is considered a feature of the site by Statutory Nature Conservation Bodies (SNCBs) then this would fall under our Marine Protected Areas (MPAs) process. The byelaw states specific areas which are based on those which SNCBs have advised us should be managed as reef features. So, if SNCBs advise that new areas should be managed in this way then the MMO would do so*" (as detailed within Table 1.1 of Sandbank Compensation Plan (document reference 7.6.1) and Table 1.1 of the Biogenic Reef Compensation Plan (document reference 7.6.2)). The Applicant is also exploring alternative options for protection of any sites, including voluntary agreements with fishermen. In addition, the Applicant would commence consultation with TCE for an AfL for any area of created reef to ensure its protection from other infrastructure developments, if this measure was to be taken forwards.

149. If cultch is required, authorisation would also be sought from the Aquaculture Business Authorisation to handle, translocate or restore native oysters (Preston *et al.*, 2020).

5.3.6 Delivery Timeframe

150. The programme of delivery to create a native oyster reef would be approved prior to the commencement of the offshore cable protection installation works. The implementation of the compensation measure would then be conducted in accordance with the programme provided within the relevant compensation plan and post-consent CIMP document. The SCIMP or BRCIMP would be developed and finalised in consultation with members of the relevant CSG and submitted to the SoS for approval in accordance with the DCO.

151. Implementation of the compensation measure would follow a phased approach (Figure 5.1), with each phase involving several work-streams and tasks. An indicative timeline for the delivery of the compensation measure is provided in Table 5.6 at the end of this Section. It is anticipated, that if granted consent, the Project will be operational by 2030, with offshore construction potentially commencing in 2027 and preparatory works undertaken from 2026 at the earliest. As noted previously, an indicative construction programme is provided in document 6.1.3 of the Environmental Statement which has been used to inform the detailed assessments as required (including in-combination and cumulative assessments). The delivery of compensation measures and associated activities could commence prior to the start of the construction phase of other offshore elements of the Project. Note that these dates are indicative at this stage.

152. It is anticipated that the Applicant will continue to develop and refine the implementation plan through consultation with stakeholders, regulators and oyster restoration experts.

153. Phase 1 (Planning phase) covers any preparatory work including the following:

- **Completion of the feasibility assessment:** Work on the feasibility analysis will continue to determine which areas within the IDRBNR SAC would be most suitable for the creation of an oyster reef based on habitat requirements, the footprint of human pressures and the feasibility of implementing reef protection measures (e.g. through byelaws). This work will involve an extension to the current habitat suitability mapping to include further variables known to affect native oyster distribution. The need for modelling to assess larval dispersal pathways and retention rates will be investigated, and the review of past restoration projects will be continued to identify optimal reef creation methods and to develop restoration targets and monitoring parameters. The results of the feasibility study will also inform the scope of any further survey work that would be required to finalise site selection and deployment decisions.

- **Engagement with oyster restoration practitioners:** Advice from oyster restoration experts will be sought to determine how the proposed oyster reef could best be created. Topic areas that require a better understanding include optimal seeding methods and stocking densities, measurable reef indicators, best practice monitoring protocols (e.g., timing of oyster deployment, monitoring frequency) and potential risks and uncertainties. Options for project partnerships or inclusions of experts in the CSG will be explored at this stage.

- **Setting objectives and formulating targets:** It is anticipated that ecological restoration objectives would be drafted following completion of the feasibility analysis and in consultation with oyster restoration practitioners. Furthermore, potential timelines to reach these objectives would be identified along with suitable methods to monitor and evaluate reef development.

- **Contractors and costings:** It is anticipated that discussions with potential suppliers of cultch and oyster seeds will begin pre-consent to determine lead times, potential costs and logistics. Suitable marine contractors to deploy the mussels and undertake monitoring would also be identified.

154. Phase 2 (Design phase) would involve the finalisation of the programme of works including decisions on reef design and deployment and associated monitoring and reporting. In addition, a set of tasks required prior to the construction of an oyster reef would be completed.

- **Governance and CIMP:** Following Phase I, the Applicant would finalise the CIMP. The CIMP would be developed in consultation with oyster restoration experts and members of the CSG.
- **Finalising restoration strategy:** The final restoration strategy including objectives and targets would be detailed within the CIMP along with the proposed methods to construct the oyster reef. This would be developed by the Applicant through regular discussions with the CSG and any project delivery partners identified during Phase 1.
- **Site survey:** A targeted survey covering the chosen reef creation area is likely to be required prior to the deployment of oysters to confirm the suitability of this area for reef development. The survey may need to include the collection of acoustic and sediment data to characterise seabed conditions and identify suitable reef construction sites and deployment methods. Results of the site-survey would feed into finalisation of CIMP. It is anticipated that the site-specific survey would need to take place to ensure sufficient time remains to finalise the CIMP and progress with implementing the compensation measure within the delivery timeframe.
- **Permits and licensing:** Work to obtain licences and permits required to construct and monitor the reef would continue throughout the planning and design phases.
    - The implementation of the selected method for protection of the reef will be progressed in parallel with the reef creation works and while partially independent of the reef creation works, will be informed by the progress of that work stream.
    - It is likely that the Applicant will progress with multiple options for the protection of the reef simultaneously, as it expected that, where a byelaw implemented by the MMO is feasible, the process is expected to take up to three years to complete; as such, the feasibility of implementing interim measures such as voluntary agreements with fishermen would be explored by the Applicant.
    - Notwithstanding the approach taken, discussions with TCE will be progressed with the intention to obtain an AfL prior to the establishment of the reef.

155. Phase 3 (Reef creation phase) would commence following approval of the CIMP by the SoS. This phase would involve the physical construction of the oyster reef at the chosen location within the IDRBNR SAC. Engagement with the CSG and the project delivery partners would continue throughout this phase.

- **Construction of reef:** The first phase of oyster deployment would commence following approval of the CIMP by the SoS and prior to the installation of the first export cable. Optimal deployment times may vary depending on the type of oyster seed used (e.g. spat on shell or translocation of adult oysters). A work programme for the oyster reef construction stage including methods for deployment would be developed in consultation with the CSG and any project delivery partners. The survival and condition of the planted oysters would be monitored within the first year of deployment, with the monitoring protocols to be developed as part of the CIMP. Seed oysters may be planted in increments to account for losses over time until the intended oyster density is reached. Stocking densities would be determined with consideration of potential oyster survival rates, which would be estimated using results from previous restoration projects.

156. The final phase of the delivery programme would comprise any monitoring and adaptive management. Post-construction surveys covering the reef creation site would be conducted to monitor the development of the reef and assess the overall performance of the compensation measure. The monitoring programme including sampling techniques and frequency would be developed in consultation with the relevant CSG. The monitoring programme would be regularly reviewed and adapted, as required, during the lifetime of the reef creation project.

5.3.7 Monitoring and Adaptive Management

157. Once suitable sites are identified and seed oysters translocated to these sites, monitoring would be undertaken to help reduce the risk of the oyster bed failing to develop. This would include the measurement of predefined reef indicators, local environmental conditions and monitoring for invasive species. Should threats to biosecurity be identified (for example an infestation of INNS) action would be taken to clear this.

158. A detailed monitoring programme and reporting framework would be developed post-consent through the relevant CSG and secured through the relevant CIMP. The monitoring programme would contain information on the type and frequency of monitoring surveys, the methodologies to be followed and the protocols for processing, sharing and managing of any data collected. Monitoring parameters would be selected based on the predefined project targets. Parameters that could be recorded include:

- Oyster habitat descriptors (e.g., bed extent, height and patchiness; oyster density, size spectrum and sex ratio);
- Oyster condition, fecundity and recruitment index;
- Gains in associated biodiversity and standing stocks; and
- Prevalence of diseases and INNS.

159. If necessary (and informed by the monitoring), a commitment to adaptive management could be made to ensure that re-seeding of the oyster bed was undertaken or that measures to help bed development and survival were implemented.

Table 5.3 Indicative timeline for creating a native oyster reef.

Phase	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Project milestones												
Consent	Q3/Q4 2025	Anticipated consent award										
	Q4 2028 onwards	Start of cable installation										
Reef creation works												
Phase 1	2024 onwards	Conduct desk based feasibility study and identify areas suitable for reef creation										
	2024 onwards	Engage with stakeholders, regulators and oyster restoration experts.										
	2025	Identify project delivery partners.										
	2024 onwards	Draft reef creation strategy including objectives, targets, proposed restoration area										

Phase	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
		and deployment methods										
	2024 onwards	Contact potential suppliers of cultch and oysters										
Phase 2	Q1 2026	Set up CSG										
	Q1 to Q4 2026	Develop and finalise CIMP including project objectives, targets, reef deployment methods and monitoring and reporting protocols.										
	Q1 2027	Submit CIMP to SoS for approval										
	2026	Plan and conduct site survey. Analyse data and identify suitable sites for reef creation within										

Phase	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
		the area of search.										
	Q3/Q4 2026	Secure / pre-order cultch and oysters for reef construction phase and potential subsequent reseeding.										
Phase 3	Q4 2026 to Q2 2027	Develop biosecurity protocols in consultation with regulators and oyster restoration experts										
	Q2 2027 to Q2 2028	As required, clean and weather cultch for reef construction phase. Allow a minimum of 12 months for weathering										

Phase	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
		before placing cultch on the seabed.										
	Q2 2028	Reef construction: Deploy cultch and target number of oysters on the seabed at the reef creation site,										
Phase 4	2029 to 2033	Ongoing monitoring as detailed within the monitoring programme										
	2029 to 2033	Determine need of re-seeding based on monitoring data										
Licensing and regulation												
	2024 onwards	Liaison with licensing and permitting authorities to develop byelaw										

Phase	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
		to protect created oyster reef										
	2024 ongoing	Liaise with fishing industry to explore potential for voluntary fishing closures										
	Q3 to Q4 2027	Obtain Marine Licence for reef construction stage										

5.3.8 Funding

160. As described above, the creation of an oyster reef within the IDRBNR would require the Applicant to carry out a series of tasks during the planning and design phases, including ongoing discussions with stakeholders and restoration experts. In addition, a targeted site survey is likely to be required to finalise the restoration strategy once the final location has been identified. For the monitoring of the reef the assumption has been made that a single monitoring survey would be required per year for the duration of the Projects lifetime. Table 5.4 provides indicative costs associated with the measure. These costs are also included within the Compensation Funding Statement (document reference 7.9) which outlines how the Applicant and its ultimate parent companies would fund compensation measures should they be required.

Table 5.4 Indicative costs for creating a native oyster reef within the IDRBNR SAC

Cost estimate subcategories	Estimated costs
DEVEX	£250,000
CAPEX	£1,655,535
OPEX	£7,000,000
Total estimated cost	£8,905,535

5.4 Option 2: Creation of Blue Mussel Beds

161. It is proposed that the creation of blue mussel beds could provide compensation for an AEoI to the IDRBNR SAC, both in relation to Annex I biogenic reefs and Annex I sandbanks.

5.4.1 Evidence Base

162. Blue mussels are gregarious, suspension-feeding bivalves, which are common around European coasts from the high intertidal to the shallow subtidal down to about 30m water depth (Jones *et al.*, 2000; Knights, 2012). They can be found in a variety of settings, ranging from littoral estuarine sand and mudflats and sublittoral sediments to gravel, pebble and rocky shores and artificial structures such as piers and offshore oil platforms (Seed and Suchanek, 1992; Tyler-Walters, 2008).

163. Blue mussels can form dense beds on both hard and soft substrate, creating a multi-layered framework of mussels where individuals remain connected through their byssus threads (Buschbaum *et al.*, 2009). Such beds can completely cover the substratum, or they consist of a mosaic of smaller mussel patches of various size and shape separated by open spaces (Seed and Suchanek, 1992).

164. The presence of high densities of blue mussels builds the foundation of a three-dimensional habitat of high spatial complexity, which differs substantially from surrounding mussel-free areas (Seed and Suchanek, 1992). Silt, organic detritus and shell debris accumulate within the bed. In this way, blue mussel beds modify sedimentary habitats and provide a habitat for a diverse community of animals and plants; living on, within or under the bed (e.g., Buschbaum *et al.*, 2009; Fariñas-Franco *et al.*, 2014; Saurel *et al.*, 2004). Mussel beds can also stabilise the sediment, stimulate the recycling of nutrients, and improve water quality by removing pollutants from the water column (Seed and Suchanek, 1992; Saurel *et al*., 2004). A range of age classes is an important indicator of mussel recruitment and growth.

165. At present, intertidal and subtidal blue mussel beds that might qualify as biogenic reefs are known to occur at several coastal and estuarine locations in the UK, including the Exe Estuary, the Solway Firth and The Wash in England, the Burry Inlet in Wales, Loch Foyle in Northern Ireland, and the Dornoch and Cromarty Firths in Scotland (Fariñas-Franco *et al.*, 2014). The Wash contains large commercial beds, which predominantly occur on intertidal flats along the lower shore (Dare *et al.*, 2004). Data on the ability of blue mussels to form stable subtidal beds within the region are limited. Commercial dredging for seed mussels takes place within the Inner Dowsing area of the IDRBNR SAC (JNCC and Natural England, 2010). Blue mussels have been found at several other locations within the IDRBNR SAC (JNCC and Natural England, 2010). Moreover, mussels were recorded across the western flanks of the Silver Pit to the north of the SAC (Tapping *et al.*, 2011). Similar to observations in the IDRBNR SAC (JNCC and Natural England, 2010), mussels at the Silver Pit occurred alongside aggregations of *S. spinulosa*, supporting the view that both species occupy very similar environmental niches (Reise and Schubert, 1987; Tapping *et al.*, 2011).

5.4.2 Delivery Process

166. The blue mussel bed creation project would be developed and delivered in close collaboration with stakeholders, regulators and restoration practitioners.

167. Should this compensation measure be adopted, the overall aim of the compensation measure would be to create subtidal blue mussel beds covering at least 17,280m^2 (assuming a 3:1 ratio) within the IDRBNR SAC if compensating for Annex I sandbanks and 4.63km^2 if compensating for Annex I *S. spinulosa* reef. The delivery process would be developed considering the following issues pertaining to blue mussel bed creation:

- Reef creation strategy (e.g., goals, stocking densities, bed structure, deployment methods);
- Project logistics and permit requirements; and
- Monitoring and adaptive management.

168. Clear objectives and targets will be set during the planning phase during development of the relevant CIMP with the stakeholder steering group to identify how the reef creation will deliver the required compensation and how its progress will be measured and evaluated. This would need to include key strategies, activities and expected outcomes. In general, objectives and targets for blue mussel bed creation may be set around the following aspects:

- Target blue mussel population structure (e.g., mortality, growth rates);

- Target structural reef attributes (e.g., bed size, complexity, fragmentation, vertical relief);
- Associated reef communities (e.g., diversity, biomass) and functions;
- Target timelines to achieve creation goals;
- Target monitoring programme;
- Reporting and communication framework; and
- Project partners and stakeholder engagement strategy.

169. Further consultation with delivery partners and stakeholders would be required to determine and agree appropriate objectives and targets, and this would form part of the relevant CIMP post-consent.

5.4.3 Site Selection and Scale

170. One of the principal challenges for blue mussel bed creation projects is identifying locations suitable to support self-sustaining mussel populations. The first step of the blue mussel creation strategy was therefore an initial feasibility analysis to evaluate the suitability of the IDRBNR SAC for the occurrence and survival of blue mussel beds. This assessment focused on providing information about the existing environmental conditions within the SAC, including its structural components and physio-chemical characteristics. Potential suitable locations for mussel bed development were then identified through habitat suitability mapping based on the known habitat requirements of blue mussel and available environmental data within the SAC.

171. Table 5.5 shows the environmental variables important for the development of subtidal blue mussel beds. Key factors for the survival of beds, in particular in their early phase, are the level of predation and physical disturbance (e.g., Capelle *et al.*, 2017; Dare *et al.*, 2004; Kristensen and Lassen, 1997). The reproduction of blue mussels is influenced by water temperature, and larval settlement and recruitment is mainly dependent on substratum availability, climatic factors, hydrodynamic processes and post-settlement mortality (e.g., Maguire *et al.*, 2007; Saurel *et al*., 2004).

Table 5.5: Key environmental factors for the development of subtidal blue mussel beds. Parameters included in the habitat suitability analysis are identified below (those not considered further at this stage are typically associated with lack of resolution/data

Environmental factor	Range	Importance	References	Mapped
Abiotic				
Substratum	Mixed and coarse sediments; sands and muds considered less optimal	Essential	Hendrick *et al.* (2011); MMO (2019)	Yes, using EUSeaMap (2021); higher resolution maps needed to refine areas of search
Substrate suitability for settlement	Spat may settle directly onto adult beds or settlement may occur in two phases whereby spat first settle on hard substrata or filamentous substrata such as algae and hydroids and then settle on hard substrata during a secondary settlement phase; settlement appears to be accelerated through the presence of other mussels.	Essential	Maguire *et al.* (2007); Saurel *et al.* (2004)	Yes, using EUSeaMap (2021); higher resolution maps needed to refine areas of search
Wave exposure	Extremely exposed to extremely sheltered	Desirable	MMO (2019)	No; lack of data
Current velocity	Optimal 0.5-1.5m/s; suboptimal 0.17-0.5m/s and 1.5-3.1m/s	Essential	MMO (2019)	Yes; but may need to be revisited comparing different threshold levels

Environmental factor	Range	Importance	References	Mapped
Water depth	Up to 30m (most data and studies are from shallow subtidal beds < 10-15m)	Essential	Hendrick *et al.* (2011); Jones *et al.* (2000); Knights (2012); Smaal *et al.* (2021)	Yes
Physical disturbance	No seabed disturbing activities (e.g., aggregate dredging, demersal fishing)	Essential	Hendrick *et al.* (2011)	Yes
Minimum Sea Surface Temperature (SST)	Optimal > 8°C; sub-optimal -4-8°C; not suitable < -4°C	Essential	MMO (2019)	No; water temperature is consistent for the whole SAC
Maximum SST	Optimal 25-30°C; not suitable > 40°C	Essential	MMO (2019)	No; water temperature is consistent for the whole SAC
Minimum salinity	Optimal > 18PSU; sub-optimal 4-18PSU; not suitable < 4PSU	Essential	MMO (2019)	No; salinity is >20PSU across the whole SAC
Maximum salinity	Optimal 25-30PSU; not suitable > 40PSU	Essential	MMO (2019)	No; salinity is consistent for the whole SAC
Dissolved oxygen	Optimal > 7mg/l; not suitable < 1.5mg/l	Essential	MMO (2019)	No, but all areas likely to be suitable
Biotic				
Predator abundance	Low Particularly important for the survival of juvenile mussels. Main blue mussel	Desirable	Capelle *et al.* (2017); Jones *et al.* (2000); Reusch and Chapman (1997)	No; factor not yet considered

Environmental factor	Range	Importance	References	Mapped
	predators in subtidal areas are starfish (e.g., *A. rubens*), crabs (e.g., *C. pagurus*) and flatfish.			
Connectivity with naturally occurring larval broodstook	Size and proximity of existing adult mussel beds; larval retention rates and dispersal pathways	Desirable	Saurel *et al*. (2004)	No; naturally occurring larval broodstook are present within the Wash; existing hydrodynamic data/ models could be used to assess connectivity
Intra- and interspecific competition	Competition for space and food	Desirable		No; factor not yet considered
Food concentration (Chlorophyll a)	Minimum concentration of 0.5-1µg/l; optimal and suboptimal levels unknown, potentially optimal >6µg/l; threshold levels depend on food type and turbidity	Desirable	MMO (2019)	No; lack of data
Absence of high impact invasive non-native species (INSS)	E.g., Pacific Oyster (*C. gigas*), American slipper limpet (*C. fornicata*), Japanese seaweed (*Sargassum muticum*)	Desirable	Mainwaring *et al*. (2014); Nehls (2009)	No; factor not yet considered

172. The results of the habitat suitability assessment based on a subset of key environmental variables are presented in Figure 5.5 to Figure 5.7 and the methodology adopted is detailed in Appendix 2. Considering the concerns from Natural England regarding avoidance of areas that would impact habitat availability for *S. spinulosa*, the area for the delivery of a biogenic reef has been drawn to exclude any known areas of *S. spinulosa* reef, or the "areas to be managed as reef" within the SAC.

173. Exclusion areas also include the location of existing infrastructure and licenced aggregate dredge sites, as these are regarded as areas that would need to be avoided (Figure 5.6 and Figure 5.7). Human activities, in particular those that impact the seabed, are a significant threat to blue mussels and their habitats. Therefore, any reef creation work would be undertaken outside the influence of pressures that have the potential to adversely affect blue mussel beds.

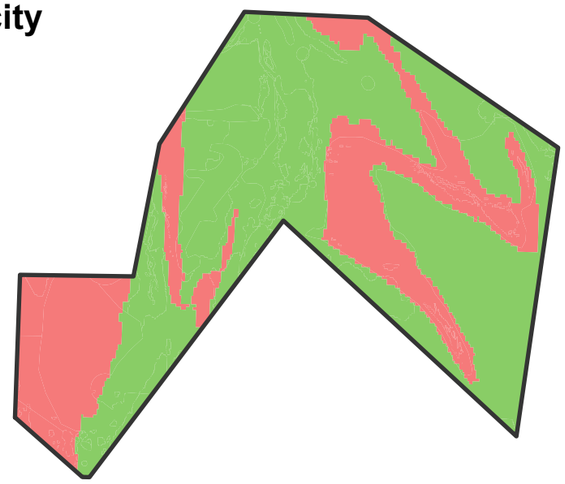
174. Based on the evidence combined, mussel reef creation search areas have been identified (Figure 5.7). As detailed within the review of commercial fisheries activity within the IDRBNR SAC (Appendix 1), the SAC is mainly targeted by UK fishing vessels using potting gear, with potting likely to occur throughout the SAC. Beam trawling is likely to take place in the nearshore portion of the SAC, inside the 6nm limit. The Applicant would commence discussions with the MMO to explore options to protect any created reef from fishing pressures, should that be considered necessary.

175. A targeted site-survey (undertaken post-consent) will likely be required prior to any creation activities to ground-truth the habitat suitability modelling and to inform deployment decisions. In addition, potential recruitment limitations will need to be assessed, preferably through model simulation, to provide information on the dispersal pathways of blue mussel larvae within the region and to assess the potential of any planted mussel beds to sustain themselves in the long-term.

176. Another key element that would require careful consideration during the planning phase is the lifespan of wild mussel beds. Blue mussel beds are typically fragmented and dynamic (Fariñas-Franco *et al.*, 2014); patches with mussels are formed, altered and broken down as a result of a wide range of factors such as recruitment, predation, growth, disease and changing environmental conditions (e.g., Dare *et al.*, 2004; de Paoli *et al.*, 2015; Svane and Ompi, 1993). For example, many of the subtidal mussel beds studied in the Wadden Sea are transient with lifespans ranging from one to three years (e.g., Capelle *et al*., 2017; Troost *et al*., 2022). Mature beds comprising older individuals tend to be more stable, showing life spans of > 5 years (Ricklefs *et al*., 2020).

177. Other natural drivers linked to mussel bed survival and growth include parasitic infestation, toxins, variation in spatfall and recruitment success, and the destabilisation of beds by tidal forces, winter storms or the build-up of mussel mud deposits (e.g., Saurel *et al*., 2004). These factors that have the potential to influence the long-term establishment of blue mussel beds within the IDRBNR SAC, will be considered further if this measure is taken forward post-consent.

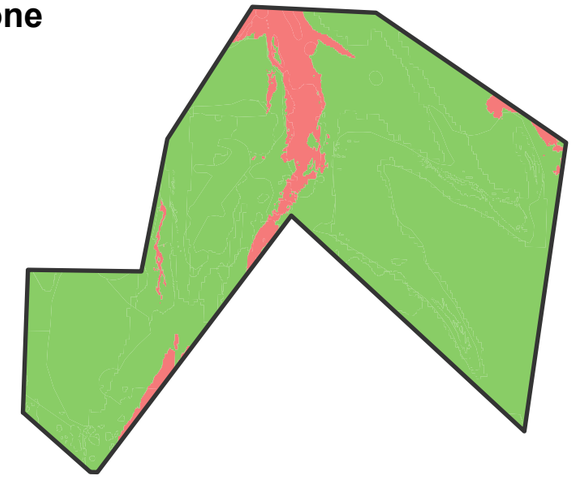
Current Velocity (Energy)



Preferred (Moderate energy)
Nonpreferred (High Energy)

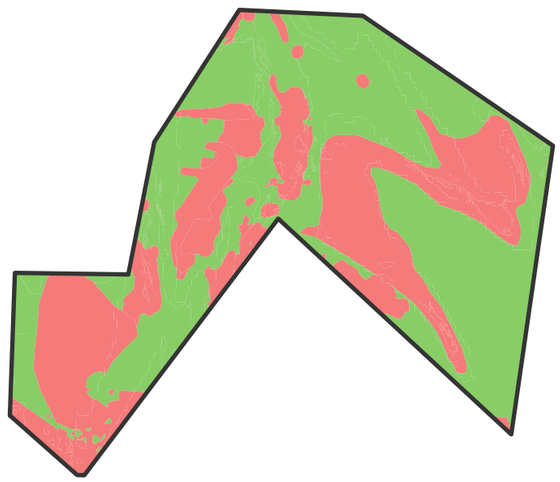
Biological Zone

N



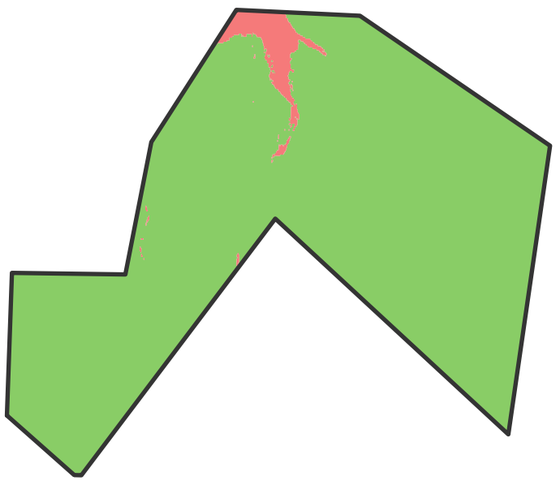
Preferred (Lower eulittoral, Mid eulittoral, Sublittoral fringe, Upper eulittoral, Upper infralittoral)
Nonpreferred (Other)

Substratum / Habitat



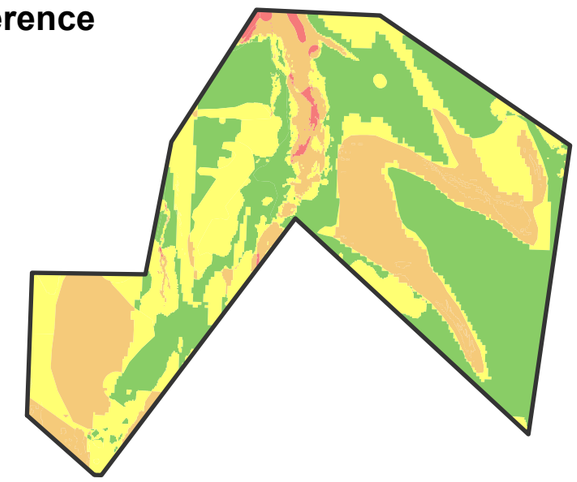
Preferred (Mixed, firm sediments, sands, muds or hard substratum)
Nonpreferred (Other)

Water Depth



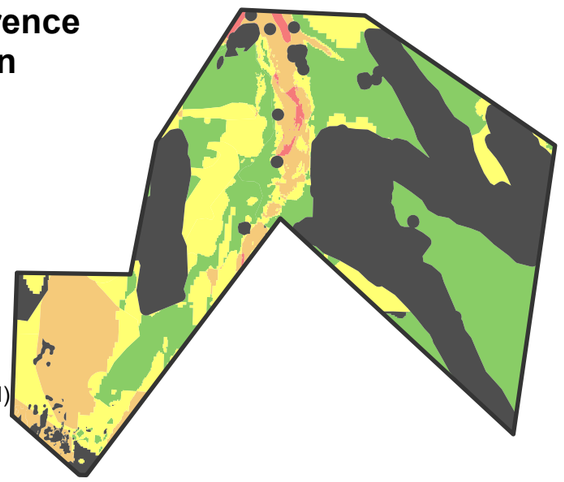
Preferred (0 - 30m)
Nonpreferred (30m+)

Habitat Preference



Least Preferred
Most Preferred

Habitat Preference with Exclusion



Excluded (Annex I)
Least Preferred
2
3
Most Preferred

Legend

Inner Dowsing, Race Bank and North Ridge SAC

Coordinate System: WGS 1984 UTM Zone 31N

0 10 20 km

Scale: 1:500,000

A3 Page Size

Blue mussel habitat suitability modelling for the Inner Dowsing, Race Bank and North Ridge SAC

