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14.0 MARINE ECOLOGY

14.1 Introduction

14.1.1 This chapter of the Preliminary Environmental Information (PEI) Report provides an initial assessment of the potential impacts and effects as a result of the construction, operation (including maintenance) and decommissioning of the Proposed Development on marine ecology.

14.1.2 A detailed description of the Proposed Development can be found within Chapter 4: Proposed Development (PEI Report, Volume I).

14.1.3 For the purposes of this assessment, the marine environment is defined as any area seaward of the mean high-water springs (MHWS) mark of any tidally influenced water body. Terrestrial and aquatic designations, habitats, and species i.e., those above the MHWS are considered in Chapter 12: Ecology and Nature Conservation (including aquatics and saltmarsh habitats recorded in Greatham Creek above MHWS) (PEI Report, Volume I). Impact pathways to coastal seabirds and associated designated sites are considered in Chapter 13: Ornithology (PEI Report, Volume I), whilst marine water quality is considered within Chapter 9: Surface Water, Flood Risk and Water Resources (PEI Report, Volume I).

14.1.4 This chapter describes the assessment methodology used, the datasets that have informed this preliminary assessment, baseline conditions, development design measures, mitigation measures and the preliminary determination of any likely significant effects on the marine environment that could result from the Proposed Development.

14.1.5 This chapter is supported by the following figures (PEI Report, Volume II) and appendix (PEI Report, Volume III):

- Figure 14-1: Study Area;
- Figure 14-2: Designated Sites with Marine Ecological Features;
- Figure 14-3: Important Intertidal and Subtidal Benthic Habitats;
- Figure 14-4: Harbour Seal Mean At-Sea Distribution; and
- Figure 14-5: Grey Seal Mean At-Sea Distribution.
- Appendix 14A: Net Zero Teesside Benthic EUNIS Biotopes in the River Tees and Tees Bay

14.2 Legislation and Planning Policy Context

14.2.1 This initial assessment has been undertaken within the context of relevant planning policies, at both national and local levels, guidance documents and legislative instruments. The background for this is detailed within Chapter 7: Legislative and Planning Policy Context (PEI Report, Volume I). A summary of the legislative background and policies relating to marine ecology is provided below.

Legislative Background

14.2.2 The following legislation is considered to be relevant to the Proposed Development in respect of marine ecology:

- The Marine and Coastal Access Act 2009 (HM Government, 2009a), which provides the legal mechanism to help ensure clean, healthy, safe, and productive and biologically diverse oceans and seas;
- The Conservation of Habitats and Species Regulations 2017 (HM Government, 2017a) (amended 2019 (HM Government, 2019)) (the Habitats Regulation), which transposes the Habitats Directive (92/43/EEC) into UK legislation out to the 12 nautical mile (NM) limit;
- The Wildlife and Countryside Act (WCA) 1981 (HM Government, 1981), which includes provisions relating to nature conservation;
- The Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2017 (HM Government, 2017b), which transposes the EU Water Framework Directive (2000/60/EC) into UK legislation;
- The Marine Strategy Regulations 2010 (HM Government, 2010), which transposes the Marine Strategy Framework Directive (2008/56/EC) into UK legislation;
- The Natural Environment and Rural Communities (NERC) Act 2006 (HM Government, 2006), which lists habitats and species of principal importance (SPI) for the purpose of conservation of biodiversity and requires public authorities to consider what actions can be taken to further the general biodiversity objection for the conservation and enhancement of biodiversity;
- The Environment Act 2021 (HM Government, 2021a), which sets clear statutory targets for the recovery of the natural world in four priority areas: air quality, biodiversity, water and waste, and includes the introduction of Biodiversity Net Gain (BNG);
- The Conservation of Seals Act 1970 (as amended) (HM Government, 1970), which provides protection and conservation for seals in England, Wales and Scotland, and adjacent territorial waters;
- The Salmon and Freshwater Fisheries Act 1975 (as amended) (HM Government, 1975), which relates to the protection of salmon and freshwater fisheries, as well as preventing the obstruction of fish migratory route;
- The Eels (England and Wales) Regulations 2009 (HM Government, 2009b), which implement Council Regulation (EC) No 1100/2007 (EC) No 1100/2007 establishing measures for the recovery of the stock of European eel including providing for the free passage of eels; and
- Local byelaws relating to fishing practices in coastal areas (0 NM to 6 NM) enforced through the North Eastern Inshore Fisheries and Conservation Authority (IFCA, 2023).

14.2.3 The following are international legislations and agreements in which the UK is a signatory concerning, which are concerned with the preservation of marine ecological receptors during the planning and execution of projects in UK waters:

- The Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas 1992 (ASCOBANS) (United Nations Environment Programme (UNEP), 1992).

Planning Policy Context

National Planning Policy

14.2.4 The key national planning policy related to the Proposed Development in relation to marine ecology are outlined below. There are no additional specific requirements in "National Policy Statement for Electricity Networks Infrastructure (EN-5) (2011 and 2023)" for the marine ecology above that which is already provided on National Policy Statement for Energy (EN-1).

Overarching National Policy Statement for Energy (EN-1), 2011

14.2.5 The NPS for Energy (EN-1) (DECC, 2011a) sets out national policy for energy infrastructure. Part 5.3 relates to biodiversity and requires that the applicant shows how the project adheres to the Government's biodiversity strategy which aims to ensure:

> *"A halting, and if possible a reversal, of declines in priority habitats and species, with wild species and habitats as part of healthy, functioning ecosystems"*; and
>
> *The general acceptance of biodiversity's essential role in enhancing the quality of life, with its conservation becoming a natural consideration in all relevant public, private and non-governmental decisions and policies"* (paragraph 5.3.5 of NPS EN-1).

14.2.6 It also states the following in relation to the impact of a development on biodiversity:

> *"As a general principle, and subject to the specific policies below, development should aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives; where significant harm cannot be avoided, then appropriate compensation measures should be sought"* (NPS EN-1 paragraph 5.3.7); and
>
> *"In taking decisions, the IPC should ensure that appropriate weight is attached to designated sites of international, national and local importance; protected species; habitats and other species of principal importance for the conservation of biodiversity; and to biodiversity and geological interests within the wider environment"* (NPS EN-1 paragraph 5.3.8).

14.2.7 Adherence to these policies must be demonstrated through robust application of the mitigation hierarchy (as set out in paragraph 5.3.18 of NPS EN-1) and can be achieved by the application of appropriate mitigation, to ensure that, verbatim of those outlined in NPS EN-1:

- during construction, they will seek to ensure that activities will be confined to the minimum areas required for the works;

- during construction and operation best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised, including as a consequence of transport access arrangements;
- habitats will, where practicable, be restored after construction works have finished; and
- opportunities will be taken to enhance existing habitats and, where practicable, to create new habitats of value within the site landscaping proposals.

14.2.8 Part 5.15 of NPS EN-1 is also of relevance to marine ecology, which relates to water quality and resources and requires applicants to consider impacts of development to water bodies and protected areas (e.g., shellfish waters) under the WFD. In particular, the assessment should demonstrate that appropriate measures will be put in place to avoid or minimise adverse impacts of abstraction and discharge of cooling water. In addition to the mitigation measures set out in NPS EN-1, the design of the cooling systems should include intake and outfall locations that avoid and minimise adverse impacts.

NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4), 2011

14.2.9 Paragraph 2.15.5 states *"As explained in Section 5.3 of EN-1, the ES should set out any effects on designated sites, protected species and on other biodiversity afforded conservation priority. Where relevant, applicants should undertake sediment transfer modelling to predict and understand impacts and help identify relevant mitigating or compensatory measures. The assessment should include the effects on water quality and resources, and on coastal change (see also Sections 5.15 and 5.5 respectively of EN-1 for further information on these)."*

14.2.10 Paragraph 2.15.7 *states "As explained in Section 5.3 of EN-1, the applicant should be careful to identify the effects on Marine Conservation Zones and designated protected areas. Applicants should consult the Marine Management Organisation (MMO) at an early stage about this."*

Draft Overarching National Policy Statement for Energy (EN-1), 2023

Marine Conservation Zones

14.2.11 Paragraph 5.4.9: Marine Conservation Zones (MCZs) (Marine Protected Areas in Scotland), introduced under the Marine and Coastal Access Act 2009, are areas that have been designated for the purpose of conserving marine flora or fauna, marine habitats or types of marine habitat or features of geological or geomorphological interest. The protected feature or features and the conservation objectives for the MCZ are stated in the designation order for the MCZ.

Marine Protected Areas

14.2.12 Paragraph 5.4.10: Marine Protected Area (MPA) is a term used to describe the network of HRA sites, SSSIs and MCZs in the English and Welsh marine environment.

14.2.13 Paragraph 5.4.11: It is important that relevant guidance on managing environmental impacts of infrastructure in marine protected areas is followed, and that equal consideration of the effect of proposals should be given to all MPAs regardless of the

legislation they were designated under. This is because all sites contribute to the network of MPAs and therefore to overall network integrity.

NPS for Renewable Energy Infrastructure (EN-3), 2023

14.2.14 Paragraph 3.316 states that *"Marine Licences are required for all the marine elements of a proposed offshore development (up to Mean High Water Springs), including associated development such as the cabling and any offshore substations that are required, and any other matters the MMO may consider relevant under s69 of the Marine and Coastal Access Act 2009."*

14.2.15 As part of marine licensing, impacts on marine protected areas (MPAs) will be considered. Further guidance on marine licensing is set out in Section 1.2 of EN-1.

Draft NPS for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4), 2023

14.2.16 Paragraph 2.13.14 states *"LNG import facilities are located on coasts and estuaries. During the operation of an LNG import facility, LNG tanker deliveries by sea will be essential to the facility. This activity gives rise to the need for dredging in order for the deep-water channel and jetty to maintain declared depths and to deepen waters to accommodate the large tankers. Subsequently the dredge spoil must be deposited responsibly."*

14.2.17 2.13.15 Dredging and associated construction e.g., of deep-water jetties, may have specific impacts on the local marine, coastal and estuarine environments, and marine biodiversity.

14.2.18 2.13.16 These habitats are often of fundamental importance to biodiversity, particularly to bird and fish life. For example, dredging can result in the smothering of nearby habitats and benthic communities, and local increases in suspended sediment concentrations may have an effect on fisheries, leading to the migration of fish, whilst disturbed sediment could contain contaminated material.

National Planning Policy Framework (NPPF), 2021

14.2.19 Planning policy to support the halting of overall declines in biodiversity is set out in the NPPF (MHCLG, 2021) and the Governments' 25-Year Environment Plan (HM Government, 2018). Both policy documents include a commitment to promote opportunities to incorporate biodiversity improvements to achieve net gains for biodiversity.

14.2.20 Whilst the NPPF does not directly apply to Nationally Significant Infrastructure Projects (NSIPs) such as the Proposed Development, the Secretary of State (SoS) may have regard to policies in the NPPF if the SoS thinks that they are important and relevant.

Governments' 25-Year Environmental Plan, 2018

14.2.21 The Governments' 25-Year Environment Plan, which aligns with the Clean Growth Strategy, is relevant to the Proposed Development. The Environment Act was passed into law in 2021. It was created to achieve the commitments outlined in the Governments' 25-Year Environment Plan, and mandates BNG for development (housing and commercial), including for NSIPs. Government is currently consulting

on secondary legislation and a Biodiversity Statement applicable to NSIPs. Therefore, whilst the Environment Act 2021 is now law, the BNG measures applicable to NSIPs are not yet in force and are anticipated to come into effect in late 2025.

14.2.22 To fulfil the aims of the 25-Year Environment Plan and the Environment Bill, Natural England developed the 'Department for Environment, Food and Rural Affairs (Defra) Biodiversity Metric'; this is a tool for measuring and accounting for biodiversity losses and gains resulting from development. The latest version of this tool (Metric 4.0), which is expected to become statutory in November 2023, includes intertidal habitats (Natural England, 2021).

The UK Marine Policy Statement (2011)

14.2.23 The UK MPS (HM Government, 2011) was adopted in 2011. It provides the policy framework for the preparation of marine plans and establishes how decisions affecting the marine area should be made (HM Government, 2011). The UK is divided into a number of marine plan areas with associated plan authorities that are responsible for preparing marine plans. In England, the MMO is the plan authority. Marine plans are a material planning consideration.

The North East Inshore Marine Plan (2021)

14.2.24 The Proposed Development Site lies within the North East Inshore Marine Plan (HM Government, 2021b), which stretches from Flamborough Head in Yorkshire to the Scottish Border. The Plan Area includes three main tidal rivers, including the River Tees.

14.2.25 The North East Inshore Marine Plan (HM Government, 2021b) is intended to provide a strategic approach to decision-making, considering future use and providing a clear approach to managing resources, activities and interactions within the area. Policies in the plan which are of relevance to marine ecology are outlined in Table 14-1.

Table 14-1: Policies in the North East Inshore Marine Plan (HM Government, 2021b) which are Relevant to Marine Ecology

POLICY NUMBER	POLICIES TEXT	RELEVANCE TO PROPOSED DEVELOPMENT
NE-BIO-1	"*Proposals that enhance the distribution of priority habitats and priority species will be supported. Proposals that may have significant adverse impacts on the distribution of priority habitats and priority species must demonstrate that they will, in order of preference:* *a) avoid;* *b) minimise;* *c) mitigate adverse impacts so they are no longer significant;* *d) compensate for significant adverse impacts that cannot be mitigated*."	The Proposed Development may result in impacts to priority habitats and species. As such, a baseline review and assessment of likely effects have been conducted in this PEI Report.
NE-BIO-2	"*Proposals that enhance or facilitate native species or habitat adaptation or connectivity, or native species migration, will be supported. Proposals that may cause significant adverse impacts on native species or habitat adaptation or connectivity, or native species migration, must demonstrate that they will, in order of preference:* *a) avoid;* *b) minimise;* *c) mitigate adverse impacts so they are no longer significant;* *d) compensate for significant adverse impacts that cannot be mitigated*."	The Proposed Development may result in impacts to native species. As such, a baseline review and assessment of likely effects have been conducted in this PEI Report.
NE-BIO-3	"*Proposals that conserve, restore or enhance coastal habitats, where important in their own right and/or for ecosystem functioning and provision of ecosystem services, will be supported. Proposals must take account of the space required for coastal habitats, where important in*	This policy applies to intertidal habitats. The Proposed Development is not expected to result in adverse impacts to intertidal coastal habitats in the Study Area due to the use of trenchless

POLICY NUMBER	POLICIES TEXT	RELEVANCE TO PROPOSED DEVELOPMENT
	their own right and/or for ecosystem functioning and provision of ecosystem services, and demonstrate that they will, in order of preference: *a) avoid;* *b) minimise;* *c) mitigate;* *d) compensate for net habitat loss.*"	technologies such as Horizontal Directional Drilling (HDD).
NE-CC-1	"*Proposals that conserve, restore or enhance habitats that provide flood defence or carbon sequestration will be supported. Proposals that may have significant adverse impacts on habitats that provide a flood defence or carbon sequestration ecosystem service must demonstrate that they will, in order of preference:* *a) avoid;* *b) minimise;* *c) mitigate adverse impacts so they are no longer significant;* *d) compensate for significant adverse impacts that cannot be mitigated*."	The proposed location for the Hydrogen Pipeline Corridor is within coastal saltmarsh habitat which typically sequesters large amounts of carbon. However, the proposed construction methodology of trenchless technologies is not expected to cause adverse effects to the habitat. The saltmarsh above MHWS is considered as part of Chapter 12: Ecology and Nature Conservation (PEI Report, Volume I). The saltmarsh designated as part of the Teesmouth and Cleveland Coast SPA is above MHWS.
NE-DIST-1	"*Proposals that may have significant adverse impacts on highly mobile species through disturbance or displacement must demonstrate that they will, in order of preference:* *a) avoid;* *b) minimise;* *c) mitigate adverse impacts so they are no longer significant*."	The Hydrogen Pipeline Corridor in Greatham Creek may have adverse impacts on highly mobile species including fish and pinnipeds. Therefore, an assessment of likely effects is included in this PEI Report.

POLICY NUMBER	POLICIES TEXT	RELEVANCE TO PROPOSED DEVELOPMENT
NE-FISH-3	"*Proposals that enhance essential fish habitat, including spawning, nursery and feeding grounds, and migratory routes, should be supported. Proposals that may have significant adverse impacts on essential fish habitat, including spawning, nursery and feeding grounds, and migratory routes, must demonstrate that they will, in order of preference:* *a) avoid;* *b) minimise;* *c) mitigate adverse impacts so they are no longer significant*."	The Hydrogen Pipeline Corridor in Greatham Creek is not considered to be located within fish habitats but may be located within a fish migratory route. However, the use of trenchless technologies is considered to be the most appropriate construction method to avoid any adverse impacts. New water abstraction points are not part of the Proposed Development. Therefore, no potential impact pathway to fish and shellfish from underwater sound or entrapment and entrainment is likely to occur.
NE-INNS-1	"*Proposals that reduce the risk of introduction and/or spread of invasive non-native species should be supported. Proposals must put in place appropriate measures to avoid or minimise significant adverse impacts that would arise through the introduction and transport of invasive non-native species, particularly when:* *1) moving equipment, boats or livestock (for example fish or shellfish) from one water body to another;* *2) introducing structures suitable for settlement of invasive non-native species, or the spread of invasive non-native species known to exist in the area*."	The Proposed Development is not expected to require vessels for the placement of the pipeline in Greatham Creek, or the movement of waterborne equipment or structures suitable for the settlement of invasive non-native species (INNS).
NE-INNS-2	"*Public authorities with functions to manage activities that could potentially introduce, transport or spread invasive non-native species should implement adequate biosecurity measures to avoid or minimise the risk of introducing, transporting or spreading invasive non-native species*."	The proposed activities in Greatham Creek are not expected to result in the introduction, transportation or spread of INNS.

