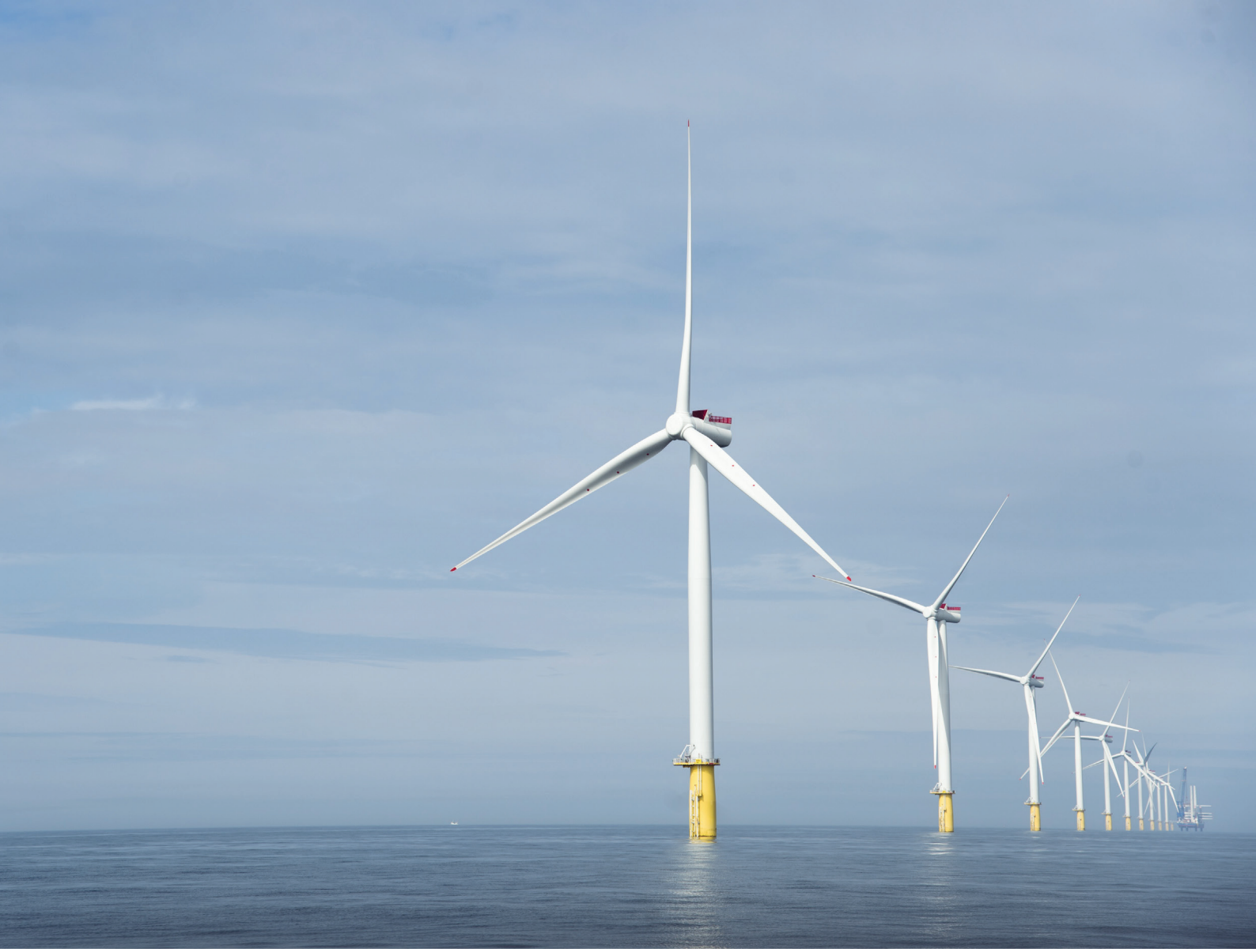

Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects

Appendix 4 - Assessment of Potential Impacts on Cromer Shoal Chalk Beds Marine Conservation Zone Features from Planting of Native Oyster Beds