Figure 5.5

OUTER DOWSING OFFSHORE WIND

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Revision: 0.1

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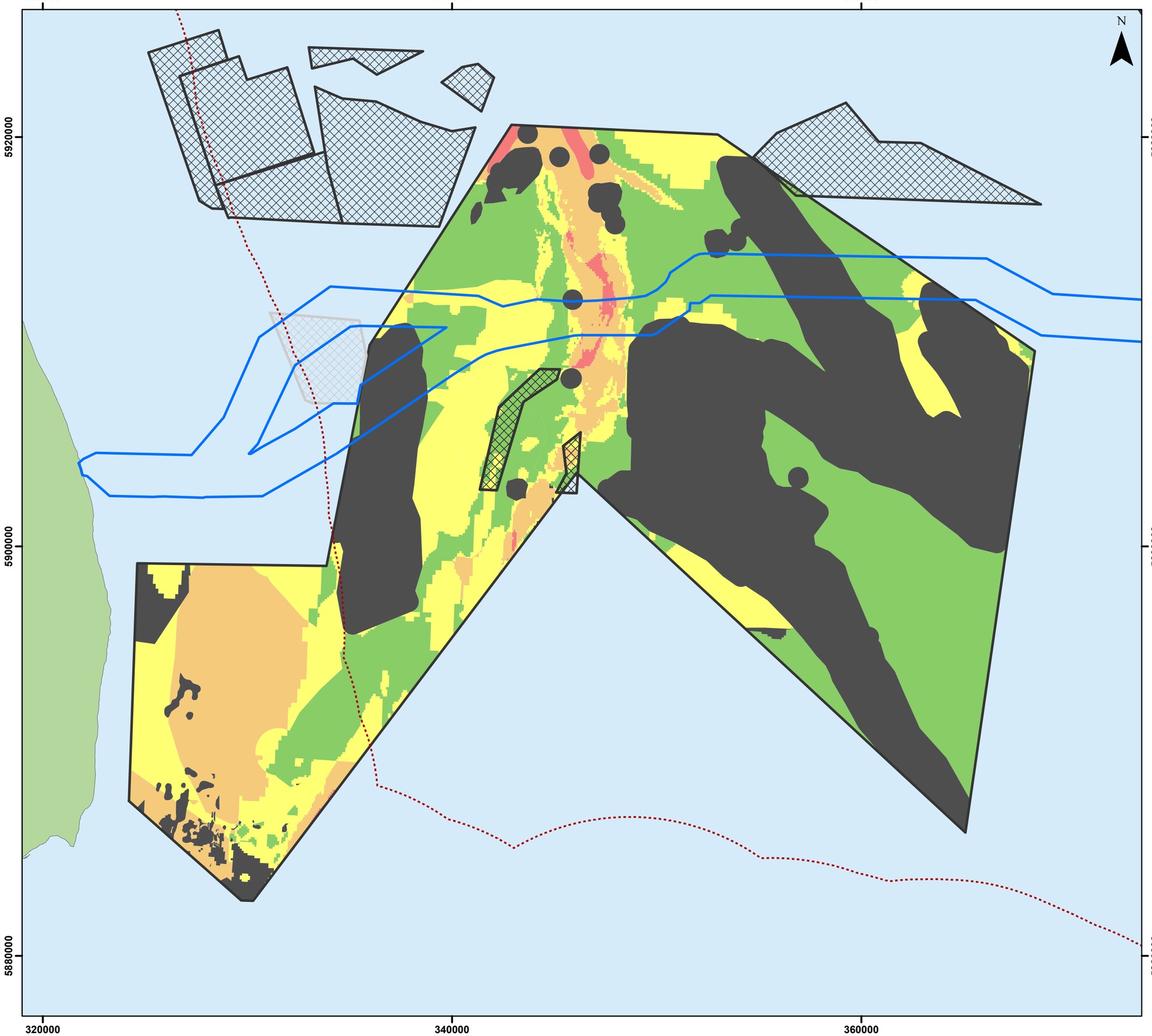


Legend

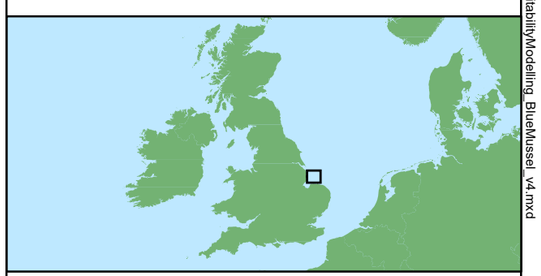
- Offshore Export Cable Corridor
- Inner Dowsing, Race Bank and North Ridge SAC
- 6nm Limit

Aggregate Areas

- Production Agreement Area
- Exploration and Option Area

Blue Mussel Habitat

- Excluded
- Least Preferred
- Most Preferred



Coordinate System: WGS 1984 UTM Zone 31N

0 5 10 km

Scale: 1:175,000

A3 Page Size

Habitat suitability model for blue mussel in the Inner Dowsing, Race Bank and North Ridge SAC with exclusion zones for protected habitat

Figure 5.6

OUTER DOWSING OFFSHORE WIND

Date: 06/03/2024
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320000
340000
360000
5920000
5900000
5880000
N
Triton Knoll
Race Bank
Inner Dowsing
Lincs
Lynn
Sheringham Shoal Extension
Sheringham Shoal

Legend

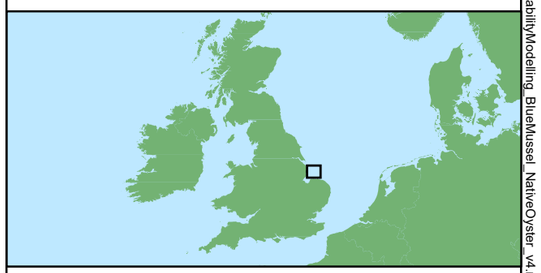
- Offshore Export Cable Corridor
- Biogenic Reef Restoration Search Area
- Inner Dowsing, Race Bank and North Ridge SAC
- 6nm Limit
- Offshore Wind Farm Sites
- Offshore Wind Farm Cable Agreements
- Open Disposal Area
- Power Cable - Active
- Pipeline - Active
- Pipeline - Not In Use

Aggregate Areas

- Production Agreement Area
- Exploration and Option Area

Blue Mussel and Native Oyster Habitat

- Most Preferred



Coordinate System: WGS 1984 UTM Zone 31N

0 5 10 km

Scale: 1:175,000

A3 Page Size

Preferred habitat in the Inner Dowsing, Race Bank and North Ridge SAC with exclusion zones for protected habitat and includes existing infrastructure

Figure 5.7

OUTER DOWSING OFFSHORE WIND

Date: 06/03/2024
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Revision: 0.1

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178. The reef creation project would aim to create self-sustaining blue mussel beds that provide ecological functions and ecosystem services similar to the *S. spinulosa* reef and/or sandbank habitat that is potentially lost. The beds should be of sufficient size and complexity to support long-term mussel survival, growth and reproduction.

179. Olsen's Piscatorial Atlas (1883) shows that blue mussels have historically been present along the Lincolnshire and North Norfolk coasts. If it is not feasible to create mussel beds within the IDRBNR SAC, they could instead be restored along the coast where they were once abundant. Under Defra's compensation hierarchy (2021), this would adhere to the second option as it would provide the same ecological function as the impacted feature; if necessary, in a different location (outside of the site boundary).

180. The target size of the mussel bed(s) to be created would be determined based on the predicted magnitude of long-term habitat loss from cable installation or protection measures, acceptable habitat compensation ratios, and the size required to establish healthy and viable beds.

181. As detailed within the Sandbank Compensation Plan (document reference 7.6.1) the predicted worst-case footprint of cable protection on sandbanks is 2,880m^2 for each of the two sandbank features to be affected within the IDRBNR SAC, leading to a total impact area of 5,760 m^2.

182. As detailed within the Biogenic Reef Compensation Plan (document reference 7.6.2), the maximum total area within the SAC that is expected to be disturbed by sandwave clearance, and therefore which could impact *S. spinulosa* reef, is approximately 4.63km^2 which equates to circa 0.55% of the total area of the SAC.

183. The definition of blue mussel reefs varies widely among European countries (Stounberg *et al*., 2024). The initial UK SAC project report on biogenic reefs (Holt *et al.*, 1998) defines biogenic reefs (including reefs formed by blue mussels) as “solid, massive structures which are created by accumulations of organisms, usually rising from the seabed, or at least clearly forming a substantial, discrete community or habitat which is very different from the surrounding seabed. The structure of the reef may be composed almost entirely of the reef building organism and its tubes or shells, or it may to some degree be composed of sediments, stones and shells bound together by the organisms.” The Wadden Sea Tri-lateral Monitoring and Assessment Program (TMAP) uses a similar definition for blue mussel beds, which are considered “benthic communities structured by blue mussels”, which “may consist of a spatially well-defined collection of more or less protruding smaller beds, which may be called patches, separated by open spaces (Nehls *et al.*, 2009). Mussel patches should be larger than 1m in diameter and located less than 25m apart to form part of a bed. Aggregations of mussels smaller than 1m in diameter should have an areal coverage of more than 5% to form part of a bed (Nehls *et al.*, 2009). Other European countries have used parameters such as minimum area, seabed mussel coverage, protrusion and stability to define biogenic bivalve reefs (Stoundberg *et al*., 2024).

184. For the compensation of *S. spinulosa* reef the Applicant is committed to providing habitat compensation at a ratio of 1:1 as the compensation measure is regarded as 'like for like' or '*taking full account of local circumstances where the risk to the feature is predicted to occur, delivered within or adjacent to the area affected by the plan or project'* (Defra, 2024).

185. For the compensation of Annex I sandbank, this strategy is lower on the compensation hierarchy i.e., comparable ecological function, different location and not like-for-like. The application of a compensation ratio of 3:1 would mean that an oyster reef of 17,280m^2 would need to be created to compensate for the loss of sandbank habitat.

186. However, any created reefs will have to be a certain size to be self-sustaining, and therefore to successfully deliver the compensation measure and limit repeated seeding, the size of the mussel beds may by necessity have to exceed any agreed ratio. Work on identifying adequate stocking densities to create a viable mussel reef is ongoing and will be progressed by the Applicant post-consent in consultation with restoration experts, if this measure is taken forward.

5.4.4 Creation Process

187. Experience from existing restoration trials and other relevant studies that have been undertaken on blue mussel beds in the UK and further afield would be used to inform appropriate methods for delivery and ensure that possible threats to creation are understood and appropriately managed.

188. The delivery of the mussel bed creation project would likely follow a phased approach, which may include the following elements:

- The collection or development of juvenile (seed) mussels;
- The growing of mussel seed to a size that would provide a partial predation refuge; and
- The relocation of the mussels to suitable subtidal locations within the IDRBNR SAC.

189. Once the upfront works are complete, a suitable marine contractor would be appointed to deploy the mussel seed onto the desired location (equating to the delivery of this measure). Following the deployment of the mussels, monitoring and any necessary adaptive management would occur.

5.4.5 Project Logistics

5.4.5.1 Availability of mussels

190. Seed mussels (from which beds can be developed) could be collected from mussel farms or wild beds such as those in the Wash, or they could be developed from suspended collectors or hatchery production (Kamermans *et al*., 2002; Maguire *et al*., 2007; Saurel *et al*., 2004). Alternatively, to limit the environmental impacts that would arise from collecting seeds from naturally occurring beds, suitably sized mussels for transplantation could be sourced directly from mussel farms. The cultivation of blue mussels is well established in the UK, with farms using both on bottom cultures and suspended culture techniques (MMO, 2019). On-bottom cultivation involves the dredging of small juvenile mussels from known beds and relaying them in more suitable areas, where they are then grown to harvestable sizes over 18-36 months (MMO, 2019). In suspended cultures, mussels are grown on submerged systems such as ropes until they are harvested for commercial use typically after about 2-3 years (MMO, 2019). Most of the blue mussel production in England, Wales and Northern Ireland, including those in the Wash and along the North Norfolk coastline rely on on-bottom cultivation, while mussel production from suspended systems is currently centred in Scotland (MMO, 2019). Efforts to expand mussel farming using suspended systems in England and Wales are increasing, with the first offshore rope grown mussel farm established by Offshore Shellfish Ltd.[8] in Lyme Bay, Devon. All methods for sourcing mussels for transplantation would be explored, and a full feasibility assessment would be carried out for the chosen method.

5.4.5.2 Licensing and regulation

191. The Applicant is proposing to consent the development of a biogenic reef through the DCO for the Project, with details of the methodologies proposed for deployment, where required, presented within the Project Description (document reference 6.1.3) and relevant impacts assessed within the technical chapters of the ES and within the RIAA. Final details of the proposed deployments will be agreed with stakeholders through consultation and subject to sign off by the SoS.

[8] https://offshoreshellfish.com/

192. To ensure the protection of the created reef, the Project is exploring multiple options, including extensions of existing, or sponsoring the development of new, byelaws to restrict other marine activities (fishing, cables, pipelines, etc.) over the reef. The Applicant has commenced discussions with the MMO to understand the byelaw process (see Table 1.1 within the Sandbank Compensation Plan (document reference 7.6.1) and the Biogenic Reef Compensation Plan (document reference 7.6.2)). It is understood the MMO supports the possible proposals of byelaw extension/creation if SNCB's support the cause for byelaws to be implemented, subject to the appropriate consultation and governance processes as outlined in paragraph 148 of this document. The Applicant is also exploring alternative options for protection of any sites, including voluntary agreements with fishermen. In addition, the Applicant would commence consultation with TCE for an Agreement for Lease for any area of created reef to ensure its protection from other infrastructure developments if this measure was to be taken forwards. Authorisation would also be sought from the Aquaculture Business Authorisation to handle and translocate blue mussels.

5.4.6 Delivery Timeframe

193. The programme of delivery to create a blue mussel reef would be approved prior to the commencement of the offshore cable protection installation works. The implementation of the compensation measure would then be conducted in accordance with the programme provided within the compensation plan and post-consent CIMP document. The relevant CIMP would be developed and finalised in consultation with members of the relevant CSG and submitted to the SoS for approval in accordance with the DCO.

194. Implementation of the compensation measure would follow a phased approach, with each phase involving several work-streams and tasks. An indicative timeline for the delivery of the compensation measure is provided in Table 5.6. It is anticipated that the Applicant will continue to develop and refine the implementation plan through consultation with stakeholders, regulators and bivalve reef restoration experts. It is anticipated, that if granted consent, the Project will be operational by 2030, with offshore construction potentially commencing in 2027 and preparatory works undertaken from 2026 at the earliest. An indicative construction programme is provided in document 6.1.3 of the Environmental Statement which has been used to inform the detailed assessments as required (including in-combination and cumulative assessments). The delivery of compensation measures and associated activities could commence prior to the start of the construction phase of other offshore elements of the Project. Note that these dates are indicative at this stage.

195. It is anticipated that the preparatory works associated with identifying site(s) and developing/sourcing an appropriate amount of seed mussel, appointing competent third parties to undertake the field-based components of the work, etc. would take about three years, after which bed(s) could be laid.

196. Phase 1 (Planning phase) covers any preparatory work until the time of consent and includes the following:

- **Completion of the feasibility assessment**: Work on the feasibility analysis will commence post-consent, if required, to determine which areas within the IDRBNR SAC would be most suitable for the creation of mussel beds based on habitat requirements, the footprint of human pressures and the feasibility of implementing reef protection measures (e.g. through byelaws). This work will involve an extension to the current habitat suitability mapping to include further variables known to affect blue mussel distribution. The need for modelling to assess larval dispersal pathways and retention rates will be investigated, and the review of past restoration projects will be continued to identify optimal reef creation methods and to develop restoration targets and monitoring parameters. The results of the feasibility study will also inform the scope of any further survey work that would be required to finalise site selection and deployment decisions.
- **Engagement with restoration practitioners and mussel farmers**: Advice from bivalve reef restoration experts and mussel farmers will be sought to determine how the proposed reef could best be created. Topic areas that require a better understanding include optimal seeding methods (e.g. mussel sizes and sources) and stocking densities, measurable reef indicators, best practice monitoring protocols (e.g., timing of mussel deployment, monitoring frequency) and potential risks and uncertainties. Options for project partnerships or inclusions of experts in the CSG will be explored at this stage.
- **Setting objectives and formulating targets**: It is anticipated that ecological restoration objectives would be drafted following completion of the feasibility analysis and in consultation with restoration practitioners. Furthermore, potential timelines to reach these objectives would be identified along with suitable methods to monitor and evaluate reef development.
- **Contractors and costings**: It is anticipated that discussions with potential suppliers of mussel seeds will begin pre-consent to determine lead times, potential costs and logistics. Suitable marine contractors to deploy the mussels and undertake monitoring would also be identified.

197. Phase 2 (Design phase) would involve the finalisation of the programme of works including decisions on reef design and deployment and associated monitoring and reporting. In addition, a set of tasks required prior to the translocation of mussels would be completed.

- **Governance and CIMP**: Following consent and approval of the Compensation Schedules, the Applicant would finalise the relevant CIMP, which will be informed by the works undertaken during the pre-consent planning phase. The CIMP would be developed in consultation with restoration experts and members of the relevant CSG.
- **Finalising restoration strategy**: The final restoration strategy including objectives and targets would be detailed within the CIMP along with the proposed methods to construct the blue mussel reef. This would be developed by the Applicant through regular discussions with the CSG and any project delivery partners identified during Phase 1.

- **Site survey**: A targeted survey covering the chosen reef creation area is likely to be required prior to the deployment of mussel to confirm the suitability of this area for reef development. The survey may need to include the collection of acoustic and sediment data to characterise seabed conditions and identify suitable reef construction sites and deployment methods. Results of the site-survey would feed into finalisation of the CIMP. It is anticipated that the site-specific survey would need to take place to ensure sufficient time remains to finalise the CIMP and progress with implementing the compensation measure within the delivery timeframe.
- **Permits and licensing**: Work to obtain licences and permits required to construct and monitor the reef are ongoing and would continue throughout the planning and design phases.
    - The implementation of the selected method for protection of the reef will be progressed in parallel with the reef creation works and while partially independent of the reef creation works, will be informed by the progress of that work stream.
    - It is likely that the Applicant will progress with multiple options for the protection of the reef simultaneously, as it expected that, where a byelaw implemented by the MMO is feasible, the process is expected to take up to three years to complete; as such, the feasibility of implementing interim measures such as voluntary agreements with fishermen are currently being explored by the Applicant.
    - Discussions with TCE will be progressed with the intention to obtain an AfL prior to the establishment of the reef.

198. Phase 3 (Reef creation phase) would commence following approval of the CIMP by the SoS. This phase would involve the deployment of blue mussels at the chosen location within the IDRBNR SAC. Mussels may be deployed in a patchy distribution to mirror the structure of natural blue mussel beds (Kristensen and Lassen, 1997). Visual characterisation of the seabed following deployment of the mussel may be required to provide a baseline for the physical structure of the established beds. The chosen deployment strategy would be in line with the best available scientific evidence and subject to agreement with the CSG. Engagement with the relevant CSG and the project delivery partners would continue throughout this phase. Once the seed is laid, establishment works would be complete, and the bed will be subject to ongoing monitoring.

199. The final phase of the delivery programme would comprise any monitoring and adaptive management. Post-construction surveys covering the reef creation site would be conducted to monitor the development of the mussel beds and assess the overall performance of the compensation measure. The monitoring programme including sampling techniques and frequency would be developed in Phase 2 in consultation with the CSG. The monitoring programme would be regularly reviewed and adapted, as required, during the lifetime of the project. For the development of the delivery timeline presented in Table 5.6, the assumption has been made that up to three monitoring surveys would be required.

200. Once suitable sites within the reef creation area are identified and mussel translocated to these sites, monitoring would be undertaken to help reduce the risk of the mussel reef failing to develop. This would include the measurement of predefined reef indicators, local environmental conditions and monitoring for invasive species. Should threats to biosecurity be identified (for example an infestation of INNS) action would be taken to clear this.

5.4.7 Monitoring and Adaptive Management

201. The monitoring programme and associated reporting framework would be developed post-consent through the CSG and secured through the CIMP. The monitoring programme would contain information on the type and frequency of monitoring surveys, the methodologies to be followed and the protocols for processing, sharing and managing of any data collected. Monitoring parameters would be selected based on the predefined project targets and may include the following:

- Mussel bed habitat descriptors (e.g., bed extent, height and patchiness, mussel density, size structure and biomass);
- Annual recruitment;
- Gains in associated biodiversity and standing stocks; and
- Prevalence of diseases and INNS.

202. If necessary (and informed by the monitoring), a commitment to adaptive management could be made to ensure that re-seeding of the bed was undertaken or that measures to help bed development and survival were implemented.

Table 5.6 Indicative timeline for recreating blue mussel beds

Year from consent	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Project milestones												
Consent	Q3/Q4 2025	Anticipated consent award										
	Q4 2028 onwards	Start of cable installation works										
Reef creation works												
Phase 1	2024 onwards	Conduct desk-based feasibility study and identify areas suitable for reef creation										
	2024 onwards	Liaise with stakeholders, regulators and oyster restoration experts to develop and implement recreation strategy.										
	2025	Identify potential project delivery partners.										
	2024 onwards	Draft reef creation strategy including objectives, targets, proposed restoration area and deployment methods										
	2024 onwards	Contact potential suppliers of cultch and oysters										
Phase 2	Q1 2026	Set up CSG										
	Q1 to Q4 2026	Develop and finalise CIMP including project objectives, targets, reef deployment										

Year from consent	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
		methods and monitoring and reporting protocols.										
	Q1 2027	Submit CIMP to SoS for approval										
	2026	Plan and conduct site survey. Analyse data and identify suitable sites for reef creation within the area of search.										
	Q3/Q4 2026	Secure/pre-order seed mussels										
Phase 3	Q4 2026 to Q2 2027	Develop biosecurity protocols in consultation with regulators and shellfish restoration experts.										
	Q2/Q3 2027	Establish mussel beds within the reef creation area. Bed size, structure and distribution and optimal timings of deployment to be determined. As required, conduct video/acoustic survey to establish baseline for deployed beds.										
Phase 4	2029 to 2033	Ongoing monitoring as detailed within the monitoring programme										

Year from consent	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
	2029-2033	Determine need of re-seeding based on monitoring data										
Licensing and regulation												
	2024 onwards	Liaison with licensing and permitting authorities to develop byelaw to protect created oyster reef										
	2024 onwards	Liaise with fishing industry to explore potential for voluntary fishing closures										

5.4.8 Funding

203. As described above, the creation of blue mussel beds within the IDRBNR would require the Applicant to carry out a series of tasks during the planning and design phases, including ongoing discussions with stakeholders and restoration experts. In addition, a targeted site survey is likely to be required to finalise the restoration strategy once the final location has been identified. For the monitoring of the reef the assumption has been made that a single monitoring survey would be required per year for the duration of the Projects lifetime. Table 5.7 provides indicative costs associated with the measure. These costs are also included within the Compensation Funding Statement (document reference 7.9) which outlines how the Applicant and its ultimate parent companies would fund compensation measures should they be required.

Table 5.7 . Indicative costs for creating a blue mussel reef within the IDRBNR SAC

Cost estimate subcategories	Estimated costs
DEVEX	£250,000
CAPEX	£1,655,535
OPEX	£7,000,000
Total estimated cost	£8,905,535

6 Anthropogenic Pressure Removal – Redundant Infrastructure Removal

204. The removal of redundant infrastructure across sandbank features could provide compensation for an AEoI to the IDRBNR SAC in relation to Annex I sandbanks.

6.1 Overview

205. The removal of redundant infrastructure is included within the suite of measures for the compensation for Annex 1 sandbank. This is the removal of infrastructure that is no longer in use, i.e. subsea cables or oil and gas infrastructure, and which has been installed on sandbank habitat within a SAC designated for sandbanks in the region (or, if no suitable infrastructure is identified within an SAC, then on similar habitat within the region).

206. This measure would demonstrate that any sandbank habitat loss within the IDRBNR SAC is compensated for by 'reinstating' or 'cleaning' an area (freeing up a previously lost area) of sandbanks within the region. Whilst the measure is outside the boundary of the IDRBNR SAC, it would maintain the ecological coherence of the sandbank network in the region. The reinstated habitat would also be considered to be of high environmental value to other species of conservation importance.

6.2 Evidence Base

207. Natural England has advised that compensation measures which reduce/remove anthropogenic pressures that impact upon the favourable conservation status of the SAC features are likely to deliver the compensation requirements from an ecological perspective. This could include the removal of redundant infrastructure which would otherwise remain in situ. However, unless the anthropogenic infrastructure is surface laid, exposed, or protected at the surface, Natural England do not consider the removal, per se, to provide benefits to the affected site or feature and, therefore, to constitute compensation.

208. The Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) (see OPRED, 2023) has highlighted the issues relating to the removal of redundant oil and gas infrastructure, specifically that this would reverse decisions made based on comparative assessments where the outcome of 'leave in-situ' has been reached after consideration of aspects such as safety, risk of technical failure, impact on the environment, impact on other users of the sea and economic factors. In addition, there is a lack of suitable in-situ surface laid infrastructure that could potentially be removed; the principle which governs pipeline decommissioning is that the end state is not a hazard to other marine users, the majority of pipelines are trenched and buried or rock protected where surface laid. In the event that in-situ pipelines become re-exposed and have significant free-spanning sections that could represent a risk to other marine users, then there is an obligation for the asset owner to either rock protect or remove these sections. This means that there is a lack of historic infrastructure available currently or that is likely to become available for removal in the future.

209. An exercise by OPRED indicates that there is only a single surface laid pipeline within an MPA, which is located West of Shetland and is rock protected. There are not known to be any surface laid, decommissioned pipelines within SACs in the southern North Sea (see OPRED, 2023). There would also be a need to transfer the oil and gas infrastructure to the Project, which would present significant procedural and liability issues on which there is currently no certainty whether this would be possible to achieve within the necessary timeframes, if at all. Furthermore, in recent years oil and gas infrastructure is being reinstated for carbon capture and storage projects. Due to these complexities, the removal of oil and gas infrastructure is not considered feasible as a compensation measure at this time and is not considered further within the Projects proposals.

210. The focus of this measure will be on the removal of disused telecommunications 'telecom' cables. Section 6 presents an initial search of the SACs within the southern North Sea with protected sandbank features and any associated disused telecom cables.

6.3 Delivery Process

211. As an initial step in the process of removing redundant infrastructure, the Applicant will identify candidate materials and determine the feasibility of removal. Following subsequent consultation with relevant stakeholders, including Natural England, removal can then be undertaken.

212. The overall process is likely to require six steps as described below.

- Step 1: The Applicant will determine the suitable infrastructure for removal and will progress discussion with asset owners to determine the legal requirements or restrictions on its removal. The aim is to obtain agreement from owners on the removal of disused infrastructure;
- Step 2: A feasibility study would be required to determine the practicalities of how the removal of the candidate infrastructure could be safely achieved including typical equipment used. This will also include an assessment of likely consents and costs associated with removal. And an indication of whether the cables are likely to be buried deeply or not using available datasets.
- Step 3: Liaison with regulators and SNCBs would be undertaken to determine which candidate infrastructure can be removed, and removal methodologies adopted that will incur minimal environmental disturbance. Any habitat disturbance effects would also be investigated in the instance that a structure has been colonised. Engagement with seabed users/owners would also be required;
- Step 4: A detailed description of best practice and operational challenges during cable recovery operations, potential consequences of poorly clearing the cables and associated risks will be produced. In addition, based on available data a more detailed list of cable types, cable materials and any other installation information which may assist the clearance work will be undertaken;
- Step 5: Infrastructure would be removed; and
- Step 6: Monitoring of the seabed following removal to understand ecological recovery.

213. Natural England is supportive of the consideration of removing surface laid infrastructure from the IDRBNR SAC or wider Marine Protected Area network, although they suggest that there is currently no evidence that telecoms cables are causing significant anthropogenic impact to the Annex I sandbank features within the National Sites Network and therefore that their removal would reduce this.

214. The final form and process of any removal would need to be agreed in consultation with Natural England. Once the method for removal has been agreed, a further marine licence would be required for the removal works. The timescales associated with the development of the detailed approach to delivering this measure exclude the option of including the permissions for these works within the DCO Application for the Project.

6.3.1 Site Selection and Scale

215. OPRED (OPRED, 2023) has highlighted the issues relating to the removal of redundant oil and gas infrastructure, specifically that this would reverse decisions made based on comparative assessments where the outcome of 'leave in-situ' has been reached after consideration of aspects such as safety, risk of technical failure, impact on the environment, impact on other users of the sea and economic factors. In addition, there is a lack of suitable in-situ surface laid infrastructure that could potentially be removed; the principle which governs pipeline decommissioning is that the end state is not a hazard to other marine users, the majority of pipelines are trenched and buried or rock protected where surface laid. In the event that in-situ pipelines become re-exposed and have significant free-spanning sections that could represent a risk to other marine users, then there is an obligation for the asset owner to either rock protect or remove these sections. This means that there is a lack of historic infrastructure available currently or that is likely to become available for removal in the future.

216. An exercise by OPRED indicates that there is only a single surface laid pipeline within an MPA, which is located West of Shetland and is rock protected. There are not known to be any surface laid, decommissioned pipelines within SACs in the southern North Sea (see OPRED, 2023). There would also be a need to transfer the oil and gas infrastructure to the Project, which would present significant procedural and liability issues on which there is currently no certainty whether this would be possible to achieve within the necessary timeframes, if at all. Furthermore, in recent years oil and gas infrastructure is being reinstated for carbon capture and storage projects. Due to these complexities, the removal of oil and gas infrastructure is not considered feasible as a compensation measure at this time and is not considered further within the Projects proposals.

217. The focus of this measure will be on the removal of disused telecommunications 'telecom' cables. Table 6.1 presents an initial search of the SACs within the southern North Sea with protected sandbank features and any associated disused telecom cables.

218. An initial search for redundant infrastructure in the IDRBNR SAC has indicated that there is no suitable infrastructure in the site and therefore the area of search has been widened to identify suitable materials for removal within SACs with protected sandbank features. A number of candidate examples have been identified within other SACs with protected sandbank features, as presented within Table 6.1.

219. On the basis that this would be a direct like-for-like replacement of equivalent habitat, a 1:1 ratio is considered appropriate.

220. It is noted by the Applicant that, should the SoS determine that compensation is required and that this should, in part, or wholly be in the form of removal of redundant infrastructure, the SoS may also set the scale of compensation. In the case of Hornsea Three, for example, the SoS inserted a condition within the DCO which dictated that a spatial scale of 41.8ha was required within the NNSSR SAC.

221. Hornsea Three received consent with the condition stating that the project must subject an area of 41.8ha to removal of marine debris. This scale was determined to provide compensation for the worst-case scenario of the loss of up to 418,404m^2 (approximately equivalent to 41.80ha) of habitat within the NNSSR SAC due to cable protection (BEIS, 2020). This represents a 1:1 ratio of effect to compensation.

222. When determining the ratio to be applied, consideration needs to be given to the area of the features affected by cable protection material and the corresponding compensation realised from removal of redundant infrastructure. It should be noted that, based on the evidence provided, it is possible that overcompensation would be an option based on the volumes of cables identified within sandbank features.