Local Planning Policy

14.2.26 The land considered for the Proposed Development is located within the administrative boundaries of Stockton on Tees Borough Council (STBC), the Redcar & Cleveland Borough Council (RCBC) and Hartlepool Borough Council (HBC).

14.2.27 Local planning policy relevant to the marine ecology assessment includes:

- Redcar and Cleveland Local Plan (adopted in May 2018) (RCBC, 2018);
- Stockton-on-Tees Local Plan (adopted in January 2019) (STBC, 2019); and
- Hartlepool Local Plan (HBC, 2018).

14.2.28 Policies N1 (Landscape) and N4 (Biodiversity and Geological Conservation) of the Redcar and Cleveland Local Plan relate to the protection of the marine environment and important sites for biodiversity including Special Protection Areas (SPAs), Ramsar, Special Areas of Conservation (SACs), Sites of Special Scientific Interest (SSSI) and local nature reserves (RCBC, 2018). Similar themes are covered by the Stockton on Tees Local Plan Policy ENV5 which aims to preserve, protect and enhance ecological networks, biodiversity and geodiversity (STBC, 2019), whilst the Hartlepool Local Plan policy NE1 aims to protect, manage and enhance Hartlepool's natural environment, including coastal environments (HBC, 2018).

14.2.29 The Stockton-on-Tees Local Plan also seeks to ensure, as part of policies SD5 and ENV7, that development proposals do not contribute to unacceptable levels of pollution, including noise pollution, and that any adverse effects are prevented or reduced by incorporating mitigation measures (STBC, 2019). This includes measures to prevent or reduce noise pollution in designated sites including Seal Sands SSSI where seals may be sensitive to any increases in noise pollution resulting from proposed developments.

14.2.30 All three local plans make specific mention of the then proposed extension of the Teesmouth and Cleveland Coast SPA into the marine environment to protect breeding colonies of common tern (*Sterna hirundo*) and avocet (*Recurvirostra* spp.) as well as non-breeding waterbirds. The policies outlined above provide the necessary safeguards to protect both designated and proposed nature conservation sites.

14.2.31 Local Priority Species for the Tees Valley which are relevant to the assessment of marine ecology include salmon (*Salmo salar*), sea trout (*Salmo trutta*), European eel (*Anguilla Anguilla*), river lamprey (*Lampetra fluviatilis*) and sea lamprey (*Petromyzon marinus*) (Tees Valley Nature Partnership, 2012).

14.2.32 Local Priority Habitats for the Tees Valley which are relevant to the assessment of marine ecology (with some overlap with terrestrial and aquatic ecology) include maritime cliffs and slopes, mudflats and saltmarsh, sand dunes and saline lagoons (Tees Valley Nature Partnership, 2012).

14.2.33 The Tees is recognised as one of the main salmon rivers in England and Wales, and as such there is currently a Salmon Action Plan (SAP) enforced by the Environment Agency (EA) (EA, 2009). The actions of high priority within the SAP include:

- improving water quality in the lower river and estuary;

- free fish passage past the Tees Barrage;
- improving evaluation of compliance against spawning targets;
- maintaining liaison with developers to ensure impacts of new developments are minimised; and
- promoting new regional byelaws relating to fishing near obstructions.

14.3 Assessment Methodology and Significance Criteria

Study Area

14.3.1 The Study Area is shown in Figure 14-1: Study Area (PEI Report, Volume II). For the assessment, the Study Area has been defined to include the predicted likely Zones of Influence (ZoI) where potential impacts and significant effects may arise from the Proposed Development. The largest predicted ZoI for marine ecology is considered to be 10 km (for designated sites), although this will be refined as part of the ES when further information is available and more detailed assessments are undertaken. The Rochdale Envelope has been applied to ensure that the baseline characterisation data is sufficient to underpin a reasonable worst-case assessment of impact pathways. Further details regarding the Rochdale Envelope approach are included in Section 14.3.

14.3.2 The ZoI, and therefore the Study Area, is specific to each marine ecological feature, recognising both the mobility of each feature and the likely impact pathways to that feature. A summary of the Study Area for each receptor is defined below:

- Designated Sites: the Study Area for the search for relevant nature conservation sites for marine ecology include a 10 km radius of the Proposed Development Site within the marine environment. This spatial extent was chosen on the basis that it provides geographical context and encompasses the relevant functional habitats and range of movement of most species found within the predicted ZoIs of the Proposed Development.
- Benthic ecology: the Study Area covers the River Tees and Tees Estuary, as well as Seal Sands, Seaton Channel and Greatham Creek. The Study Area also extends from the south bank of the Tees Estuary to Redcar in Tees Bay, encompassing South Gare Breakwater and Coatham Sands.
- Fish and shellfish: the Study Area for these receptors is defined as the area comprising the River Tees and Tees Estuary, Seaton Channel, and Greatham Creek. The wider coastal area which falls within The International Council for the Exploration of the Sea (ICES) statistical rectangle 38E8 (ICES StatRecs), including Tees Bay, has also been considered.
- Marine mammals: the Study Area for marine mammals includes the Greater North Sea Ecoregion (North Sea, English Channel, Skagerrak and Kattegat), recognising the highly mobile and transient nature of this receptor. However, it is considered unlikely that most cetacean species will occur in the River Tees itself, although consideration has been given to the nearby coastal area. The particular focus within the Study Area for seals are Seal Sands and Greatham Creek.

Impact Assessment Methodology

14.3.3 The impacts and likely significant effects on marine ecology outlined in this chapter as part of project specific ecological impact assessments (EcIAs), have been undertaken in accordance with the Chartered Institute of Ecology and Environmental Management's (CIEEM's) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2019), tailored to consider the interconnectivity of marine ecology and the small number of impacts likely to occur. A detailed assessment methodology is outlined in Chapter 2: Assessment Methodology (PEI Report, Volume I).

14.3.4 The aims of the EcIA are to:

- identify important ecological features (e.g., designated sites, habitats or species) which have the potential to be impacted by the Proposed Development;
- provide a robust assessment of the ecological impacts and resultant likely significant effects of the Proposed Development, which may be beneficial (i.e., positive) or adverse (i.e., negative);
- facilitate determination of the consequences of the Proposed Development in terms of national, regional and local policies relevant to nature conservation and biodiversity, where the level of detail provided is proportionate to the scale of the development and the complexity of its impact pathways;
- identify appropriate mitigation to reduce any likely significant effects; and
- set out the steps to be taken to adhere to legal requirements relating to the relevant ecological features concerned.

Value/Importance of Marine Ecology Features

14.3.5 The assessment has determined the worst-case scenario for impact pathways to marine ecology and has focused on those features considered to be 'important'. The importance of an ecological feature has been defined with reference to a specific geographical context and the scale of protection, ensuring consistency with CIEEM (2019) guidance.

14.3.6 Marine features are highly connected with few boundaries and therefore the levels of geographical importance must recognise this. The levels presented below are based on the level to which the marine ecological receptor may qualify as a legislative or policy designating feature. Therefore, the approach adopts the level of legislative designation as a proxy for the geographical importance of a marine species receptor:

- international (designated National Site Network sites in accordance with the Habitats Regulations– Special Areas of Conservation (SACs), Special Protected Areas (SPAs), as well as Ramsar Sites);
- national (UK protected areas – Sites of Special Scientific Interest (SSSI), Marine Protected Areas (MPAs), and Marine Conservation Zones (MCZs));
- regional or local (ecological features that do not meet criteria for valuation at an international or national level, but that have sufficient value to merit retention or mitigation e.g., for the purpose of ensuring no net loss of biodiversity).

The value of sites, habitats and potential for protected and notable species are evaluated with reference to both their importance in terms of 'biodiversity conservation' value (which relates to the need to conserve representative areas of different habitats and the genetic diversity of species populations) and their legal status.

14.3.7 The importance criteria for marine ecological features are shown in Table 14-2.

Table 14-2: Importance Criteria for Marine Ecology Features

IMPORTANCE	DESCRIPTION*
Very High	Designated sites and qualifying/supporting features of international importance. Species which are legally protected and/or in significant decline (i.e., classified as 'endangered' or 'critically endangered' according to the International Union for Conservation of Nature (IUCN) Red List (IUCN, 2023)). High quality examples of rare habitats which are threatened throughout their range.
High	Designated sites and qualifying/supporting features of national conservational importance. Priority habitats and species or those considered to be of principal importance for the conservation of biodiversity in England and those species considered vulnerable to decline (i.e. classified as 'vulnerable' or 'near threatened' according to the IUCN Red List). High quality examples of uncommon habitats which are vulnerable throughout their range.
Medium	Habitats and species of regional or local importance (i.e., Annex 1 habitats, in accordance with the Habitats Regulations, which are not a qualifying feature of a nearby designated site). Those species considered to be of 'least concern' (according to the IUCN Red List or listed in the OSPAR list of threatened and/or declining species for the North-East Atlantic). Poor quality examples of rare or uncommon habitats which are threatened or vulnerable throughout their range.
Low	Habitats and species of low conservation importance, such as those generally abundant and widespread around the UK with no specific local value.

*Should there be any overlap in the description of a particular feature/receptor, the worst-case importance criteria are adopted.

Magnitude of Impacts

14.3.1 The potential magnitude of change on marine ecological features arising from activities occurring as part of the Proposed Development is determined in consideration of their beneficial or adverse nature; extent; duration; timing; frequency; and reversibility of the impact.

14.3.2 Temporary, permanent, direct and indirect impacts have been considered during the construction, operation and decommissioning phases of the Proposed Development, and any mitigation measures necessary have been identified. To ensure compliance with National and European policy, consideration is still given to the need to maintain and enhance biodiversity.

Significance Criteria

14.3.3 To determine the likely significance of effect, the following parameters have been considered:

- impact type – direct or indirect, positive or negative, temporary or permanent;
- magnitude of impact – the 'amount' or intensity of an impact. This may sometimes be synonymous with 'extent' (see below) for certain receptors, such as habitats loss. For mortality it may be the number of individuals killed;
- spatial extent of impact – the area over which the impact will occur; and
- temporal nature of impact – timing, frequency and duration.

14.3.4 The assessment has also given regard to the sensitivity of an ecological feature to an impact which is determined by its:

- adaptability i.e., the capacity, or lack thereof, of a feature to avoid or adapt to a change; and
- tolerance/resilience i.e., capacity, or lack thereof, of a feature to accommodate temporary or permanent change or recover to pre-existing state following exposure to a change.

14.3.5 By combining the characteristics of an impact pathway with the importance and sensitivity of ecological features or receptors, a measure of the significance of effects on marine ecology can be derived.

14.3.6 For each marine ecological receptor, only those characteristics relevant to understanding the ecological effect and determining the effect significance are described. The determination of the significance of effects has been made based on the predicted impacts as outlined in paragraph 14.3.9 to designated sites, ecosystems, habitats, and species.

14.3.7 Conclusions on the significance of effects are assessed as being either:

- Not Significant – no effect to one or more of the features described above; or
- Significant – one or more features described above are affected.

14.3.8 CIEEM does not advocate a matrix approach for determining the significance of effects on ecological receptors (CIEEM, 2018). However, maintaining consistency with other disciplines/the wider PEI Report, where a matrix approach is suitable, should be considered. As such, the assessment conclusions presented within this chapter have been translated into the significance terminology used within the wider PEI Report, as outlined in Table 14-3.

Table 14-3: Description of Significance Terminology

CLASSIFICATION OF EFFECT BASED ON CIEEM GUIDANCE	TERMINOLOGY USED ELSEWHERE	DESCRIPTION IN ACCORDANCE WITH CIEEM GUIDANCE
Significant (Beneficial)	Major Beneficial	Beneficial effect on designated sites, ecosystems, habitat and species at the international level.
	Moderate Beneficial	Beneficial effect on designated sites, ecosystems, habitat and species at the national level.
Non-significant	Minor Beneficial	Beneficial effect on designated sites, ecosystems, habitat and species at a local level or regional level.
	Negligible	No effect on designated sites, ecosystems, habitat and species.
	Minor Adverse	Adverse effect on designated sites, ecosystems, habitat and species at the local level or regional level.
Significant (Adverse)	Moderate Adverse	Adverse effect on designated sites, ecosystems, habitat and species at the national level.
	Major Adverse	Adverse effect on designated sites, ecosystems, habitat and species at the international level.

Sources of Information/Data

14.3.9 Baseline conditions for marine ecology have been determined using findings from a desk-based study. The study area shown in Figure 14-1: Study Area (PEI Report, Volume II) were used to define the area of search for the desk-based study.

14.3.10 The desk-based study identified several publicly available data sources relevant to the Study Area for each marine receptor. The desk-based study determined the nature conservation designated sites and protected species and habitats considered within this assessment of impact pathways from the Proposed Development. Furthermore, the data sources were used to provide the relative importance,

functionality and geographical context of each receptor. Data sources identified include:

- The Marine Life Information Network (MarLIN, 2023);
- EA TraC data 1987 – 2019 (EA, 2021a);
- EA River Tees Fish Counts for salmon and brown trout taken at the Tees Barrage 2011 – 2022 (EA, 2023a);
- habitat mapping undertaken by the Joint Nature Conservation Committee (JNCC) (2019a) – Marine Nature Conservation Review (MNCR) area summaries and the EA (2023b) – saltmarsh zonation and extent in England;
- European Marine Observation Data Network (EMODnet) (EMODnet, 2021) Seabed Habitats Project for broad-scale habitat maps of the Study Area;
- European University Information Systems organisation (EUNIS) (European Environment Agency (EEA), 2021) for classifying benthic habitats;
- EA ecology and fish data explorer (EA, 2021b);
- Spawning and nursery grounds for UK waters (Coull *et al.,* 1998; Ellis *et al.,* 2012);
- Salmon Stocks and Fisheries in England and Wales (Cefas, 2019 and 2022);
- Salmonid and fisheries statistics for England and Wales (EA, 2022e);
- UK fleet landings by rectangle stock and estimated EEZ 2016-2020 (updated) (MMO, 2021);
- ICES publications and data (ICES, 2022);
- SCANS (Small Cetacean Abundance in the European Atlantic and North Sea) data (Hammond *et al.*, 2021);
- Inter-Agency Marine Mammal Working Group (IAMMWG) publications (IAMMWG, 2022);
- Sea Mammal Research Unit (SMRU) and Special Committee on Seals research reports (SCOS) (SMRU & SCOS, 2021);
- Habitat-based predictions of at-sea distributions for grey and harbour seals in the British Isles (Carter *et al*., 2020);
- INCA Tees Seals Research Programme publications (INCA, 2022);
- academic papers and online reports as available for the Study Area;
- designated sites condition assessments as available; and
- existing reference baseline data (where available and relevant) from other developments in the area e.g., the Net Zero Teesside (NZT) Project.

14.3.11 Following a review of available data, with consideration of the potential impact pathways associated with the Proposed Development, no project specific marine ecology surveys are proposed, as detailed in Table 14-4.

14.3.12 The presence of harbour and grey seals in the Study Area is well known, including abundances, seasonality, and the known haul-out locations for these species. Therefore, no effort-based surveys for marine mammals have been proposed. However, incidental sightings of seals at Seal Sands and Greatham Creek have been recorded as part of the breeding and non-breeding bird surveys for the Proposed Development and will continue to be observed and recorded. This includes information on the species, their location, abundance, the presence of pups, and if seals are moulting.

14.3.13 Benthic ecology within the Study Area is well understood, through existing surveys undertaken by the JNCC (2019) and the EA (2022c), and the subtidal and intertidal benthic surveys completed for the NZT Project in the River Tees and Tees Bay. Trenchless technologies in the marine environment and existing pipeline bridges are proposed for the Hydrogen Pipeline Corridor at Greatham Creek. The use of trenchless technologies will result in the avoidance of most impact pathways to benthic habitats and species and negate the requirement for further surveys. This will continue to be reviewed as the Proposed Development design progresses and following any input or requirements from statutory consultees such as Natural England.

14.3.14 Fish and shellfish surveys are not considered necessary. The proposed Hhydrogen Ppipeline Ccorridor in the vicinity of Greatham Creek is not considered to be located within fish habitats but may be located within a fish migratory route. However, the use of trenchless technologies is considered to be the most appropriate construction method to avoid any adverse impacts to this receptor. Furthermore, new water abstraction points are not part of the Proposed Development, meaning that there are no potential impact pathways to fish and shellfish from underwater sound or entrapment and entrainment.

Consultation

14.3.15 An EIA Scoping Opinion was requested from the Planning Inspectorate (the Inspectorate) in April 2023. A response was received on 17th May 2023. A high-level summary of responses to the Scoping Opinion relevant to marine ecology outlined in Table 14-4.

Table 14-4: Responses to Scoping Comments

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
The Inspectorate	Scoping opinion – 17/05/2023	The inspectorate agrees that effects to the Southern North Sea SAC can be scoped out of the ES on the basis that the site is over 100km from the Proposed Development and there are no impact pathways from underwater sound.	This comment is acknowledged. This SAC is scoped out from further assessment as outlined in Section 14.4 of this PEI Report chapter.
The Inspectorate	Scoping opinion – 17/05/2023	The Inspectorate agrees that marine mammal and benthic ecology surveys can be scoped out on the basis set out in the Scoping Report. With regard to fish surveys, the Inspectorate notes that potential impact pathways from underwater sound, and possibly entrapment and entrainment have been identified.	This comment is acknowledged. Fish and shellfish surveys are not considered necessary. The proposed Hydrogen Pipeline Corridor in the vicinity of Greatham Creek is not considered to be located within fish habitats but may be located within a fish migratory route. However, the use of trenchless technologies is considered to be the most appropriate construction method to avoid any adverse impacts to this receptor. Furthermore, new water abstraction points are not part of the Proposed Development, meaning that there are no potential impact pathways to fish and shellfish from underwater sound or entrapment and entrainment. If the scope of the Proposed Development changes, the need for surveys will be discussed with the relevant consultation bodies.