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Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects

Appendix 4: Assessment of Potential Impacts on Cromer Shoal Chalk Beds Marine Conservation Zone Features from Planting of Native Oyster Bed

Title**:**	
Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects Stage 1 Cromer Shoal Chalk Beds Marine Conservation Zone Assessment Appendix 4 Assessment of Potential Impacts on Cromer Shoal Chalk Beds Marine Conservation Zone Features from Planting of Native Oyster Bed	
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Prepared by: **Royal HaskoningDHV**	
Approved by:	Date:
Sarah Chandler, Equinor	August 2022

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Glossary of Acronyms

AoO	Advice on Operations
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CSBC	Cromer Shoal Chalk Beds
DEEP	Dornoch Environmental Enhancement Project
DEP	Dudgeon Offshore Wind Farm Extension Project
INNS	Invasive Non-Native Species
JNCC	Joint Nature Conservation Committee
km	Kilometre
m	metre
MCAA	Marine and Coastal Access Act
MCZ	Marine Conservation Zone
MCZA	Marine Conservation Zone Assessment
MEEB	Measures of Equivalent Environmental Benefit
MMO	Marine Management Organisation
NORI	Native Oyster Restoration Initiative
ROV	Remotely Operated Vehicle
SACO	Supplementary Advice on Conservation Objectives
SEP	Sheringham Shoal Offshore Wind Farm Extension Project

Glossary of Terms

Dudgeon Offshore Wind Farm Extension Project (DEP)	The Dudgeon Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
Dudgeon Offshore Wind Farm Extension Project (DEP) offshore site	The Dudgeon Offshore Wind Farm Extension offshore lease area consisting of the DEP wind farm site, interlink cable corridors and offshore export cable corridor (up to mean high water springs).
DEP North array area	The wind farm array area of the DEP offshore site located to the north of the existing Dudgeon Offshore Wind Farm
DEP South array area	The wind farm array area of the DEP offshore site located to the south of the existing Dudgeon Offshore Wind Farm
DEP wind farm site	The offshore area of DEP within which wind turbines, infield cables and offshore substation platform/s will be located. This is also the collective term for the DEP North and South array areas.
Export cable corridor	This is the area which will contain the offshore export cables between offshore substation platform/s and landfall.
Horizontal directional drilling (HDD) zones	The areas within the onshore cable corridor which would house HDD entry or exit points.
Infield cables	Cables which link the wind turbine generators to the offshore substation platform(s).
Interlink cables	Cables linking two separate project areas. This can be cables linking: 1) DEP South array area and DEP North array area 2) DEP South array area and SEP 3) DEP North array area and SEP 1 is relevant if DEP is constructed in isolation or first in a phased development. 2 and 3 are relevant where both SEP and DEP are built.
Interlink cable corridor	This is the area which will contain the interlink cables between offshore substation platform/s.

Landfall	The point at the coastline at which the offshore export cables are brought onshore, connecting to the onshore cables at the transition joint bay above mean high water
Offshore export cables	The cables which would bring electricity from the offshore substation platform(s) to the landfall.
Offshore scoping area	An area that encompasses all planned offshore infrastructure, including landfall options at both Weybourne and Bacton, and allows sufficient room for receptor identification and environmental surveys. This will be refined following further site selection and consultation.
Offshore substation platform (OSP)	A fixed structure located within the wind farm area, containing electrical equipment to aggregate the power from the wind turbine generators and convert it into a more suitable form for export to shore.
Sheringham Shoal Offshore Wind Farm Extension Project (SEP) offshore site	Sheringham Shoal Offshore Wind Farm Extension lease area consisting of the SEP wind farm site and offshore export cable corridor (up to mean high water springs).
Sheringham Shoal Offshore Wind Farm Extension Project (SEP)	The Sheringham Shoal Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
SEP wind farm site	The offshore area of SEP within which wind turbines, infield cables and offshore substation platform/s will be located.
The Applicant	Equinor New Energy Limited