223. This measure would demonstrate that any sandbank habitat loss within the IDRBNR SAC is compensated for by 'reinstating' or 'cleaning' an area (freeing up a previously lost area) of sandbanks within the region. Whilst the measure is outside the boundary of the IDRBNR SAC, it would maintain the ecological coherence of the sandbank network in the region. The reinstated habitat would also be considered to be of high environmental value to other species of conservation importance.

224. The worst-case quantum of effect from cable protection within the IDRBNR SAC is detailed in the Sandbank Compensation Plan (document reference 7.6.1). Using the 1:1 ratio, the amount of disused cable that would need to be recovered to comfortably offset the area affected would be 5,760m^2. Using a 2:1 ratio, the amount to be recovered would be 11,520m^2.

225. As detailed within Table 6.1, from initial investigations there appears to be enough redundant infrastructure (m/m^2) intersecting with sandbank features that is potentially available for removal at both the 1:1 and 2:1 ratio. For example, there is, potentially, up to 83,702.10m/13,146.6m^2 of possible surface area from cables in the HHW SAC and NNSSR SAC, combined (Figure 6.1 and Figure 6.2).

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STRATOS
North Norfolk Sandbanks and Saturn Reef SAC
Haisborough, Hammond and Winterton SAC
UK-GERMANY 5
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Legend

- Special Areas of Conservation
- Disused Telecom Cables

Annex I Reef Points (Subtype)

- Bedrock
- Bedrock/Stony
- Biogenic
- Stony

Annex I Reefs (Subtype)

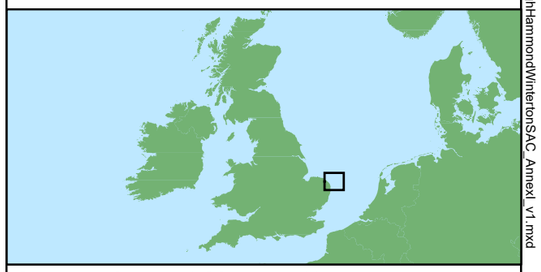
- Bedrock/Stony
- Biogenic

Managed As Reefs (Confidence)

- High
- Potential

Annex I Sandbanks (Confidence)

- High
- Potential



Coordinate System: WGS 1984 UTM Zone 31N

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Subsea telecommunication search within the Haisborough, Hammond and Winterton SAC (KISORCA data)

Figure 6.1

OUTER DOWSING OFFSHORE WIND

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400000 420000 440000 460000 480000

5960000 5940000 5920000 5900000 5880000

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STRATOS

North Norfolk Sandbanks and Saturn Reef SAC

Haisborough, Hammond and Winterton SAC

Legend

- North Norfolk Sandbanks & Saturn Reef SAC
- Disused Telecom Cables

Annex I Reef Points (Subtype)

- Bedrock
- Bedrock/Stony
- Biogenic
- Stony

Annex I Reefs (Subtype)

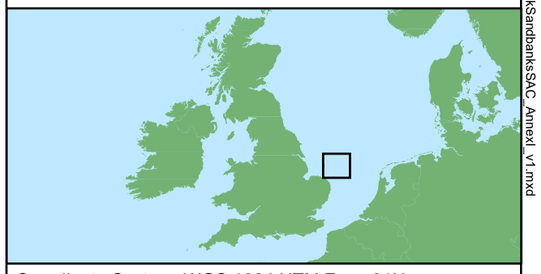
- Bedrock/Stony
- Biogenic

Managed As Reefs (Confidence)

- High
- Potential

Annex I Sandbanks (Confidence)

- High
- Potential



Coordinate System: WGS 1984 UTM Zone 31N

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Subsea telecommunication search within the North Norfolk Sandbank and Saturn Reef SAC (KISORCA data)

Figure 6.2

OUTER DOWSING OFFSHORE WIND

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Contains ESRI Basemapping;

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226. The Applicant is in the process of engaging with the relevant asset owners with a view to determining the potential for the Project to remove sections of the cables which intersect with sandbank features. Based on agreements between other projects and out of service asset owners and attendance at COWSC Expert Working Group 4 (infrastructure removal), and discussions with the relevant asset owners (see Technical Consultation, document reference 6.1.6) that it is likely to be less complicated to agree mechanisms for liability and transfer compared to oil and gas infrastructure as subsea cables are not obligated by the same decommissioning regulations and that cable owners are generally supportive of this as a potential measure. Pre-consent, the Project will continue to engage with relevant stakeholders such as MMO and SNCBs and infrastructure owners to determine the optimum infrastructure for removal and to identify necessary mechanisms for transfer of ownership and liability.

227. It is noted that Natural England's preference is that infrastructure should be surface laid in order to provide an opportunity for compensation. The Project considers that in mobile and dynamic environments such as sandbanks, these assets due to shallow burial depth are likely to be exposed and reburied at different points in time. Therefore, removing these assets where they are present in sandbank features would prevent re-exposure in the future, removing the potential for future impact on the sandbank features in question. However, as part of this measure the Applicant has proposed a geophysical survey in order to assess the condition and burial status of the cables in question which would allow for the determination of whether the required compensation quantum could be delivered by exposed areas of cable only.

Table 6.1. Summary of disused telecom cables within SACs with protected sandbank features (supported by Figure 6.1 and Figure 6.2).

SAC	Disused telecom cable review	Cable name	Cable owner	Length (m) and surface area (m^2) of cable intersecting with sandbank features (assuming 5cm cable diameter)
IDRBNR SAC	No disused telecom cables within the SAC but there are cables that cross undesignated sandbanks near the Norfolk coastline	Not considered further at this stage as outside existing SACs	n/a	n/a
HHW SAC	Disused telecom cable that runs through several protected sandbank features within the SAC	UK – Germany 5	British Telecom (BT)	25,462.1m 3,999.6m^2
Margate and Long Sands (M&LS) SAC	No disused telecom cables within the SAC but there are cables that cross undesignated sandbanks to the east of the SAC but not in great lengths	Not considered further at this stage as outside SAC	n/a	n/a
NNSSR SAC	Potentially disused telecom cable that runs through protected sandbank features within the SAC (requires verification)	Stratos	BT / BAE Systems Inc.	58,240m 9,147m^2

Note: At this stage it is not known if cables are surface laid

6.3.2 Delivery Timeframe

228. As noted above, whilst the Applicant considers that the need for compensation should be determined once it is known whether an adverse effect to the features of the IDRBNR SAC will occur (i.e. post installation for sandbanks, the feature for which this measure is being promoted as an option), it is currently anticipated that this compensatory measure, where it is shown to be feasible, could be progressed in terms of detailed design prior to the installation of any cable protection material, with the removal then progressed as quickly as possible thereafter, if required. Table 6.2 provides an indicative delivery timeline. It is anticipated, that if granted consent, the Project will be operational by 2030, with offshore construction potentially commencing in 2027 and preparatory works undertaken from 2026 at the earliest. An indicative construction programme is provided in document 6.1.3 of the Environmental Statement which has been used to inform the detailed assessments as required (including in-combination and cumulative assessments). The delivery of compensation measures and associated activities could commence prior to the start of the construction phase of other offshore elements of the Project. Note that these dates are indicative at this stage.

Table 6.2. Project Indicative timelines for Removal of Infrastructure.

Year from consent	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Project milestones												
Consent	Q3/Q4 2025	Anticipated consent award										
	Q4 2028 onwards	Start of cable installation										
Infrastructure Removal												
Phase 1	2024	Engagement with relevant asset owners to determine potential for removal of redundant infrastructure and associated legal requirements										
	Q4 2024 / 2025	Feasibility study to determine the practicality of removal and consents required										
	2025 / Q1 2026	Liaison with MMO and Natural England to agree infrastructure to be removed / ongoing discussions with asset owners										
Phase 2	2026	Geophysical survey of the infrastructure to assess location, condition, level of exposure and habitat type										
	2026 / 2027	Agreement of operating protocol and risk assessment										
	2026 / 2027	Infrastructure removal										

Year from consent	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Phase 3	2028 onwards	Ongoing monitoring of the seabed following removal to assess ecological recovery										

6.3.3 Monitoring and Adaptive Management

229. Once redundant infrastructure has been removed from the seabed it is considered likely that monitoring will be required in order to assess the recovery of the relevant features and wider SAC following removal. It is expected that a monitoring programme would be established with clear objectives agreed.

230. If removal of redundant telecoms cable that are laid on sandbank habitat within a SAC designated for sandbanks is unsuccessful within the identified areas adaptive management would be implemented. Adaptive management, if triggered, would be in the form of one of two alternatives:

- Searching alternative areas outside the SAC's identified for redundant infrastructure removal, to identify surface laid infrastructure that is deemed to be having a negative impact on ecologically important sandbank habitat; or
- Payment into a suitable strategic compensation measure.

6.4 Funding

231. For the removal of redundant infrastructure the cost below is based on the assumption of compensation being provided on the basis of a 1:1 ratio. As noted in paragraph 179 it is expected that a detailed post removal monitoring programme would be established. For the purposes of costing this measure this has been assumed to be a maximum of three surveys during the operational phase. Table 6.3 provides indicative costs for the measure. These costs are also included within the Compensation Funding Statement (document reference 7.9) which outlines how the Applicant and its ultimate parent companies would fund compensation measures should they be required.

Table 6.3 Funding requirements for the removal of redundant infrastructure

Cost estimate subcategories	Project Costs
DEVEX	£500,000
CAPEX	£7,335,000
OPEX	£1,500,000
Total estimated cost	£8,885,000

6.5 Next Steps

232. The Applicant will continue to liaise with owners and operators to identify redundant infrastructure and assess habitat involved as comparable to potential sandbank loss in IDRBNR SAC.

7 Anthropogenic Pressure Removal - Removal of Aggregate Industry Pressures

233. The removal of aggregate industry pressures could provide compensation for an AEoI in relation to Annex I sandbanks.

7.1 Overview

234. One of the anthropogenic pressures acting on the marine environment is aggregate extraction. Mobile sandbank systems, such as that within the IDRBNR SAC, are dependent on a continuous resupply of sediment, both locally and on a wider scale; therefore, the removal of sediment within a sandbank system, even if not directly on a sandbank, may act to reduce the resilience of the sandbank system to recover from impacts.

235. There are a number of licensed aggregate extraction areas within and adjacent to the IDRBNR SAC (Figure 7.1). These sites have all been awarded Marine Licences for removal of material, following robust Environmental Impact Assessment (EIA) and HRA processes, and this measure is not intended to include a reassessment of those impacts. However, it is noted that many of these sites may have been awarded licences up to 15 years ago (or longer for the initial licence). Whilst the conclusions of the assessments undertaken at the point of consent for those projects were able to conclude no AEoI to the IDRBNR SAC, the conservation status of the site has been reassessed since the award of these licences and aspects of the features of these sites are now deemed to be in unfavourable status. Proposed aggregate extraction areas (i.e. exploration and options areas and preferred bidder status) are not currently considered options for this measure as the Marine Licences for those sites will be determined based on the current unfavourable condition of the site.

236. Therefore, whilst not necessarily the cause of the change in the conservation status of the features of the SAC, aggregates removal is a pressure acting on the features and as such the early removal/reduction of this pressure on the SAC could be considered to be compensation.

7.2 Progress on this Measure

- The Project is investigating the feasibility of aggregate pressure removal to reduce existing pressures on the IDRBNR SAC.
- Figure 7.1 demonstrates the current aggregate licence areas within the IDNRRB SAC. Figure 7.2 and Figure 7.3 present aggregate licence areas within the HHW SAC and the M&LS SAC (both of which Natural England favoured for pressure removal on sandbanks).
- The Project anticipates that a reduction in aggregate removal within an SAC would benefit supporting features and processes of the SAC.
- The Project will liaise with aggregate licence holders to explore commercial appetite for a percentage buy out of total licenced aggregate removal quantities. It is assumed that this would have to represent an area as well as volumes to facilitate a benefit to the SAC and a compensation to the area impacted by cable protection.

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493 - Tarmac Marine Ltd
106/1 - Hanson Aggregates Marine Ltd
106/2 - Hanson Aggregates Marine Ltd
197 - Tarmac Marine Ltd
106/3 - Hanson Aggregates Marine Ltd
515/2 - Westminster Gravels Ltd
515/1 - Westminster Gravels Ltd
400 - Hanson Aggregates Marine Ltd
1805 - Hanson Aggregates Marine Ltd
2103 - Area 481 Extension
481/1 - Tarmac Marine Ltd
481/1 - Van Oord Ltd
481/2 - Van Oord Ltd
481/2 - Tarmac Marine Ltd
2103 - Area 481 Extension

Triton Knoll Offshore Wind Farm
Under construction (2019 - 2021) (see Note)

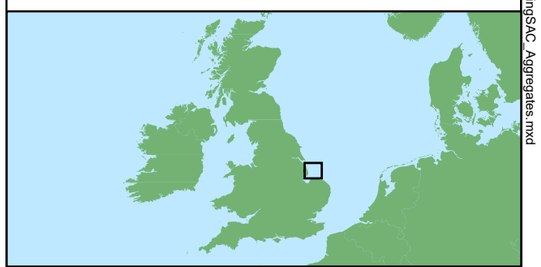
N

Legend

- Array Area
- Offshore Export Cable Corridor
- Inner Dowsing, Race Bank and North Ridge Special Area of Conservation

Aggregates (The Crown Estate)

- Exploration and Option Area
- Production Agreement Area
- Aggregates Area 2103



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Aggregate Licence Areas within the Inner Dowsing, Race Bank and North Ridge SAC

Figure 7.1

OUTER DOWSING OFFSHORE WIND

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Revision: 0.1

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494 - Tarmac Marine Ltd
254 - Tarmac Marine Ltd
240 - Hanson Aggregates Marine Ltd
242/361 - Hanson Aggregates Marine Ltd
513/1 - CEMEX UK Marine Ltd
1804 - CEMEX UK Marine Ltd
228 - Volker Dredging Ltd
1804 - CEMEX UK Marine Ltd
513/2 - CEMEX UK Marine Ltd
401/2A - Hanson Aggregates Marine Ltd
511 - CEMEX UK Marine Ltd
512 - CEMEX UK Marine Ltd

Legend

- Haisborough, Hammond and Winterton Special Area of Conservation

Aggregates (The Crown Estate)

- Exploration and Option Area
- Production Agreement Area

Coordinate System: WGS 1984 UTM Zone 31N

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Aggregate Licence Areas within the Haisborough, Hammond and Winterton SAC

Figure 7.2

OUTER DOWSING OFFSHORE WIND

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509/1 - Tarmac Marine Ltd
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510/2 - CEMEX UK Marine Ltd
508 - Britannia Aggregates Ltd
509/3 - Tarmac Marine Ltd
510/1 - CEMEX UK Marine Ltd
524 - DEME Building Materials Ltd
528/2 - Hanson Aggregates Marine Ltd

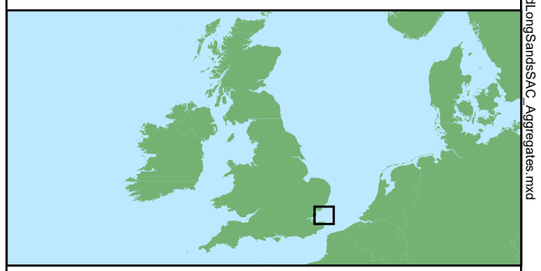
Legend

Margate and Long Sands Special Area of Conservation

Aggregates (The Crown Estate)

Exploration and Option Area

Production Agreement Area



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Aggregate Licence Areas within the Margate and Long Sands SAC

Figure 7.3

OUTER DOWSING OFFSHORE WIND

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7.2.1 Delivery Timeframe

237. As noted above, whilst the Applicant considers that the need for compensation should be determined once it is known whether an adverse effect to the features of the IDRBNR SAC will occur (i.e. post installation for sandbanks, the feature for which this measure is being promoted as an option), it is currently anticipated that this compensatory measure, where it is shown to be feasible, could be progressed in terms of detailed design and agreement prior to the installation of any cable protection material, with the removal of pressures then progressed as quickly as possible thereafter, if required. Table 7.1 provides an indicative delivery timeline. It is anticipated, that if granted consent, the Project will be operational by 2030, with offshore construction potentially commencing in 2027 and preparatory works undertaken from 2026 at the earliest. An indicative construction programme is provided in document 6.1.3 of the Environmental Statement which has been used to inform the detailed assessments as required (including in-combination and cumulative assessments). The delivery of compensation measures and associated activities could commence prior to the start of the construction phase of other offshore elements of the Project. Note that these dates are indicative at this stage.

7.3 Monitoring and Adaptive Management

238. As detailed above, this measure is still being investigated with the key aggregate licence holders. If this measure is to be taken forward for further investigation, following developments in these discussions, monitoring and adaptive management proposals will be developed and presented within the SCIMP.

7.4 Funding

239. As detailed above, this measure is still being investigated with the key aggregate licence holders. If this measure is to be taken forward for further investigation, following developments in these discussions, funding will be developed and presented within the SCIMP.

7.5 Next Steps

240. The Applicant will continue to liaise with aggregate licence holders to explore commercial appetite for a percentage buy out of total licenced aggregate removal quantities.

Table 7.1 Project Indicative timelines for Removal of Aggregate Industry Pressures.

Year from consent	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Project milestones												
Consent	Q3/Q4 2025	Anticipated consent award										
	Q4 2028 onwards	Start of export cable installation										
Removal of Aggregate Industry Pressures												
Phase 1	2024	Engagement with relevant licence holders to explore potential licenced areas for total buy out / percentage buy out of a licenced removal quantity										
	2024	Work with legal to identify mechanism to allow a dredging licence to be awarded / purchased without the intention to undertake that activity										
	Q4 2024 / 2025	Feasibility study to determine the ecological benefits of potential proposals										
	2025 / Q1 2026	Liaison with MMO and Natural England to agree the approach/ongoing discussions with licence holders										
Phase 2	2026 / 2027	Formal agreement with licence holder										

Year from consent	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Phase 3	2028 onwards	Ongoing monitoring of the seabed to assess ecological status										

8 Marine Debris/Litter Removal

241. Marine debris/litter removal could provide compensation for an AEoI to the IDRBNR SAC, both in relation to Annex I biogenic reefs and Annex I sandbanks.

8.1 Overview

242. The Applicant understands that this measure has limited support from stakeholders and is challenging to implement in the field as discussed within section 2 of this document. However, it is necessary to note the previous DCO precedent regarding this measure and that predating Defra SoS conformation of SAC extensions being available as a strategic measure, the limited number of appropriate measures available.

243. The removal of marine debris would be a direct means to improve habitat quality within the IDRBNR SAC serving to support the restoration of the sandbank habitat and biogenic reef. It is expected that any debris/litter to be removed would predominantly constitute abandoned or lost fishing gear or dropped objects. The exact nature of the material to be removed would be subject to technical feasibility, HSE, legal and industry acceptability (for example, oil and gas platforms, installed subsea infrastructure and pipelines are excluded) and developed further.

244. If this remediation activity was supported by an awareness campaign (see Marine Debris Awareness and Engagement below) that targeted the introduction of measures to facilitate the rapid recovery of any lost gear in the future, the contribution it would make to restoration of the SAC would be even greater and further harm could be avoided or limited.

245. For the purpose of the Project “without prejudice” benthic compensation strategy, ‘marine debris’ consists of any lost or abandoned, non-natural or introduced material on the seabed which does not offer a practical purpose, has low biodiversity value and may detract from the extent and functionality of the designated features of the targeted SAC(s).

8.2 Evidence Base

246. The problems caused by marine debris are well documented (Veiga *et al*., 2016; Richardson *et al*., 2019). Discarded fishing gear is a particularly destructive type of marine debris. If not retrieved, discarded fishing gear can move with marine currents, scouring large areas of seabed and therefore affect an area far greater than its actual size. Marine litter such as lost and abandoned fishing gear has the potential to:

- "ghost fish" – resulting in the unintentional catch of marine life;
- damage habitats through abrasion;
- cause injury or death to marine life from entanglement;
- cause navigation and safety hazards to fishing due to snagging of gear, potentially resulting in further losses; and
- other sources of marine debris, such as discarded anchor and chain, could also sweep the seabed, continually affecting a larger area.

247. Removal would benefit the Annex I sandbanks feature with natural sediment composition and associated benthic communities recovering quickly within the areas from which debris/litter was removed. Hence the removal of litter/debris would support the restoration of the SACs in general and directly counteract any deemed impact within the SACs.

8.3 Delivery Process

248. The Applicant propose to work with the agreed delivery partners (currently proposed to be the EIFCA and the MMO, the local fishing industry, and local conservation groups) to establish areas where there is known or likely potential for lost or abandoned fishing gear. This process would be followed by site investigation works to identify the precise location of marine litter. Following identification of any marine litter, the necessary approvals would be secured, and the material subsequently removed in a single campaign and returned to shore for re-purposing where possible, or appropriate waste disposal.

249. A marine debris data search will collate data to identify an area within the IDRBNR SAC which may contain high levels of marine debris. If no suitable areas are identified within the SAC, the search would be widened to other suitable sites within the network or neighbouring sandbank features.

250. It is not possible (at this stage) to precisely establish the volume of marine litter that could be removed, therefore, whilst the primary target for such removals would be the IDRBNR SAC itself, removal could be extended to subtidal sandbanks (i.e. the qualifying feature) within other SACS's or at high quality subtidal sandbank habitat outside of the SAC.

251. The removal of marine litter could be achieved and evidenced once such litter was identified through industry consultation and site based geophysical surveys. Removal would be undertaken using appropriately equipped vessels and standard extraction techniques.

252. Identification of suitable measures to ensure rapid recovery of lost gear would be developed with the relevant IFCA. These may comprise options such as voluntary reporting and provision of technical solutions (such as transponders) that can be fixed to static gear.

253. It is proposed that the delivery of this measure would be a single removal campaign undertaken in partnership with the relevant IFCA, the local fishing industry and potentially other conservation organisations involved in ocean clear-up campaigns.

8.3.1 Site Selection and Scale

254. The objective of marine debris removal is to restore sandbank habitat within the extent of the footprint of the litter. This will be achieved through the direct removal of such material from the seabed.

255. The geographic focus of this compensation measure would, as a minimum, be within the IDRBNR SAC, although, if necessary, the scale of this measure could be expanded further to include marine litter removal work over a wider area, for example where there are neighbouring sandbank features.

8.3.2 Delivery Timeframe

256. The implementation of this compensation would include the establishment of a BCSG following consent approval. A SCIMP would then be developed for this compensation option in consultation with the SCSG, if required and chosen.

257. As noted above, whilst the Applicant considers that the need for compensation should be determined once it is known whether an adverse effect to the features of the IDRBNR SAC will occur (i.e. post installation for sandbanks, the feature for which this measure is being promoted as an option), the Applicant does recognise that, if possible, compensation should be in place prior to the impact on the qualifying features. Debris removal works would provide an immediate improvement in terms of physical attributes and ecosystem recovery. It is anticipated, that if granted consent, the Project will be operational by 2030, with offshore construction potentially commencing in 2027 and preparatory works undertaken from 2026 at the earliest. An indicative construction programme is provided in document 6.1.3 of the Environmental Statement which has been used to inform the detailed assessments as required (including in-combination and cumulative assessments). The delivery of compensation measures and associated activities could commence prior to the start of the construction phase of other offshore elements of the Project. Note that these dates are indicative at this stage.

8.3.3 Monitoring Plan and Adaptive Management

258. The monitoring of debris removal work would be limited to the duration of the works themselves. The removal process would be monitored, and the amount of debris recorded and reported, but there would not be an ongoing monitoring/adaptive management process.

259. The report would include photographs of the debris following removal, a categorisation of the type of debris, a figure showing the locations of each item of marine debris and identification of any areas of scour or habitat damage that were visible around the item of debris.

260. Once the debris had been removed, the impact will have been removed, and the affected area would be expected to recover. It is not considered that ongoing monitoring following completion of the debris removal campaign will be needed to provide any further evidence of habitat restoration following removal of the debris.

261. Adaptive management, if required, could form one of the following alternatives:

- Searching ecologically important sandbanks and supporting habitats outside the IDRBNR SAC or alternative SACs to identify and remove marine debris/litter; or
- Payment into a suitable strategic compensation measure.

8.4 Funding

262. Given the uncertainties associated with this measure an estimation for costing has not been included at this stage.

8.5 Next Steps

263. Should this compensation measure be taken forward, the Applicant would liaise with the EIFCA and MMO to identify and map known seabed debris. They would then commission geophysical surveys to determine the precise location of marine debris, including the presence of other potentially recoverable abandoned infrastructure or dropped objects.

9 Marine Debris/Litter Awareness and Engagement

264. Marine debris /litter removal could provide additional compensation for an AEoI to the IDRBNR SAC, both in relation to Annex I biogenic reefs and Annex I sandbanks.

9.1.1 Overview

265. The conservation objectives of the IDRBNR SAC include ensuring that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its qualifying features by maintaining or restoring their structure and function. As discussed above, this can in part be achieved by the recovery and removal of marine debris. However, in addition to the direct causes of loss of fishing gear (such as snagging and entanglement) there are also indirect causes that result in lost or abandoned gear, including a lack of disposal facilities and inaccessible or expensive disposal facilities for redundant gear.

266. It is logical that the reduction of the input of debris into the marine environment at source is the first step in alleviating this pressure. Consequently, a reduction and awareness campaign could be implemented with the aim of reducing future marine debris entering the IDRBNR SAC to support recovery and removal of marine debris and thus providing a longer-term compensation measure.

9.2 Evidence Base

267. As previously discussed, marine debris can be very destructive to the seabed, leading to continual sweeping and scouring of benthic and epibenthic communities.

268. The awareness campaign would focus on stakeholder engagement to promote a ‘stopping at the source’ approach to reducing marine debris and aims to target several marine debris sources including lost and abandoned fishing gear, debris from other industries, recreational activities, and onshore sources. This campaign would aim to promote long term changes in activities and processes from those groups that the awareness campaign will target.

9.3 Delivery Process

269. An education programme would be set up in agreement with the MMO, with the aim of reducing the quantity of debris being added to the marine environment. This would include consultation with the fishing industry and the provision of better methods for static gear removal and the provision of collection bins in strategic locations which will make the disposal of waste easier and more cost effective and reduce the marine debris that may otherwise be discarded at sea.

270. Industry awareness events for the fishing industry would be closely linked to the rapid retrieval campaign, in terms of illustrating success through use of technology or other strategies but would also focus on disseminating the economic cost and potential loss to catch resulting from marine debris presence. Workshops will additionally aim to encourage the fishing industry to play an active role in collecting marine debris identified at sea, where practicable. Existing best practice guidance would be promoted.

271. Marine debris removal works would be accompanied by awareness events within the fisheries industry in the EIFCA's district and for vessels that operate within the IDRBNR SAC. These could be undertaken in partnership with relevant Non-Governmental Organisations (NGOs), the MMO and National Federation of Fishing Organisations (NFFO), and would focus on the ecological, safety and economic risks associated with lost gear.

272. The awareness campaign would aim to conduct a variety of awareness events and work with various stakeholder groups/industries to launch initiatives, or support ongoing initiatives, to help reduce marine debris entering the marine environment in the long term.

273. It is also proposed that the identification of suitable measures to facilitate the rapid recovery of lost gear would be developed with the EIFCA. These may comprise options such as voluntary reporting and provisions of technical solutions that can be fixed to static gear.

274. The education, awareness and provision of facilities campaign will focus on engagement with the local fishing and conservation organisations to identify opportunities where projects can facilitate the reduction of marine debris by managing the problem at the source. This will involve a number of strands:

- Consultation with the fishing industry (especially targeting those who fish in the IDRBNR SAC) to:
    - Ensure awareness of the legal requirements not to discard fishing gear and/or waste at sea, to attempt to retrieve it if lost, to carry equipment to allow retrieval, and to report lost gear within 24 hours if all of the gear has not been retrieved;
    - Highlight the advantages of less destructive fishing methods; and
    - Identify possible ways that the Applicant could contribute to less destructive fishing methods being used. This could include data sharing with the fishing industry of the locations of Annex I habitats within the IDRBNR SAC, for example through the provision of memory sticks with relevant shapefiles installed.
- The provision, by the Applicant, of better methods for static gear retrieval such as beacons and tracking systems to ensure that static gear can be swiftly retrieved or relocated if it has moved;
- The provision by the Applicant of safe fishing gear disposal bins at local fishing ports and on vessels: although not common, fishing gear can be illegally disposed of at sea if it has become damaged. Once placed in the disposal bins the Applicant would then arrange for safe disposal or recycling of the gear. Bins could also be provided for fishermen to dispose of general waste which otherwise may enter the marine environment;
- Education campaigns to encourage behavioural changes to reduce litter; and
- Provision by the Applicant of safe disposal bins at local beaches or tourism locations to provide facilities to aid in correct disposal of litter. Once placed in the disposal bins the Applicant would then arrange for safe disposal or recycling of the waste.

9.3.1 Delivery Timeframe

275. The programme of delivery to improve the recovery process of lost gear would be agreed within the approved compensation plan prior to the commencement of offshore cable protection installation works, and ideally delivered prior to completion of those works. The first year of delivery would focus on the identification of appropriate solutions and engagement within the fishing industry (through the EIFCA), potentially including education and awareness events.

276. As noted above, whilst the Applicant considers that the need for compensation should be determined once it is known whether an adverse effect to the features of the IDRBNR SAC will occur (i.e. post installation for sandbanks, the feature for which this measure is being promoted as an option), the Applicant does recognise that, if possible, compensation should be in place prior to the impact on the qualifying features. The education/awareness/technology delivery measures could be delivered simultaneously to offshore export cable installation works. It is anticipated, that if granted consent, the Project will be operational by 2030, with offshore construction potentially commencing in 2027 and preparatory works undertaken from 2026 at the earliest. An indicative construction programme is provided in document 6.1.3 of the Environmental Statement which has been used to inform the detailed assessments as required (including in-combination and cumulative assessments). The delivery of compensation measures and associated activities could commence prior to the start of the construction phase of other offshore elements of the Project. Note that these dates are indicative at this stage.