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
The Inspectorate	Scoping opinion – 17/05/2023	The Scoping Report does not include any information about the predicted noise and vibration levels from the proposed works or sensitivity of ecological receptors. The Inspectorate therefore does not have sufficient information to reasonably conclude that there will be no likely significant effects.	Airborne sound disturbance is assessed in Section 14.6. A list of potential construction activities near Greatham Creek and predicted sound pressure levels are provided in Table 14-10.
The Inspectorate	Scoping opinion – 17/05/2023	The Scoping Report seeks to scope out effects from underwater sound. The Inspectorate notes that the proposed hydrogen pipeline would cross the tidal River Tees and that there is potential for noise and vibration impacts arising from construction of the pipeline to migratory fish. This matter should be assessed in the ES.	It is assumed at this stage that the depths of the trenchless technologies (such as HDD) will be such that there is no pathway for effects to marine ecological receptors. It is also assumed that the works will be through bedrock below marine sediment and at a sufficient depth where underwater sound effects to migratory fish are likely to be negligible. This is in line with the current tunnelling methodology which states a tunnelling depth of 10 – 15 m below the riverbed will be achieved. Therefore, it is considered that underwater sound effects as a result of trenchless technologies (such as HDD) will not result in likely significant effects and can be scoped out from further assessment. This will be reviewed as the EIA progresses and confirmed in the ES.

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
The Inspectorate	Scoping opinion – 17/05/2023	The Inspectorate notes that permanent loss of habitat in the intertidal area is not proposed but if the approach changes, consideration would be given to the 'requirements of the Environment Act 2021' including a BNG assessment.	This comment is acknowledged. This will be reviewed if there are any Proposed Development design changes.
The Inspectorate	Scoping opinion – 17/05/2023	The Inspectorate draw the Applicant's attention to the EA's comments regarding the presence of coastal saltmarsh habitat adjacent to Greatham Creek. The baseline habitat should be correctly described in the ES and supporting figures. The assessment of impacts arising from installation of the proposed pipelines should include consideration of this habitat and identify any mitigation required for likely significant effects, and how this would be secured in the DCO.	This habitat is located above the MHWS and is considered to be coastal/terrestrial. The characterisation of habitats of this characterisation and any potential effects are considered in Chapter 12: Ecology and Nature Conservation (including aquatics) (PEI Report, Volume I).
The Inspectorate	Scoping opinion – 17/05/2023	The ES should include an assessment of effects arising from the risk of fish entrapment and entrainment associated with abstraction of water from WFD waterbodies and/or cooling water systems required for the Proposed Development. The ES should identify any mitigation required, and how this would be secured in the DCO.	The Proposed Development will use water from existing sources; either raw water supply to the Teesworks site; or a new connection to the existing NWL supply either via tie in to NZT infrastructure or the installation of a new connection. Therefore, there is considered to be no impact pathway to fish and shellfish from entrapment and entrainment, and this will not be considered further.

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
The Inspectorate	Scoping opinion – 17/05/2023	If cooling water is proposed to be discharged to the Tees Estuary or other WFD waterbodies, the ES should include an assessment of likely significant effects arising from thermal properties of the discharge of the cooling water.	Discharge of cooling water to the Tees Estuary or other WFD waterbodies is not proposed as part of the Proposed Development.
The Inspectorate	Scoping opinion – 17/05/2023	If any hard structures (e.g. pipe outflow, rock armouring or equivalent) are proposed then the assessment of habitat loss and disturbance should also consider potential changes in coastal processes and introduction of invasive non-native species (INNS).	No hard structures are being placed in the marine environment. No pathway for the introduction of INNS has been identified at this stage.
Environment Agency	Scoping Opinion – 09/05/2023	The applicant should be aware that large areas adjacent to Greatham Creek, which have been classified as 'Coastal and floodplain grazing marsh', are in fact coastal saltmarsh habitat as a result of the EA's managed realignment projects of 2014 and 2018 respectively.	This habitat is located above the MHWS and is considered to be coastal/terrestrial. The characterisation of habitats of this characterisation and any potential effects are considered in Chapter 12: Ecology and Nature Conservation (PEI Report, Volume I).
Environment Agency	Scoping Opinion – 09/05/2023	It is preferred that the abstraction from WFD waterbodies is avoided where practicable to avoid the risk of fish entrainment. If abstraction from WFD waterbodies is proposed, the impact of fish entrainment should be assessed, and appropriate mitigation proposed to prevent entrainment.	The Proposed Development will use water from the existing NWL raw water feed or alternatively demineralised water from Wilton International. Therefore, there is considered no impact pathway to fish and shellfish from entrainment and mitigation measures will not be considered further.

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
Environment Agency	Scoping Opinion – 09/05/2023	If cooling waters is discharged to the Tees estuary or other WFD waterbodies, the implications of this in relation to WFD status will need to be fully considered. Thermal modelling will be required to assess the range of the thermal discharge.	There will be no direct discharge of cooling water from the Main Site or via the NZT effluent outfall into the River Tees and Tees Bay. Therefore, there is considered no impact pathway from cooling water discharge, and this will not be considered further.
Environment Agency	Scoping Opinion – 09/05/2023	It is unclear from the Scoping Report whether there is a potential for noise and / or vibration to occur during the creation of the hydrogen pipeline corridors. Therefore, the applicant should consider potential effects from noise and vibration on migratory fish.	It is assumed at this stage that the depths of the trenchless techniques (such as HDD) (10-15 m) will be such that there is no pathway for effect to marine ecological receptors. It is also assumed that the works will be through bedrock below marine sediment and at a sufficient depth where underwater sound effects to migratory fish are unlikely. Therefore, underwater sound effects as a result of trenchless techniques have been scoped out from further assessment. There are no other known pathways for underwater sound disturbance at this stage for example, Unexploded Ordnance (UXO) clearance, vessel movements, or piling/ drilling in the marine environment.
Natural England	09/05/2023	With all HDD there is a risk of 'frac-out'. Natural England recommend that the Construction and Environmental Management Plan (CEMP) or equivalent should include a frac-out contingency plan and a pollution incident	The potential for 'frac-out' risk as a result of HDD activities will be considered further as part of the ES. Any requirement for a frac-out contingency plan and a pollution incident response plan will be outlined within the Framework Construction Environmental

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		response plan. These should detail the clean-up operation. We would expect to be consulted on the CEMP later in the DCO process.	Management Plan (CEMP) to be submitted with the ES. A Hydraulic Fracture Risk Assessment will also be developed prior to construction of the Proposed Development.
Natural England	09/05/2023	The EIA scoping report is contradictory. Paragraph 6.8.27 suggests that UXO clearance measures are unlikely but Table B1 includes relevant screening measures. We would recommend that such measures are included. If not an explanation of the reasoning for omitting these measures should be provided.	It is not envisaged that there will be any planned UXO clearance within the marine environment as part of the Proposed Development. Any impact pathways associated with UXO are scoped out from further assessment.
Natural England	09/05/2023	Entrapment and entrainment within the water cooling system poses a risk to fish. Uptake of water for the water cooling system should consider all life stages of fish species and reduce fish entrainment.	The Proposed Development will use water from the existing NWL raw water supply to the Teesworks site; or a new connection to the existing NWL supply either via tie in to NZT infrastructure or the installation of a new connection. Therefore, there is considered no impact pathway to fish and shellfish from entrapment and entrainment, and this will not be considered further.
Natural England	09/05/2023	Hard structures (pipe outflow, rock armouring or equivalent) need to be assessed in the context not only of loss of habitat, but also potential changes in coastal processes and introduction of INNS.	No hard structures are being placed in the marine environment. At this stage, no pathway for the introduction of INNS has been identified. Therefore, a biosecurity plan for INNS in the marine

CONSULTEE	DATE AND METHOD OF CONSULTATION	SUMMARY OF CONSULTEE COMMENTS	SUMMARY OF RESPONSE/ HOW COMMENTS HAVE BEEN ADDRESSED
		We note the applicant's reference to INNS and would advise a biosecurity plan, making sure everything brought to site (material/ gear/ water) has been assessed for INNS.	environment is not required and will not be produced.
Natural England	09/05/2023	The ES should use an appropriate biodiversity metric such as Biodiversity Metric 4.0 together with ecological advice to calculate the change in biodiversity resulting from proposed development and demonstrate how proposals can achieve a net gain.	Permanent loss of habitat in the intertidal area is not proposed. However, BNG requirements will be reviewed if there are any Proposed Development design changes.

Use of the Rochdale Envelope

14.3.16 To ensure a robust assessment of the likely significance of the environmental effects of the Proposed Development, the EIA is being undertaken adopting the principles of the 'Rochdale Envelope' approach where appropriate in line with The Inspectorate's Advice Note 9 (The Planning Inspectorate, 2018). This involves assessing the maximum/minimum reasonable worst-case parameters for the elements where flexibility needs to be retained (building dimensions or operational modes for example).

14.3.17 As outlined in Chapter 4: The Proposed Development (PEI Report, Volume I), the Proposed Development will include the installation of a hydrogen pipeline for the transportation of hydrogen (H_2) produced at the Production Facility, to off-takers in Teesside. The pipeline will be required to cross Greatham Creek to reach some of these off-takers.

14.3.18 As described in Chapter 5: Construction Programme and Management (PEI Report, Volume I), various pipeline routings and construction methodologies are currently being considered. These include options such as trenchless crossings (likely HDD), installation on existing above ground pipe racks, and repurposing and reuse of existing pipelines (where practicable). This is subject to ongoing design work, discussions with landowners and statutory consultees, as well as being informed by environmental surveys. At the north-western extent of the Hydrogen Pipeline Corridor, various options are still being considered and assessed, having regard to engineering constraints and environmental sensitivities, particularly around the Greatham Creek area.

14.3.19 The current preferred route for the Hydrogen Pipeline Corridor at Greatham Creek is between the mouth of Greatham Creek and the A178 Seaton Carew/Tees Road, by creating a new trenchless crossing to the west of the existing bridge.

14.3.20 The use of trenchless techniques (likely a micro-bored tunnel (MBT)) is also proposed for the proposed pipeline crossing options under the River Tees. The Applicant is not considering any scenario other than trenchless options for the crossing of the River Tees.

14.3.21 The routes have been selected to avoid environmentally sensitive areas where practicable. It is assumed that there will be no vessels required as part of the installation of the hydrogen pipeline crossings as all works will be undertaken from adjacent land.

14.3.22 For further detail regarding the proposed pipeline routings and construction methodologies, refer to Chapter 4: Proposed Development (PEI Report, Volume I), Chapter 5: Construction Programme and Management (PEI Report, Volume I) and Chapter 6: Need, Alternatives and Design Evolution (PEI Report, Volume I).

14.4 Baseline Conditions

14.4.1 The marine ecological baseline relevant to the Proposed Development is summarised below.

Existing Baseline

Designated Sites

14.4.2 The Proposed Development Site is situated within the Teesmouth and Cleveland Coast SPA/Ramsar/SSSI and Teesmouth National Nature Reserve (NNR). These sites, shown on Figure 14-2: Designated Sites with Marine Ecological Features (PEI Report, Volume II) and listed in Table 14-5, are in place for the protection of seals, and providing refuge at important haul-out sites. These sites are also designated for the protection of habitats and birds.

14.4.3 There are also several European designated sites within the Study Area and the wider North Sea which are designated for mobile marine mammals, listed in Table 14-5. These sites will be considered as part of the Habitats Regulations Assessment (HRA) which will be submitted as part of the DCO Application.

Table 14-5: National and European Designated Sites of Relevance to Marine Receptors

DESIGNATED/ PROTECTED SITE	APPROX. DISTANCE FROM STUDY AREA	DESIGNATED FEATURES RELEVANT TO THIS ASSESSMENT
NATIONAL SITES		
Teesmouth and Cleveland Coast SSSI	0 km	Breeding population of harbour seals
Teesmouth National Nature Reserve (NNR)	0 km	Protects habitats, birds and seals
EUROPEAN SITES		
Teesmouth and Cleveland Coast SPA/RAMSAR	0 km	Breeding and non-breeding wetland birds and supporting habitats (intertidal sand and mudflats, rocky shore, saltmarsh, freshwater marsh and sand dunes)
Berwickshire and North Northumberland Coast SAC	85.6 km	Grey seal
Southern North Sea SAC	100.5 km	Harbour porpoise

14.4.4 The Southern North Sea SAC, which is designated for harbour porpoise, is located over 100 km away from the Proposed Development Site. This SAC has been scoped out from further assessment, as there is considered to be no pathway for effect to this designated site.

14.4.5 There are no sites within the Study Area designated for the protection of fish species. The fish species present in the Teesmouth and Cleveland Coast SPA/Ramsar site and

Teesmouth and Cleveland Coast SSSI provide an important food source to the protected features of the sites.

Benthic Habitats and Species

14.4.6 The information provided below on benthic habitats and species is derived from the following sources:

- Habitat mapping undertaken by the JNCC – Marine Nature Conservation Review (MNCR) area summaries (JNCC, 2019a);
- EA saltmarsh zonation and extent in England (EA, 2023b);
- Teesmouth and Cleveland Coast European Marine Site (EMS) Rocky Shore Survey 2010 (Natural England, 2015a);
- The intertidal mudflats GIS layer (Natural England, 2015b); and
- The UK Sea Map (JNCC, 2018).

Greatham Creek and Seal Sands

14.4.7 The marine habitats around Greatham Creek and Seal Sands consist of extensive areas of soft sediment including mud and sandflats. There is also coastal saltmarsh present in the intertidal zone of both areas (a designating feature of the Teesmouth and Cleveland Coast SSSI) and on Seal Sands a small patchy area of boulders (as outlined in Appendix 14A: Net Zero Teesside Benthic EUNIS Biotopes in the River Tees and Tees Bay (PEI Report, Volume III)).

14.4.8 The subtidal extent of Seaton Channel, Greatham Creek, and Seal Sands is also characterised by soft sediments, mud in particular (JNCC, 2019a). These habitats support several invertebrate species, including polychaetes ragworm (*Hediste diversicolor)* and the bristleworm (*Pygospio elegans),* as well as bivalves including the common cockle (*Cerastoderma edule)*.

14.4.9 Survey data is not available for Greatham Creek and Seals Sands specifically, but mapping data from magic.gov.uk indicates the EUNIS habitats present are as follows (as shown by Figure 14-3: Important Intertidal and Subtidal Benthic Habitats (PEI Report, Volume II)):

- Infralittoral/circalittoral soft sediments including sand and muddy sand (EUNIS A2.2), mud (EUNIS, A2.3) and mixed sediments (EUNIS, A2.4);
- 'Coastal saltmarsh and reed beds' (EUNIS A2.5); and
- 'Sublittoral sand' (EUNIS A5.2).

River Tees

14.4.10 The mouth of the River Tees is primarily comprised of estuarine soft sediment, with the muddy habitat becoming more dominant as mud content increases further into the estuary and river (JNCC, 2019a).

14.4.11 Intertidal rocky shore with areas of loose cobbles and boulders is also present along the eastern coastline of the river mouth to the left of the South Gare Breakwater (as

outlined in Appendix 14A: Net Zero Teesside Benthic EUNIS Biotopes in the River Tees and Tees Bay (PEI Report, Volume III)). These areas are highly exposed to wave action (JNCC, 2019a).

14.4.12 Bran Sands is located to the west of Coatham Sands on the other side of the dune system, within the mouth of the Tees Estuary. This is characterised as homogenous intertidal muddy sandflats (JNCC, 2019a). The location of Bran Sands means that it is comparatively sheltered from wave exposure, thereby allowing silt deposition and the formation of more muddy substrates. This muddy and sheltered habitat has allowed a more productive community of polychaetes and shellfish to develop compared to Coatham Sands. In particular, the intertidal Phase I survey identified higher abundances of the common cockle (*Cerastoderma edule*) and the lugworm (*Arenicola marina*).

14.4.13 Further upstream in the river, the mud content of the sediments increases. Littoral mud is common along estuarine shorelines and is composed of fine particulate sediment, such as clay and silt (EEA, 2019). These habitats often form extensive mudflats. Little oxygen penetrates these sediments; however, they still support communities of bivalves, oligochaetes and polychaetes (EEA, 2019). This is part of the habitat which qualifies as an Annex I priority habitat 'Mudflats and Sandflats not covered by seawater at low tide' (1140).

14.4.14 Biotopes present in the intertidal zones of the River Tees are:

- 'Amphipods and *Scolelepis* spp. In littoral medium-fine sand' (EUNIS A2.223);
- '*Hediste diversicolor* and *Macoma balthica* in littoral sandy mud' (EUNIS A2.312);
- 'Pontic association with *Enteromorpha intestinalis'* (EUNIS A1.241);
- 'Barnacles and *Littorina* spp. On unstable eulittoral mixed substrata' (EUNIS A2.431)
- *'Fucus serratus* on full salinity sheltered lower eulittoral rock' (EUNIS A1.3151);
- *'Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock' (EUNIS A1.113);
- *'Fucus vesiculosus* on moderately exposed to sheltered mid eulittoral rock' (EUNIS A1.313);
- *'Enteromorpha* spp. On freshwater-influenced and/or unstable upper eulittoral rock' (EUNIS A1.451);
- *'Ascophyllum nodosum* on very sheltered mid eulittoral rock' (EUNIS A1.314);
- '*Cerastoderma edule* and polychaetes in littoral muddy sand' (EUNIS A2.242) (represent of Annex I priority habitat and representative of UK habitats of principal importance (HPI) under Section 41 of the NERC Act 2006 (HM Government, 2006), although is not a qualifying feature of any nearby designated site);
- 'Littoral mud' (EUNIS A2.3); and

- *'Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock' (EUNIS A1.213).