APPENDIX 4 ASSESSMENT OF POTENTIAL IMPACTS ON CROMER SHOAL CHALK BEDS MARINE CONSERVATION ZONE FEATURES FROM PLANTING OF NATIVE OYSTER BED

1 Introduction

1. This appendix provides a Stage 1 assessment of potential impacts on the subtidal mixed sediment feature of the Cromer Shoal Chalk Beds (CSCB) Marine Conservation Zone (MCZ) from the planting of native oyster bed as part of the Sheringham Shoal Offshore Wind Farm Extension Project (SEP) and the Dudgeon Offshore Wind Farm Extension Project (DEP) without prejudice Measures of Equivalent Environmental Benefit (MEEB) proposals.
2. As outlined in the **In-Principle MEEB Plan** (document reference 5.7.1) which is provided on a precautionary basis, and without prejudice to the conclusions of the **Stage 1 CSCB MCZ Assessment (MCZA)** (document reference 5.6), if MEEB is deemed to be required by the Secretary of State, the planting of native oyster bed within the CSCB MCZ would be progressed as the preferred MEEB. Therefore, this assessment is provided to determine whether the planting of oyster bed within the MCZ has potential to hinder the conservation objective of maintaining (or restoring) the MCZ features in favourable conservation status.
3. The preferred location for MEEB in the MCZ is outwith the SEP and DEP order limits (**Figure 2-1**). It is not anticipated that a lease from The Crown Estate is required to deploy a native oyster bed however a marine licence is likely to be required due to the potential requirement to lay cultch. If MEEB is deemed to be required by the Secretary of State a marine licence application would be submitted to the Marine Management Organisation (MMO).
4. This report provides the Stage 1 Assessment which is a requirement under Section 126 of the Marine and Coastal Access Act (2009) (MCAA). The MCZA will be undertaken by the MMO with the **Stage 1 CSCB MCZA** (document reference 5.6) and relevant supporting appendices intended to provide the information required for that assessment. The **Stage 1 CSCB MCZA** (document reference 5.6) and its supporting appendices (where relevant) are therefore structured to match the approach that will be taken by the MMO. This document is therefore a ‘shadow MCZA’. See the **Stage 1 CSCB MCZA** (document reference 5.6) for more details on guidance and legislation as it relates to MCZs.

2 Background and Native Oyster Restoration Project Description

5. The restoration of a native oyster bed is required to deliver equivalent environmental benefit to up to 1,800m^2 long term habitat loss on subtidal coarse sediment, subtidal mixed sediments and subtidal sand features of the MCZ. For the purposes of the **In-Principle MEEB Plan** (document reference 5.7.1), the aim would be to deploy and maintain an oyster bed of 10,000m^2 with an average density of 5 live oysters per m^2. This would provide a greater than 1:5 ratio of MEEB, offering long term enhanced ecological function to the habitat being lost and would restore a historic feature of the region. This scale of restoration effort has also been selected because once fully functioning, it is expected that the native oyster bed would become self-sustaining. This would restore the status of native oyster in the CSCB MCZ to that of a healthy native oyster population.

6. Following a site selection exercise (see **Annex C: European Native Oyster Restoration: Site Selection** (document reference 5.6.4)), the area shown in **Figure 2-1** has been identified as an initial native oyster restoration site search area.

7. This provides a 1km^2 area, within which the 10,000m^2 bed (see **Section 5.4** of **Annex C: European Native Oyster Restoration: Site Selection** (document reference 5.6.4)) could be planted. This 1km^2 area will be the area surveyed post-consent to confirm the suitability of the site for native oyster restoration.