9.3.2 Monitoring Plan and Adaptive Management

277. An annual report is proposed, for the duration of the relevant offshore construction works, that covers measures associated with the uptake of technology aimed at the rapid identification and reporting or lost gear. The need for any future ongoing reporting would be defined within the SCIMP.

278. Management and monitoring of the awareness of marine debris would include the quantification of any fishing equipment and discarded material disposed of within bins and monitoring of how often fishing gear retrieval was successful following any provision of new technology. Attendance at the provided events and industry forums would also be monitored.

279. No adaptive management is proposed for this strategy.

9.4 Funding

280. Given that this measure is associated with the removal of marine debris and that there are inherent uncertainties around that measure, indicative costings have not been provided at this stage.

281. Next Steps

9.5

282. Should this compensation measure be taken forward, the Applicant would prioritise liaison with the EIFCA, the MMO and the local fishing industry.

10 Seagrass Bed Habitat Creation/Restoration

283. Seagrass bed habitat creation/ restoration could provide compensation for an AEoI to the IDRBNR SAC in relation to Annex I sandbanks.

10.1 Overview

284. The current Defra guidance (Defra, 2021) states that if 'like for like' benthic compensation cannot be provided, then the provision of 'non-like-for-like' compensation should be considered'.

285. One such approach that would represent a 'non-like-for-like' measure would be the restoration or creation of habitat, that whilst not classified as the same as sandbank habitat, has a similar or identical ecological function. Seagrass beds are a sub-types of Annex I habitat "Sandbanks slightly covered by sea water all the time" (Ward *et al*., 2022). In terms of the new compensation hierarchy (Defra, 2024), this measure can be classed as Number 6: "taking no account of local circumstances where the risk to the feature is predicted to occur, delivered at a distance to the area affected by the plan or project".

286. Seagrass beds around the world have shown long term declines (Dunic *et al.*, 2021). In UK waters, beds have declined by 85% since the 1920s (Berry, 2000), with 39% lost since the 1980s (Green *et al*., 2021). Factors contributing to the decline of seagrass meadows include wasting disease, pollution and physical disturbance (Green *et al*., 2021). Subsequently, UK recovery has been slow, although this is not limited to UK waters with similar patterns observed along the Atlantic coast of North America (Davison and Hughes, 1998).

287. As seagrass has declined in coverage, the appreciation for why these habitats are of importance has increased. As a result, restoration projects which support these important seagrass habitats are vital, with many projects resulting in a collaboration between NGOs, academia, statutory nature conservation bodies and local councils.

10.2 Evidence Base

288. This measure will demonstrate that any sandbank habitat loss is offset, or compensated for, by the creation and/or restoration of seagrass beds within the region to compensate against any impact to the sandbank habitat. This measure is expected to have a beneficial effect on other ecological facets such as providing habitat for fish species which in turn provide a food resource for local bird populations.

289. In the British Isles, two species of seagrass of the genus *Zostera* occur, common seagrass *Z. marina* and dwarf seagrass *Z. noltii*. *Z. marina* is the larger of the two British species and typically occurs in the shallow sublittoral down to about 4 m depth, in fully marine conditions and is the species associated with "Sandbanks which are slightly covered by sea water all the time"; *Z. noltii* is an intertidal plant found from mid- to low-tide mark, usually in poorly-draining muddy sediments.

290. Seagrass beds are one of the most productive of shallow, sedimentary habitats with the high level of primary production supporting a rich, resident fauna and the beds are used as refuge and nursery areas by many fish species (Davison and Hughes, 1998; Unsworth and Butterworth, 2021). This will have an indirect effect on birds as the beds provide suitable nursery habitat for important prey species such as sandeel, herring and sprat. The IDRBNR SAC is encompassed by the Greater Wash SPA which is classified for the protection of red-throated diver, common scoter, and little gull during the non-breeding season, and for breeding Sandwich tern, common tern and little tern.

291. Seagrass beds also stabilise sediment, inhibit erosion and encourage deposition of suspended material (Hiscock and Sewell, 2005) and have a high potential to act as significant carbon sinks (Duarte *et al.*, 2013).

292. Seagrass beds are protected by a variety of conservation legislation and policies being designated as Annex I feature under the EU Habitats Directive, protected features of Marine Protected Areas (including MCZ and Special Conservation Areas (SAC)). Seagrass beds (*Z. marina* and *Z. noltii*) are listed as a Priority Habitat derived from Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006. They also have protection as a habitat in support of seahorses under the Wildlife and Countryside Act 1981. Seagrass beds also qualify as 'higher sensitivity' habitats in the Environment Agency guidance for undertaking Water Framework Directive (WFD) assessments in estuarine and coastal waters and represent a sub-element (along with saltmarsh) of the angiosperm Biological Quality Element (BQE), one of the five BQEs used to classify the ecological status of water bodies.

293. In recent years, a number of seagrass restoration projects have been undertaken in the UK with a number of projects currently underway. Restoration trials are ongoing at sites in the Essex Estuaries SAC with the aim of identifying the most successful and efficient planting method for *Z. noltii*, to enhance the natural recovery of intertidal beds in the Stour, Orwell, and Blackwater estuaries (Project Seagrass). This has involved the successful transplantation of sediment cores with viable seagrass within an existing bed to aid its expansion, while it is planned to employ this methodology to transplant cores away from the "donor meadow" to sites where seagrass has significantly declined or is now absent.

294. Ørsted and Yorkshire Wildlife Trust have teamed up to develop a seagrass restoration project as part of Ørsted's Hornsea Project Four offshore wind farm, in the Humber Estuary. The restoration efforts form part of a resilience measure to the compensation put forward for the kittiwake feature of the Flamborough and Filey Coast SPA. The measure is expected to provide habitat enhancement for key prey fish species for the birds of interest. It is proposed that a total of 30 ha is restored as part of this project.

295. Other Projects on the east coast include the ReMEDIES Save Our Seabed project in the Essex Estuaries SAC, between Jaywick to Shoebury.

296. A restoration project is underway aimed to restore 8ha of subtidal seagrass beds split equally between the Plymouth Sound Estuaries SAC and the Solent Maritime SAC. The work has involved the transplanting of small hessian bags of seedlings cultivated from seed-bearing shoots picked by divers (Nolan, 2020). The aim is to grow tens of thousands of seedlings over the next three years in this way (Nolan, 2020). The Ocean Conservation Trust (OCT) are monitoring the restoration site in Plymouth Sound, where over 18,000 seeds and seedling bags were transplanted by hand, to determine growth rates and overall success.

297. Other UK examples include the Seagrass Ocean Rescue project in Wales, which included Project Seagrass Sky Ocean Rescue, University of Swansea, World Wide Fund for Nature (WWF) and Pembrokeshire Coastal Forum. Several other seagrass restoration and management projects have a similar collaborative approach in Europe, with ZORRO (ZOsteRa RestOration) project in Sweden and the NOVAGRASS project in Denmark involving several universities, consultancies and government organisations.

298. The creation of a subtidal bed is not deemed suitable within the IDRBNR SAC as there is no evidence of seagrass beds occurring historically, therefore alternative subtidal sites are to be investigated, particularly to the west along the Lincolnshire coast. Guidance and potential collaboration with delivery partners could be sought from groups currently undertaking subtidal projects as detailed above.

299. In the instance where the development of subtidal beds is not possible, emphasis could be shifted to potential intertidal sites within the wider region of the southern North Sea with the aim of expanding current projects. Projects currently underway in the east coast of England include the ReMEDIES Save Our Seabed project in the Essex Estuaries Special Area of Conservation between Jaywick to Shoebury that aims to reduce the negative impact of recreational boating activities, such as mooring and anchoring on current seagrass meadows - Essex Wildlife Trust is working with Natural England and other ReMEDIES partners to develop and deliver this project. If the Project were to collaborate with any Project partners, it would be made clear that the work would be additional to the work being currently undertaken.

10.3 Delivery Process

300. A typical project outline is provided in the Seagrass Restoration Handbook UK and Ireland (Gamble *et al*., 2021), which recommends the following steps when conducting seagrass restoration:

- Stage 1 - Feasibility and pre-project planning:
  - Review relevant strategies and carry out site options review;
  - Plan and begin engagement with regulator stakeholders and partners; and
  - Conduct feasibility study – prior to any physical undertaking the feasibility of the project should be assessed to determine whether successful creation/restoration is achievable at the proposed restoration location.
- Stage 2 – Project design:
  - Define restoration goals and objectives;

- Conduct baseline surveys;
- Design restoration plan and monitoring; and
- Engage with stakeholders.

- Stage 3 – Pre-restoration/creation tasks:
  - Apply for permissions and licensing; and
  - Collect seagrass seeds/hoots/processing.
- Stage 4 – Start restoration/creation:
  - Seagrass seed or shoot deployment; and
  - Ongoing monitoring.

301. A feasibility study would be undertaken to inform site selection and restoration/creation methodology most likely to result in a successful restoration/creation programme. Factors that will be considered prior to restoration efforts being initiated to ensure the viability of seagrass restoration include looking for sites that:

- Have historical evidence that the area has previously supported seagrass habitat;
- Are sheltered from wave action;
- Have suitable topographical and hydro-morphological conditions including sedimentation rates;
- Have sufficient nutrients and available light; and
- Have good water quality.

302. One approach to identifying suitable sites could be to adopt a model developed in relation to habitat restoration within the Plymouth Sound and Estuaries and Solent Maritime SACs which utilises a Species Distribution Model (SDM) developed to investigate environmental characteristics of locations with existing seagrass beds and used to predict the suitability of other areas for restoration (Early *et al.*, 2022).

303. Site selection field visits and environmental data collection to understand local site conditions will be undertaken to determine suitability of existing seagrass beds for restoration or site suitability for bed creation and determining the appropriate methodologies to adopt for the sites selected. Examples of intertidal and subtidal methodologies are given below.

10.3.1 Site Selection and Scale

304. The primary objective in relation to the Project would be to undertake off-site creation or restoration of a seagrass, which provides a similar ecological feature to the sandbank feature that is potentially lost.

305. The overall objectives of the IDRBNR SAC are to ensure that the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its 'qualifying features', by maintaining or restoring the structure and function (including typical species) of its qualifying natural habitats. Seagrass beds are considered to be a sub-type of Annex I habitat "Sandbanks slightly covered by sea water all the time" (Ward *et al*., 2022). Hence the creation of seagrass beds is likely to support typical species of the subtidal sandbanks feature such as burrowing invertebrates (due to the protection and stabilisation element) and help in the recovery and maintaining of site integrity in the face of any loss of Annex I habitat as part of the proposed development. Where habitat restoration and/or creation is undertaken the conservation objective would be to develop and maintain seagrass beds at favourable status.

306. Further consultation would be required to determine and agree appropriate scales and ratios required to determine how much seagrass habitat restoration/creation would be acceptable as compensation. As per the guidance (Defra, 2021), the agreed ratios are likely to be higher, particularly in circumstances where the compensation is lower on the compensation hierarchy (i.e., comparable ecological function, different location and not like-for-like).

307. As detailed in Table 1.2 of Sandbank Compensation Plan (document reference 7.6.1), Natural England advised that subtidal seagrass is not known to be present within the IDRBNR SAC and historic evidence suggests that subtidal seagrass has never been found east of the Solent. Therefore, it is Natural England's view that this proposal should only be included as a very small part (<10%) of a package of compensation measures. The Applicant acknowledges Natural England's position but does not believe that there would be a need to include seagrass bed restoration in addition to any other of the options identified as potential compensation measures should compensation be required (e.g. other measures would be sufficient to deliver the compensation in isolation).

308. Part of the delivery including aims, objectives and scale would be agreed through the SCSG at the post-consent phase and secured through the SCIMP, if this was a measure that the Project wanted to take further. This would include key strategies and activities, expected outcomes, and risks and challenges in relation to both ecological and societal goals.

10.3.2 Delivery Timeframe

309. The programme of delivery to create or restore seagrass beds would be agreed within the post-consent CIMP document with associated work starting before the commencement of cable installation works, which includes conducting feasibility studies, liaising with stakeholders, regulators and restoration experts to develop restoration strategy and drafting restoration strategy including objectives, targets, proposed restoration area and deployment methods. The SCIMP would be developed and finalised in consultation with members of the SCSG and seagrass restoration experts.

310. An indicative timeline for the delivery of the compensation measure is provided in Figure 5.1. below. It is anticipated, that if granted consent, the Project will be operational by 2030, with offshore construction potentially commencing in 2027 and preparatory works undertaken from 2026 at the earliest. An indicative construction programme is provided in document 6.1.3 of the Environmental Statement which has been used to inform the detailed assessments as required (including in-combination and cumulative assessments). As noted above, whilst the Applicant considers that the need for compensation should be determined once it is known whether an adverse effect to the features of the IDRBNR SAC will occur (i.e. post installation for sandbanks, the feature for which this measure is being promoted as an option), the delivery of compensation measures and associated activities could commence prior to the start of the construction phase of other offshore elements of the Project. Note that these dates are indicative at this stage. It is anticipated that the Applicant will continue to develop and refine the implementation plan through consultation with stakeholders, regulators and seagrass restoration practitioners.

Table 10.1 Indicative timeline for creating a seagrass bed.

Year from consent	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Project milestones												
Consent	Q3/Q4 2025	Anticipated consent award										
	Q4 2028 onwards	Start of cable installation										
Seabed restoration works												
Phase 1	2024 onwards	Conduct feasibility study and identify areas suitable for seagrass restoration										
	2024 onwards	Liaise with stakeholders, regulators and restoration experts to develop restoration strategy.										
	2025	Identify potential project delivery partners.										
	2024 onwards	Draft restoration strategy including objectives, targets, proposed restoration area and deployment methods										
Phase 2	Q1 2026	Set up SCSG										
	Q1 to Q4 2026	Develop and finalise SCIMP including project objectives, targets, deployment methods and monitoring and reporting protocols.										
	Q1 2027	Submit SCIMP to SoS for approval										

Year from consent	Indicative time based on current project timeline	Task	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
	2026	Plan and conduct baseline survey. Analyse data and identify suitable sites for seagrass restoration within the area of search.										
	Q3/Q4 2026	Secure / pre-order seagrass seeds/shoots										
Phase 3	Q2/Q3 2027	Deploy seagrass seeds/shoots. Optimal timing and deployment strategy to be determined.										
Phase 4	2028 to 2033	Ongoing monitoring as detailed within the monitoring programme										
	2028-2033	Determine need of re-seeding based on monitoring data										
Licensing and regulation												
	2024 onwards	Liaison with licensing and permitting authorities to develop byelaw to protect created seagrass bed										
	2026	Obtain Marine Licence from the MMO										

10.3.3 Monitoring and Adaptive Management

311. To determine the success of the seagrass bed restoration/creation a monitoring programme will be instigated with comparison with baseline information from natural seagrass beds with similar physical and environmental characteristics. If, in the long term, the seagrass beds at the creation/restoration site meet or exceed the characteristics of these reference sites the project can be considered a success.

312. In the event that the creation of subtidal seagrass beds is unsuccessful or not retained, consideration would be given to whether remedial measures (i.e. re-seeding of seagrass) could be effective to maintain the seagrass bed or whether an alternative compensation measure should be progressed.

313. Should the re-seeding of a subtidal seagrass be deemed inappropriate adaptive management or unsuccessful, the following alternatives would be considered:

- Payment into a suitable strategic compensation measure.

10.4 Funding

314. For the seagrass creation the cost below is based on the assumption of compensation being provided on the basis of a 1:1 ratio. Based on Natural England's position that this measure would only comprise a maximum of 10% of the compensation delivery, survey costs have been assumed to be covered within the costs for other measures which this measure would be a component of the overall package. Therefore, no opex costs are identified.

Table 10.2: Indicative costs for seagrass creation measure

Cost estimate subcategories	Project Costs
DEVEX	£100,000
CAPEX	£1,290,535
Total estimated cost	£1,390,535

10.5 Next Steps

315. If this compensation measure is taken forward, the Applicant would prioritise engagement with relevant local initiatives and potential delivery partners.

11 References

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Annex 1 – Commercial fisheries activity review within the IDRBNR SAC and proposed extension areas (NiMa, 2024)

Outer Dowsing Offshore Wind

Commercial Fisheries Activity in Inner Dowsing, Race Bank and North Ridge Special Area of Conservation (SAC) and Haisborough, Hammond and Winterton SAC.

nimo CONSULTANTS

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1. Introduction

Outer Dowsing Offshore Wind (the Project) are developing without prejudice compensation plans in response to the potential for project impacts on sandbank and biogenic reef features within Inner Dowsing, Race Bank and North Ridge (IDRBNR) Special Area of Conservation (SAC).

Possible plans include the creation and recreation of biogenic reef, with the Project exploring the potential for creation of blue mussel and native oyster beds within IDRBNR SAC, and extension of the IDRBNR SAC and Haisborough, Hammond and Winterton (HHW) SAC to include additional areas of sandbank complex.

The Project are currently working to identify the potential acceptability of these plans, in terms of the ability to find suitable locations for reef development and the practicality of establishing new reef area, suitable locations for SAC expansion to capture sandbank areas, and in terms of stakeholder acceptance of the plans. As part of this exercise, the Project are seeking to take account of commercial fishing activity in the SACs and consider existing fishing pressures on them; this document provides an assessment of fishing activity and pressures.

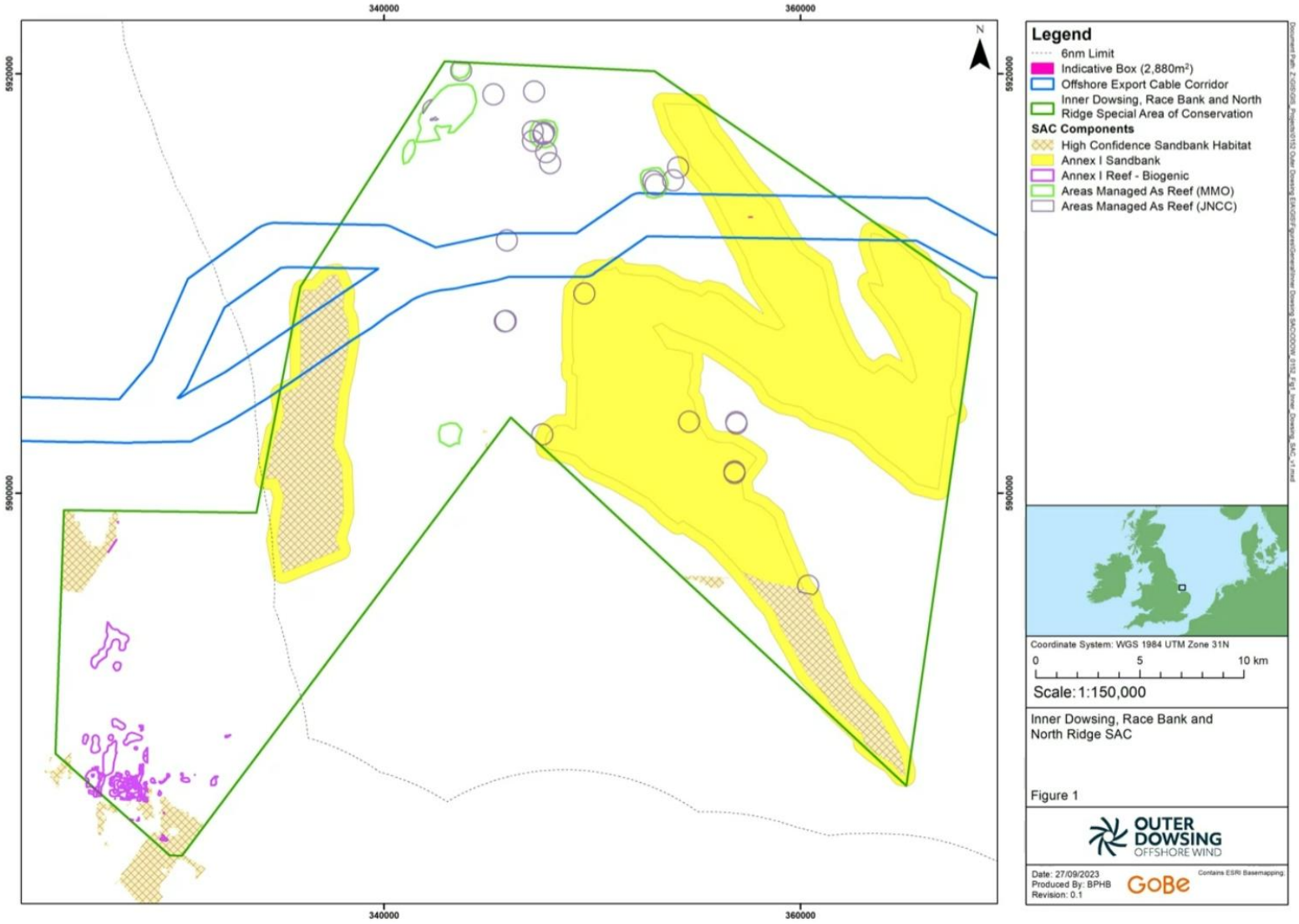

Figure 1.1 Inner Dowsing, Race Bank and North Ridge SAC boundaries, showing the location of the Project offshore Export Cable Corridor and designated habitat features (sandbanks and reefs).

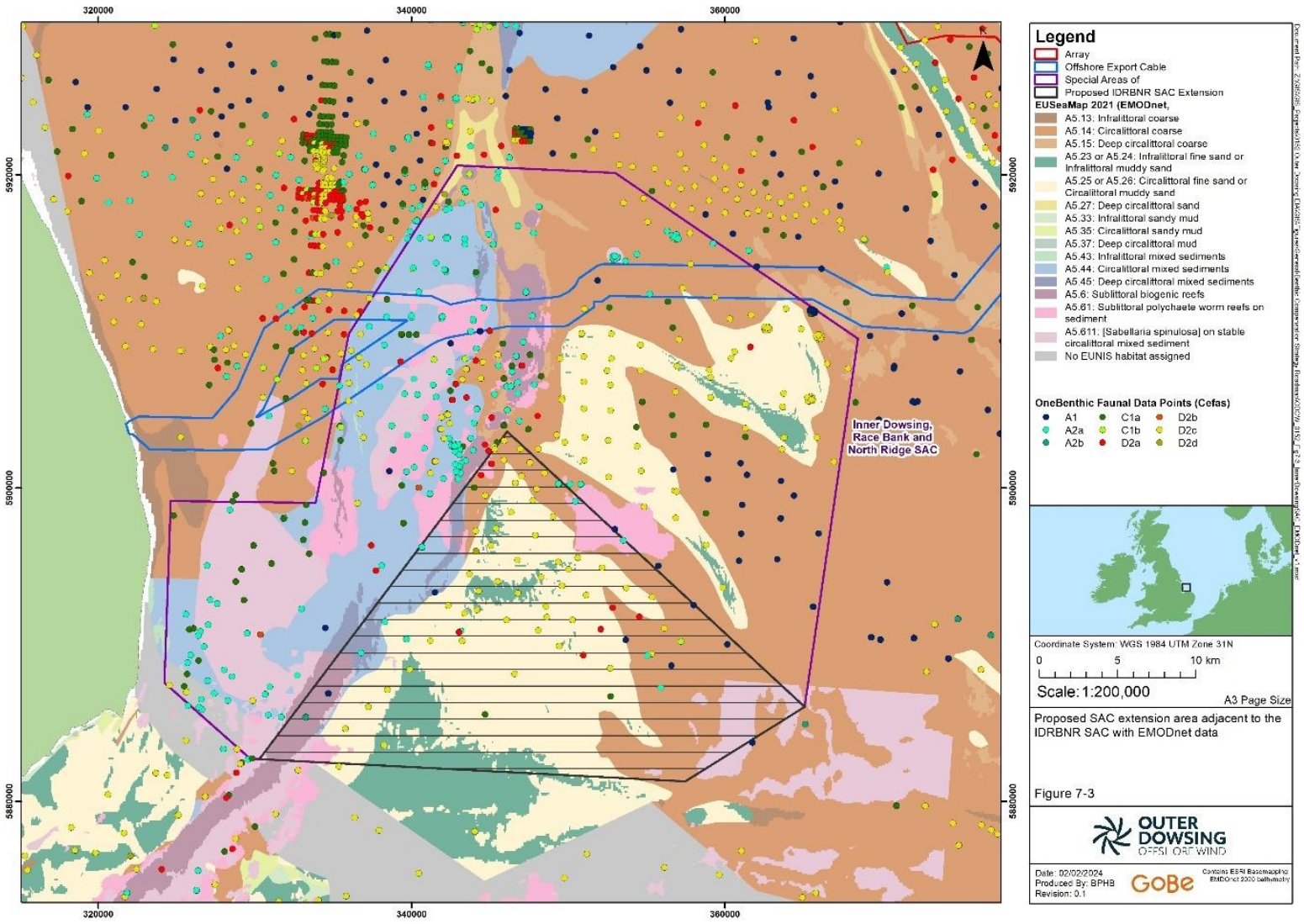

Figure 1.2 IDRBNR SAC boundaries, showing the location of the Project offshore ECC and the proposed SAC extension area (black hatching).

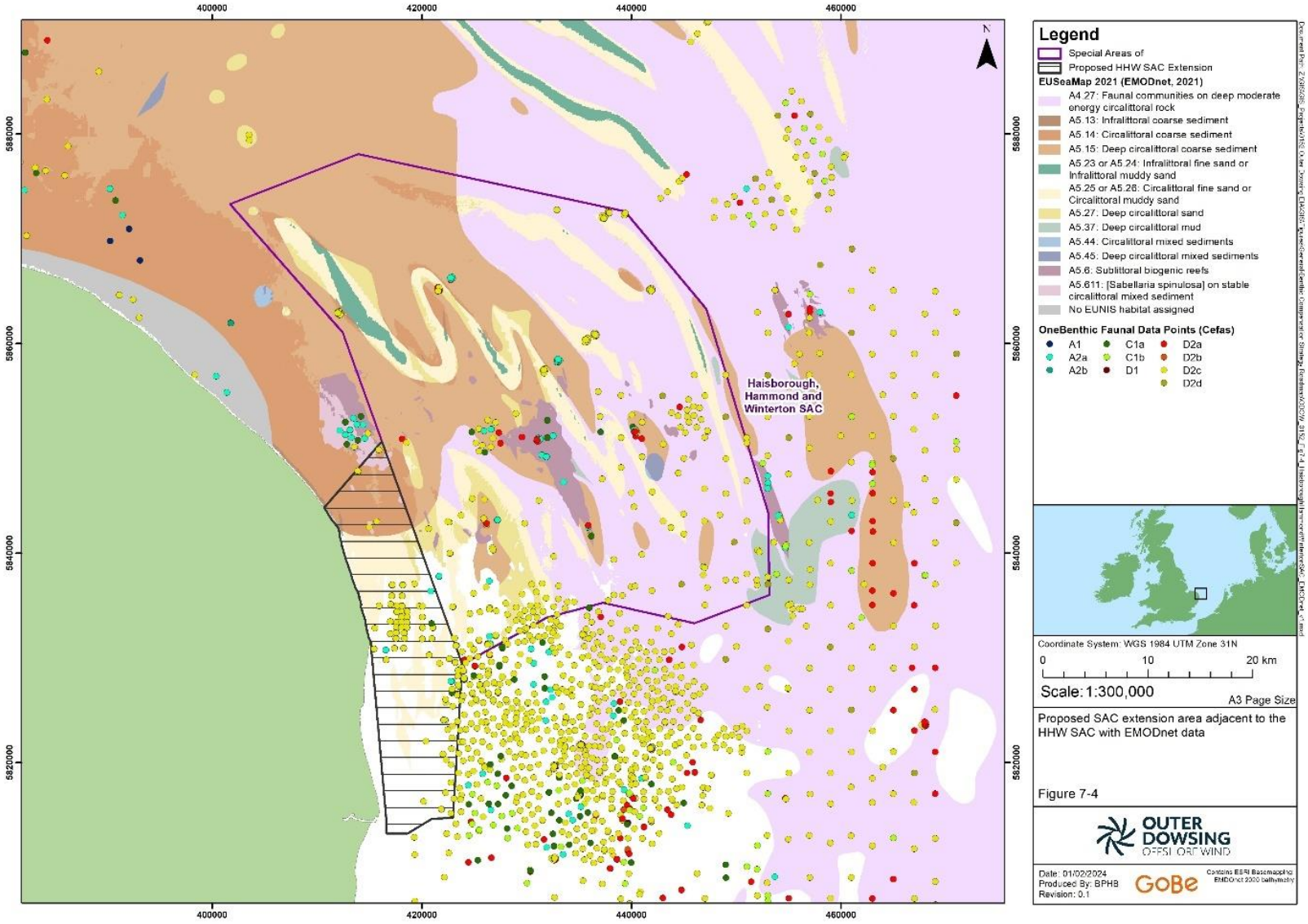

Figure 1.3 Haisborough, Hammond and Winteron SAC boundaries, showing the proposed SAC extension area (black hatching).

2. Approach to Assessment

2.1 Scope of the Assessment

The geographic scope of this assessment covers the whole of the IDRBNR SAC, HHW SAC and proposed SAC extension areas, shown in Figure 2.1.

For the purpose of recording fisheries landings, ICES Divisions[1] are divided into statistical rectangles which are consistent across the UK, Norway and European Union Member States operating in the North Sea.

The IDRBNR SAC and proposed extension area is located predominantly within ICES rectangle 35F0, with a very small portion lying within ICES rectangle 35F1; these two rectangles represent the assessment study area.

The SACs cross the 6 nautical mile (nm) boundary and 12 nm boundary and therefore lie across three different areas in terms of fisheries administration: the Eastern Inshore Fisheries and Conservation Authority (Eastern IFCA; 0 – 6 nm) and the Marine Management Organisation (MMO; beyond 6 nm and offshore of 12 nm).

The HHW SAC and proposed extension area is located predominantly within ICES rectangles 34F1 and 34F2, with small portions lying in ICES rectangles 35F1, 35F2 and 33F1; these five rectangles represent the assessment study area.

For the purposes of the assessment, commercial fishing is defined as fishing activity legally undertaken where the catch is sold for taxable profit.