Tees Bay

14.4.15 The intertidal zone of Tees Bay consists of Coatham Sands, which is an exposed intertidal sandflat running from Redcar to South Gare Breakwater, approximately 4 km in length (as outlined in Appendix 14A: Net Zero Teesside Benthic EUNIS Biotopes in the River Tees and Tees Bay (PEI Report, Volume III)).

14.4.16 A Phase I and II intertidal benthic survey was undertaken in September 2019 by AECOM as part of the NZT Carbon Capture, Usage and Storage (CCUS) Project (The Inspectorate, Ref: EN010103) to characterise the intertidal habitats and species present within the vicinity of the Proposed Development Site (AECOM, 2021). Faunal communities exhibited low abundance, biomass, species richness and diversity, and except lugworm casts (*Arenicola* sp.), identified towards the northern end, very little evidence of benthic faunal activity was observed across Coatham Sands. The following biotopes were identified:

- Littoral sand and muddy sand (EUNIS A2.2) which included the following communities:
  - 'Talitrids on the upper shore and strandline' (EUNIS A2.211);
  - 'Polychaetes in littoral fine sand' (EUNIS A2.231), which also falls within the Annex I habitat 'mudflats and sandflats not covered by seawater at low tide';
  - 'Barren or amphipod-dominated mobile sand shores' (EUNIS A2.22), which qualifies as the Annex I habitat type 'mudflats and sandflats not covered by seawater at low tide';
  - *Cerastoderma edule* and polychaetes in littoral muddy sand (A2.242), which is present at Bran Sands; and
- '*Fucus vesiculosus* on variable salinity mid eulittoral boulders and stable mixed substrata' (EUNIS A1.323) (around the eastern edge of South Gare breakwater).

Subtidal Benthic Ecology

River Tees

14.4.17 Habitat mapping undertaken by the JNCC (JNCC, 2019) identified the habitat in the River Tees mouth to consist of extensive subtidal estuarine soft sediment (EUNIS A5.2, A5.3 and A5.4), with the mud content of the sediment quickly increasing with distance upstream with changes in salinity between North Gare Sands and Bran Sands and around the mouth of Seaton Channel.

14.4.18 Subtidal benthic surveys conducted in the Study Area by AECOM in 2019 as part of the NZT Project (AECOM, 2021) identified the following biotope in the area of the river sampled:

- *Nephtys hombergii* and *Macoma baltica* in infralittoral sandy mud (A5.331) (as outlined at Appendix 14A: Net Zero Teesside Benthic EUNIS Biotopes in the River Tees and Tees Bay (PEI Report, Volume III)).

Tees Bay

14.4.19 The subtidal benthic habitat in Tees Bay is characterised by soft sediments (JNCC, 2019a). A subtidal benthic survey conducted in Tees Bay in December 2019 as part of the NZT Project (AECOM, 2021) recorded two biotopes in the bay:

- '*Nephtys 32runcat* and *Bathyporeia* spp. In infralittoral sand' (EUNIS A5.233); and
- '*Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand' (EUNIS A5.242).

14.4.20 The former biotope was found in the shallow inshore area which is characterised by moderate to high exposure and sediments possessing a low clay/silt content, while the latter characterised stations which were located, in most cases, in slightly deeper, less exposed waters with a higher percentage of silt/clay (as outlined in Appendix 14A: Net Zero Teesside Benthic EUNIS Biotopes in the River Tees and Tees Bay (PEI Report, Volume III)). These two biotopes qualify as HPI as they are listed under Section 41 of the NERC Act (HM Government, 2006) and belong to the UK BAP priority habitat type, 'subtidal sands and gravels.'

Protected Habitats and Species

14.4.21 The saltmarsh habitat that exists in Greatham Creek and Seal Sands is a designating feature of the Teesmouth and Cleveland Coast SSSI. There are no benthic species that are specifically protected.

Invasive Non-Native Species

14.4.22 During intertidal and subtidal benthic surveys conducted in the Study Area by AECOM in 2019 (AECOM, 2021), one INNS of seaweed was found, namely wakame (*Undaria pinnatifida*), which was observed in intertidal habitat around South Gare breakwater with a sporadic distribution. There were no INNS observed in the subtidal habitat.

Fish and Shellfish

Summary of Species

14.4.23 Fish communities in the Teesside Region (including the River Tees, Tees Estuary, and Greatham Creek) are characterised by a diverse range of pelagic and demersal fish species, with assemblages typically including herring (*Clupea harengus*), mackerel (*Scomber scombrus*), cod (*Gadus morhua*), whiting (*Merlangius merlangus*), haddock (*Melanogrammus aeglefinus*), plaice (*Pleuronectes platessa*) and dab (*Limanda limanda*), (Teal, 2011; Callaway *et al*., 2002; EA, 2021a) (see Plate 14-1).

14.4.24 Within Greatham Creek, 3-spined stickleback (*Gasterosteus aculeatus*), common goby (*Pomatoschistus microps*), European flounder (*Platichthys flesus*) and European eel (*Anguilla 32runcate*) are present (Sun *et al*., 2021), and are therefore also likely to be present in the River Tees.

14.4.25 The river is an important waterbody for diadromous (i.e., migratory) fish species including salmon (*Salmo salar*), brown trout (*Salmo trutta*), European eel, river lamprey (*Lampetra fluvialis*) and sea lamprey (*Petromyzon marinus*). Shellfish species found in the Study Area include the Norway lobster, *Nephrops* sp., edible crab (*Cancer pagurus*) and European lobster (*Homarus gammurus*).

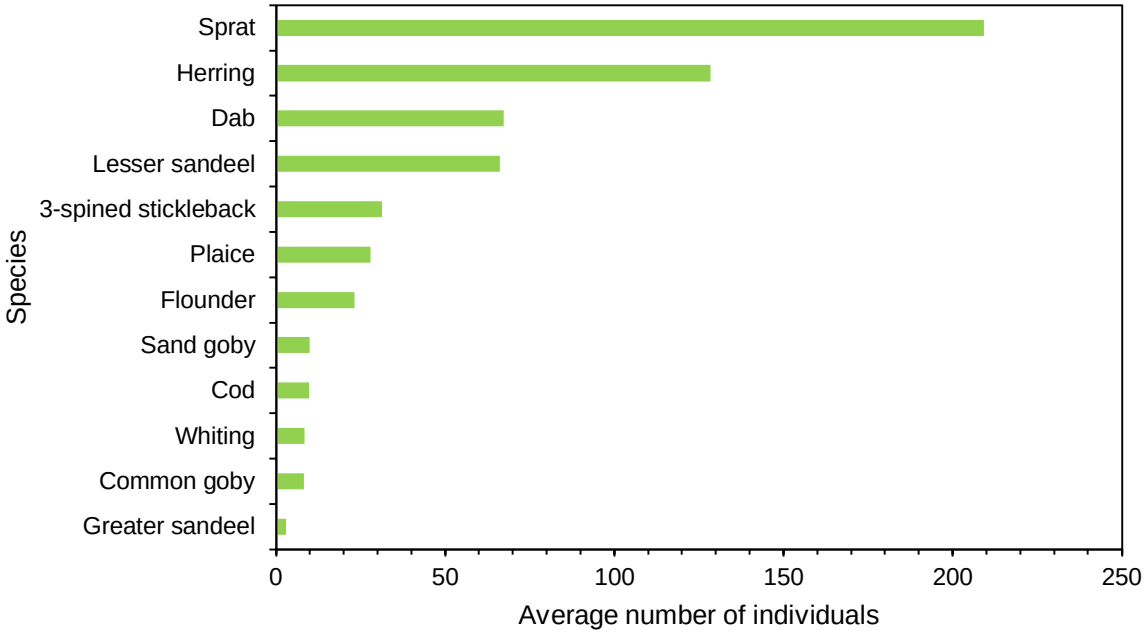

Plate 14-1: Average TraC Fish Counts for the top 10 Species Recorded in the Tees Estuary from 2010 to 2019 (EA TraC data, 2021a)

Spawning and Nursery Grounds

14.4.26 Broadscale fish sensitivity maps (Coull *et al*., 1998; Ellis *et al.,* 2012) indicate that spawning areas for lemon sole (*Microstomus kitt*) and Nephrops (Table 14-6) are found in Tees Bay. Haddock spawning grounds are also considered to occur in low abundance (González-Irusta and Wright, 2016). Lemon sole prefer deep sandy and gravelly habitats (Hinz *et al*., 2006), whereas Nephrops are more commonly found in marine environments with muddy substrates (Johnson *et al*., 2013).

14.4.27 The Study Area falls within nursery grounds for the following species: herring, anglerfish (*Lophius piscatorius*), plaice, cod, whiting, spurdog (*Squalus acanthias*), sprat (*Sprattus sprattus*), Nephrops and lemon sole (Coull *et al*., 1998; Ellis *et al.,* 2012).

14.4.28 These spawning and nursery grounds are considered to be present mostly in the surrounding coastal areas, although some species may occur in the estuary. For example, plaice have life history stages which occur within estuaries. Plaice larvae enter estuarine nursery areas during the flood tide where they stay whilst metamorphosing into adults, at which point they start to prefer sandy sediments (Heessen *et al*., 2015).

14.4.29 The nursery grounds for herring located in Tees Bay (Coull *et al*., 1998) are of high intensity (Ellis *et al*., 2012). Spawning and nursery grounds for sand eel are not located in Tees Bay but cover much of the North Sea (Coull *et al*., 1998; Ellis *et al*., 2012). Adults of both species are found in the River Tees and estuary in small numbers. The highest concentrations of sand eel are found in the lower reaches of the River Tees, whereas herring are found throughout the river, including Greatham Creek (EA, 2021a).

14.4.30 Both salmon and brown trout are also known to spawn in the upper reaches of the River Tees (Table 14-6). Brown trout is also known to occur in small numbers within Greatham Creek (Sun *et al*., 2021).

Table 14-6: Peak Spawning Times of Species for which Spawning Grounds Occur in the Study Area (Coull *et al*., 1998; Ellis *et al*., 2012)

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Lemon Sole												
Nephrops				*	*	*						
Salmon												
Brown Trout												
Herring (Banks/Dogger stock)												
Sandeel *Ammodytes* spp.												
*peak spawning												

Migratory Fish

14.4.31 Diadromous fish species migrate between bodies of freshwater and seawater during different life phases. Major physiological changes associated with these movements occur to adapt to altered salinity and during such periods, sensitivity to environmental stressors increases (Shrimpton, 2012). Owing to their conservation importance, it is necessary to understand the migration patterns of the diadromous species known, or likely, to be present within the Study Area.

14.4.32 Several studies to observe migratory fish behaviour have occurred within the River Tees. Salmon and brown trout specifically have been heavily recorded migrating upstream. A three-year (2008, 2009 and 2013) tracking study of fish passage at the River Tees Barrage conducted by Moore and Potter (2014) observed a total of 237 fish species, 84% of which were salmon.

Salmon and Brown Trout

14.4.33 Salmon are an anadromous[1] migratory species, which during their lifetime utilise both marine and freshwater habitats. Spawning of salmon typically occurs in November or December, in the upper reaches of rivers where eggs are deposited into nests known as 'redds' cut into gravelly substrate (Heessen *et al.,* 2015; NASCO, 2010).

14.4.34 In the River Tees, the greatest numbers of redds are located upstream of Eggleston, with a relatively high density between Stapleton and Whorlton (EA, 2009). Once hatched, the larvae remain within the interstitial gravels (Heessen *et al*., 2015), before developing into fry, and from then to a 'parr' and a 'smolt' stage (McCormick *et al*., 1998). The migration of smolt down-river to the ocean usually occurs from spring to early summer, generally occurring earlier in the season for larger smolt (Thorstad *et al*., 2012; Heessen *et al*., 2015).

14.4.35 Brown trout life history traits include individuals that complete their lifecycle in freshwater, and those that predominately inhabit estuarine waters (Harris *et al*., 2017). Sea trout are therefore anadromous brown trout. Brown trout exhibit a similar life cycle to Atlantic salmon. However, some immature smolt migrate back to freshwater environments after only a very short time feeding at sea (usually in the first winter in the ocean) (Gargan *et al*., 2006). Adult brown trout returning to freshwater to spawn are more likely to stray from natal rivers (Degerman *et al*., 2012; Gauld *et al*., 2013; King *et al*., 2016). Spawning usually takes place in autumn or winter, on stone and gravel bottoms (Heessen *et al*., 2015).

14.4.36 The results of the monthly upstream fish count from 2011 to 2022 show that salmon and brown trout were recorded to occur in the months of June to October (refer to Plate 14-2). Typically, peak numbers of fish were recorded in July and August though in 2015 the peak occurred in September. An average of the counts over this period shows the peak value occurred in August (mean = 180.2; std. = 219.5). Particularly high numbers of salmon and brown trout were reported in 2012 (1,661 individuals) and 2013 (1,161 individuals) however, in recent years numbers have declined, with only 266 individuals recorded in 2022. Counts only include the upstream migration of salmon and brown trout through the fish pass.

14.4.37 Brown trout were observed in the autumn breeding season downstream of Cloff Bridge Weir in Claxton Beck stream which flowed into Greatham Creek before the removal of the weir (Sun *et al*., 2021). Since the removal of the weir in 2018, the presence of brown trout has declined.

[1] Anadromous fish are fish that migrate from the sea into freshwater for spawning. This distinguishes them from catadromous fish, such as eels which migrate in the opposite direction, moving from freshwater to spawn in the sea.

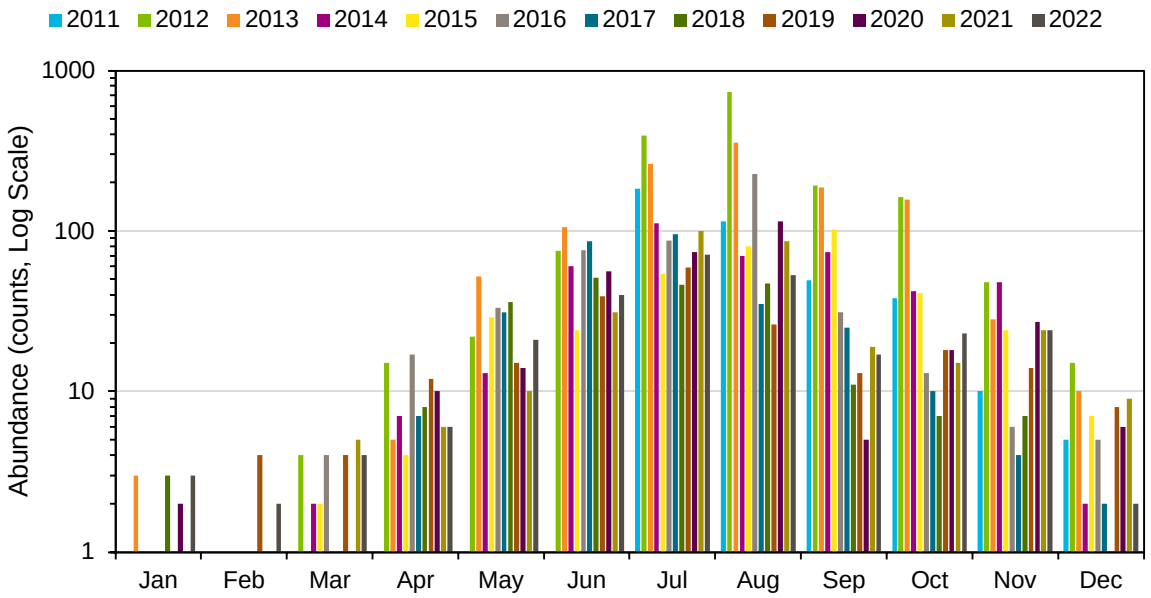

Plate 14-2: Monthly Combined Upstream Counts for Salmon and Brown Trout from 2011 to 2022 at the Tees Barrage on the Lower Tees, Reported by the EA (EA, 2023a).

Note: No data were reported for January to June 2011.

European eel

14.4.38 European eel is a catadromous migratory species, whose spawning occurs in the Sargasso Sea where the adults subsequently die. Spawning occurs mainly in spring (Righton *et al*., 2016). Newly hatched larvae metamorphose into glass eels which then travel across shelf seas, using tidal stream transport. Glass eels migrate upstream into freshwater, predominately during spring but may continue to do so until early Autumn (Heessen *et al*., 2015; ICES, 2010). Once within freshwater habitats, eels remain for five to 15 years, transforming into yellow eels and then finally to silver eels when they begin their downstream migration through rivers and estuaries towards spawning grounds, predominately between August and December (Behrmann-Godel and Eckmann, 2003; Tesch, 2003; Chadwick *et al.,* 2007).

14.4.39 Throughout England, European eels are present in almost all rivers, although in recent years their numbers have dramatically declined. This has resulted in European eels being listed as 'critically endangered' on the IUCN Red List since 2008. Reasons for the decline in numbers include barriers to migration, hydropower turbines, loss of wetland, and the introduction of the parasitic nematode *Anguillicola crassus* (UK BAP, 2012). The River Tees Barrage has the potential to act as a barrier but has built opportunities for the migration of glass eels into its design, though the escapement of adult silver eels around the barrage is unknown.

14.4.40 The current population size and distribution of European eels in the River Tees is unknown. However, they have been reported in the EA TraC surveys in the River Tees (see Plate 14-3), with a total of 178 individuals found in total across all surveys. TraC surveys included counts taken from Greatham Creek, though no European eels were

recorded from this site. The majority of European eel were recorded in the upper reaches of the River Tees.