Sheringham Shoal and Dudgeon Extension Projects

Figure 2-1 Proposed initial 1km^2 native oyster restoration site search area and the indicative size of the 10,000m^2 restored reef

1:25,000

Legend:

- Sheringham Shoal Offshore Wind Farm Extension Site
- Offshore Cable Corridors
- Offshore Temporary Work Area
- Existing Offshore Wind Farm
- Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ)
- Indicative size of the 10,000m2 restored reef
- Proposed initial 1km2 native oyster restoration site search area

Broadscale Habitat

- High energy infralittoral rock (A3.1)
- Moderate energy infralittoral rock (A3.2)
- Features of infralittoral rock (A3.7)
- High energy circalittoral rock (A4.1)
- Moderate energy circalittoral rock (A4.2)
- Features of circalittoral rock (A4.7)
- Subtidal coarse sediment (A5.1)
- Subtidal sand (A5.2)
- Subtidal mud (A5.3)
- Subtidal mixed sediments (A5.4)
- Subtidal macrophyte-dominated sediment (A5.5)
- Subtidal biogenic reefs (A5.6)
- Circalittoral rock and other hard substrata (A4)
- High energy circalittoral rock (A4.1)
- Subtidal coarse sediment (A5.1)
- Subtidal sand (A5.2)
- Subtidal mud (A5.3)
- Subtidal mixed sediments (A5.4)

Habitat Features of Conservation Importance

- Blue Mussel Beds (HOCI 1)
- Fragile sponge and anthozoan communities on subtidal rocky habitats (HOCI 7)
- Horse mussel (Modiolus modiolus) reefs (HOCI 9)
- Peat and clay exposures (HOCI 15)
- Ross worm (Sabellaria spinulosa) reefs (HOCI 16)
- Subtidal chalk (HOCI 20)
- Peat and clay exposures (HOCI 15)
- Subtidal chalk (HOCI 20)

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Document No: PB8164-RHD-ZZ-OF-DR-Z-0252

Co-ordinate System: WGS 1984 UTM Zone 31N

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8. Planting of native oyster bed within the CSCB MCZ would provide enhanced ecological function to the habitat which is being lost and would restore a historic feature of the region.

9. As discussed in **Annex C European Native Oyster Restoration: Site Selection** (document reference 5.6.4), cultch may be required to enhance the substrate suitability for planting of oyster. For example, the Essex Native Oyster Restoration Initiative (NORI) project used a mixture of aggregate pebbles from an onshore source and waste oyster shell from local markets; and the Dornoch Environmental Enhancement Project (DEEP) used waste shell from the scallop and mussel industry.

10. Following a more detailed site selection exercise, including a survey of the existing habitat, the requirement for cultch would be determined and suitable sources identified.

11. If MEEB is deemed to be required by the Secretary of State for SEP and DEP, a phased and adaptive approach to oyster bed restoration is recommended, starting with a pilot project introducing 300 – 1,000 adult oysters to several potential suitable locations within the initial oyster restoration site search area. These oysters would be deployed in cages or bags. If acceptable survival is achieved after one year at least one of the locations, then the project can enter the reef restoration phase:

    - **Phase 1** (first year) would involve the deployment of 1,000m^3 of cultch being spread over a 5,000m^2 area, followed by the reintroduction of 52,500 oysters on the cultch. Survival would be monitored prior to Phase 2.
    - **Phase 2** (second year) would involve a further deployment of 1,000m^3 cultch within the remaining 5,000m^2 of the restoration area, followed by reintroduction of 52,500 oysters over the remaining 5,000m^2 area. This would give a combined total area for Phase 1 and Phase 2 of 10,000m^2, with 105,000 oysters reintroduced. With ongoing monitoring, lessons learnt during Phase 1 deployment can be captured during Phase 2, with deployment adapted accordingly.

12. Justification for the area and number of native oyster required is provided in the **In-Principle MEEB Plan** (document reference 5.7.1). The appropriate season for deployment of the reef restoration (Phases 1 to 2) will be determined through the MEEB Implementation and Monitoring Plan in consultation with oyster restoration specialists, taking into account the age and condition of the seed oysters; optimal temperature, lunar cycle and food availability; and periods of minimal predator abundance to maximise the survival rates of deployed oyster. However, late spring to early summer (April/ May) is expected to be the optimal native oyster reintroduction period.