[1] ICES standardise the division of sea areas to enable statistical analysis of data. Each ICES statistical rectangle is '30 min latitude by 1-degree longitude' in size (approximately 30 x 30 nautical miles). A number of rectangles are amalgamated to create ICES statistical areas.

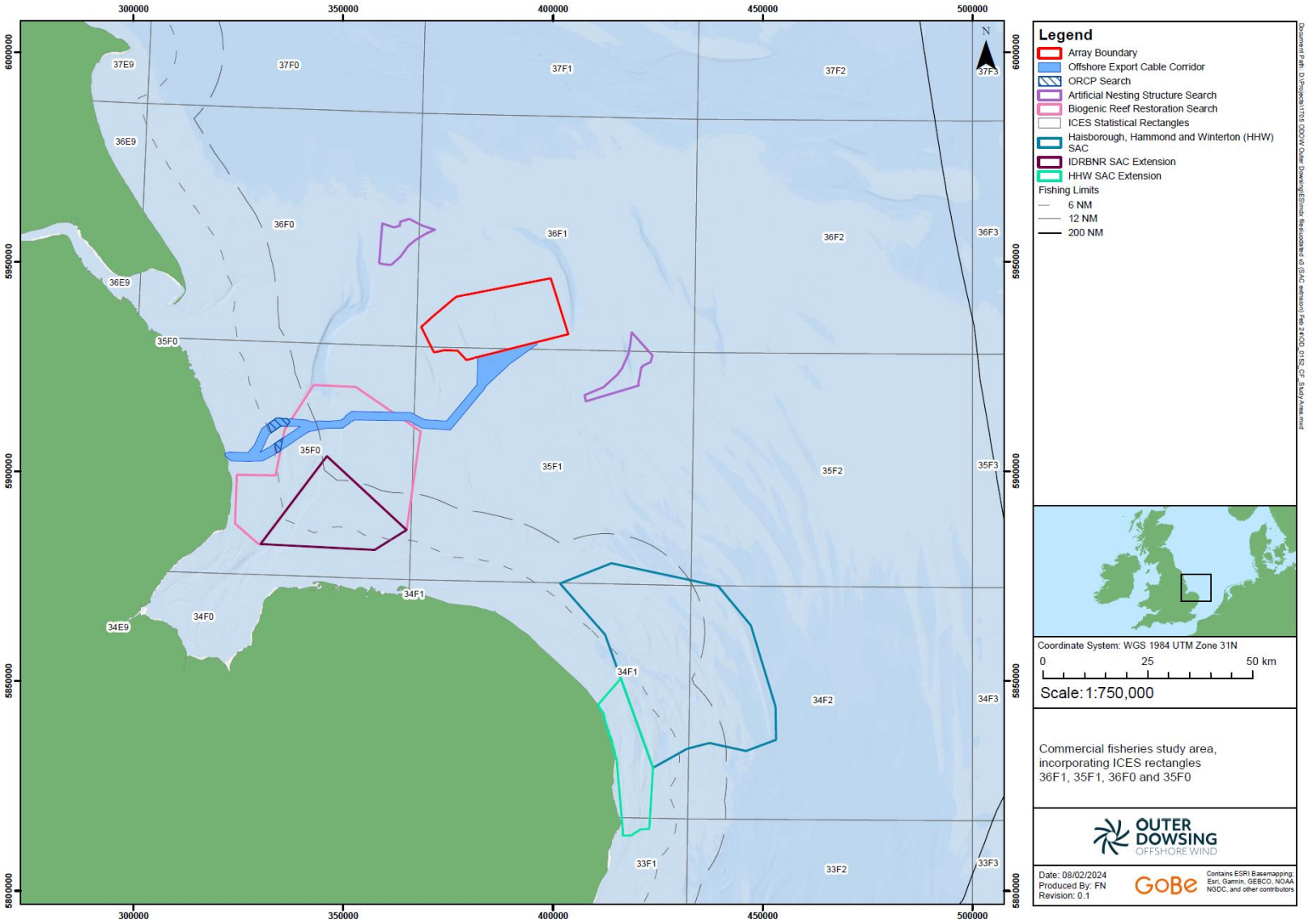

Figure 2.1 The Project boundaries and SACs and proposed extension areas, relative to ICES rectangles and fishing limits.

2.2 Data Sources

The commercial fisheries data sources presented in Table 2.1 have been used to inform this assessment. Where data sources allow, a minimum five-year trend analysis has been undertaken, using the most recent annual datasets available at the time of writing.

Additional literature has also informed this assessment, notably the Marine Management Organisation (MMO) fisheries assessment of the IDRBNR SAC (Joyce et. al., 2021) and impact assessments for the HHW SAC (Defra, 2010, MMO, 2013 and EIFCA, 2019)

Table 2.1 Data sources used to inform this assessment.

Country	Data	Time period	Source
Landings statistics			
UK	Landings statistics data for UK-registered vessels, with data query attributes for: landing year; landing month; vessel length category; ICES rectangle; vessel/gear type; port of landing; species; live weight (tonnes); and value. These landings statistics are published annually by the MMO and include vessels registered to the following UK administrations and British crown dependencies.	2017 to 2021 (2022 landings statistics have been recently published and also considered in this assessment)	MMO
All Europe	Landings statistics for EU registered vessels with data query attributes for: landing year; landing quarter; ICES rectangle; vessel length; gear type; species; and, landed weight (tonnes).	2012 to 2016	European Union (EU) Data Collection Framework (DCF) database
Spatial data			
UK	VMS data for UK registered vessels ≥15m length. Note that UK vessels ≥12m in length have VMS on board, however, to date, the MMO provide amalgamated VMS datasets for ≥15m vessels only. VMS data sourced from MMO displays the first sales value (£) of catches.	2016 to 2020	MMO
All Europe	VMS data for EU registered vessels ≥12m length. VMS data sourced from ICES displays the surface Swept Area Ratio (SAR) of catches by different gear types and covers EU (including UK) registered vessels 12m and over in length. Surface SAR indicates the number of times in an annual period that a fishing gear makes contact with (or sweeps) the seabed surface.	2017 to 2020	ICES

	Surface SAR provides a proxy for fishing intensity.		
All Europe	Fishing vessel route density, based on vessel Automatic Information System (AIS) positional data. AIS is required to be fitted on fishing vessels ≥15m length.	2019 to 2022	European Maritime Safety Agency (EMSA)
Site survey data			
UK – The Project's data	The Project's marine traffic (AIS and radar) survey data.	Summer 2022 and Winter 2023	Anatec
UK – The Project's data	The Project's fisheries scouting survey data, noting fishing gear and vessel observations.	2021 and 2022	NFFO Services

2.3 Data Limitations

A range of different data limitations and uncertainty exist for all of the commercial fisheries datasets assessed. The level of uncertainty and confidence of each data set (Table 2.2) is defined in based on judgement of the assessment team.

Limitations of landings data include the spatial size of ICES rectangles which can misrepresent actual activity across the SAC and care is therefore required when interpreting these data.

It is noted that all commercial landings by UK registered vessels are subject to the Register of Buyers and Sellers legislation and therefore landings by UK vessels of all lengths are recorded within the MMO iFISH database. While it is recognised that there is no statutory requirement for owners of vessels 10m and under to declare their catches, registered buyers are legally required to provide sales notes of all commercially sold fish and shellfish under the Registration of Fish Buyers and Sellers and Designation of Fish Auction Sites Regulations 2005 due to the 2005 Registration of Buyers and Sellers of First-Sale Fish Scheme (RBS legislation). The RBS legislation is applicable to licenced fishing vessels of all lengths and requires name and PLN (port letter and number) of the vessel which landed the fish to be recorded in relation to each purchase. For the 10 metre and under sector, landing statistics are recorded on sales notes provided by the registered buyers. Information that may not be formally recorded on the sales note, such as gear and fishing area, is added by coastal staff based on local knowledge of the vessels they administer – for example, from observations of the vessel during inspections at ports or from air and sea surveillance activities as well as discussions with the owner and/or operator of the vessel. There are occasions when fish are not subject to the RBS legislation and therefore are not represented within the MMO landings statistics database, for instance when purchases of first sale fish direct from a fishing vessel are wholly for private consumption, and less than 25kg is bought per day.

Lack of recent landings statistics for EU (non-UK) fleets is also recognised as a data limitation; based on the most recent European Commission data call, more recent landings data (2017-2019) is no longer available by ICES rectangle. Data at a scale of ICES division (e.g., the whole of the southern North Sea) is less useful to understand fishing activity specific to the area overlapping the SAC. To assist in mitigating this, recently published 2022 MMO landings statistics, which include non-UK fleet landings into UK ports by ICES rectangle, have been reviewed.

All UK and EU fishing vessels (i.e., fishing vessels flying the flag of the UK or an EU Member State), and third-party fishing vessels operating in UK and EU waters that are ≥ 12m in length are required to have a Vessel Monitoring System on board. This reports the vessels' position to fisheries management authorities, which in the case of EU fishing vessels, is every two

hours. Since 1st January 2012, this obligation has applied to vessels that are ≥ 12m in length. Limitations of publicly available VMS data are primarily focused on the coverage being limited to larger vessels 15 m and over for UK fishing vessels. It is important to be aware that where mapped VMS data may appear to show inshore areas as having lower (or no) fishing activity compared with offshore areas, this is not necessarily the case because VMS data do not include vessels typically operating in inshore area (i.e., which typically comprises of vessels <15m in length). To assist in mitigating the risk of under-representing smaller inshore vessels, site-specific marine traffic survey data comprising information on vessel movements gathered by Automatic Identification System (AIS) and radar has been analysed alongside VMS data (Anatec, 2022 and 2023), though it is acknowledged that these surveys were focused on data collection across the array area.

Table 2.2 Data limitations and uncertainty (the uncertainty and confidence levels are defined based on judgement).

Data Source	Type of Data	Limitations and uncertainty
Landings statistics		
MMO	Landings statistics (2017-2022) data for UK-registered vessels.	The data is recorded from sales notes and landing declarations for all vessel lengths. Due to the UK legislation of Registration of Buyers and Sellers data is considered accurate and verifiable. Data assessed with: low uncertainty and high confidence.
EU DCF	Landings statistics (2012-2016) data for all EU landings by country, species and gear type.	The data Is submitted by individual member states and therefore limitations vary per country. Vessels under 10m may be omitted or mis-represented by the data. Accuracy is likely to be greater for landings from larger vessels. For UK vessels under 10m length data is assessed with: high uncertainty and low confidence. For all other EU vessels data is assessed with: low uncertainty and high confidence.
Spatial data		
MMO	UK VMS data for vessels ≥15m length.	The data is only available for 15m and over vessels, so is not representative of <15m vessels. Data assessed with: medium uncertainty and medium confidence.
ICES	EU SAR data for vessels ≥12m length.	The data is only available for 12m and over vessels, so is not representative of <12m vessels. Data assessed with: medium uncertainty and medium confidence.
EMSA	AIS data for fishing vessels ≥15m length.	The data is only available for 15m and over vessels, so is not representative of <15m vessels. Data assessed with: medium uncertainty and medium confidence.
Anatec	Marine traffic (AIS and radar) survey data (2022 and 2023).	An assessment undertaken into fishing vessel activity to inform the Navigational Risk Assessment (NRA) undertaken for the Project Based on a 14-day AIS and radar survey in summer 2022 and in winter 2023. Data assessed with: low uncertainty and high confidence.
NFFO Services	Fisheries scouting survey (2021 and 2022).	Fishing gear observations made from scouting survey vessel during scouting surveys undertaken across the array area and offshore ECC from summer 2021 to summer 2022.

		Data assessed with: low uncertainty and high confidence.

3. Fishing Activity in the IDRBNR SAC

The following sections describe fishing activities in the SAC and proposed extension area, based on the datasets listed in Table 2.1.

3.1 Existing Fisheries Management

In addition to limits on catch volumes, a number of fisheries restrictions are in place based primarily on byelaws, intended to protect fish stocks and their habitats. These restrictions include limits on minimum landings sizes, technical measures relating to fishing gear design and use, limits on fishing effort, and temporary and permanent fishery closures.

Within the SAC, spatial restrictions are in place as follows (Figure 3.1):

- Eastern IFCA Byelaw 3 – molluscan shellfish methods of fishing, prohibiting fishing for oysters, mussels, cockles, clams, king or queen scallops unless holding the appropriate certificate;
- Eastern IFCA Byelaw 12 – inshore trawling restriction, prohibiting fishing vessels over 15.24 m length from using towed nets within 3NM of the coast;
- Eastern IFCA Byelaw 15 – towed gear restriction for bivalve molluscs, prohibiting fishing vessels over 14m length from fishing for molluscs using any type of towed gear;
- Eastern IFCA Whelk Permit Byelaw 2016 – a person must not use fishing gear other than a whelk pot in fishing for whelk and must not set whelk pots unless the whelk pots are marked with valid whelk permit tags provided by the Authority;
- MMO Byelaw Inner Dowsing Race Bank and North Ridge Special Area of Conservation (SAC) 2022–- a person must not use bottom towed fishing gear (trawls, seines, dredges or similar) in a specified area of reef or a specified area of sandbank; and
- MMO Byelaw Inner Dowsing Race Bank and North Ridge SAC 2022 – a person must not use static fishing gear (fixed nets and pots) in a specified area of reef.

The MMO 2022 byelaw specifically seeks to protect sandbank and reef features in the SAC from fishing pressures (Figure 3.2). The establishment of the byelaw was informed by the MMO fisheries assessment of the SAC (Joyce et. al., 2021), which concluded that the preferred means of protection of the SAC would be via implementation of a (now active) byelaw to ensure the risk of adverse effect on site integrity is removed by prohibiting bottom towed fishing gear over the sandbank and reef features and prohibiting static gears over the reef features.

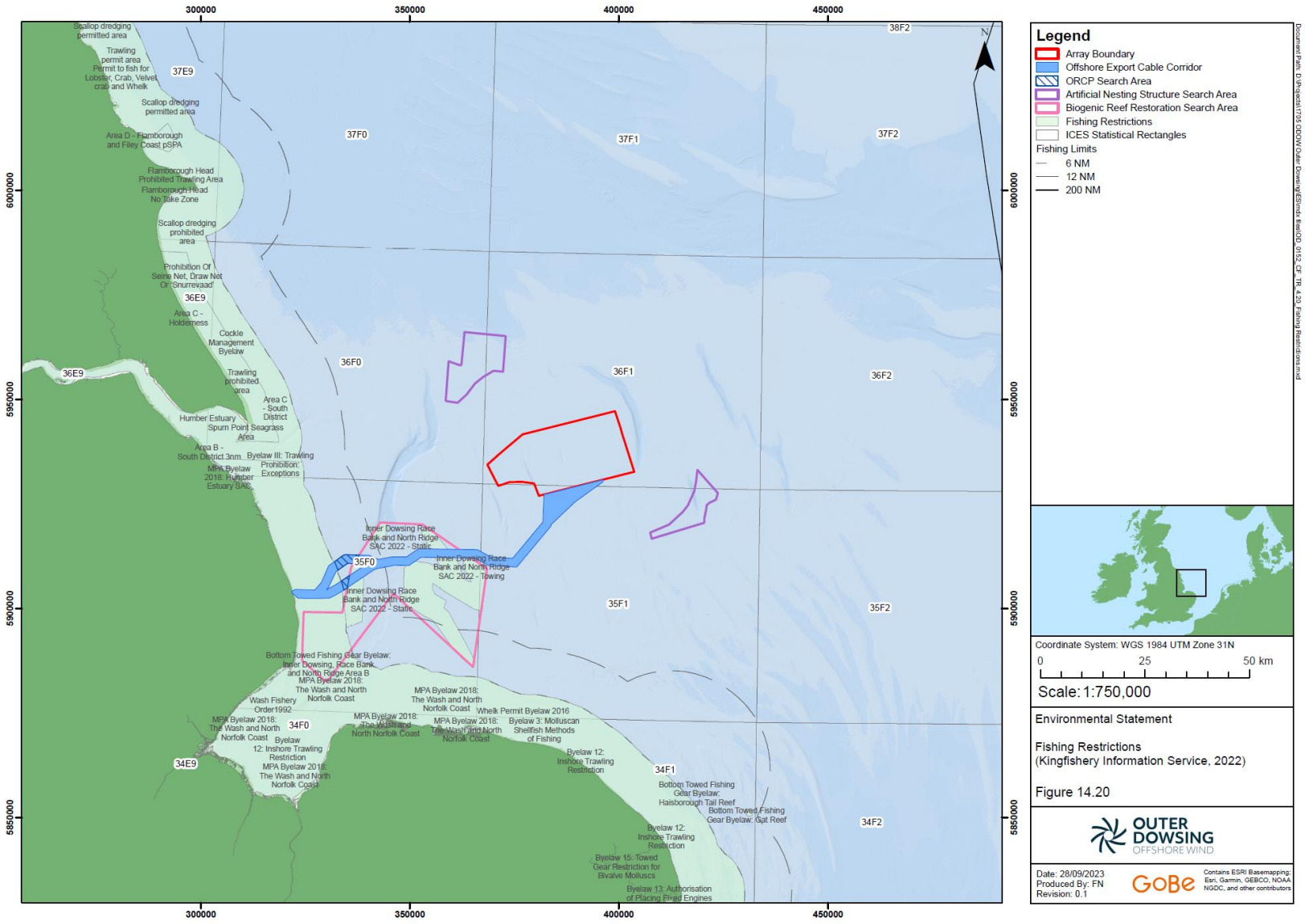

Figure 3.1 Spatial fishery restrictions in the SAC.

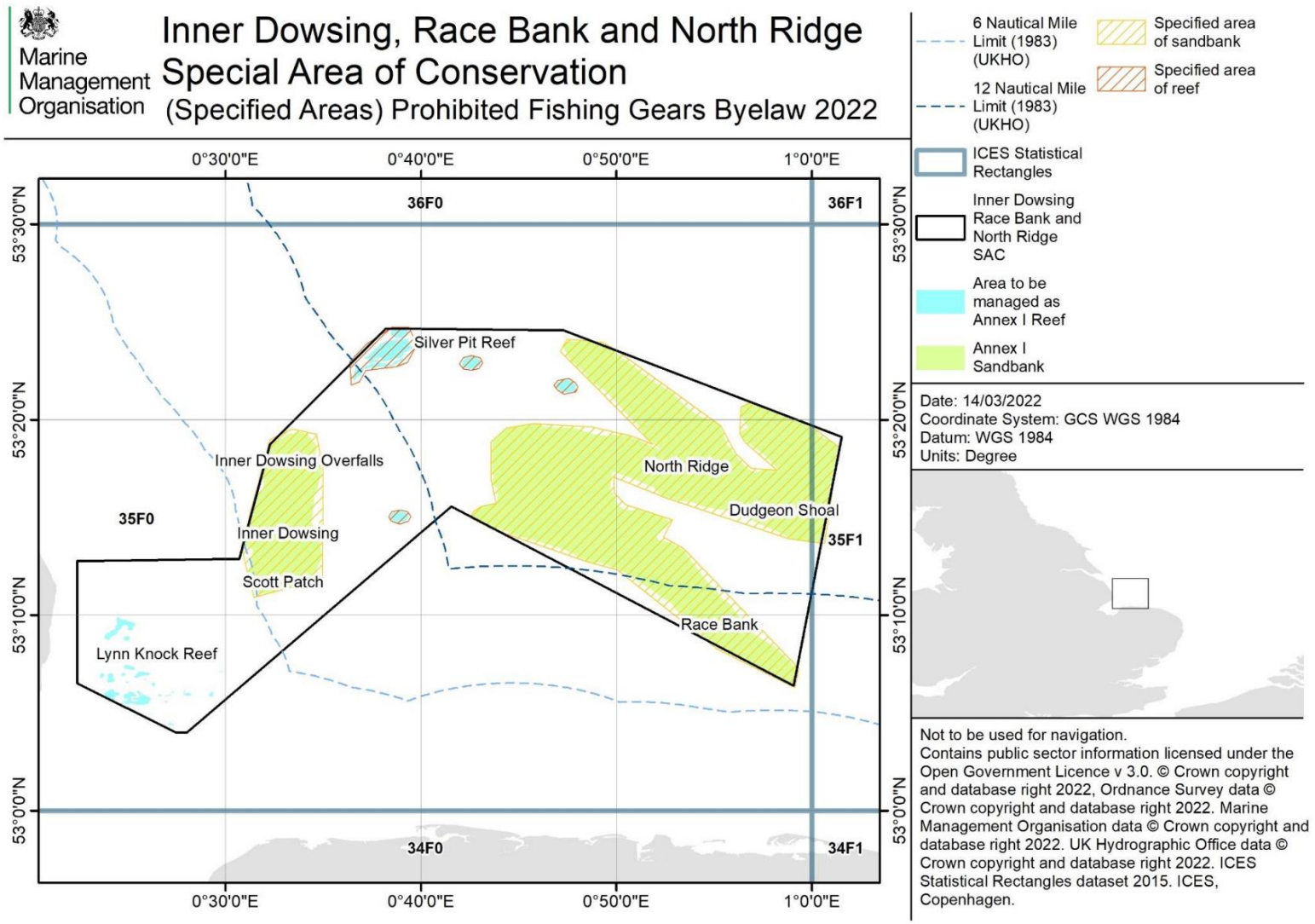

Figure 3.2 Specified areas of sandbank and reef within the SAC where a byelaw prohibits fishing using certain fishing gear types (MMO, 2022).

3.2 Overview

An overview of UK and EU vessel landings is provided immediately below. Data indicates that the vast majority of vessels operating within the SAC and proposed extension area are UK vessels.

3.2.1 UK Landings

The annual average value of landings by UK-registered fishing vessels from the two ICES rectangles that overlap the SAC is depicted in Figure 3.3 below, across a ten-year time series.

The average annual value of landings from ICES rectangle 35F0 across the most recent five-year time series from 2017 to 2021 was £2.1 million and in rectangle 35F1 was £1.9 million.

Over 99% of landings by UK vessels from the two rectangles by UK vessels are of shellfish species. Figure 3.4 indicates that the key species landed from ICES rectangle 35F0 are cockles *Cerastoderma edule*, brown crabs *Cancer pagurus*, whelks *Buccinum undatum*, brown shrimps *Crangon crangon* and lobsters *Homarus gammarus*. A brown shrimp beam trawl fishery and hand-worked cockle fishery are both focused on The Wash, to the south of the Project's offshore export cable corridor. The key species landed from ICES rectangle 35F1 are whelks, lobsters and brown crabs.

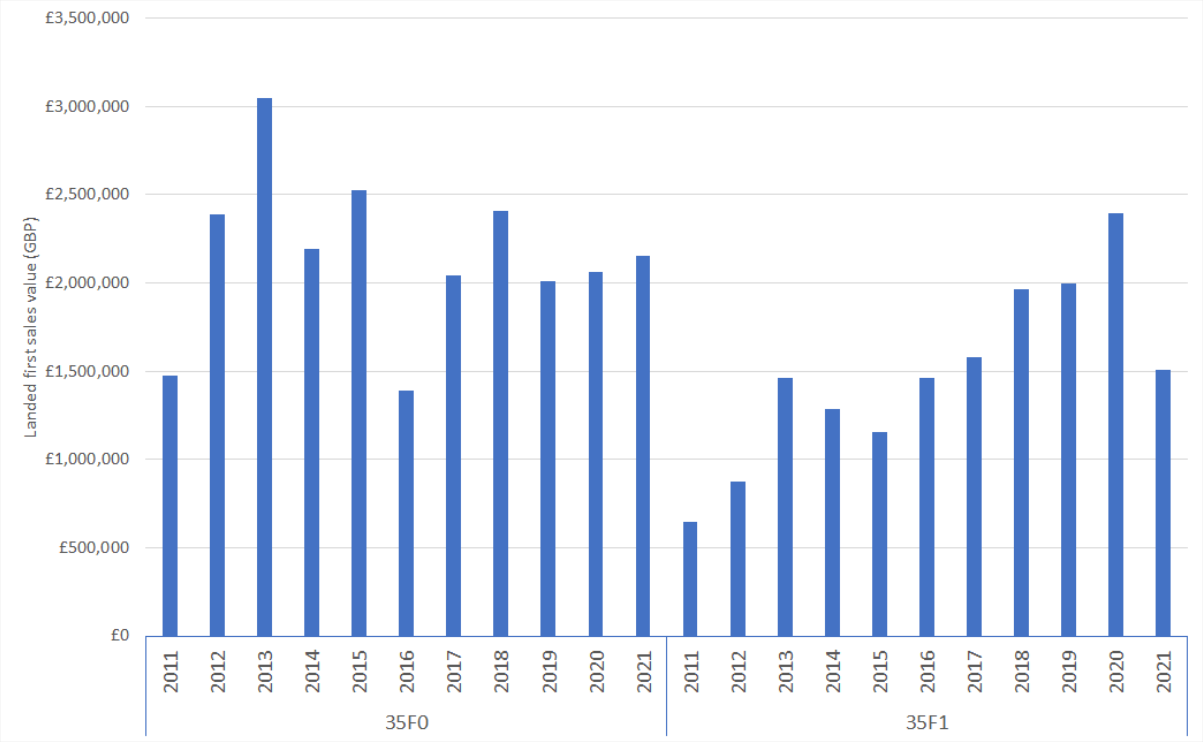

Figure 3.3 Value of landings (2011 to 2021) by ICES rectangle (Source: MMO, 2022).

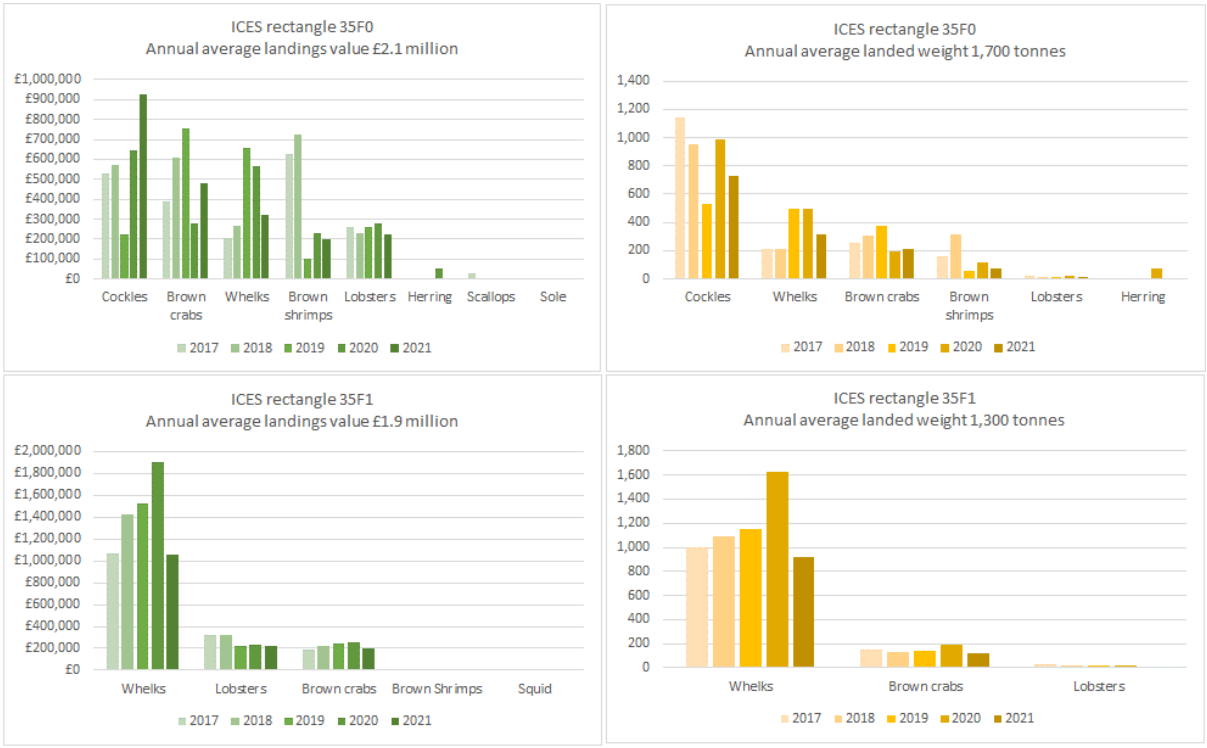

Figure 3.4 Key species by annual landed value (GBP) and weight (tonnes) (2017 to 2021) from ICES rectangles 35F0 and 35F1 (Source: MMO, 2022).

3.2.2 Non-UK Landings

Landings data sourced from the EU DCF database indicates that there is potential for some non-UK fishing activity in the study area (Figure 3.5). In ICES rectangles 35F0 and 35F1 the majority of landings are made by UK-registered vessels, with EU landings data indicating some presence of French otter trawlers targeting whiting *Merlangius merlangus* and mackerel *Scomber scomber* and Dutch beam trawlers targeting plaice *Pleuronectes platessa* and sole *Solea solea*.

EU DCF landings data disaggregated by ICES rectangle is dated, leaving some degree of uncertainty around current EU fleet activity in the SAC. However, very recently published MMO UK landings statistics for 2022 do also record EU fleet activity and in 2022 no landings from ICES rectangles 35F0 and 35F1 were attributed to EU vessels, indicating very limited potential for non-UK fishing activity in the SAC (MMO, 2023).