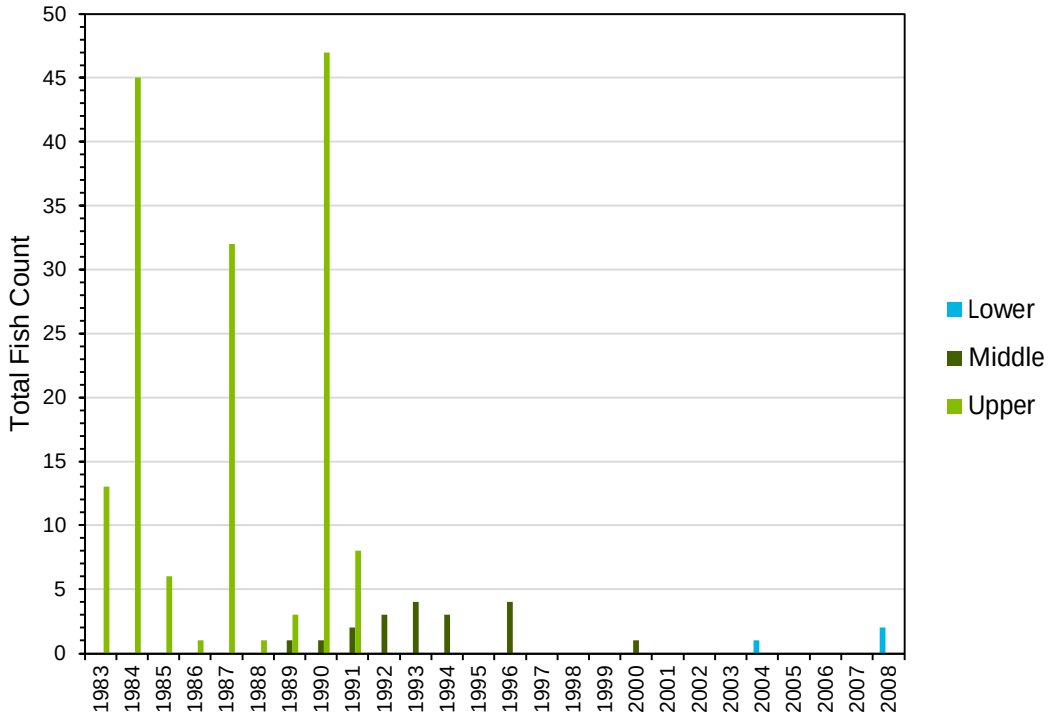

Plate 14-3: Total Fish Counts for European eel, in EA (2021a) TraC Surveys in the Three Reaches of the River Tees

14.4.41 However, European eel are known from other studies to be present in Greatham Creek, with recorded density increasing after the removal of Cloff Bridge Weir by the Tees Rivers Trust in 2018 (Sun et al., 2021). The colonisation of juvenile eels also occurred rapidly following the removal of the barrier.

River and Sea Lamprey

14.4.42 Sea lamprey and river lamprey are both anadromous migratory species, spawning in freshwater. Adults return to freshwater once they have spent several years in the marine environment (Laughton and Burns, 2003). Both species spawn in spring and early summer (Laughton and Burns, 2003).

14.4.43 Sea lamprey are widely dispersed in the open sea as they are solitary feeders, and rarely found in coastal and estuarine waters (Moore *et al*., 2003; Heessen *et al*., 2015). The distribution of sea lamprey is chiefly defined by their fish host which includes salmon (Waldman *et al*., 2008) and they are often found at considerable depths in deeper offshore waters (Moore *et al*., 2003). When returning to freshwater, sea lamprey generally chooses larger rivers compared to river lamprey, although they can be found in tributaries of all sizes (Heessen *et al*., 2015).

14.4.44 River lamprey generally spend one to two years in estuaries and in the autumn, between October and December, stop feeding and move upstream (Natural England, 2010). Sea lamprey normally migrate into freshwater in April and May as adults,

whilst the migration to sea can vary from river to river, although the metamorphosis of larvae into adults occurs in July and September (Maitland, 2003).

14.4.45 The UK distribution of river lamprey and sea lamprey, presented in Plate 14-4, shows that both species have been recorded in the River Tees. River lamprey were also recorded in the EA TraC surveys of the River Tees, with three individuals observed in the middle reaches in 1992. Although this suggests that sea lamprey is present in the River Tees, this species has not been recorded during the EA TraC surveys to date.

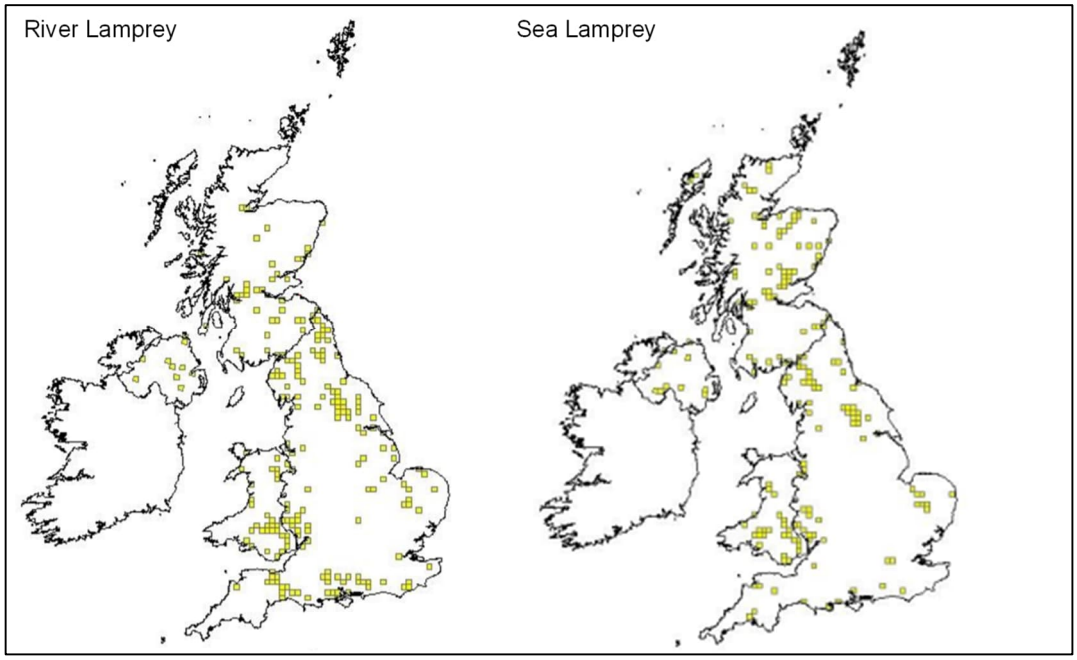

Plate 14-4: UK Distribution of River Lamprey (left) and Sea Lamprey (right) (JNCC, 2013a and 2013b)

Protected Fish Species

14.4.46 Table 14-7 lists all the fish species known to be present in the Study Area which are protected under national and international conservation legislation. With the exceptions of sand eel and the diadromous fish, all the species listed are also considered to be of commercial importance within the Study Area.

14.4.47 There are no shellfish species which are afforded conservation protection known to be present in the Study Area.

Table 14-7: Summary of Relevant Fish Species Protected by National and International Legislation or Policy

COMMON NAMES	LATIN NAMES	HABITATS DIRECTIVE ANNEX II AND IV SPECIES	OSPAR LIST OF THREATENED AND/OR DECLINING SPECIES	BONN CONVENTION APPENDIX I AND II SPECIES	BERN CONVENTION APPENDIX II AND III SPECIES	NERC 2006 SPECIES OF PRINCIPAL	FEATURES OF CONSERVATION INTEREST	IUCN RED LIST*
Herring	*Clupea harengus*					✓	✓	LC (↑)
Mackerel	*Scomber scombrus*					✓	✓	LC (↓)
Cod	*Gadus morhua*		✓			✓	✓	VU (-)
Whiting	*Merlangius merlangus*					✓	✓	LC (?)
Haddock	*Melanogrammus aeglefinus*							VU (-)
Plaice	*Pleuronectes platessa*					✓	✓	LC (↑)
Dab	*Limanda limanda*							LC (↑)
Sandeel	*Ammodytidae*					✓[1]	✓[1]	LC (?)[1]
Atlantic salmon	*Salmo salar*	✓	✓			✓	✓	LC (-)

COMMON NAMES	LATIN NAMES	HABITATS DIRECTIVE ANNEX II AND IV SPECIES	OSPAR LIST OF THREATENED AND/OR DECLINING SPECIES	BONN CONVENTION APPENDIX I AND II SPECIES	BERN CONVENTION APPENDIX II AND III SPECIES	NERC 2006 SPECIES OF PRINCIPAL	FEATURES OF CONSERVATION INTEREST	IUCN RED LIST*
Brown trout	*Salmo trutta*					✓		LC (?)
European eel	*Anguilla anguilla*		✓	✓		✓	✓	CR (↓)
Sea lamprey	*Petromyzon marinus*	✓	✓		✓	✓	✓	LC (↔)
River lamprey	*Lampetra fluviatilis*	✓				✓	✓	LC (?)

* IUCN Red List Status defined as 'CR' = Critically Endangered, 'EN' = Endangered, 'VU' = Vulnerable, 'NT' = Near Threatened, 'LC' = Least Concern and 'DD' = Data Deficient.
Population trends are also shown in brackets ('↑' = increasing, '↓' = decreasing, '↔' = stable, '?' = unknown and '-' = unspecified).

Marine Mammals

Cetaceans

14.4.48 The Proposed Development Site is located within the International Council for the Exploration of the Sea (ICES) Greater North Sea Ecoregion, which in part forms the boundaries for the Inter-Agency Marine Mammal Working Group (IAMMWG) Marine Mammal Management Units (Mus) for the North Sea (ICES, 2021; IAMMWG, 2022).

14.4.49 Within the Greater North Sea Ecoregion, there are four commonly occurring or resident cetacean species: harbour porpoise (*Phocoena phocoena)*, bottlenose dolphin (*Tursiops 41runcates*), white-beaked dolphin (*Lagenorhynchus albirostris*) and minke whale (*Balaenoptera acutorostrata*) (ICES, 2023). There are a further six cetacean species which are considered to occur regularly, but are less common than those mentioned above, namely: common dolphin (*Delphinus delphis*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), Risso's dolphin (*Grampus griseus*), long-finned pilot whale *Globicephala mela*, killer whale (*Orcinus orca*) and humpback whale (*Megaptera novaeangliae*).

14.4.50 However, it is considered unlikely that these species will occur in the River Tees itself, although harbour porpoise could occur in the surrounding coastal waters, such as in Tees Bay. Harbour porpoise are present in the North Sea throughout the year, with numbers peaking from July – September (Hague, *et al*., 2020) coinciding with mating/calving periods (May – August) (Learmonth *et al*., 2014). No designated sites for harbour porpoise are located within the Study Area. However, the Southern North Sea SAC, for which harbour porpoise is a qualifying feature, is located approximately 100.5 km to the south.

14.4.51 All cetacean species are protected in the UK by the WCA (1981) and are European Protected Species (EPS) under the European Commission Habitats Directive (Annex II and IV). They are also protected internationally by the Bern Convention Appendix II (Council of Europe, 1979). Furthermore, all but the minke whale are also protected internationally by the Bonn Convention Appendix II (Conservation of Migratory Species (CMS), 2020) and the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS, 1991).

Pinnipeds

14.4.52 The immediate area around the Proposed Development Site is of local importance for harbour seal *Phoca vitulina* and grey seal *Halichoerus grypus* due to the presence of a breeding colony and haul-out sites at Seal Sands and along Greatham Creek. Harbour seals are the most abundant (INCA, 2022).

Harbour Seal

14.4.53 Seal Sands is a known haul-out site for a breeding colony of harbour seal, which use the intertidal mudflat in this area. Greatham Creek is also known to be frequented by small numbers of individuals, which haul-out at multiple locations along the creek, particularly at Bailey Bridge. Seal Sands is designated for harbour seal as part of the Teesmouth and Cleveland Coast SSSI and Teesmouth NNR.

14.4.54 Seals Sands and its population in the River Tees, is the only significant haul-out site within the Northeast England MU (SCOS, 2021), which also includes harbour seals found at Holy Island, situated off the north-east coast of England, south of Berwick-upon-Tweed.

14.4.55 Seals 'haul-out' at shore sites for breeding, nursing, moulting and resting (SCOS, 2021). Harbour seals haul-out patterns tend to be strongly influenced by tidal cycles and many seals haul-out on the falling tide in areas below the high tide mark. The highest numbers of seals are usually hauled-out during the breeding season and subsequent moult, although numbers may remain high year-round in areas with suitable foraging grounds available locally (Härkönen, 1987; Wilson, 2001). Foraging areas for harbour seal are thought to extend 40 – 50 km from haul-out sites (SCOS, 2021). They typically consume 3-5 kg of food per day depending on the availability of prey species (SCOS, 2021).

14.4.56 Plate 14-5 shows the maximum number of harbour seal recorded in Greatham Creek and Seal Sands, including the haul-out site at Bailey Bridge, between 1989 and 2022 (INCA, 2022). The annual estimate represents the maximum number of seals hauled-out at any one time over the entire survey period. Surveying was carried out on an annual basis between June and September and generally encompassed the pupping period and a proportion of the moulting period.

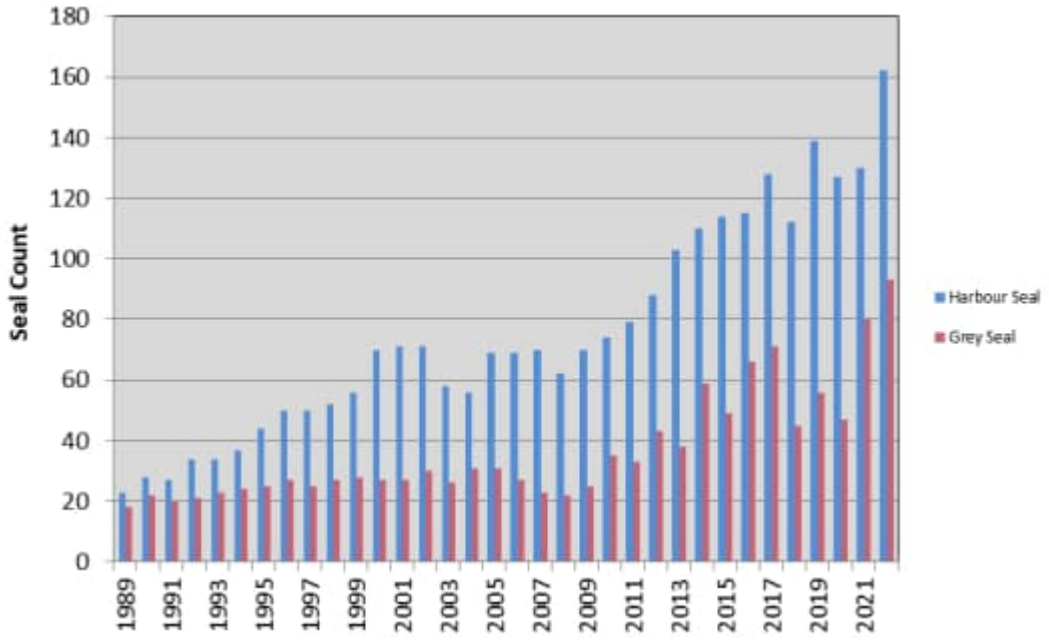

Plate 14-5: Maximum Number of Harbour Seals and Grey Seals Recorded at Greatham Creek and Seal Sands (INCA, 2022)

14.4.57 Incidental sightings of harbour seal were recorded on Seal Sands while undertaking other surveys for the Proposed Development on nine different days between October 2022 and March 2023. A total of 144 were recorded across this period and all were considered to be adults. The seals were observed hauled-out at scattered locations on Seal Sands and in Greatham Creek.

14.4.58 The maximum number of harbour seal in the Tees Estuary has increased overall since 2010, with the highest estimate recorded to date observed in August 2022 with 162 individuals (INCA, 2022). This included 36 pups, the highest number and increase recorded. There were also no pup deaths reported during weaning in 2022, being the highest survivability rate recorded since 1989. Within the Tees Estuary, pupping is known to take place mostly at Seal Sands, with some also at Bailey Bridge.

14.4.59 The pupping season at the Tees typically occurs during late June and lasts for about three weeks into late July, typical of other populations in the north-east Atlantic (INCA, 2022). The moulting season follows, typically from mid-August until early September, when seals spend a considerable amount of time out of the water to rest and conserve heat.

14.4.60 Although harbour seals are present within the vicinity of the Proposed Development Site and are likely to use the adjacent sea area for foraging, in the context of wider populations in the North Sea, the immediate Study Area is not considered to be heavily used by this species compared to other areas around the UK coast (as shown by Figure 14-4: Harbour Seal Mean At-Sea Distribution (PEI Report, Volume II)).

14.4.61 Populations along the eastern English coast, from Kent to the Scottish border, have generally increased in recent decades, including in the Tees. However, since 2019, there has been a decrease in the numbers of harbour seal in other parts of the UK, particularly in Scotland, attributed in part to outbreaks in phocine distemper virus (PDV) (SCOS, 2021). Whilst the range of this species is at a 'favourable' conservation status, its overall conservation status is considered to be 'unfavourable – inadequate'. However, this is a positive change from 'unfavourable – bad' since the last reporting in 2013, due to an overall increase in the abundance of harbour seal in the UK (JNCC, 2019b). The global conservation status of harbour seal is of 'least concern' (IUCN, 2023).

Grey Seal

14.4.62 The Proposed Development Site and the wider Tees area fall within the Northeast England Seal Management Unit. Within this management unit there are major colonies of grey seal, in both the north (Isle of May, Fast Castle, Farne Islands) and south (Donna Nook, Blakeney Point and Horsey/Winterton), either side of the Tees area (as shown by to Plate 14-6). On Plate 14-6, blue ovals indicate groups of colonies within each region, whilst red stars denote less frequently surveyed colonies in England, Northern Ireland and the Isle of Man.