13. The method for deployment will be established post consent as the MEEB Implementation and Monitoring Plan (see the **In-Principle MEEB Plan** (document reference 5.7.1)) develops, following commissioning of contractor(s), vessel(s) and equipment for deployment. The approach is likely to utilise a boat-based chute to direct the oysters to the selected sea bed location. This may require a diver or Remotely Operated Vehicle (ROV) survey following placement of the oysters on the sea bed to ensure the appropriate density of oysters deployed from the vessel.

3 Stage 1 Assessment

3.1 Disturbance of the Substrate on the Surface of the Sea Bed from Native Oyster Bed Restoration

14. The initial oyster restoration site search area (**Figure 2-1**) is composed of subtidal mixed sediment which is appropriate for native oyster larval settlement (and therefore long-term persistence of the reintroduced bed). Therefore, only this broadscale marine habitat feature (i.e. Subtidal mixed sediments - A5.4) has potential to be affected by habitat loss / physical disturbance. Disturbance of the substrate on the surface of the sea bed could occur as a result of cultch and native oyster deployment.

15. Up to 2,000m^3 of cultch and 105,000 native oysters would be deployed during Phase 1 and Phase 2 and the worst-case maximum area of sea bed within the CSCB MCZ which could be affected, would be 10,000m^2. It is important to note that whilst disturbance of the sea bed would occur, the potential for adverse impacts are limited since cultch (i.e. shell material which would be subject to biosecurity protocols and likely sourced from the local area – see **Section 3.2.1**) would be deployed on mixed sediment which is likely to include shell. This therefore does not represent the introduction of a wholly new substrate type. In addition, the target is for 5 oysters per m^2 (which aligns with the OSPAR definition of a native oyster bed (OSPAR, 2009)). Therefore, the native oyster bed would not affect the entirety of or occur uniformly over the 10,000m^2 area.

16. Subtidal mixed sediments - A5.4 has an estimated spatial extent within the MCZ of 49km^2. Therefore, up to 0.02% of the feature could potentially be subject to disturbance by the restoration works.

17. The impact of disturbance of the substrate on the surface of the sea bed from the introduction of native oyster bed has been defined using the pressures identified by Natural England's Advice on Operations (AoO) for the CSCB MCZ (Natural England, 2021). Since the introduction of native oyster is not listed as an activity in Natural England's Supplementary Advice on Conservation Objectives (SACO), shellfish aquaculture: bottom culture has been selected as a proxy. The following physical pressures have been assessed:

- Disturbance of the substrate on the surface of the sea bed.

18. The remainder of this section assesses the impact of disturbance of the substrate on the surface of the sea bed from the introduction of native oyster bed against the attributes and targets of the protected feature as provided by the SACO.

3.1.1 Physical Attributes

19. The following physical attributes of subtidal mixed sediment are relevant to disturbance of the substrate on the surface of the sea bed:

- Extent and distribution; and
- Sediment composition and distribution.

20. The extent, distribution and sediment composition of the subtidal mixed sediment feature would largely be maintained across the CSCB MCZ. The added cultch and native oyster would settle onto the subtidal mixed sediment and, over time, become incorporated within it forming a biogenic reef structure similar to subtidal mixed sediment but with an enhanced ecological function.

3.1.2 Biological Attributes

21. The following biological attributes of subtidal mixed sediment are relevant to disturbance of the substrate of the sea bed from native oyster restoration:

- Distribution - presence and spatial distribution of biological communities;
- Structure and function: presence and abundance of key structural and influential species; and
- Species composition of component communities.