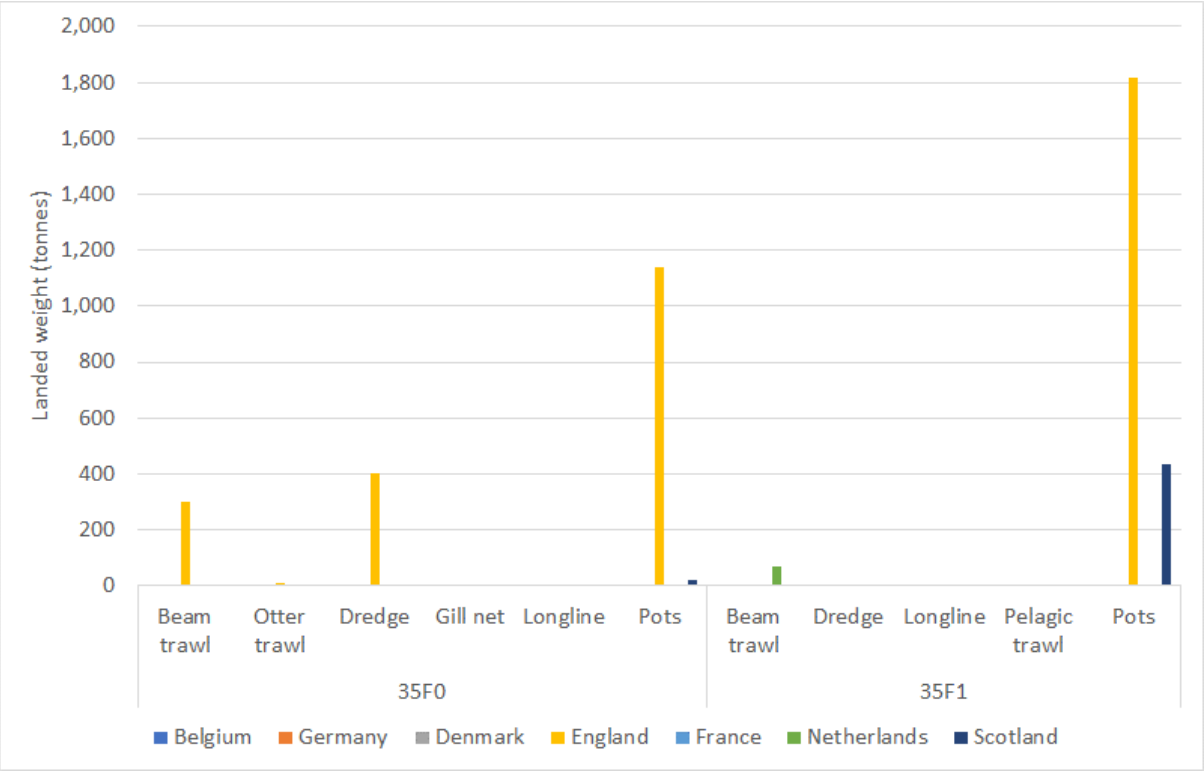

Figure 3.5 Average annual landed weight (tonnes) landed by all UK and EU countries (2012 to 2016[2]) (Source: EU DCF, 2022).

3.3 Fishing by Gear Type

3.3.1 Overview

Several fishing fleets are active across the two ICES rectangles as indicated by landings statistics for gear type (Figure 3.6). UK-registered vessels deploying pots dominate landings in terms of both landed weight and value. Landings associated with the 'other mobile gears' category shown in Figure 3.6 are of cockle in The Wash, a fishery that does not overlap with the SAC. Landings data also indicates the use of beam trawls in ICES rectangle 35F0.

[2] From 2017 onwards landings data in the EU DCF database by country are not available by ICES rectangle, hence the presentation of data from 2012 to 2016 to ensure focus on the commercial fisheries study area.

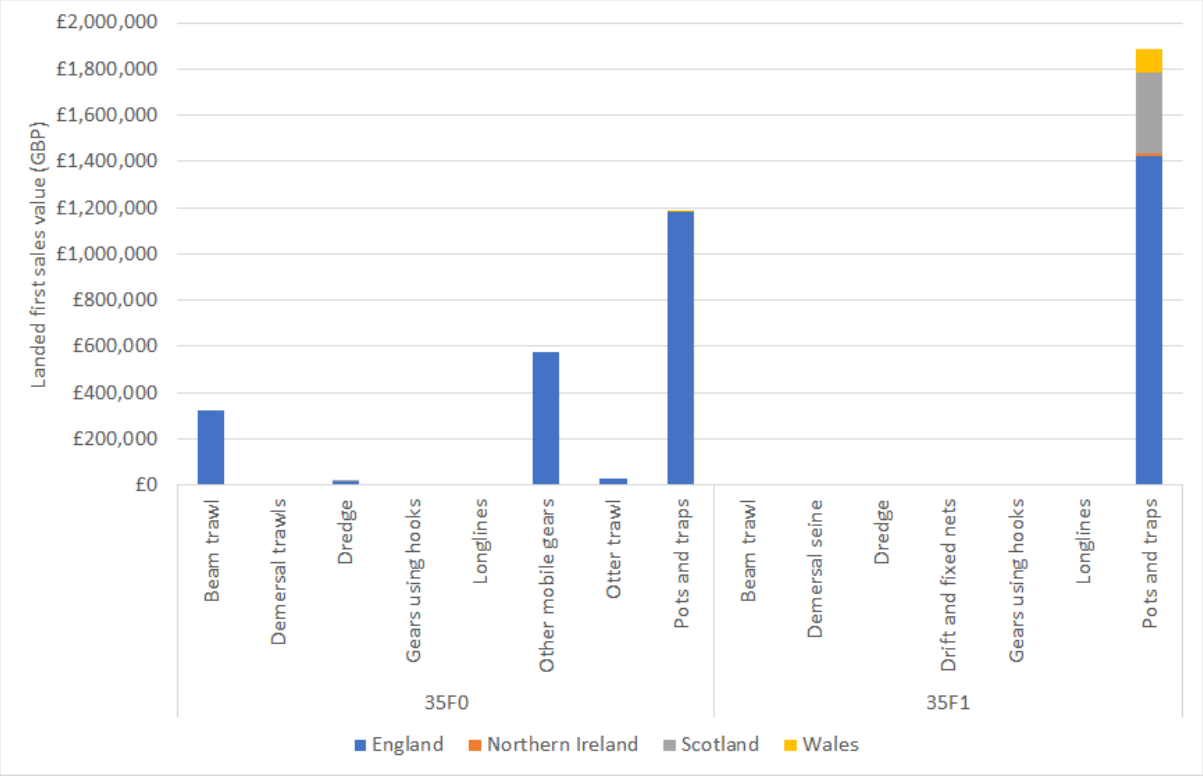

Figure 3.6 Annual average landings value 2017 to 2021 by gear type and UK vessel origin for the study area (Source: MMO, 2022).

The proportion of the total landings from ICES rectangles 35F0 and 35F1 that can be attributed to Inner Dowsing, Race Bank and North Ridge SAC can be estimated (assuming uniform landings across entire rectangles) based on the proportion of the area of the rectangles that is occupied by the SAC.

The sea area of ICES 35F0 is 2710.35 km^2, of which 831.93 km^2 is occupied by Inner Dowsing, Race Bank and North Ridge SAC. The sea area of ICES 35F1 is 3714 km^2, of which 13.41 km^2 is occupied by Inner Dowsing, Race Bank and North Ridge SAC. Therefore, Inner Dowsing, Race Bank and North Ridge SAC accounts for 30.69% of ICES Rectangle 35F0 and 0.36% of ICES Rectangle 35F1 respectively. These percentages were used to calculate the values shown in Table 3.1 and Table 3.2. While such a simplistic calculation brings a high level of uncertainty to the resulting figure, it does further demonstrate that the key gear types active in the SAC are pots and beam trawls.

Table 3.1 Annual average (2018 to 2022) landed weight from ICES rectangles 35F0 and 35F1 by gear type.

Gear Type	Landed Weight (tonnes, rounded to nearest whole tonne)			
	ICES rectangle 35F0 (100.00%)	***SAC proportion (30.69%)***	**ICES rectangle 35F1 (100.00%)**	***SAC proportion (0.36%)***
Pots and traps	670	*206*	1,229	*4*
Other mobile gears (cockles)	675	*207*	0	*0*
Beam trawls	97	*30*	1	*0*
Demersal trawls	9	*3*	0	*0*

Dredge	20	*6*	0	*0*
Pelagic trawls	15	*5*	0	*0*
Longlines	0	*0*	0	*0*
Demersal seine	0	*0*	1	*0*
Drift and fixed nets	0	*0*	0	*0*

Table 3.2 Annual average (2018 to 2022) landed value from ICES rectangles 35F0 and 35F1 by gear type.

Gear Type	Landed Value (GBP)			
	ICES rectangle 35F0 (100.00%)	***SAC proportion (30.69%)***	**ICES rectangle 35F1 (100.00%)**	***SAC proportion (0.36%)***
Pots and traps	£1,206,060	*£370,140*	£1,732,001	*£6,235*
Other mobile gears (cockles)	£532,034	*£163,281*	£0	*£0*
Beam trawls	£231,042	*£70,907*	£2,621	*£9*
Demersal trawls	£19,610	*£6,018*	£0	*£0*
Dredge	£16,812	*£5,160*	£265	*£1*
Pelagic trawls	£10,915	*£3,350*	£0	*£0*
Longlines	£186	*£57*	£760	*£3*
Demersal seine	£0	*£0*	£2,816	*£10*
Drift and fixed nets	£0	*£0*	£807	*£3*

3.3.2 Pots and Traps

Landings Data Summary

Key species targeted using pots are brown crab, lobster and whelk. Landings data indicates that landings of crab and lobster across the two ICES rectangles have remained relatively consistent over the past several years, with landings of whelk more noticeably fluctuating. Data indicates that whelks are targeted year-round, with a spring peak in the fishery. Crab fisheries peak in late summer and lobster fisheries peak in late summer and in the winter in the run-up to Christmas. Almost 80% of landings are made by vessels under 15-metres length. Some vessels will operate fleets of crab and lobster pots and whelk pots simultaneously.

Spatial Data Summary

VMS data sourced from the MMO (Figure 3.7, Figure 3.8) displays the value of catches for UK registered vessels 15m and over in length. Data indicates limited activity by larger (15-metre length and over) potting vessels within the SAC, with some larger vessel activity in the far northern and eastern portions of the SAC, presumably avoiding the static gear restriction around Silver Pit Reef specified in the SAC byelaw.

A mapping project undertaken by the EIFCA in 2010 described the spatial coverage of fishing for shellfish species for all vessels in the UK fleet. Figure 3.9 presents the shellfish fishing grounds which indicates that in 2010 whelk, crab and lobster and brown shrimp fishing grounds overlapped with some areas of the SAC. It is understood that the 2010 mapping is based on targeted interviews with a sample of fishermen (~12) active at that time and is

therefore not representative of the entire fleet or current activity. It is also not reflective of activity outside of the mapped areas.

Fisheries scouting surveys were conducted between July 2021 and June 2022 across the Project area. The aim of these surveys was to identify potting areas and gear within the offshore ECC and array area, enabling liaison with relevant operators ahead of site investigation survey. The surveys recorded static potting gear in distinct locations along the offshore ECC, within the SAC, as shown in Figure 3.10.

MMO Fisheries Assessment Summary

The MMO fisheries assessment of the SAC (Joyce et. al., 2021) commented that there are approximately ten under 10-metre potting vessels active in the SAC. Up to six of these fish regularly in the site on and around the 6 nm limit adjacent to Inner Dowsing sandbank with the remaining four vessels fishing more occasionally. Approximately seven whelk potters fish regularly within the site and a further seven fish occasionally. A few vessels larger than 12-metres use pots within the site but the vast majority of effort comes from a single vessel.

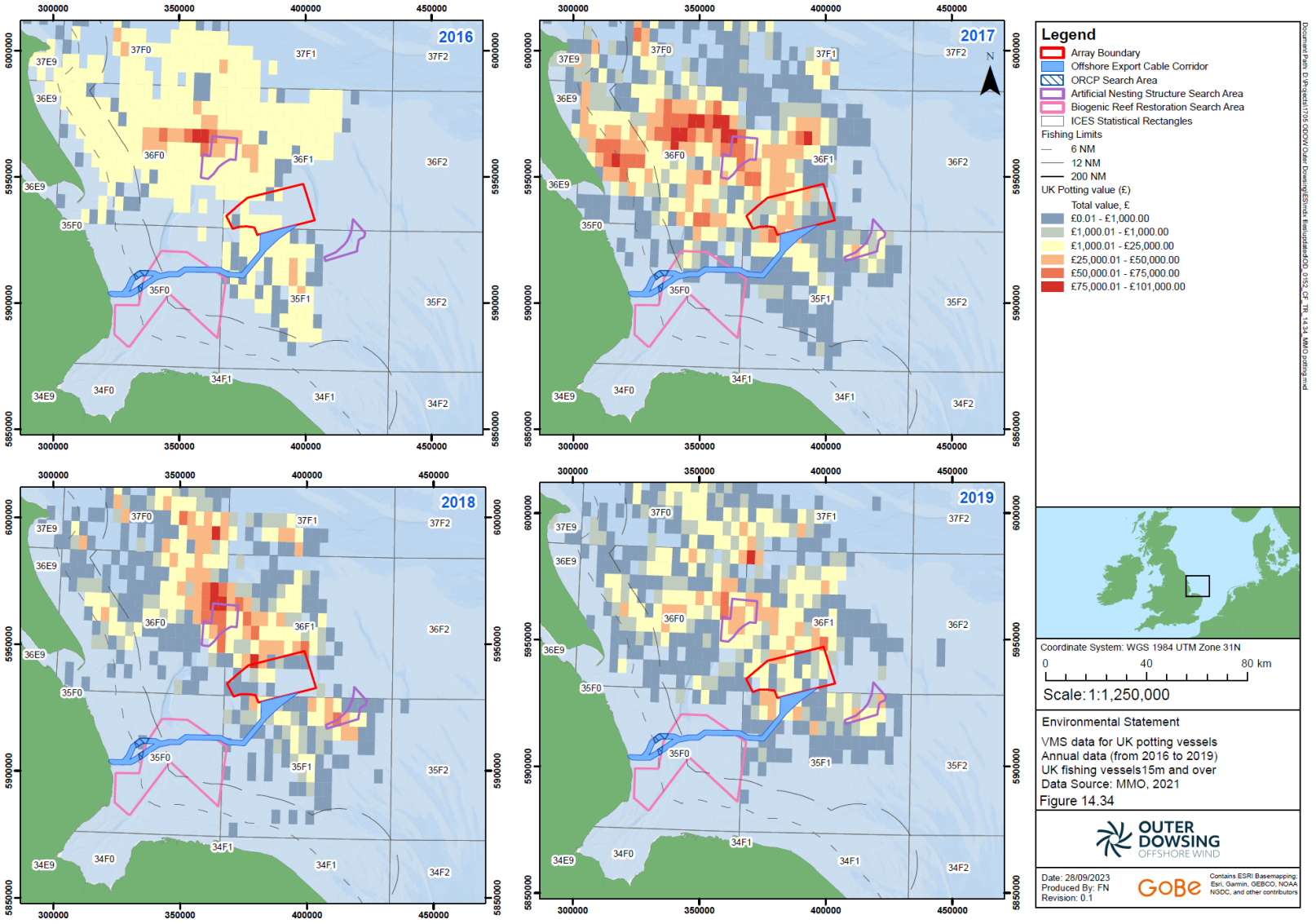

Figure 3.7 UK vessels ≥ 15m length actively fishing using pots and traps 2016 to 2019 (Source: MMO, 2021).

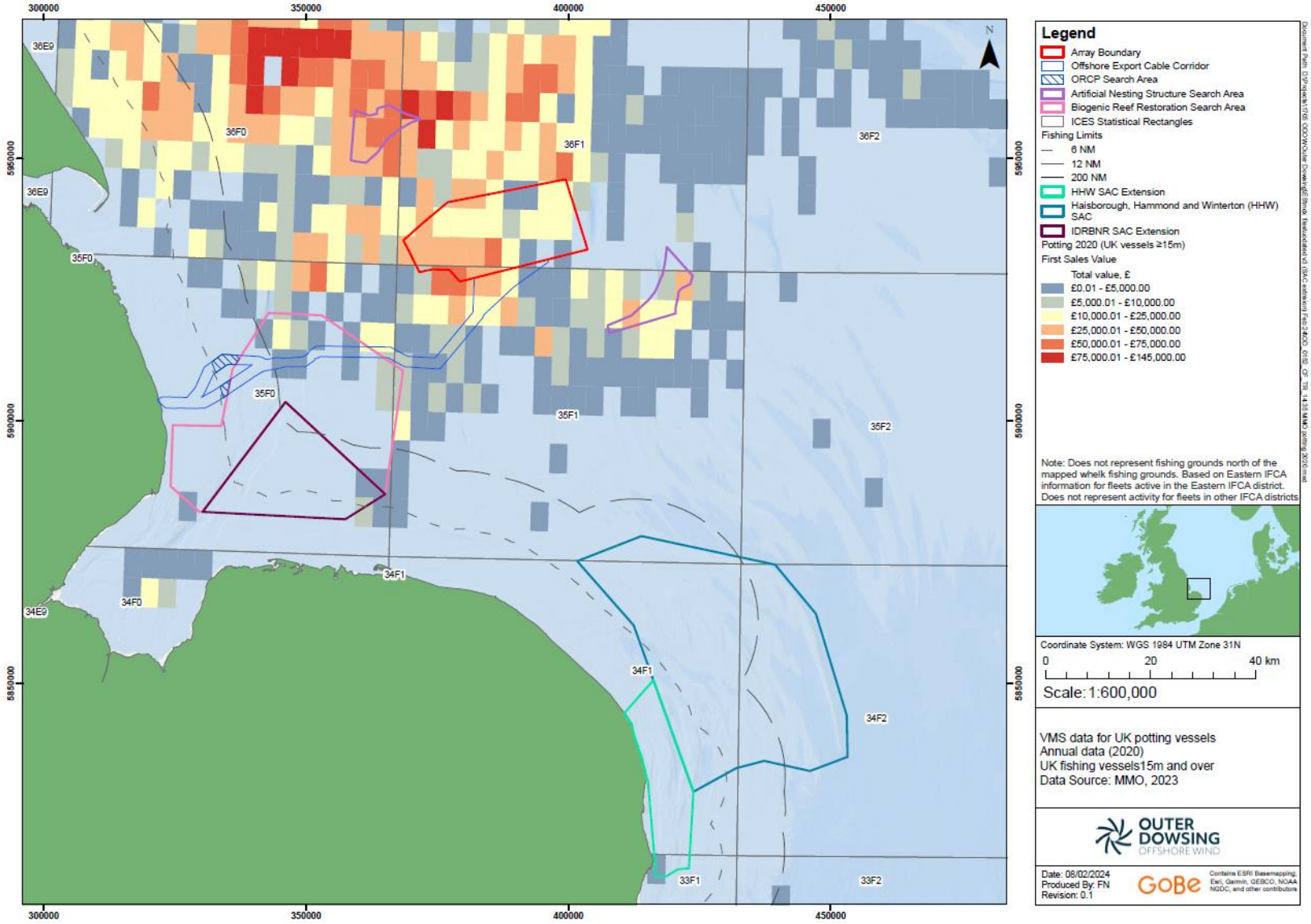

Figure 3.8 UK vessels ≥ 15m length actively fishing using pots and traps 2020 (Source: MMO, 2023).

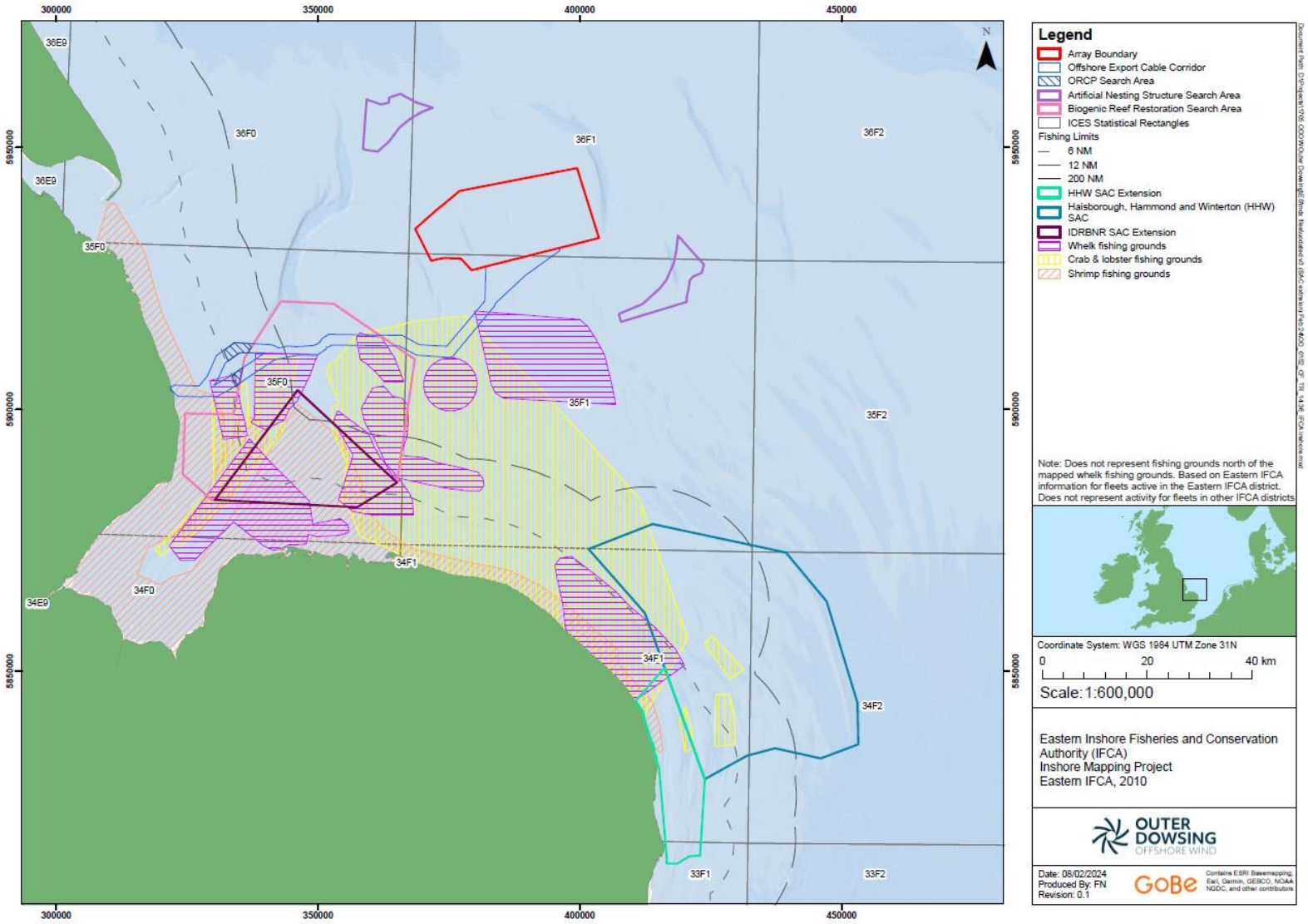

Figure 3.9 EIFCA Mapping Project – shellfish fishing grounds based on interviews undertaken by the EIFCA with a sample of fishermen in 2010.

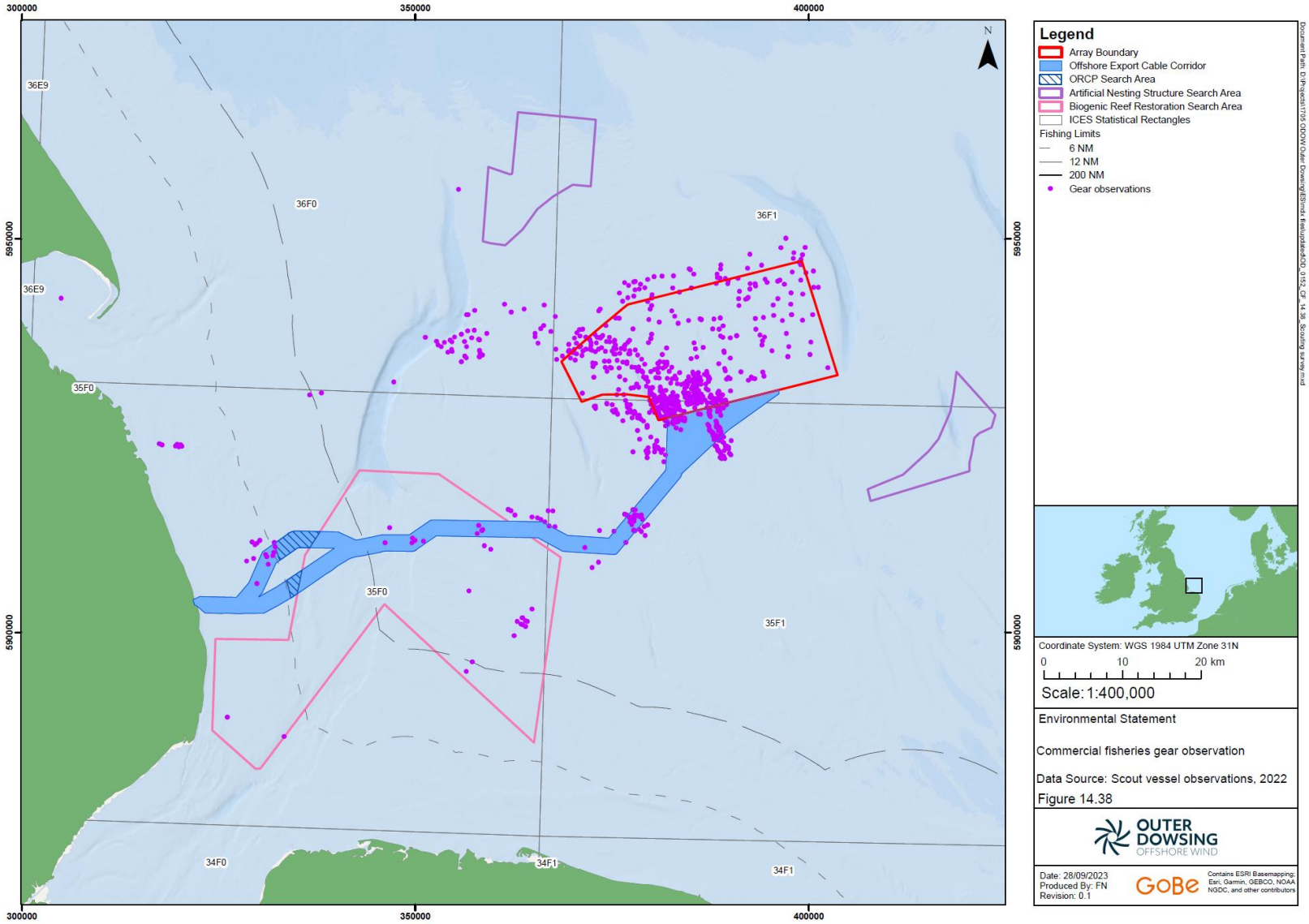

Figure 3.10 Fisheries scouting survey static gear observations during 2021 and 2022 (Source: NFFO Services, 2022).

3.3.3 Beam Trawls

Landings Data Summary

UK beam trawlers active in the ICES rectangles are primarily associated with the brown shrimp fishery in The Wash, recognised as a nationally important fishery representing over 90% of UK North Sea brown shrimp landings. Brown shrimp vessels operate principally in inshore waters, normally from 0 to 6NM and are from 7m to 18m in length. Landings data indicates that landings of brown shrimp across the two ICES rectangles declined notably after 2018 and have remained relatively stable since then, resulting in average annual landings of 50 tonnes of brown shrimp between 2019 and 2022. Data indicates that brown shrimp are primarily targeted through autumn and winter. Almost 70% of landings are made by vessels under 15-metres length.

Spatial Data Summary

VMS data sourced from ICES displays the surface SAR of catches by different gear types and covers EU (including UK) registered vessels 12m and over in length. Surface SAR indicates the number of times in an annual period that a fishing gear makes contact with (or sweeps) the seabed surface. Surface SAR provides a proxy for fishing intensity.

VMS data sourced from the MMO displays the value of catches for UK registered vessels 15m and over in length.

VMS data indicates a concentration of UK beam trawl activity in and around The Wash embayment, associated primarily with the brown shrimp fishery, with some potential for activity to overlap with the very inshore portion of the SAC, but with beam trawl activity broadly avoiding the SAC (and its associated byelaw restrictions). Shrimp trawling can be carried out in water depths up to 50m, however, brown shrimp trawling is primarily carried out in waters of 0 to 10m depth, often following the submerged edges of sandbanks, and channels between sandbanks.

EU beam trawl activity is focused outside of the SAC with key EU fishing grounds located to the southeast.

MMO Fisheries Assessment Summary

The MMO fisheries assessment of the SAC (Joyce et. al., 2021) commented that seven 10-metre beam trawlers may fish occasionally within the SAC.