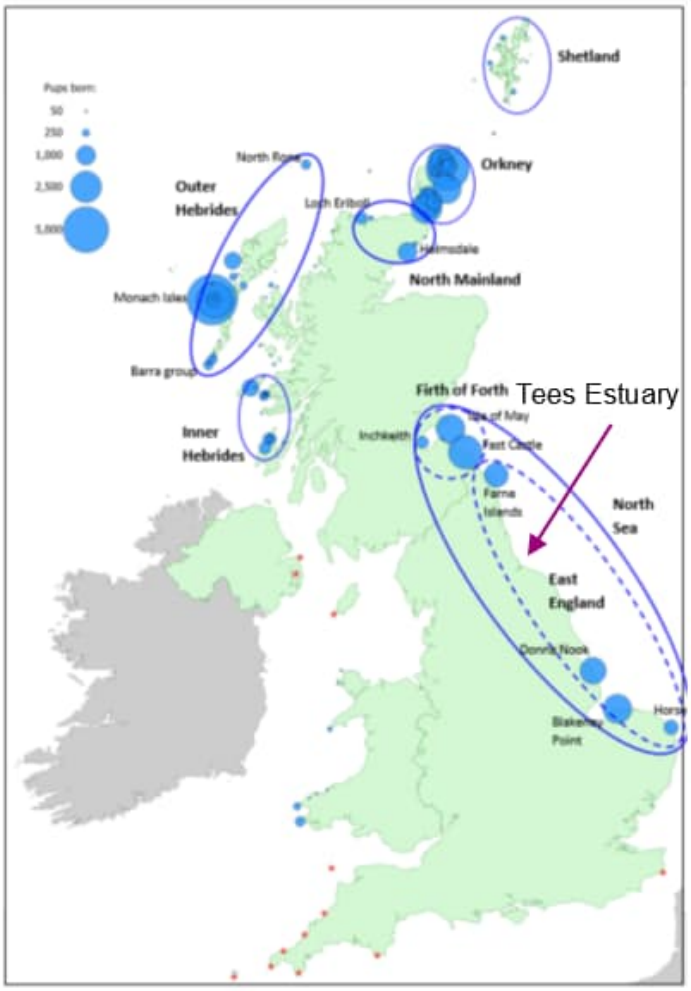

Plate 14-6: Distribution and Size of the Main Grey Seal Breeding Colonies in the UK (SCOS, 2021)

14.4.63 The latest count of grey seals in the North Sea, which included the Northeast England MU, as well as East Scotland and Southeast England MUs, took place in between 2016-2018 and was estimated at 19,160 individuals (SCOS, 2021). Pup production in Northeast England has continued to increase rapidly with a mean increase of 53% between 2014 and 2019. Most of the increase in the North Sea has been due to the continued rapid expansion of newer colonies on the mainland coasts in Berkwickshire, Lincolnshire, Norfolk and Suffolk.

14.4.64 Grey seals forage in the open sea in depths up to 100 m and, like harbour seals, they return regularly to haul-out on land where they rest, moult and breed. They may range widely to forage, with foraging trips lasting between 1 to 30 days (SCOS, 2021). Modelling has shown that grey seals typically spend 43% of their foraging time within 10 km of a haul-out site (McConnell *et al*., 1999), with maximum foraging range believed to be up to 135 km (SCOS, 2020).

14.4.65 Seal Sands on the River Tees is an important haul-out site for this species, although the grey seal population here is smaller than that for harbour seals (Plate 14-5; INCA, 2022). However, there has been an overall increase in the grey seal population since

2010. Maximum recordings of individuals on Seal Sands were down between 2018 and 2020. However, a peak count of 96 individuals was recorded in August 2022, when all grey seals counted were hauled-out on Seal Sands, suggesting that population size is increasing.

14.4.66 Incidental sightings recorded during other related surveys on nine different days between October 2022 and March 2023 observed 94 adult grey seals, all haul-out on Seal Sands.

14.4.67 In December 2022, a grey seal pup at Seal Sands was recorded alongside an adult female, which is thought to be the first observation of a grey seal born in the Tees (INCA, 2022). Grey seals are also known to use Greatham Creek but are only occasionally recorded here in small numbers.

14.4.68 Although grey seals are present within the Study Area and are likely to use the adjacent sea area for foraging, in the context of the populations in the wider North Sea, the Study Area is not considered to be heavily used by this species (Figure 14-5: Grey seal mean at-sea distribution (Carter *et al*., 2020), PEI Report, Volume II). This is supported by historical boat-based surveys in the vicinity of the Dogger Bank Teesside A & B Wind Farm which recorded relatively few sightings of grey seal (<20 per sampling month) (January 2010 to June 2012) (Gardline Environmental, 2012). The average absolute density estimated for the survey period was 0.02131 (95% CI = 0.016 – 0.033) with a peak density of 0.5 seals per km^2.

14.4.69 The UK grey seal population is considered to be stable and increasing, particularly within the eastern England colonies which is supported by local observations in Teesmouth (SCOS, 2021; INCA, 2022). Overall, this species is at 'favourable' conservation status in the UK (JNCC, 2019b). Globally, populations are also considered to be increasing and therefore the conservation status of this species is of 'least concern' (IUCN, 2023).

Future Baseline

14.4.70 The River Tees and Estuary has had a long industrial and urbanised history during which time disturbance to the marine environment has been high. Historically, human activities have led to range of impacts including increased water pollution and reduced access to upstream environments which have resulted in several well documented ecological effects, including a decline in the abundance of migratory fish species and seals within the Tees Estuary (Cefas *et al*., 2019; INCA, 2019).

14.4.71 In recent years, conservation and management efforts have seen an improvement in environmental conditions and a recovery in some species' populations. Trends for several species, such as harbour seal, are generally increasing (INCA, 2019), whilst for others such as Atlantic salmon, populations remain at risk (Cefas *et al*., 2019). Future management measures (e.g., continued improvements in water quality, removal of instream barriers and the installation of fish passes and screening at intakes) can be expected to facilitate improvements in species populations, although it is not possible to quantify the future benefits of such measures.

14.4.72 However, starting in October 2021 and continuing periodically through 2022, large numbers of dead and dying crustaceans were washed up on the north-east England

coastline, including Teesside (Defra, 2023). Some crustaceans were observed displaying unusual twitching behaviour. The exact cause of death has been highly disputed. However, several explanations have been proposed, including disease, harmful algal blooms, chemical toxicity resulting from historical industrial activity in Teesside, and dredging in the Tees area, including Tees Estuary. The most likely cause of death is a novel pathogen. However, the mortality event is still largely unexplained, suggesting similar events could continue to occur into the future without an identifiable cause and therefore focused mitigation.

14.4.73 Other factors which pose a risk to marine ecological receptors include the prevalence of disease and climate change. Outbreaks of PDV can lead to mass mortality of seals. In 2019, unprecedented levels of seal pup mortality were observed in the Study Area and although no specific cause was identified, individuals displayed symptoms which indicated some type of infection (INCA, 2019).

14.4.74 Climate change is not expected to have an impact on the future baseline of the Study Area within the relatively short timeframe of the Proposed Development. Changes in sea temperature may have a small effect on the abundance and distribution of certain species. However, these changes are unlikely to be detectable in the short term of the construction phase of the Proposed Development. Changes due to sea temperature increase are more likely to occur during the operational or decommissioning phases. Impacts during decommissioning are thought to be similar to those during construction and changes in the baseline are not likely to be significant.

14.5 Proposed Design and Impact Avoidance Measures

14.5.1 The following design and impact avoidance measures are those that are inherent to the design of the Proposed Development. The measures proposed have considered the reasonable worst-case scenarios.

14.5.2 A Framework CEMP will be included within the ES which will accompany the DCO Application. It will set out the key measures to be employed during the construction phase of the Proposed Development to control and minimise the impacts on the environment. The CEMP will set out how impacts upon the marine environment will be managed during construction. A Final CEMP will be prepared by the construction contractor in accordance with the Framework CEMP prior to construction. The submission, approval, and implementation of the Final CEMP will be secured by a Requirement of the draft DCO. The Framework CEMP will include the requirement for a Water Management Plan (WMP). These documents are intended to secure all good practice and mitigation measures to be executed during the construction phase to control and minimise impacts on the environment.

Table 14-8: Summary of Design and Impact Avoidance Measures

DESIGN AND IMPACT AVOIDANCE MEASURE	DESCRIPTION
Use of trenchless ('no dig') construction technologies (HDD/ MBT) for pipeline installation	Trenchless technologies (such as HDD) will be utilised for the Hydrogen Pipeline Corridor crossing of Greatham Creek, to minimise disturbance to the marine environment and other sensitive receptors. The Applicant is not considering any scenario other than trenchless techniques (most likely MBT) for the crossing of the River Tees. Trenchless technologies are also proposed in other environmentally sensitive areas.
Vessels	It is assumed that there will be no vessels required as part of the installation of all trenchless crossings as all works will be undertaken from adjacent land. However, if vessels are required, it is assumed that all vessels associated with the Proposed Development adhere to the following: – Harbour Authority approvals; – International Convention for the Control and Management of Ships' Ballast Water and Sediments with the aim of preventing the spread of marine INNS (IMO, 2017); – International Maritime Organisation (IMO) Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species (Biofouling Guidelines) (IMO, 2011); – International Regulations for Preventing Collisions at Sea (IMO, 1972) and regulations relating to International Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73/78) (IMO, 2021) with the aim of preventing and minimising pollution from ships; and – The Shipboard Oil Pollution Emergency Plan (IMO, 2019); all vessels shall have a contingency plan for marine oil pollution.
Specified construction hours	Construction working hours will generally be Monday to Friday 07:00 to 19:00 and Saturday 07:00 to 16:00 plus, up to one hour before and/or after for mobilisation (start-up and close down) procedures, thereby offering marine ecological receptors respite from any disturbance. However, some construction activities that cannot be interrupted, such as certain specialist crossing activities

DESIGN AND IMPACT AVOIDANCE MEASURE	DESCRIPTION
	such as HDD (which produce continuous sound sources only), are likely to continue outside the general core working hours and may operate 24 hours a day at certain times.
Controlled use of construction and operational lighting	Construction and operational lighting will be arranged so that glare and light spill outside the construction site is minimised to avoid impacts to sensitive ecological features. An Outline Lighting Design will be prepared to accompany the DCO application to demonstrate how lighting impacts on sensitive ecological features will be reduced.
Water Management Plan	Within the Final CEMP prepared by the contractor there will be a Water Management Plan (WMP) that sets out the principles that will be adhered to manage the risk of water pollution. The overriding principles of the WMP and the range of measures to be adopted, are outlined in Chapter 9: Surface Water, Flood Risk and Water Resources (PEI Report, Volume I). These include measures in relation to: – drainage and run-off strategies during construction and operation phases; – bunding of certain materials; – pollution prevention plan; and – emergency response plan.
Drainage Strategy	A formal Surface Water Drainage Strategy will be developed for the operational phase of the Proposed Development. A Surface Water Maintenance and Management Plan will also be developed prior to construction, detailing information relating to access, and maintenance of the different Sustainable Drainage Systems (SuDS) and surface water features proposed on the Proposed Development Site. A site Emergency Response Plan will be produced for the operational phase to deal with emergency situations involving loss of containment of any hazardous substances. Key actions which will be included within this plan are outlined in Chapter 9: Surface Water, Flood Risk and Water Resources (PEI Report, Volume I).

DESIGN AND IMPACT AVOIDANCE MEASURE	DESCRIPTION
Decommissioning Environmental Management Plan (DEMP)	A DEMP will be produced and agreed with the relevant statutory consultees as part of the Environmental Permitting and site surrender process. The DEMP will consider in detail all potential environmental risks on the Proposed Development Site and contain guidance on how these risks can be removed or mitigated. Decommissioning activities will be conducted in accordance with the appropriate guidance and legislation.

14.6 Impacts and Likely Significant Effects

14.6.1 This section presents a preliminary assessment of impacts and likely significant effects associated with construction, operation (including maintenance) and decommissioning of the Proposed Development on marine ecological receptors in the absence of any mitigation, over and above that which is inherent to the design and good practice as detailed in Section 14.5.

14.6.2 The proposed use of trenchless technologies for the Hydrogen Pipeline Corridor crossings of Greatham Creek and the River Tees are considered unlikely to result in any impacts to marine ecology.

14.6.3 Visual disturbance to fish and marine mammals from the use of artificial lighting has also been scoped out. Construction and operational lighting will be arranged so that glare and light spill outside the construction site is minimised to avoid impacts to sensitive ecological features. An Indicative Lighting Strategy will be prepared to demonstrate how lighting impacts on sensitive ecological features (as detailed in Table 14-8).

14.6.4 Underwater sound has been scoped out from further assessment, as the use of vessels is not proposed; any drilling or piling in the marine environment is not likely to be required; and planned UXO clearance is considered unlikely. Trenchless technologies such as HDD will be at a depth of approximately 10-15 m and will be such that there is no pathway for planned activities for effect to marine ecological receptors, as the works will be through bedrock below marine sediment. This is assumed to occur at a sufficient depth where underwater sound effects to migratory fish are unlikely.

14.6.5 It is also considered that there is no pathway for introduction of marine INNS.

14.6.6 It is not yet fully understood how net nutrient neutrality associated with the Proposed Development may impact marine ecological features. Process water effluent discharge is currently considered to be the only pathway through which a change from existing conditions could occur. As a result, hydrodynamic dispersion modelling for the discharge of a nitrogen load associated with the Proposed

Development into Tees Bay is due to be undertaken. Once the modelling has been conducted, further assessment will be required to assess any impacts that may occur which will be completed in detail during the EIA and reported in the Habitats Regulations Assessment. Surface water runoff impacts from foul effluent and impact from atmospheric deposition are proposed to be screened out of the nutrient neutrality assessment. However, impacts from these pathways (except atmospheric deposition) will be considered further in relation to the operational phase of the Proposed Development and will be included in the ES. Atmospheric deposition of nitrogen is not considered further for EIA purposes on the basis that tidal washing will remove any nitrogen from the Proposed Development within the intertidal zone, meaning any effects to marine receptors will be negligible.

14.6.7 The likely impacts and effects of the Proposed Development on marine ecological features, that have been scoped in for consideration within this PEI Report chapter, are summarised in Table 14-9.

Table 14-9: Likely Impacts Scoped in for Further Assessment and Marine Ecological Features Most Likely to be Affected by the Proposed Development

	DESIGNATED SITES	INTERTIDAL HABITATS AND SPECIES	SUBTIDAL HABITATS AND SPECIES	FISH AND SHELLFISH	MARINE MAMMALS
Indirect Effects to Marine Ecology from Changes in Marine Water Quality During Construction	✓	✓	✓	✓	✓
Changes in the Airborne Soundscape and Visual Disturbance During Construction	✓				✓

Construction

14.6.8 The following sections present a preliminary assessment of likely significant effects during construction of the Proposed Development on marine ecological features.

Indirect Effects to Marine Ecology from Changes in Marine Water Quality

14.6.9 During land-based construction activities for the Proposed Development, there is the potential for discharges into the marine environment from polluted surface water run-off and land drainage, including accidental spillages of fuel, oils and chemicals, as well as 'frac-out' events. These discharges have the potential to alter water quality

in terms of physico-chemical, biological, and chemical parameters in Greatham Creek, the Tees Estuary and Tees Bay, with indirect effects to marine ecology.

14.6.10 The release of air pollutants produced by land-based construction machinery and vehicles during the construction is predicted to have no significant effect upon air quality (see Chapter 8: Air Quality, PEI Report Volume I). As such, there is considered to be no pathway for impacts to water quality and hence marine ecology. Furthermore, it is not anticipated that vessels will be required for the Proposed Development, and therefore accidental spillages of vessel fuel is unlikely and have not been assessed as there will be no impact pathway.

14.6.11 Several design and good practice mitigation measures have been proposed (outlined in Section 14.5) which are intended to reduce and avoid the risk of pollutants entering the marine environment.

14.6.12 The direct effects to marine water quality are considered in Chapter 9: Surface Water, Flood Risk and Water Resources (PEI Report, Volume I). With the implementation of appropriate design and good practise measures as detailed in the chapter, the assessment concludes that effects to the nearby waterbodies from changes in surface water quality during the construction phase will not be significant.

14.6.13 All non-marine waterbodies that could also be impacted ultimately discharge into Tees Estuary and then Tees Bay. However, given the highly dynamic nature of Greatham Creek, the Tees River, and Tees Bay, in the unlikely event that pollutants or contaminants were accidently released, these would be rapidly dispersed and diluted. This would mean that any indirect effects to benthic ecology would be highly localised, temporary, and short-term. Furthermore, mobile receptors such as fish and marine mammals (including seals) are expected to move away from any affected area, and thus effects to these receptors would be limited.

14.6.14 Considering the nature of the impact, any significant effect to the abundance, distribution or functioning of habitats and species populations beyond the local level is considered unlikely. Therefore, indirect effects to marine ecology receptors from changes in marine water quality during the construction of the Proposed Development are predicted to be negligible (Not Significant).

Changes in the Airborne Soundscape and Visual Disturbance During Construction

14.6.15 Marine and land-based construction activities associated with the Proposed Development will create airborne sound and changes in visual cues which has the potential to disturb seals that are hauled-out nearby or have surfaced. The effects of disturbance could include a cessation of feeding, travelling, resting, breeding and/or socialising. Long-term effects of repeated disturbance could include a permanent displacement and/or a decline in fitness and productivity (such as moulting and breeding success).

14.6.16 A haul-out site for breeding grey and harbour seals is located at Seal Sands. Seals are also known to haul-out along Greatham Creek and at Bailey Bridge, travelling between these locations. These sites are in proximity to the Proposed Development Site boundary, with the furthest haul-out site located approximately 2.5 km to the east. Seal Sands supports the greatest number of seals followed by Greatham Creek

and Bailey Bridge. On Seal Sands, the majority of harbour seals and grey seals are known to haul-out at hall-out sites A and D, respectively, as shown on Plate 14-7.