22. Areas of mixed sediments in the proposed initial oyster restoration site search area (**Figure 2-1**) conforms mostly to 'Offshore circalittoral mixed sediment' (SS.SMx.Omx) in the Marine Habitat Classification scheme (Connor *et al*., 2004), in that it supports a diverse faunal community, given the heterogeneous sediment, with large amounts of both infauna and epifauna. Connor *et al*. (2004) characterise the community as being dominated by a rich community of attached Hydrozoa, Bryozoa and sponges. The loose rocky structures have potential to host a high diversity of scaleworms and syllid worms while encrusting keel worms *Spirobranchus lamarcki* are also common. The rocky substratum also allows the settlement of large numbers of ascidians, particularly the baked bean ascidian *Dendrodoa grossularia* which can occur in dense accumulations. The underlying soft sediments would be composed of a heterogeneous mix of mud / gravel and sand, which can support a wide range of infauna due to the mix of sediment types available. Also supported are a wide range of infauna such as burrowing amphipods and bivalves but also numerous mobile predators such as squat lobsters *Galatheidae* and the long clawed porcelain crab *Pisidia longicornis*. Loose aggregations of the reef-building worm *Sabellaria spinulosa* are also likely to be present.

23. Native oyster is thought to have been a historic feature in the north Norfolk coast (see **Annex C European Native Oyster Restoration: Site Selection** (document reference 5.6.4)) and therefore oyster bed planting is considered to contribute to the restore target for the MCZ. Deployment of cultch and native oysters could, in the immediate short term, result in localised disturbance and disrupt the presence, species composition and spatial distribution of the existing biological communities, but would not represent the introduction of a wholly different substrate that would lead to the development of an alternate community. In addition, over time, establishment of the oyster bed would restore a key structural and influential species once widespread throughout the region, providing wider biodiversity benefits (Didderen *et al*., 2020).

24. Based on the relevant pressures, receptor sensitivity, and assessment of impacts against the attributes of subtidal mixed sediment, it can be concluded that the conservation objective of maintaining or restoring the protected features of the CSCB MCZ in a favourable condition **will not be hindered** by disturbance of the substrate on the surface of the sea bed from the planting of native oyster bed.

3.2 Potential Introduction or Spread of Microbial Pathogens and Invasive Non-Native Species (INNS)

3.2.1 Background and Embedded Mitigation

25. Following detailed site selection, including a survey of the existing habitat, the requirement for cultch would be determined and suitable sources identified. As discussed in **Annex C European Native Oyster Restoration: Site Selection** (document reference 5.6.4), 50,000 oyster are estimated to be required to maintain a sufficient effective population size over the long term.

26. There are a number of oyster hatcheries throughout the UK which could be used to source seed oyster and it is likely that multiple sources will be used to establish the numbers required. The Applicant would, as far as possible, seek to use suppliers and partners from within the Norfolk region, minimising the potential for spread of INNS.

27. Biosecurity of the cultch and oyster sources will be a key consideration in the selection process to ensure no pathogens or INNS are spread with the cultch material or native oysters. If cultch is required, it would be stored in an outdoor area close to where it would be deployed from for weathering for 12 months before being placed on the sea bed. This would limit the potential for spread of pathogens. The MEEB Implementation and Monitoring Plan will incorporate mitigation protocols to secure biosecurity measures once the source of cultch and oyster are confirmed.

28. Actions that would be implemented to minimise risks of introducing and spreading disease are listed below:

- Identification and use of reliable sources of stock;
- Application of good management practices;
- Effective disease recognition and diagnosis; and

- Identification of effective measures to adopt in the event of a disease outbreak or other unknown mortality.

29. If required, the Applicant would work with the Centre for Environment, Fisheries and Aquaculture Science (Cefas) to develop a biosecurity measures plan.

3.2.2 Biological Attributes

30. The following biological attributes of subtidal mixed sediment are relevant to Potential Introduction or Spread of Microbial Pathogens and INNS:

- Structure: non-native species and pathogens (habitat).

3.2.2.1 Introduction of Microbial Pathogens

31. A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi. The import or rearing of cultivated stock can introduce a range of pathogens and parasites into the marine environment which could be deemed damaging (Murray and Peeler, 2005).