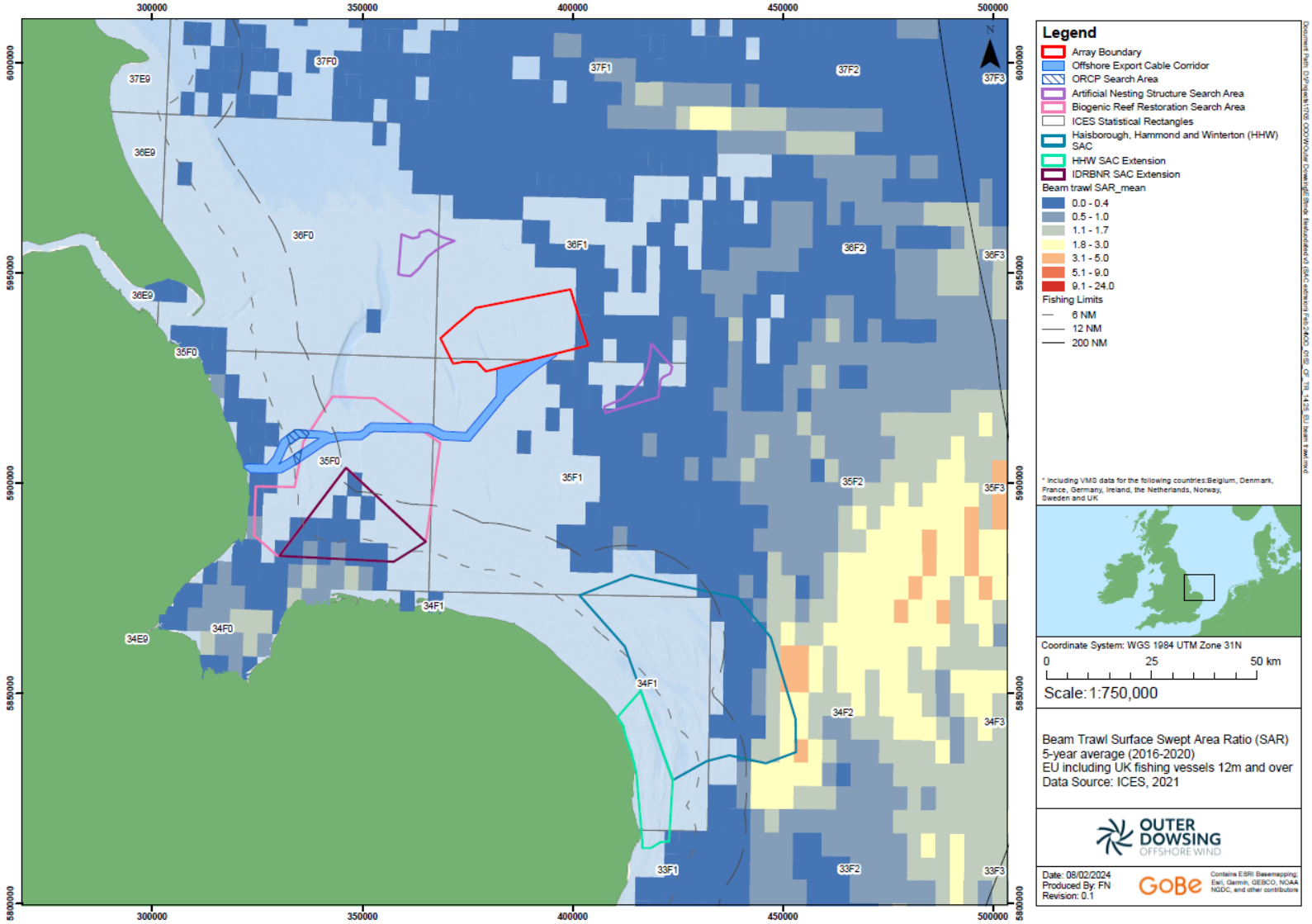

Figure 3.11 Surface Swept Area Ratio 2016 to 2020 for EU (including UK) vessels ≥ 12m length using beam trawl gear (Source: ICES, 2021).

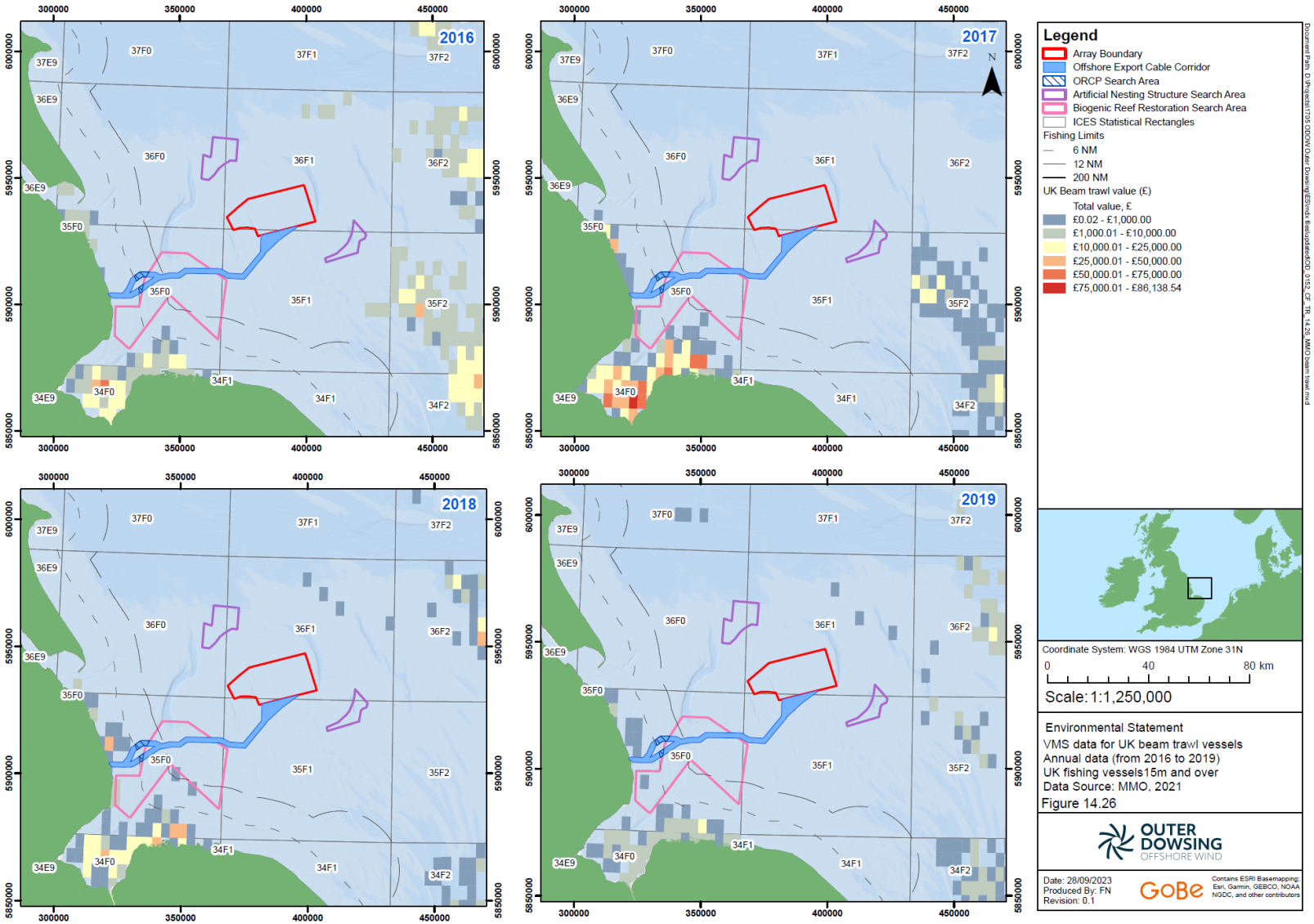

Figure 3.12 UK vessels ≥ 15m length actively fishing using beam trawls 2016 to 2019 (Source: MMO, 2021).

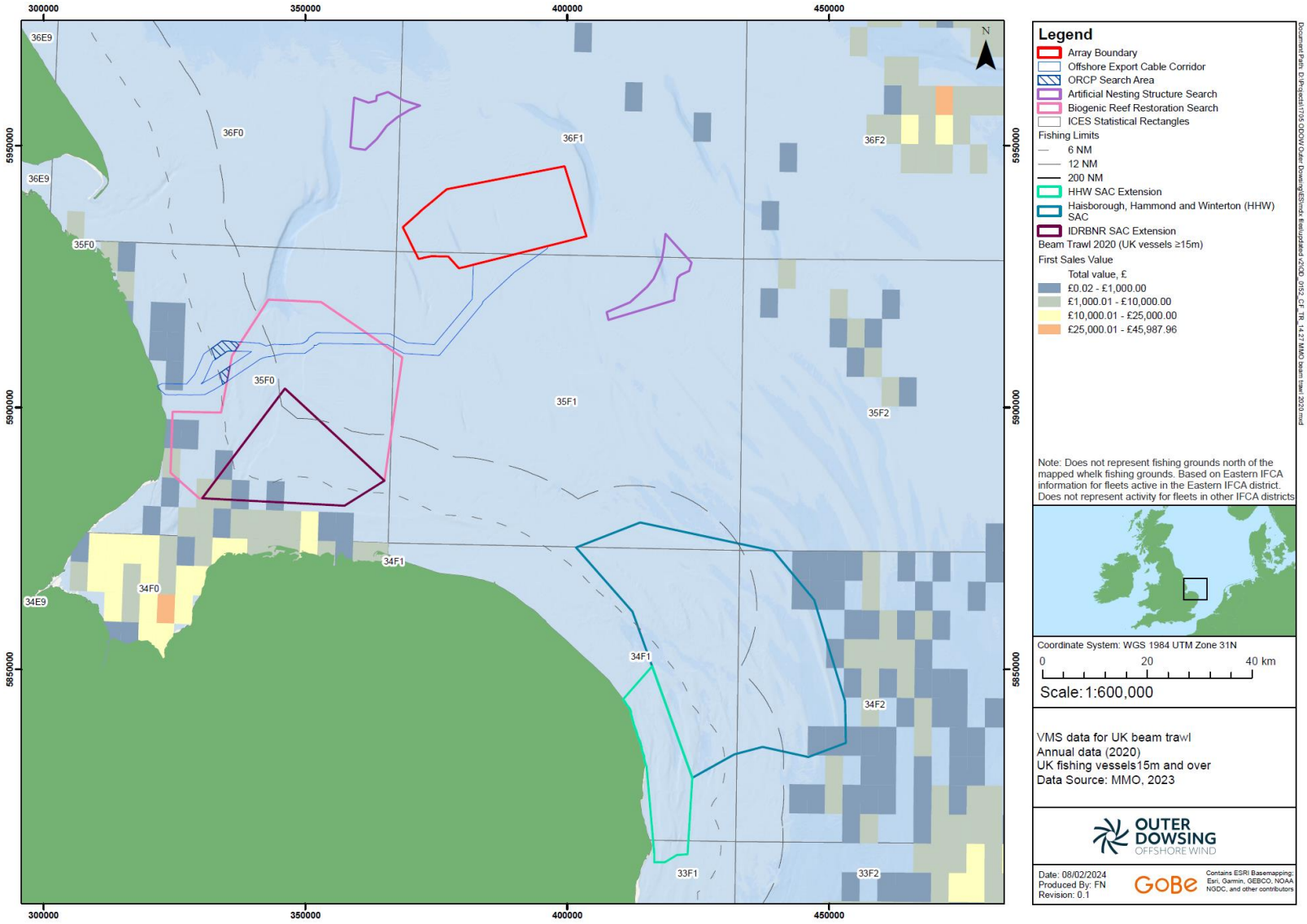

Figure 3.13 UK vessels ≥ 15m length actively fishing using beam trawls 2020 (Source: MMO, 2023).

3.3.4 Other Gear Types

A number of other gear types may be deployed across the two ICES rectangles, but are unlikely to be actively deployed with any frequency within the SAC. These gear types are include:

- Demersal Trawls–- The MMO fisheries assessment of the SAC (Joyce et. al., 2021) notes whitefish trawling is limited and carried out by approximately two under 10-metre vessels. Vessels fish between October and July. Landings data indicates that demersal trawls may occasionally be used within the SAC to target mixed demersal whitefish and in 2022 approximately 4 tonnes of landings from ICES rectangles 35F0 (no landings were made from 35F1) were attributed to demersal trawls (MMO, 2023) (Figure 3.15 and Figure 3.16). EU demersal trawl activity is focused outside of the SAC with key EU fishing grounds located to the east, but VMS data indicates the potential for some EU (French) fishing activity in the northern extent of the SAC (Figure 3.14).
- Dredges – Whilst landings data indicates landings by dredge gear from the two ICES rectangles, this is associated with the cockle fishery in the Wash, which does not overlap with the SAC.
- Pelagic Trawls – Landings data indicates a catch of herring by pelagic trawl from ICES rectangle 35F0 in 2020. This is an isolated landing event and in 2022 no landings from ICES rectangles 35F0 and 35F1 were attributed to pelagic trawls (MMO, 2023).
- Longlines–- The MMO fisheries assessment of the SAC (Joyce et. al., 2021) notes that that in 2016, there were reports of six under 10 metre vessels fishing with longlines which work around the Inner Dowsing sandbank area in winter targeting cod. Landings data indicates that longlines may occasionally be used across the two ICES rectangles to target ray species and in 2022 approximately 0.3 tonnes of landings from ICES rectangles 35F0 and 35F1 were attributed to longlines (MMO, 2023).
- Demersal Seine–- Flyseine activity in the Channel and southern North Sea is understood to be increasing, involving a relatively small number of powerful vessels, which are either purpose-built or converted beam trawlers (Defra, 2022). MMO landings data validates this trend, with 2021 and 2022 landings data showing an increase in landings by demersal seine, with target species including squid Loligo, mullets Mugilidae and whiting. The extent to which activity may overlap with the SAC is unknown, but in 2022 approximately 3 tonnes of landings from ICES rectangles 35F1 (no landings were made from 35F0) were attributed to demersal seine gear (MMO, 2023), indicating that activity is likely to be focused further offshore and outside of the SAC.
- Drift and Fixed Nets–- The MMO fisheries assessment of the SAC (Joyce et. al., 2021) notes that the gill netting occurs occasionally in winter in the SAC (depending on weather). Landings data indicates that historically nets were used across the two ICES rectangles to target small volumes of herring. In 2022 less than 0.2 tonnes of landings from ICES rectangles 35F0 and 35F1 were attributed to drift and fixed nets (MMO, 2023).

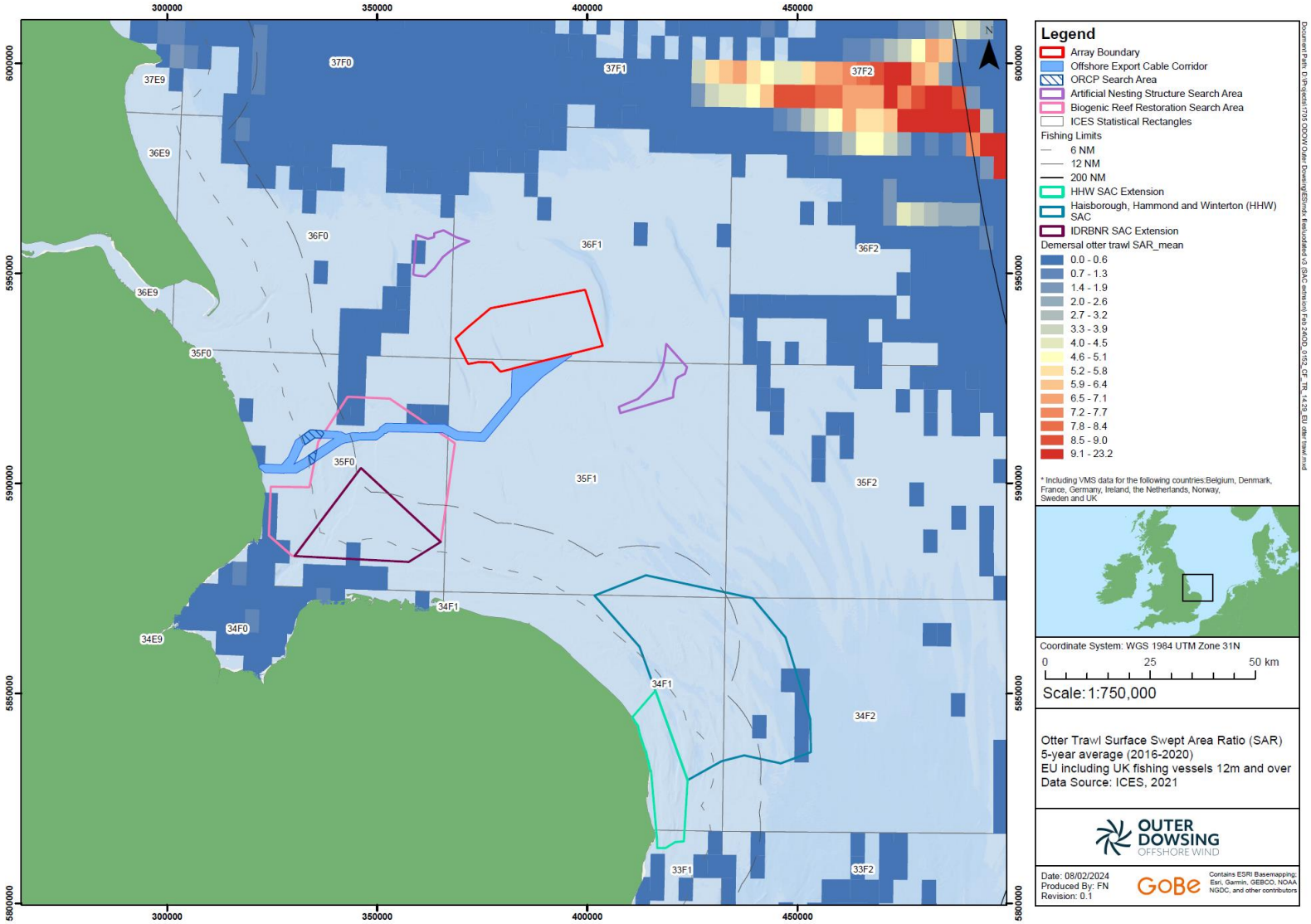

Figure 3.14 Surface Swept Area Ratio 2016 to 2020 for EU (including UK) vessels ≥ 12m length using demersal otter trawl gear (Source: ICES, 2021).

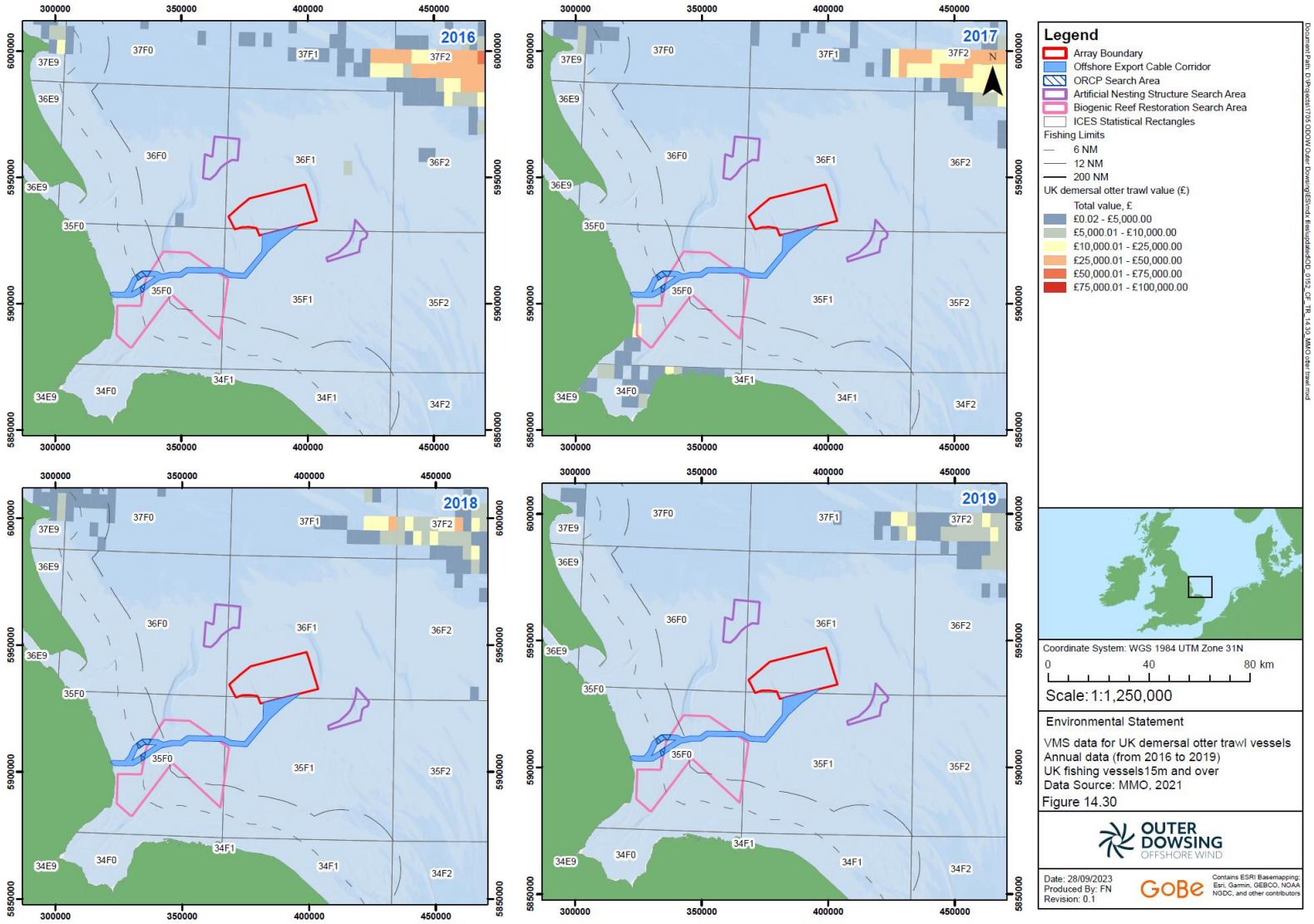

Figure 3.15 UK vessels ≥ 15m length actively fishing using demersal otter trawls 2016 to 2019 (Source: MMO, 2021).

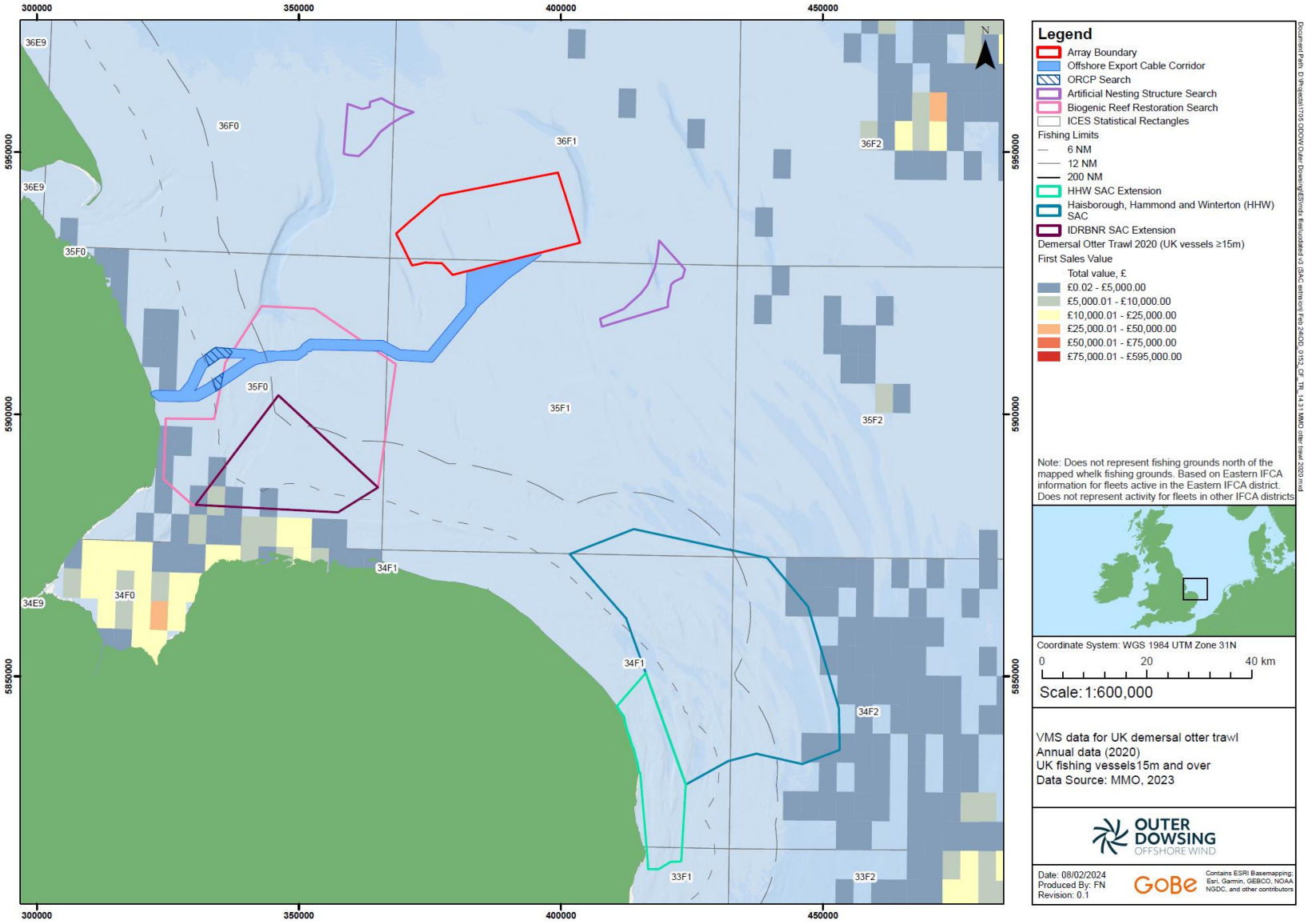

Figure 3.16 UK vessels ≥ 15m length actively fishing using demersal otter trawls 2020 (Source: MMO, 2023).

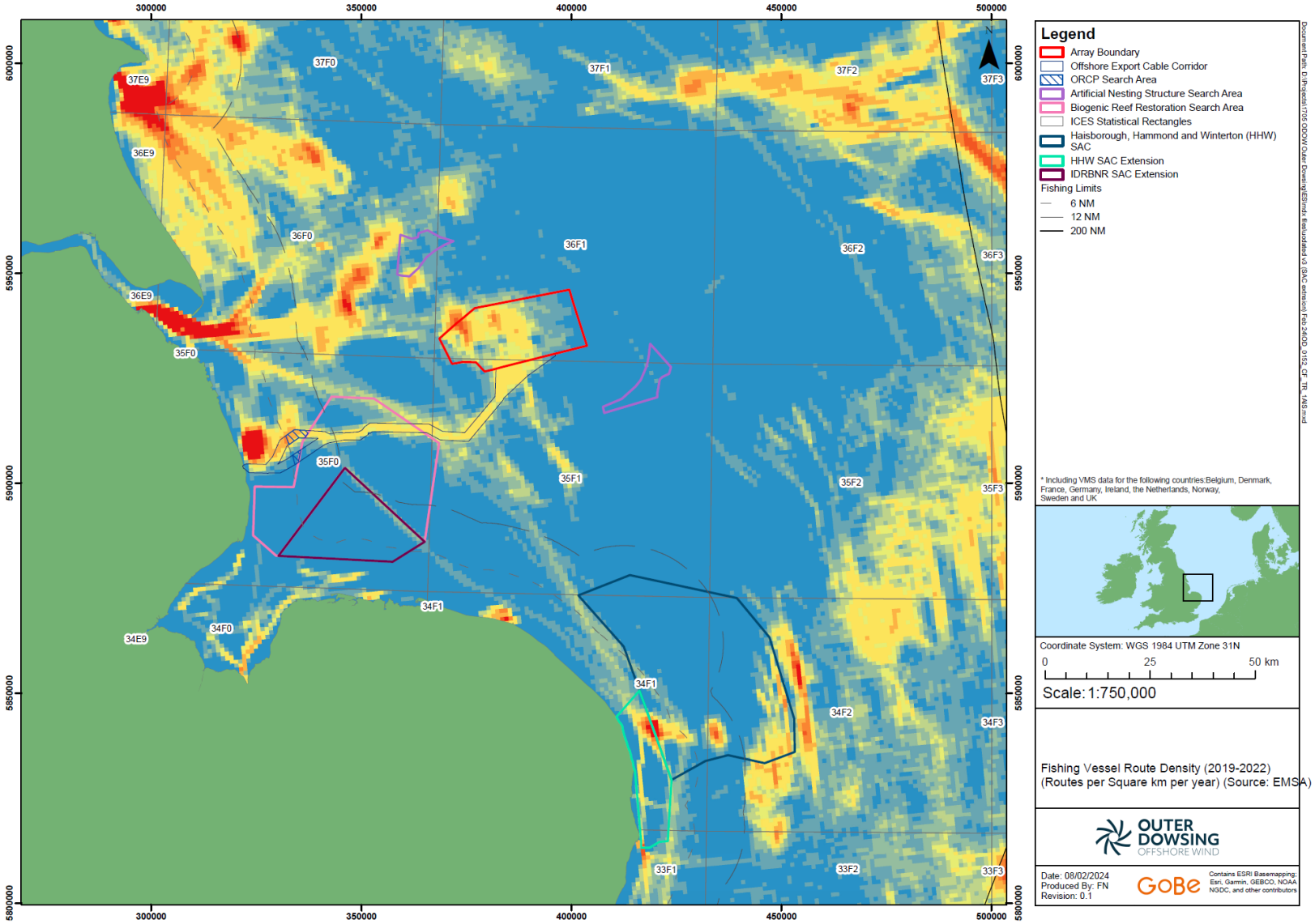

Figure 3.17 Fishing vessel route density 2019 to 2022 (Source: EMSA, 2023).

4. Fishing Activity in the HHW SAC

4.1 Existing Fisheries Management

Within the SAC, spatial restrictions are in place as follows (Figure 3.1):

- Eastern IFCA Byelaws identified in Section 3.1 above; and
- MMO Haisborough, Hammond and Winterton European Marine Site (Specified Areas) Bottom Towed Fishing Gear Byelaw 2009 – no person shall use any bottom towed fishing gear in the specified areas.

The MMO 2009 byelaw specifically seeks to protect biogenic ross worm reefs in two specified areas within the SAC.

4.2 Overview

An overview of UK and EU vessel landings is provided immediately below. Data indicates that the vast majority of vessels operating within the SAC and proposed extension area are UK vessels.

4.2.1 UK Landings

The annual average value of landings by UK-registered fishing vessels from the five ICES rectangles that overlap the SAC and proposed extension area is depicted in Figure 4.1Figure 3.3 below, across a five-year time series.

The average annual value of landings from ICES rectangle 34F1 (overlapping much of the western portion of the SAC and most of the proposed extension area), across the most recent five-year time series from 2018 to 2022 was £712,500 and in rectangle 34F2 (overlapping much of the eastern portion of the SAC) was £280,000.

Approximately 70% of landings by UK vessels from the two rectangles by UK vessels are of shellfish species, with demersal fish species landings accounting for the majority of other landings. Figure 4.2Figure 3.4 indicates that the key species landed from ICES rectangle 34F1 are lobsters, brown crabs, whelks and bass. The key species landed from ICES rectangle 34F2 are sole and plaice.