Plate 14-7: Location of Haul-Out Sites on Seal Sands (INCA, 2022)

14.6.17 To inform the assessment of changes in the airborne soundscape, baseline ambient sound measurements have been taken from the industrial area surrounding Seal Sands, including on the Seal Sands emergency access road, next to the Venator Greatham Works on Tees Road, and the Seal Sands Office. Noise sensitive receptors are shown in Figure 11-1: Noise Sensitive Receptors (PEI Report, Volume II).

14.6.18 Indicative predictions of construction sound levels will be made to determine the impacts of construction activities on sensitive ecological receptors. The free-field (A-weighted) sound level for a particular receptor for each construction activity will be

predicted assuming a 12-hour working day and extended working hours for activities such as installation of the HDD, where the working day assumption might be extended to 24-hours. Construction activities likely to result in the highest airborne sound levels, include vibratory sheet piling (for the HDD pit setup and anchors), directional drilling, and excavation and backfilling of land-based open-cut trenches.

14.6.19 Sound exposure level (SEL) weighted thresholds will be equated to the onset of the auditory impacts of Permanent Threshold Shifts (PTS)[2] and Temporary Threshold Shifts (TTS)[3] in phocids (harbour and grey seals). These weightings are specific to the phocid seal group, which are 134 and 154 decibels (dB) re (20 µPa) in air, respectively (Southall *et al.,* 2019). These differ from the A-weighting which will be applied in the model, and which is typically used for human receptors. The weightings will reflect variations in peak sensitivity of the receptor groups, which occurs at around 10 kilohertz (kHz) for seals.

14.6.20 Construction activities are expected to be dominated by low or mid-frequency sound. It is also expected that there will be less propagation of high frequency sound (compared to mid- or low-frequency sound) due to ground absorption and dispersion. Thus, in the absence of high frequency sound it will be considered reasonable to assume that the predicted human A-weighted sound pressure level (L_{Aeq}) is equivalent (and a likely worst-case) to phocid-weighted sound pressure level. However, to permit a comparison between the L_{Aeq} value and the TTS and PTS thresholds for seals in air provided by Popper *et al*. (2014) (which are expressed in different units), the predicted L_{Aeq} levels will be reported as 12-hour and 24-hour (for activities where the working day assumption might be extended to 24-hours) unweighted sound pressure levels and then converted to an unweighted SEL. The predicted and threshold values can then be compared for determination of likely impact for phocid seals.

14.6.21 The Tees Estuary is highly industrialised, with lots of activity expected to produce airborne noise. Thus, seals are expected to be habituated to some level of airborne noise in the local area. In addition, the main A178 Seaton Carew Road which crosses Greatham Creek via a bridge to the west of the proposed hydrogen pipeline routes is expected to produce a large amount of background noise.

14.6.22 Any sound production resulting from construction activities for the pipeline crossing is not expected to be considerably greater than the baseline ambient sound levels created by the road and the surrounding industrial activity. The construction activities and estimated sound pressure levels are outlined in Table 14-10. Where sound production is above baseline ambient sound levels, activities will have a very short duration, each lasting a maximum of between one and three weeks.

[2] Permanent Threshold Shift (PTS) - is a permanent elevation in hearing threshold (i.e., an unrecoverable reduction in hearing sensitivity). PTS can occur from a variety of causes, but it is most often the result of intense and / or repeated noise exposures.
[3] Temporary Threshold Shift (TTS) - is a recoverable elevation in hearing threshold (i.e., a non-permanent reduction in hearing sensitivity) most commonly resulting from long-term noise exposure not high enough to cause PTS.

Table 14-10: Sound Pressures Levels for Activities Occurring in the Vicinity of Greatham Creek (Decibels at 10 m)

ACTIVITY	EQUIPMENT	A-WEIGHT SOUND PRESSURE LEVEL (DB AT 10 M)
HDD pit setup/anchors	Vibratory sheet piling rig	88
	Tracked excavator	77
Drilling and pullback	Directional drill (generator)	77
	Tracked drilling rig	86
	Water pump	78

14.6.23 Therefore, considering the nature of the impact, any airborne sound production and visual disturbance is not likely to affect the abundance, distribution or functioning of marine mammals, particularly seals, and their habitats, or the condition of surrounding designated sites in place for the protection of seals (e.g., harbour seal – Teesmouth and Cleveland Coast SSSI).

14.6.24 However, further modelling of the airborne soundscape baseline ambient sound measurements is required, to allow a direct comparison with the threshold criteria presented by Southall *et al.* (2019). At this stage, it cannot yet be concluded that effects resulting from changes in the airborne soundscape and visual disturbance during the construction of the Proposed Development are considered to be Not Significant. Once this analysis has been completed during the EIA further consideration will be given to the requirement for any embedded mitigation measures, such as a seasonal restriction to avoid the most sensitive period for seals (i.e., the breeding and moulting season for harbour seal, from June through to early July).

14.6.25 Table 14-11 provides a summary of the effects described above on marine ecological features during the construction of the Proposed Development.

Table 14-11: Summary of Effects on Marine Ecological Features During Construction of the Proposed Development

ECOLOGICAL FEATURES	IMPACT PATHWAY	VALUE/ IMPORTANCE	SIGNIFICANCE OF LIKELY EFFECTS (WITH EMBEDDED MITIGATION)	ADDITIONAL MITIGATION	RESIDUAL EFFECTS
All marine features	Indirect effects to marine ecology from changes in marine water quality during construction	Low to very high	Not Significant	N/A	Not Significant
Marine mammals	Changes in the airborne soundscape and visual disturbance during construction	Very high	Significant (to be confirmed once further modelling is completed – at this stage a Not Significant conclusion is predicted but cannot be confirmed)	N/A (Further consideration to be given, at the ES stage, to the requirement for further embedded mitigation, such as a seasonal restriction)	Not Significant

Operation

14.6.26 No likely impact pathways to marine ecology receptors have been identified during the operation of the Proposed Development at this stage. However, further consideration of surface water effects, potential pollution of Tees Bay and effects to overall water quality will be undertaken during the EIA. As provided within Chapter 9: Surface Water, Flood Risk and Water Resources (PEI Report, Volume I), these impact pathways are currently considered to be Not Significant.

Decommissioning

14.6.27 No likely effects to marine ecology features have been identified for the decommissioning of the Proposed Development. The effects during decommissioning are generally considered to be less than or equal to those during construction. Therefore, effects are considered to be Not Significant.

14.7 Mitigation and Enhancement Measures

14.7.1 No additional mitigation or enhancement measures have been identified at this stage beyond the embedded design and impact avoidance measures already proposed in Section 14.5.

14.8 Limitations and Difficulties

14.8.1 Construction information and the design for the Proposed Development are still being refined, for example, the exact routing and methods of installation for the hydrogen pipeline. Therefore, a reasonable set of worst-case assumptions have been identified and assessed, using the Rochdale Envelope principle. There is considered to be sufficient information made available within this chapter to enable an informed view of the likely significant environmental effects of the Proposed Development.

14.8.2 As the description of the Proposed Development evolves and further information regarding the proposed construction methodologies become available, the assessment presented within this Chapter of the PEI Report will be re-examined and updated as appropriate during the EIA and reported in the ES. Ongoing engagement with the relevant stakeholders regarding the progress of these assessments will be carried out on matters pertaining to marine ecology.

14.8.3 Information on airborne soundscape modelling is not yet available. However, it is expected that there could be some limitations with the modelling approach such as differences between thresholds for humans and thresholds for phocids. However, the current preliminary assessment considers the worst-case activity for each phase of the Proposed Development and the modelling to be undertaken will likely use a precautionary approach which is likely to over-estimate effects.

14.9 Residual Effects and Conclusions

14.9.1 Having taken into account the design and good practice measures as detailed in Section 14.5, this preliminary assessment has concluded that there will be no significant residual effects to marine ecology as associated with the construction, operation and decommissioning of the Proposed Development.

14.10 References

- AECOM (2021). *Net Zero Teesside – Environmental Statement: Appendix 14A: Intertidal Benthic Ecology Survey Report* [Online]. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010103/EN010103-001113-NZT%20DCO%206.4.29%20ES%20Vol%20III%20Appendix%2014A%20Intertidal%20Benthic%20Ecology%20Survey%20Report.pdf. [Accessed: 04/05/2023].
- Aerestrup, K., Økland, F., Hansen, M.M., Righton, D., Gargan, P., Castonguay, M., Bernatchez, L., Howey, P., Sparholt, H., Pedersen, M.I. and McKinley, R.S. (2009). Oceanic spawning migration of the European eel (*Anguilla anguilla). Science*, 325(5948), pp. 1660 – 1660.
- United Nations Environment Programme (UNEP) (1992). *Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas* [Online]. Available at: https://www.ascobans.org/en/legalinstrument/ascobans. [Accessed: 04/05/2023].
- Behrmann-Godel, J. and Eckmann, R. (2003). *A preliminary telemetry study of the migration of silver European eel (Anguilla anguilla L.) in the River Mosel, Germany. Ecology of Freshwater Fish*, 12(3), pp. 196 – 202.
- Callaway, R., Alsvåg, J., De Boois, I., Cotter, J., Ford, A., Hinz, H., Jennings, S., Kröncke, I., Lancaster, J., Piet, G. and Prince, P. (2002). *Diversity and community structure of epibenthic invertebrates and fish in the North Sea*. *ICES Journal of Marine Science,* 59(6), pp. 1199 – 1214.
- Carter, M.I., Boehme, L., Duck, C.D., Grecian, J., Hastie, G.D., McConnell, B.J., Miller, D.L., Morris, C., Moss, S., Thompson, D. and Thompson, P. (2020). *Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles: Report to BEIS*, OESEA-16-76, OESEA-17-78.
- Cefas. (2019). Centre for Environment, Fisheries and Aquaculture Science, Environment Agency, and Natural Resources Wales (2019). *Salmon Stocks and Fisheries in England and Wales in 2018* [Online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810720/SalmonReport-2018-assessment_final.pdf. [Accessed: 03/04/2023].
- Cefas (2022). *Salmon Stocks and Fisheries in England and Wales, 2021 – Preliminary assessment prepared for ICES, March 2022* [Online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1093963/SalmonReport-2021-assessment.pdf. [Accessed: 09/02/2023].
- Chadwick, S., Knights, B., Thorley, J.L. and Bark, A. (2007). A long-term study of population characteristics and downstream migrations of the European eel

Anguilla anguilla (L.) and the effects of a migration barrier in the Girnock Burn, north-east Scotland. *Journal of Fish Biology*, 70(5), pp. 1535 – 1553.

- CIEEM (2019). *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine* [online]. Available at: https://cieem.net/resource/guidelines-for-ecological-impact-assessment-ecia/
- Cheney, B., Graham, I.M., Barton, T.R., Hammond, P.S. and Thompson, P.M. (2018). Site Condition Monitoring of bottlenose dolphins within the Moray Firth Special Area of Conservation: 2014-2016. *Scottish Natural Heritage Research Report No. 1021*.
- Conservation of Migratory Species (CMS) (2020). *Bonn Convention: Appendices I and II of the Convention on the Conservation of Migratory Species of Wild Animals (CMS)* [Online]. Available at: https://www.cms.int/sites/default/files/basic_page_documents/appendices_cop13_e_0.pdf. [Accessed: 04/05/2023].
- Coull, K.A., Johnstone, R. and Rogers, S.I. (1998). *Fisheries Sensitivity Maps in British Waters.* UKOOA Ltd.
- Council of Europe (1979). *Bern Convention – Convention on the Conservation of European Wildlife and Natural Habitats: Appendix II – Strictly Protected Fauna Species* [Online]. Available at: https://rm.coe.int/168078e2ff. [Accessed: 04/05/2023].
- Cowx, I.G. and Fraser, D. (2003). Monitoring the Atlantic Salmon, Conserving Natura 2000 Rivers Monitoring Series No. 7. *English Nature*.
- DECC (2011a). *Overarching National Policy Statement for Energy (EN-1)* [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf
- DECC (2011b). *National Policy Statement for Gas Supply Infrastructure and Gas and Oil Pipelines (EN-4)* [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47857/1941-nps-gas-supply-oil-en4.pdf
- DECC (2011c). National Policy Statement for Electricity Networks Infrastructure (EN-5) [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47858/1942-national-policy-statement-electricity-networks.pdf
- Defra (2023). *Independent Expert Assessment of Unusual Crustacean Mortality in the North-east of England in 2021 and 2022*. [Online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1131769/Independent_Expert_Assessment_of_Unusual_Crustacean_Mortality_in_the_north-east_of_England_in_2021_and_2022.pdf. [Accessed: 20/04/2023].

- Degerman, E., Leonardsson, K. and Lundqvist, H. (2012). Coastal migrations, temporary use of neighbouring rivers, and growth of sea trout (*Salmo trutta) from nine northern Baltic Sea rivers. ICES Journal of Marine Science*, 69(6), pp. 971 – 980.
- Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. (2012). Spawning and nursery grounds of selected fish species in UK waters. *Science Series Technical Report*. Cefas, Lowestoft 147, 56 pp.
- EMODNet (2021). *Broad-Scale Predictive Habitat Map - EUNIS 2019 classification full detail* [Online]. Available at: https://emodnet.ec.europa.eu/geoviewer/#!/. [Accessed: 03/04/2023].
- Environment Agency (2009). *River Tees Salmon Action Plan Review*. APEM Scientific Report EA 410441.
- Environment Agency (2021a). *TraC Fish Counts for all Species for all Estuaries and all years* [Online]. Available at: https://www.data.gov.uk/dataset/41308817-191b-459d-aa39-788f74c76623/trac-fish-counts-for-all-species-for-all-estuaries-and-all-years. [Accessed: 14/04/2023].
- Environment Agency (2021b). *Ecology and fish data explorer* [Online]. Available at: https://environment.data.gov.uk/ecology/explorer/. [Accessed: 14/04/2023].
- Environment Agency (2023a). *River Tees fish counts* [Online]. Available at: https://www.gov.uk/government/statistical-data-sets/river-tees-upstream-fish-counts. [Accessed: 09/02/2023].
- Environment Agency (2023b). *Saltmarsh Extent & Zonation* [Online]. Available at: https://www.data.gov.uk/dataset/0e9982d3-1fef-47de-9af0-4b1398330d88/saltmarsh-extent-zonation. [Accessed: 14/04/2023].
- European Commission (2013). *Interpretation Manual of European Union Habitats* [Online]. Available at: https://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/Int_Manual_EU28.pdf. [Accessed: 03/04/2023].
- European Environment Agency (2021). *EUNIS habitat type hierarchical view (version 2012) - updated 2019* [Online]. Available at: https://eunis.eea.europa.eu/habitats-code-browser.jsp?expand=#level_1. [Accessed: 03/04/2023].
- Evans, P.G.H., Anderwald, P, and Baines, M.E. (2003). *UK Cetacean Status Review.* Sea Watch Foundation. Report to English Nature & Countryside Council for Wales, Oxford.
- Forewind (2014). Dogger Bank A & B Environmental Statement – Chapter 12 Marine and Intertidal Ecology. 159 pp.
- Gardline Environmental Ltd. (2012). Ornithological Survey Monthly Field Report. Forewind Dogger Bank Wind Farm Project. Dogger Bank, January 2012.

- Gargan, P.G., Roche, W.K., Forde, G.P. and Ferguson, A. (2006). Characteristics of the sea trout (Salmo trutta L.) stocks from the Owengowla and Invermore fisheries, Connemara, Western Ireland, and recent trends in marine survival. *Sea trout: biology, conservation and management*. Blackwell, Oxford, pp. 60 – 75.
- Gauld, N.R., Campbell, R.N.B. and Lucas, M.C. (2013). Reduced flow impacts salmonid smolt emigration in a river with low-head weirs. *Science of the total environment*, 458, pp. 435 – 443.
- González-Irusta, J.M. and Wright, P.J. (2016). Spawning grounds of haddock (*Melanogrammus aeglefinus*) in the North Sea and West of Scotland. *Fisheries Research*, 183, pp. 180 – 191.
- Greenstreet, S.P.R., Holland, G.J., Guirey, E.J., Armstrong, A., Fraser, H.M., and Gibb, I.M. (2010). Combining hydroacoustic seabed survey and grab sampling techniques to assess "local" sandeel population abundance. *ICES Journal of Marine Science*, 67, pp. 971 – 984.
- Hague, E.L., Sinclair, R.R. and Sparling, C.E. (2020). Regional baselines for marine mammal knowledge across the North Sea and Atlantic areas of Scottish waters. *Scottish Marine and Freshwater Series*, 11(12). A report published by Marine Scotland Science.
- Hammond, P. *et al*. (2013). Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management. *Biological Conservation*, 164, pp. 107-122.
- Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M.B., Scheidat, M., Teilmann, J., Vingada, J. and Øien, N. (2021). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. 40 pp. [online]. Available at: https://synergy.st-andrews.ac.uk/scans3/files/2017/05/SCANS-III-design-based-estimates-2017-05-12-final-revised.pdf. [Accessed: 09/02/2023].
- Härkönen, T. and Heide-Jorgensen, M.P. (1990). Comparative life histories of East Atlantic and other harbour seal populations. *Ophelia*, 32, 211 – 235.
- Härkönen, T.J. (1987). Influence of feeding on haul-out patterns and sizes of sub-populations in harbour seals. *Netherlands Journal of Sea Research*, 21(4), pp. 331 – 339.
- Harris, G. (ed.) (2017). Sea Trout – Science and Management. Proceedings of the 2nd International Sea Trout Symposium held in Dundalk, Republic of Ireland, on 20 – 22 October 2015.
- Hartlepool Borough Council (2018). *Hartlepool Local Plan*. [Online]. Available at: https://www.hartlepool.gov.uk/downloads/file/4393/hartlepool_local_plan_-_adopted_may_2018pdf. [Accessed: 04/05/2023].
- Heessen, H.J.L., Daan, N. and Ellis, J.R. (2015). Fish atlas of the Celtic Sea, North Sea, and Baltic Sea. Wageningen, Wageningen Academic Publishers.