32. When new species are brought into a country and quarantining controls are weak the risks of transfer of pathogens or contamination of material by alien invasive species are high (Occhipinti Ambrogi *et al*., 2008). The oysters selected for the restoration site will be sourced from a reputable cultivating company based in the United Kingdom. Biosecurity protocols will be followed throughout the restoration process to reduce the likelihood of any pathogens potentially being introduced and/or spread. Therefore, it is considered that these risks can be minimised.

33. The impact of microbial pathogens has been defined using the following 'medium to high risk' pressure identified by Natural England's AoO for the CSCB MCZ:

- Introduction of microbial pathogens.

34. The sensitivity to this pressure is not defined for subtidal mixed sediments however for subtidal coarse sediment and subtidal sand is defined as low sensitivity. Therefore, it is expected that subtidal mixed sediments are also likely to be of low sensitivity

35. Based on the relevant pressures, receptor sensitivity, and the embedded mitigation regarding the sourcing of native oyster and biosecurity protocols (**Section 3.2.1**), it can be concluded that the conservation objective of maintaining the subtidal mixed sediment feature of the CSCB MCZ in a favourable condition or restoring it to a favourable condition **will not be hindered** by the risks of introduction and spread of microbial pathogens related to the planting of native oyster bed.

3.2.2.2 Introduction or Spread of Invasive Non-Native Species (INNS)

36. Hard substrate introduced by the proposed oyster bed and resulting biogenic reef could act as potential 'stepping stones' or vectors for INNS, as well as supporting species non-native to otherwise softer/mixed substrate habitats. This assessment considers the effects of the proposed initial oyster restoration site search area and resulting colonisation by faunal communities on the subtidal mixed sediment feature which could be affected by the introduction of INNS.

37. The relevant attribute for subtidal mixed sediments for this potential impact is:
    - Structure: Non-native species and pathogens.

38. The impact of the introduction of INNS has been defined using the following 'medium to high risk' pressure identified by Natural England's AoO for the CSCB MCZ:
    - Introduction or spread of INNS.

39. The sensitivity of subtidal mixed sediments to INNS is medium.

40. The native oysters selected for the restoration site will be sourced from a reputable cultivating company based in the United Kingdom. Biosecurity protocols will be followed throughout the restoration process to reduce any INNS that could potentially be introduced and/or spread (**Section 3.2.1**).

41. Based on the relevant pressures, receptor sensitivity, and assessment of impacts against the attributes of subtidal mixed sediment feature, it can be concluded that the conservation objective of maintaining the subtidal mixed sediment feature of the CSCB MCZ in a favourable condition or restoring it to a favourable condition **will not be hindered** by the risks of introduction and spread of INNS from the planting of native oyster bed.

4 Summary

42. The introduction of cultch and native oyster has potential to impact an area of 10,000m^2 of the subtidal mixed sediment feature of the CSCB MCZ however the deployment would result in a patchy distribution and would not be uniform throughout the 10,000m^2 area. Native oyster is thought to have been a historic feature along the north Norfolk coast (see **Annex C European Native Oyster Restoration: Site Selection** (document reference 5.6.4)) and therefore oyster bed planting is considered to contribute to the restore target for the MCZ. Deployment of cultch and native oysters could, in the immediate short term, result in localised disturbance and disrupt the presence, species composition and spatial distribution of the existing biological communities but would not represent the introduction of a wholly different substrate that would lead to the development of an alternate community. Over time, establishment of the oyster bed would restore a key structural and influential species once widespread throughout the region, providing wider biodiversity benefits.

43. Introduction of cultch and native oyster has potential to increase the risk of the introduction and spread of microbial pathogens and INNS. However, stringent biosecurity protocols would be put in place to minimise this risk.

44. Therefore, it can be concluded that the conservation objective of maintaining the protected features of the CSCB MCZ in a favourable condition or restoring them to a favourable condition **will not be hindered** by disturbance to the substrate of the sea bed or the risk of introduction or spread of microbial pathogens and INNS from the planting of native oyster bed.

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