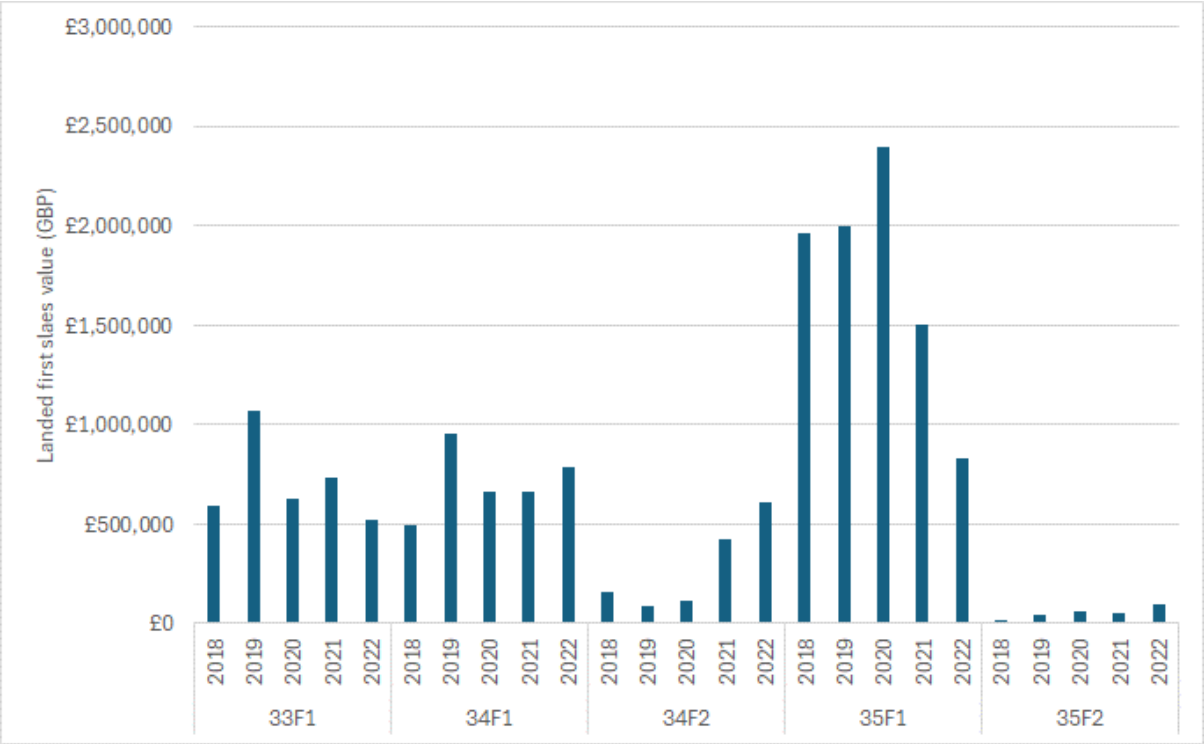

Figure 4.1 Value of landings (2018 to 2022) by ICES rectangle (Source: MMO, 2023).

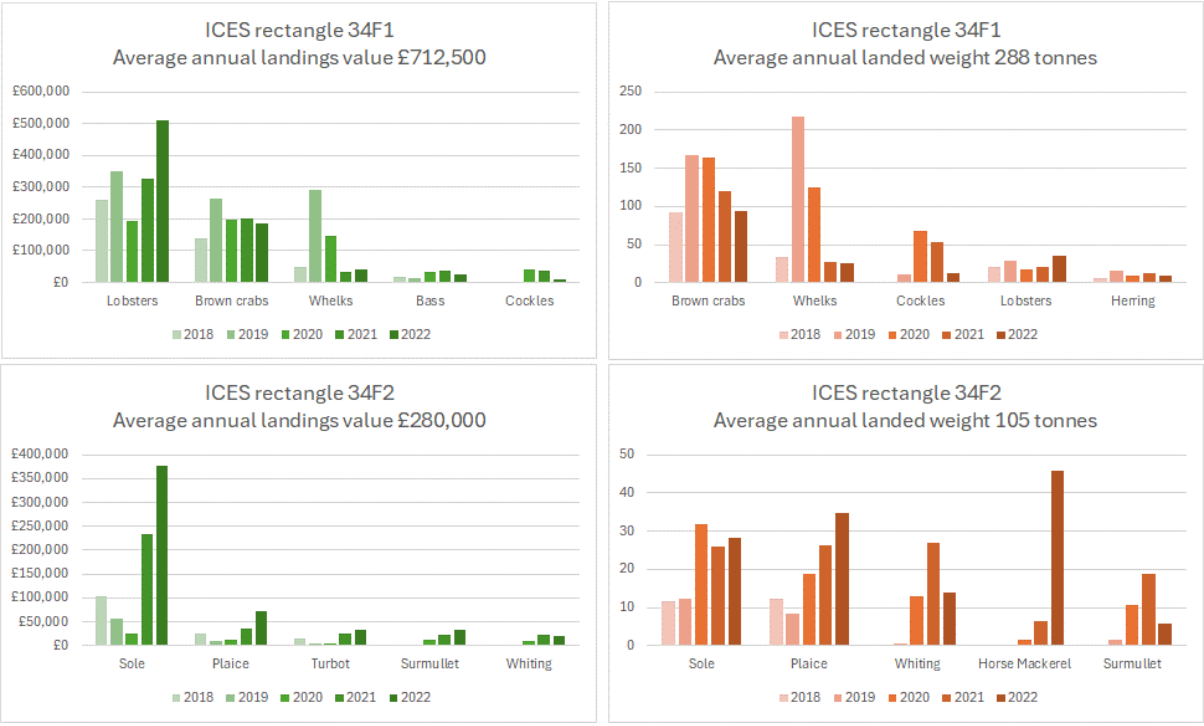

Figure 4.2 Key species by annual landed value (GBP) and weight (tonnes) (2018 to 2022) from ICES rectangles 34F1 and 34F2 (Source: MMO, 2023).

4.2.2 Non-UK Landings

Landings data sourced from the EU DCF database indicates that there is potential for some non-UK fishing activity in the study area. In ICES rectangles 34F1 and 34F2 the majority of

landings are made by UK-registered vessels, with EU landings data indicating some presence of Belgian and Dutch vessels targeting plaice and sole in ICES rectangle 34F2.

EU DCF landings data disaggregated by ICES rectangle is dated, leaving some degree of uncertainty around current EU fleet activity in the SAC. However, very recently published MMO UK landings statistics for 2022 do also record EU fleet activity where EU vessels land into UK ports and in 2022 no landings from ICES rectangles 34F1 or 34F2 were attributed to EU vessels, indicating very limited potential for non-UK fishing activity in the SAC (MMO, 2023).

4.3 Fishing by Gear Type

4.3.1 Overview

Several fishing fleets are active across the two main ICES rectangles as indicated by landings statistics for gear type (Figure 4.3Figure 3.6). UK-registered vessels deploying pots dominate landings in terms of both landed weight and value in the nearshore portion of the SAC and across the proposed extension area. Further offshore in ICES rectangle 34F2 data indicates demersal trawl, beam trawl and demersal seine activity, noting a decline in beam trawl activity across the five-year period and an increase in demersal trawl/seine activity.

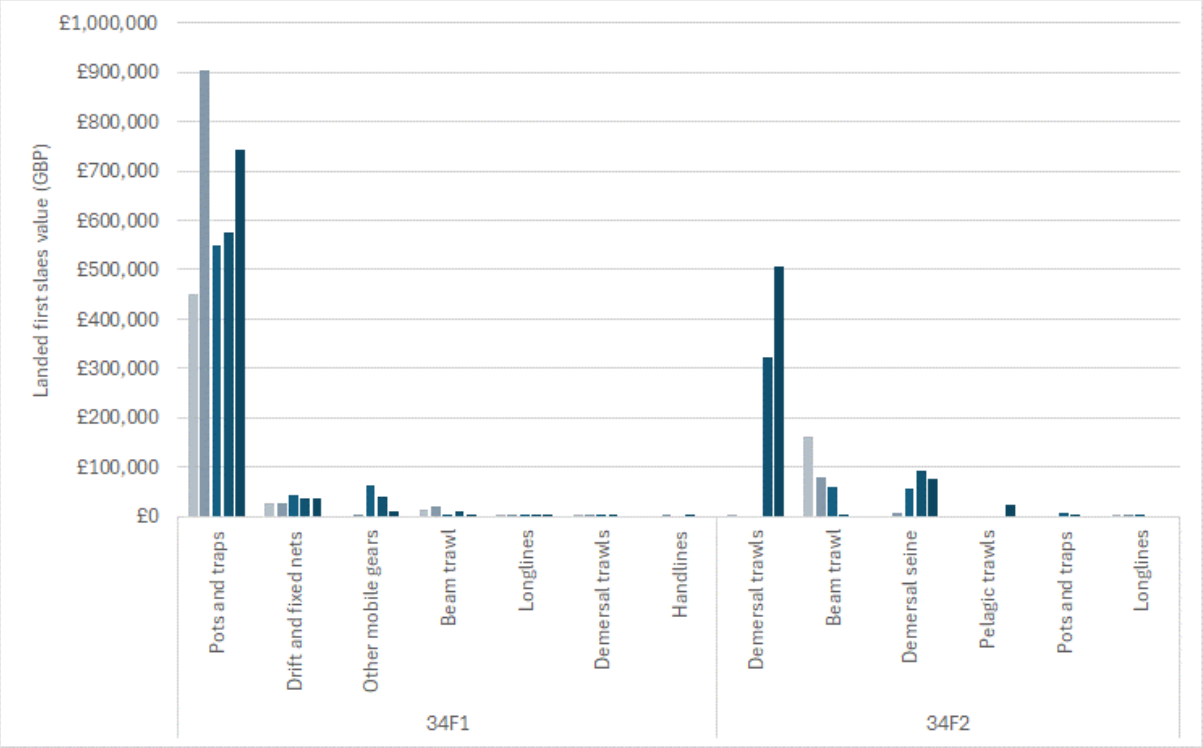

Figure 4.3 Landings value 2018 to 2022 by gear type in ICES rectangles 34F1 and 34F2 (Source: MMO, 2023).

4.3.2 Pots and Traps

Landings Data Summary

Key species targeted using pots are lobster, brown crab and whelk. Landings data indicates that landings of crab and lobster across the two ICES rectangles have remained relatively consistent over the past several years, though with a notable spike in lobster landings in 2022. Landings of whelk have more noticeably fluctuated.

Data indicates that whelks are targeted year-round, with a spring peak in the fishery. Crab fisheries peak in early summer and lobster fisheries peak in late summer. Almost 100% of landings are made by vessels under 15-metres length. Some vessels will operate fleets of crab and lobster pots and whelk pots simultaneously.

Spatial Data Summary

VMS data sourced from the MMO (Figure 3.7) displays the value of catches for UK registered vessels 15m and over in length. Data indicates no activity by larger (15-metre length and over) potting vessels within the SAC, with minimal larger vessel activity in the far southern portion of the proposed extension area.

A mapping project undertaken by the EIFCA in 2010 described the spatial coverage of fishing for shellfish species for all vessels in the UK fleet. Figure 3.9 presents the shellfish fishing grounds which indicates that in 2010 whelk, crab and lobster and brown shrimp fishing grounds overlapped with some areas of the SAC, though with grounds covering relatively small portions of the SAC and proposed extension area. It is understood that the 2010 mapping is based on targeted interviews with a sample of fishermen (~12) active at that time and is therefore not representative of the entire fleet or current activity. It is also not reflective of activity outside of the mapped areas.

Defra, MMO and EIFCA Fisheries Assessment Summaries

The Defra impact assessment noted that within the SAC, UK vessels operate exclusively within 6 nm and predominately UK vessels fish from 6-12 nm. UK vessels within the SAC mainly use pots, targeting crabs and lobsters, velvet crabs and whelks. Within a couple miles of the shore most fishing activity is undertaken by vessels working from beaches between Cromer/Sheringham to Caister inclusive. Small (under 10 metre) beach-launched boats also operate from Great Yarmouth beaches. They mainly fish using parlour pots and the number of pots used by individual fishers is relatively low at around 300.

The MMO assessment states that the majority of the UK vessels which operate within ICES area 35F1, 35F2, 34F1 and 34F2 are under 10 metres in length and include potting vessels targeting crab and lobster.

The EIFCA assessment comments that fishing activity within the SAC is considered to be very low.

4.3.3 Demersal Trawls and Seines

Landings Data Summary

Key species targeted using pots are sole and plaice. Landings data indicates that landings by demersal trawl across the two ICES rectangles have increased notably in 2021 and 2022, having been very limited across 2018 to 2020. Across the five-year period landings by demersal trawl had an annual average value of £167,000 in ICES rectangles 34F1 and 34F2. Over 99% of these landings are attributed to ICES rectangle 34F2 indicating that demersal trawl activity is focused on waters further offshore, around and beyond the 12 nm limit.

Spatial Data Summary

VMS data (Figure 3.14 and Figure 3.16) indicates some potential for demersal trawl activity to overlap with the easternmost boundary of the SAC, but with activity broadly avoiding the SAC.

VMS ‘ping’ data shown in Figure 4.4 is now relatively dated but demonstrates a historical pattern of activity with key grounds targeted using demersal gears being located to the east of the SAC and along the eastern boundary of the SAC, following the edge of the sandbank feature.

Defra, MMO and EIFCA Fisheries Assessment Summaries

The assessments provide limited information on demersal trawl activity in the SAC, noting that they pre-date the increase in demersal landings observed in 2021 and 2022. The Joint Nature Conservation Committee (JNCC) webpage for the HHW SAC notes that ‘the south-eastern corner of the site is heavily fished by trawlers. UK and non-UK registered vessels have been active in the area’ (JNCC, 2023).

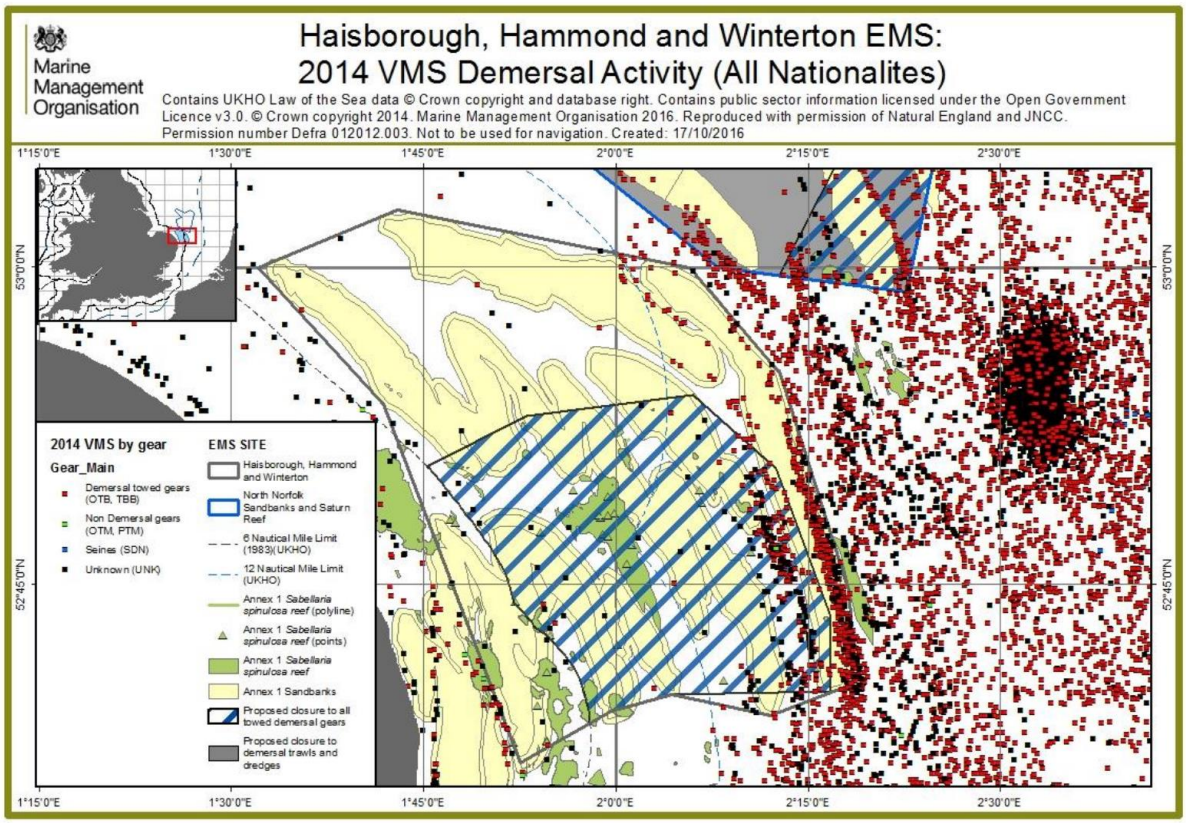

Figure 4.4 VMS reports indicating all Member States (including UK) demersal fishing activity (0-6 knots) in Haisborough, Hammond and Winterton EMS 2014 (Source: Royal Haskoning DHV, 2020).

4.3.4 Other Gear Types

A number of other gear types may be deployed across the study area, but are unlikely to be actively deployed with any frequency within the SAC. These gear types are include:

- Drift and Fixed Nets - Landings data indicates that nets are used by vessels under 10 m length across the study area to target herring and smaller volumes of bass. Landings, averaging 15 tonnes per year, are primarily made into Great Yarmouth. The Defra assessment states that drift net fishers operating mainly from Caister operate along the East Anglian coast. It can be expected that some netting activity will take place within the SAC and proposed extension area
- Beam Trawls - Landings data indicates that beam trawls may occasionally be used within the SAC to target sole and plaice, though landings have declined substantially across the 2018 to 2022 period, with no landings of these species recorded in 2022. EU beam trawl activity is focused outside of the SAC with VMS data indicating the potential for some EU beam trawl activity in the far south-eastern extent of the SAC (Figure 3.12). The Defra assessment notes that vessels from Lowestoft and Great Yarmouth and occasionally King"s Lynn beam trawl for brown shrimp close to the beaches.
- Pelagic Trawls – Landings data indicates a catch of horse mackerel by pelagic trawl from the study area in 2022. This is an isolated landing event and across 2018 to 2021 no landings were attributed to pelagic trawls (MMO, 2023).
- Longlines and Handlines - Landings data indicates that longlines and handlines may occasionally be used across the study area to target bass, thornback ray and dogfish, with landings of any individual species not exceeding 1 tonne per year (MMO, 2023).

- Demersal Seine–- Flyseine activity in the Channel and southern North Sea is understood to be increasing, involving a relatively small number of powerful vessels, which are either purpose-built or converted beam trawlers (Defra, 2022). MMO landings data validates this trend, with 2021 landings data showing a peak in landings by demersal seine, with target species including mullets and whiting. The extent to which activity may overlap with the SAC is unknown, but no landings are recorded from ICES rectangles 34F1 indicating that activity is likely to be focused further offshore and outside of the SAC.

5. Summary

5.1 IDRBNR SAC

The IDRBNR SAC and proposed extension area is utilised by UK fishing vessels using potting gears. Data indicates the potential for potting activity throughout the SAC and proposed extension area, with larger vessels active further offshore in the northern and eastern portions of the SAC and smaller vessels active inshore. Within the SAC some areas of reef are closed to static gear as a result of implementation of an MMO byelaw from 2022 onwards.

Within the IDRBNR SAC, data indicates the potential presence of beam trawlers targeting brown shrimp in the nearshore portion of the SAC, inside of the 6 nm limit. Data indicates the potential for other fishing gear types to be deployed within the SAC, though not with high frequency. Within the SAC some areas of sandbank and reef are closed to bottom towed fishing methods as a result of implementation of an MMO byelaw from 2022 onwards. Areas of reef are also closed to static gear methods within the SAC.

5.2 HHW SAC

The HHW SAC and proposed extension area is utilised by UK fishing vessels using potting gears. Data indicates the potential for potting activity throughout the SAC and proposed extension area though across more spatially limited areas than within the IDRBNR SAC.

Within the HHW SAC, data indicates the potential presence of smaller inshore beam trawlers targeting brown shrimp, and netting vessels seasonally targeting bass and herring, in the nearshore portion of the SAC, inside of the 6 nm limit.

Data indicates the presence of demersal and beam trawl activity by larger vessels targeting sole, plaice and other demersal species, with landings and spatial data indicating that this activity is focused offshore and in the far south-eastern portion of the SAC. Within the SAC, two reef areas are closed to bottom towed gear as a result of MMO byelaw implementation.

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Annex 2 - Habitat Suitability Modelling

316. A preliminary habitat suitability mapping exercise was conducted by the Applicant to identify suitable areas within the IDRBNR SAC for the development of native oyster and blue mussel reefs. Potential suitable areas were identified using the following environmental factors:

- Substratum / Habitat Preferences
- Biological Zone Preference
- Suspended Sediment Concentrations (mg/l)
- Large-scale Seabed Dynamics
- Wave Exposure
- Current Velocity (m/s)
- Water Depth (m)
- Water Temperature (°C)
- Salinity (psu)

317. Data for the Habitat Modelling factors were collated from various sources and classified for each species to correspond to the suitability ranges identified from the scientific literature. Annex I data (sandbanks and areas of reef) were treated as a hard constraint and were thus coloured black and removed from the model for all species.

318. Areas within each data layer were assigned a value of 1 or 0, with 1 suitable and 0 not suitable, based on the identified tolerance ranges. There were several factors which were dropped from the model due to the data being homogenous across the study area. These factors would therefore have no influence determining more preferred areas within the suitability model. Equal weightings were assigned to the remaining factors that made up the Habitat Model. Data layers were then merged for each species, with values of each factor summed, to provide an integer scale used to determine habitat suitability. A Red-Amber-Green (RAG) colour scale was used to illustrate this with the higher the value being the most preferred area (green) and the lower the value being the least preferred (red). The modelling process was undertaken using ESRI ArcPro software in November 2023.

319. The habitat suitability study will be refined during the ongoing planning phase using additional and, where available, higher resolution environmental data layers to enable a more precise assessment of suitable reef creation sites.

Annex 3 - Examples of bivalve reef restoration projects

Table 0.1. Examples of European blue mussel restoration projects and other relevant studies

Project name	Location	Main aim	Restoration activities	Objectives and outcomes	References
Re-lay experiment 1990-1993, Danish waters	Limfjorden, Denmark	To study the growth and mortality of re-laid blue mussels	Harvested undersized (< 45 mm) mussels were relaid to two commercial subtidal culture beds and four experimental new beds (each covering an area of about 30,000 m^2). Distribution, growth and mortality parameters were measured by divers using submersible video. Damage and mortality rates during the initial harvesting were also investigated.	Mortality of mussels due to harvesting was found to be between 8-10%. One of the six beds was decimated by seas tars within the 3 months of relaying. The remaining beds persisted over the 34-month observation period. Natural mean densities of mussels in Limfjorden in 1993-1995 reported to range between 0.21 and 3.86 kg m^{-2}	Kristensen and Lassen (1997)
Mussel bed restoration experiment, 2010-2011, Danish water	Nørrefjord, Denmark, up to 12 m water depth	Restore blue mussel beds to enhance fish habitats	Created blue mussel beds and tested their effects on the abundance of fish and epifauna. Individual beds were constructed in a patchy distribution, with beds of 1-2 m diameter, ~0.5 m height, and spaced 3-10 m apart; each bed contained about 28 kg of mussels either placed directly on the seabed or on top of degradable hemp sacks with or without empty mussel shells.	Multiple beds were established over an area of 121,000 m2 Diver and video observations made to estimate mussel survival rates using BACI design with sampling before and one year after mussel bed establishment in both control and impact area. About 5% of mussels survived after 1 year; structure of the beds was still intact as the empty mussel shells remained on the seabed. Positive effects on fish abundance and diversity were observed.	Kristensen *et al*. (2015)

Table 0.2. Examples of European native oyster restoration projects.

Project name	Location	Main aim	Restoration activities	Objectives and outcomes	References
Solent Oyster Restoration Project, England (2016-present)[1]	Solent waters	Restore native oyster populations in the Solent	Restoration activities have focussed on the deployment of broodstock cages from existing pontoons in marinas and bays and the placement of cultch and adult oysters onto the seabed in Langstone Harbour. Oysters in broodstock cages	Over one billion larvae released; 84,000 oysters restored into nurseries or onto the seabed; intertidal oyster ranching pilot sites established; one oyster reef restored using 361 m^3 of cultch across 2,000 m^2 with about 15,000 oysters.	BMF (2021); Holbrook (2020)

Project name	Location	Main aim	Restoration activities	Objectives and outcomes	References
			are regularly monitored to assess growth rates and reproductive outputs.		
Chichester Harbour Oyster Partnership Initiative (CHOPI) (2010-present)[2]	Chichester Harbour	Protect the nature oyster culture in Chichester Harbour	Activities have focussed on removing the non-native slipper limpet (*C. fornicata*) from the seabed and relaying broodstock. An Oyster Permit Byelaw was introduced in 2015 to control extractive activities and to introduce harvest limits.		Holbrook (2020)
Essex Native Oyster Restoration Initiative (ENORI) (2013-present)[3]	Blackwater, Crouch, Roach and Colne Estuaries (BCRC) MCZ	Recover native oyster beds within the estuaries	Restoration takes place in areas of 'subtidal mixed substrate' within a protected 2 km^2 restoration box inside the BCRC MCZ. Activities included small-scale trials to test the suitability of different settlement materials. This was followed by active habitat and reef restoration through the deployment of cultch and mature oysters.	To date, over 45,000 oysters and about 8,000 m^2 of cultch (shells and gravel) were deployed.	Holbrook (2020); Preston *et al*. (2020)
Wild Oysters Project (2020-2023)[4]	England	Re-introduce oyster larvae	Installation of up to 141 oyster nurseries in marinas and ports within three UK bays (Tyne and Wear England, Firth of Clyde Scotland, and Conway Bay Wales). Nurseries consist of suspended systems containing mature oysters, building upon experiences from the Solent Oyster Restoration Project. Other activities include seabed restoration, baseline surveys. and cultch deployment.	To culture > 9 billion oyster larvae.	Holbrook (2020); NORA (2023)
Wales Native Oyster Restoration Project (2019-2023)	Milford Haven, Wales	Investigate the viability of restoring the native oyster in Wales	Activities included introducing juvenile oysters and clean shell material at several historic oyster grounds in the Milford Haven estuary.		Native Oyster Network UK & Ireland (2023b); NRW (2021)
Dornoch Firth Environmental Enhancement Project (DEEP) (2014-present)	Dornoch Firth, Scotland	Establish a self-sustaining oyster population with densities comparable to numbers in the 1900s	Activities have focussed on studying the most appropriate cultch type and larval settlement cues. In 2017, 300 oysters were transplanted into the Dornoch Firth. Research into the characteristics and functions of local horse mussel populations has been used to inform future restoration activities.	Pilot phase: about 300 wild oysters from Loch Ryan transplanted on two sites in the Dornoch Firth using ballasted bags; high survival rate of up to 86% observed. Phase 1: deployment of cultch and up to 20,000 oysters achieved in 2021; ongoing monitoring every six months.	Holbrook (2020); NORA (2023)

Project name	Location	Main aim	Restoration activities	Objectives and outcomes	References
				Phase 2: deployment of up to 200,000 oysters within the next three years, and up to 4 million oysters over about 40 ha by 2030.	
Loch Craignish Native Oyster Restoration Project[5] (2020-2025)	Loch Craignish and Loch Broom, Scotland	Restore native oyster beds	Small juvenile oysters (~ 1 g) sourced from Morecambe Bay Hatchery are grown in floating nursery cages in Loch Craignish. Grown oysters (10-15 g) are then translocated to suitable pre-surveyed sites around the lochs or used to provide oyster stocks for other restoration projects.	Aim to grow up to 1 million native oysters in Loch Craignish; 300,000 young oysters planted on the seabed to date; restoration sites are regularly monitored.	NORA (2023)
Swansea Bay, Wales (2015-present)	Swansea Bay		About 40,000 adult oysters were re-laid as broodstock.		Holbrook (2020)
Strangford Lough, Ireland (1998-present)			In 1998, 75 tonnes of cultch were deployed, and 250,000 oyster spat laid.		Holbrook (2020)
RESTORE and PROCEED projects, Germany (2016-present)[6]	German North Sea		The aims of the projects are to develop and test methods for the long-term restoration of oyster stocks in the German North Sea. Work to date included test deployments of young oysters and subsequent monitoring of growth, health and reproduction. Following this, a pilot oyster reef was constructed within the "Borkum Reef ground" SAC. Site selection was based on a detailed feasibility analysis (summarised in Pogoda et al., 2020)	Colonisation experiment in 2017: deployment of seed oysters (2 mm size) within oyster baskets (26 m water depth); monthly monitoring of growth and development of associated communities Construction of pilot reef in 2020: deployment of 80 tonnes of limestone and empty oyster shells as reef substrate, and about 100,000 juvenile oysters (spat on shell deployed in nets); regular monitoring ongoing	NORA (2023); Pogoda *et al*. (2020)
Various	Dutch North Sea		To be reviewed	Translocated adult oysters	Bos *et al*. (2023); Sas *et al*. (2019)
BioReef, Denmark (2022-2027)	Danish North Sea or Kattegat	Develop methods to establish viable bivalve reefs in Danish waters	The project aims to develop methods and protocols for restoring populations of native oysters and horse musses. This includes the development of hatchery methods for the large-scale production of horse mussel seeds and disease-free European native oyster spats. In addition, methods for successful on bottom deployment on selected sites within Danish waters will be investigated.		NORA (2023); Ørsted (2023)

Project name	Location	Main aim	Restoration activities	Objectives and outcomes	References
The bivalve project, Sweden (2018-2021)	Sweden	Increase the knowledge base about the current status of OSPAR-listed bivalve species	Activities included studies to quantify population changes of blue mussels and native oysters in Swedish waters, stock enhancement trials, and the establishment of national and international networks.		NORA (2023)

[1] https://www.bluemarinefoundation.com/project/solent/
[2] https://nativeoysternetwork.org/portfolio/chopi/
[3] https://essexnativeoyster.com/
[4] https://wild-oysters.org/
[5] https://www.seawilding.org/native-oyster-project
[6] https://noraeurope.eu/germany-restore-project/; https://www.awi.de/en/science/biosciences/shelf-sea-system-ecology/main-research-focus/european-oyster.html