- Hinz, H., Bergmann, M., Shucksmith, R., Kaiser, M.J. and Rogers, S.I. (2006). Habitat association of plaice, sole, and lemon sole in the English Channel. *ICES Journal of Marine Science*, 63(5), pp. 912-927.
- HM Government (1970). *Conservation of Seals Act 1970* [Online]. Available at: https://www.legislation.gov.uk/ukpga/1970/30. [Accessed 14/04/2023].
- HM Government (1975). *The Salmon and Freshwater Fisheries Act 1975* [Online]. Available at: https://www.legislation.gov.uk/ukpga/1975/51/contents. [Accessed: 12/04/2023].
- HM Government (1981). *Wildlife and Countryside Act 1981* [Online]. Available at: https://www.legislation.gov.uk/ukpga/1981/69/contents. [Accessed: 11/04/2023].
- HM Government (2006). *NERC Act 2006* [Online]. Available at: https://www.legislation.gov.uk/ukpga/2006/16/contents. [Accessed: 11 April 2023].
- HM Government (2009a). *Marine and Coastal Access Act* [Online]. Available at: https://www.legislation.gov.uk/ukpga/2009/23/contents. [Accessed: 11/04/2023].
- HM Government (2009b). *The Eels (England and Wales) Regulations 2009* [Online]. Available at: https://www.legislation.gov.uk/uksi/2009/3344/made. [Accessed:12/04/2023].
- HM Government (2010). *The Marine Strategy Regulations 2010* [Online]. Available at: https://www.legislation.gov.uk/uksi/2010/1627/contents/made. [Accessed: 11/04/2023].
- HM Government (2011). *The UK Marine Policy Statement* [online]. Available at: https://www.gov.uk/government/publications/uk-marine-policy-statement
- HM Government (2017a). *The Conservation of Habitats and Species Regulations 2017* [Online]. Available at: https://www.legislation.gov.uk/uksi/2017/1012/contents/made. [Accessed: 11/04/2023].
- HM Government (2017b). *The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017* [Online]. Available at: https://www.legislation.gov.uk/uksi/2017/407/contents/made. [Accessed: 12/04/2023].
- HM Government (2018). *Governments' 25-Year Environmental Plan* [online]. Available at: https://www.gov.uk/government/publications/25-year-environment-plan
- HM Government (2019). *The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019* [Online]. Available at: https://www.legislation.gov.uk/ukdsi/2019/9780111176573. [Accessed: 11/04/2023].

- HM Government (2021a). *Environment Act 2021* [Online]. Available at: https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted. [Accessed: 11/04/2023].
- HM Government (2021b). *North East Inshore and North East Offshore Marine Plan* [Online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1004484/FINAL_North_East_Marine_Plan__1_.pdf. [Accessed: 14/04/2023].
- ter Hofstede, R. H., Winter, H. V. and Bos, O. G. (2008). *Distribution of fish species for the generic Appropriate Assessment for the construction of offshore wind farms.* IMARES Report C050/08.
- Holland, G.J., Greenstreet, S.P.R., Gibb, I.M., Fraser H.M., and Robertson, M.R. (2005). Identifying Sandeel *Ammodytes marinus* sediment habitat preferences in the marine environment. *Marine Ecology Progress Series*, 303, pp. 269 – 282.
- IAMMWG. (2022). Updated abundance estimates for cetacean management units in UK waters (Revised March 2022). Peterborough: JNCC Report No. 547.
- IJsselddijk, L. *et al.* (2018). Spatiotemporal trends in white-beaked dolphin strandings along the North Sea coast from 1991-2017. *Lutra*, 61(1), pp. 153-163.
- International Council for the Exploration of the Sea (ICES) (2010). Report of the ICES/EIFAC Working Group on Eels (WGEEL). ICES Document CM 2010/ACFM: 18.
- Inter-Agency Marine Mammal Working Group (IAMMWG). (2022). Updated abundance estimates for cetacean Management Units in UK waters (Revised 2022). JNCC Report No. 680. Peterborough: Joint Nature Conservation Committee.
- International Council for the Exploration of the Seas (ICES) (2014). *OSPAR request on implementation of MSFD for marine mammals. Special request* [Online]. Available at: https://www.ascobans.org/en/document/ices-advice-may-2014-ospar-request-implementation-msfd-marine-mammals. [Accessed: 08/02/2023].
- International Council for the Exploration of the Sea (ICES). (2021). *Greater North Sea Ecoregion – Ecosystem Overview* [Online]. Available at: https://www.ices.dk/sites/pub/Publication%20Reports/Advice/2021/2021/EcosystemOverview_GreaterNorthSea_%202021.pdf. [Accessed: 09/02/2023].
- International Council for the Exploration of the Seas (ICES) (2022). *ICES Ecosystem Overviews: Greater North Sea Ecoregion* [Online]. Available at: https://ices-library.figshare.com/articles/report/Greater_North_Sea_ecoregion_Ecosystem_Overview/21731912. [Accessed: 07/02/2023].
- International Maritime Organisation (2019*). Shipboard Marine Pollution Emergency Plans* [Online]. Available at: https://www.imo.org/en/OurWork/Environment/Pages/Shipboard-Marine-Pollution-Emergency-Plans.aspx. [Accessed: 04/05/2023].

- Industry Nature Conservation Association (INCA) (2018). *Tees Seals Research Programme.* Monitoring Report No. 30 (1989 – 2018). 19 pp.
- Industry Nature Conservation Association (INCA) (2019).
- Industry Nature Conservation Association (INCA) (2022). Tees Seals Research Programme. Monitoring Report No. 32 (2020 – 2022). 16 pp.
- International Maritime Organisation (IMO) (1972). *International Regulations for Preventing Collisions at Sea* [Online]. Available at: Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs) (imo.org) [Accessed 11/05/2021].
- International Maritime Organisation (IMO) (2011). 2011 *Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species.* Annex 26. Resolution MEPC.207(62). Adopted 15 July 2011.
- International Maritime Organisation (IMO) (2017). *International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM)* [Online]. Available at: https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships%27-Ballast-Water-and-Sediments-(BWM).aspx [Accessed: 10/05/2021].
- International Union for Conservation of Nature (IUCN) (2023). *The IUCN Red List of Threatened Species. Version 2022-2* [Online]. Available at: http://www.iucnredlist.org. [Accessed: 08/02/2023].
- Joint Nature Conservation Committee (JNCC) (2018). UK Sea Map 2018 Version 2 – for external release [Online]. Available at: https://hub.jncc.gov.uk/assets/202874e5-0446-4ba7-8323-24462077561e. [Accessed: 04/05/2023]
- Joint Nature Conservation Committee (JNCC) (2019a). *MNCR Area Summaries – South-east Scotland and north-east England* [Online]. Available at: https://www.data.gov.uk/dataset/9ba98fbe-a76e-466d-a43d-98dfcf2062dd/mncr-area-summaries-south-east-scotland-and-north-east-england. [Accessed: 04/05/2023].
- Joint Nature Conservation Committee (JNCC) (2019b). Article 17 Habitats Directive Report 2019: Species Conservation Status Assessments 2019 [Online]. Available: https://jncc.gov.uk/our-work/article-17-habitats-directive-report-2019-species/. [Accessed: 08/02/2023].
- Joint Nature Conservation Committee (JNCC) (2023). *1140 Mudflats and sandflats not covered by seawater at low tide* [Online]. Available at: https://sac.jncc.gov.uk/habitat/H1140/. [Accessed: 03/04/2023].
- Johnson, M.P., Lordan, C. and Power, A.M (2013). Habitat and ecology of *Nephrops norvegicus*. *Advances in marine biology*, 64, pp. 27-63.

- Kelly, F. L. and King, J. J. (2001). A review of the ecology and distribution of three lamprey species, *Lampetra fluviatilis* (L), *Lampetra planeri* (L.), and *Petromyzon marinus* (L.): a context for conservation and biodiversity considerations in Ireland. *Biology and Environment: Proceedings of the Royal Irish Academy,* 101(3), pp. 165 – 185.
- King, R.A., Hillman, R., Elsmere, P., Stockley, B. and Stevens, J.R. (2016). Investigating patterns of straying and mixed stock exploitation of sea trout, Salmo trutta, in rivers sharing an estuary in south-west England. *Fisheries Management and Ecology*, 23(5), pp. 376 – 389.
- Laughton, R. and Burns, S. (2003). Assessment of sea lamprey distribution and abundance in the River Spey: Phase III. Scottish Natural Heritage Commissioned Report No. 043 (ROAME No. F02AC604).
- Learmonth, J.A., Murphy, S., Luque, P.L., Reid, R.J., Patterson, I.A.P., Brownlow, A., Ross, H.M., Barley, J.P., Begona Santos, M. and Pierce, G.J. (2014). Life history of harbor porpoises (*Phocoena phocoena*) in Scottish (UK) waters. *Marine Mammal Science*, 30(4), pp. 1427-1455.
- Maeda, S., Sakurai, K., Akamatsu, T., Matsuda, A., Yamamura, O., Kobayashi, M. and Matsuishi, T. (2021). Foraging activity of harbour porpoises around a bottom-gillnet in a coastal fishing ground, under the risk of bycatch. *PLoS ONE*, 16(2), e0246838.
- Maitland, P. S. (2003). Ecology of the River Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.
- Malcolm, I.A., Godfrey, J. and Youngson. A.F. (2010). Review of migratory routes and behaviour of Atlantic salmon, sea trout and European eel in Scotland's coastal environment: implications for the development of marine renewables. *Scottish Marine and Freshwater Science,* 1(14).
- Marine Management Organisation (2021). *UK sea fisheries annual statistics report 2020* [Online]. Available at: https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2020. [Accessed: 14/04/2023].
- MarLIN (2023). *The Marine Life Information Network* [Online]. Available at: https://www.marlin.ac.uk/. [Accessed: 14/04/2023].
- McConnell, B.J., Fedak, M.A., Lovell, P. and Hammond, P.S. (1999). Movements and foraging areas of grey seals in the North Sea. *Journal of Applied Ecology*, 36(4), pp. 573-590.
- McCormick, S.D., Hansen, L.P., Quinn, T.P. and Saunders, R.L. (1998). Movement, migration, and smolting of Atlantic salmon (*Salmo salar*). *Canadian Journal of Fisheries and Aquatic Sciences*, 55(S1), pp. 77 – 92.
- MHCLG (2021) *National Planning Policy Framework* [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

- Moore, J. A. Hartel, K. E. Craddock, J. E. and Galbraith, J. K. (2003). An annotated list of deepwater fishes from off the New England region, with new area records. *Northeastern Naturalist*, 10(2), pp. 159 – 248.
- Moore, A. and Potter, E.C.E. (2014). Provisional Assessment of the River Tees Barrage Fish Passage. CEFAS.
- NASCO. (2010). NASCO Guidelines for the Protection, Restoration and Enhancement of Atlantic Salmon Habitat. North Atlantic Salmon Conservation Organization (NASCO), Edinburgh, Scotland, UK. NASCO Council Document CNL(10)51. 12pp.
- Natural England (2015a). *Teesmouth and Cleveland coast EMS Rocky Shore Survey 2010* [Online]. Available at: https://www.data.gov.uk/dataset/f1850621-02ee-435f-9e58-97e5987ecfbb/teesmouth-and-cleveland-coast-ems-rocky-shore-survey-2010. [Accessed: 04/05/2023].
- Natural England (2015b). *Intertidal mudflats layer for England* [Online]. Available at: https://www.data.gov.uk/dataset/619a22fe-15ad-4494-a948-6c0062c8736d/intertidal-mudflats-layer-for-england. [Accessed: 04/05/2023].
- Natural England (2021) *The Biodiversity Metric 4.0* [Online]. Available at: https://publications.naturalengland.org.uk/publication/6049804846366720. [Accessed: 04/05/2023],
- North Eastern Inshore Fisheries and Conservation Authority (2023) *Byelaws*. [Online]. Available at: https://www.ne-ifca.gov.uk/byelaws. [Accessed: 04/05/2023].
- OSPAR (2017). *List of Threatened and/or declining species and habitats* (Agreement 2008-06). [Online]. Available at: https://www.ospar.org/work-areas/bdc/species-habitats. [Accessed: 09/02/2023].
- OSPAR (2021) *OSPAR List of Substances Used and Discharged Offshore which Are Considered to Pose Little or No Risk to the Environment (PLONOR) – Update 2021* [Online]. Available at: https://www.ospar.org/documents?v=32939. [Accessed: 27/03/2023].
- Pierpoint, C (2008). Harbour Porpoise *Phocoena* foraging strategy at a high energy, near-shore site in south west Wales. UK. *Journal of the Marine Biological Association of the United Kingdom*, 88(6), pp. 1167 - 1173.
- Pierce, G. J., Thompson, P.M., Miller, A., Diack, J.S.W., Miller, D. and Boyle, P.R. (1991). Seasonal variation in the diet of common seals (*Phoca vitulina*) in the Moray Firth area of Scotland. *Journal of Zoology*, 223, pp. 641 – 652.
- The Planning Inspectorate (2018). Advice Note Nine: Rochdale Envelope. [Online]. Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-nine-rochdale-envelope/ [Accessed: 29/08/2023]Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D.A., Bartol, S., Carlson, T.J., Coombs, S., Ellison, W.T., Gentry, R.L., Halvorsen, M.B., Løkkeborg,

S., Rogers, P.H., Southall, B.L., Zeddies, D.G. and Tavolga, W.N. (2014). Sound Exposure Guidelinesfor Fishes and Sea Turtles:A Technical Report prepared by ANSI-Accredited Standards CommitteeS3/SC1 and registered with ANSI.

- Potter, E.C.E. and Dare, P.J. (2003). Research on migratory salmonids, eel and freshwater fish stocks and fisheries. Science series technical report-centre for environment fisheries and aquaculture science.
- Redcar and Cleveland Borough Council (2018). *Redcar and Cleveland Local Plan – Adopted May 2018* [Online]. Available at: https://www.redcar-cleveland.gov.uk/sites/default/files/2022-04/Local%20Plan%20Adopted%20May%202018.pdf. [Accessed: 04/05/2023].
- Reid, J.B., Evans, P.G.H. and Northridge, S.P. (2003). Atlas of Cetacean Distribution in north-west European Waters. Joint Nature Conservation Committee, Peterborough.
- Righton, D., Westerberg, H., Feunteun, E., Økland, F., Gargan, P., Amilhat, E., Metcalfe, J., Lobon-Cervia, J., Sjöberg, N., Simon, J. and Acou, A. (2016). Empirical observations of the spawning migration of European eels: The long and dangerous road to the Sargasso Sea. *Science Advances*, 2(10), 15 pp.
- Royal HaskoningDHV UK Ltd. (2015). York potash Harbour Facilities Order 201X – Environmental Statement. Chapter 8: Marine Ecology. 261 pp.
- Royal HaskoningDHV UK Ltd. (2018). Northern Gateway Container Terminal – Extension to the 2008 Harbour Revision Order. Supplementary Environmental Information. 136 pp.
- Seal Conservation Society (2011). *Harbour Seal (Phoca vitulina)* [Online] Available at: https://www.pinnipeds.org/seal-information/species-information-pages/the-phocid-seals/harbour-seal. [Accessed: 07/02/2023].
- Sea Watch Foundation (2012a). *Cetaceans of Eastern England* [Online]. Available at: https://seawatchfoundation.org.uk/wp-content/uploads/2012/07/EasternEngland.pdf. [Accessed: 08/02/2023].
- Sea Watch Foundation (2012b). *The Harbour Porpoise in UK Waters* [Online]. Available at: https://seawatchfoundation.org.uk/wp-content/uploads/2012/07/Harbour_Porpoise.pdf. [Accessed: 08/02/2023].
- Sheridan, S., Turnpenny, A., Horsfield, D., Bamford, D., Bayliss, B., Coates, S., Dolben, I., Frear, P., Hazard, E., Tavner, I. and Trudgill, N. (2013). Screening at intakes and outfalls: measures to protect eel (*Anguilla anguilla*). *International Fish Screening Techniques*, 71, pp. 17 – 30.
- Shrimpton, J.M. (2012). Seawater to freshwater transitions in diadromous fishes. In Fish physiology. *Academic Press,* 32, pp. 327 – 393.
- Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketten, D.R., Bowles, A.E., Ellison, W.T., Nowacek D.P. and Tyack, P.L. (2019). *Marine Mammal Noise*

Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquatic Mammals. 45(2), 125 – 232.

- Special Committee on Seals (SCOS) (2020). Scientific Advice on Matters Related to the Management of Seal Populations: 2020 [Online]. Available at: http://www.smru.st-andrews.ac.uk/files/2021/06/SCOS-2020.pdf. [Accessed: 07/02/2022].
- Special Committee on Seals (SCOS) (2021). Scientific Advice on Matters Related to the Management of Seal Populations: 2021 [Online]. Available at: http://www.smru.st-andrews.ac.uk/files/2022/08/SCOS-2021.pdf. [Accessed: 07/02/2022].
- Stockton-on-Tees Borough Council (2019). *Stockton-on-Tees Local Plan* [Online]. Available at: https://stockton.gov.uk/media/2518/Local-Plan-2019/pdf/Local_Plan_2019.pdf?m=637810468860870000. [Accessed: 04/05/2023].
- Sun, J., Galib, S.M. and Lucas, M.C. (2021). Rapid response of fish and aquatic habitat to removal of a tidal barrier. *Aquatic conservation: marine and freshwater ecosystems*, 31(7), pp. 1802-1816.
- Tappin, D.R., Pearce, B., Fitch, S., Dove, D., Gearey, B., Hill, J.M., Chambers, C., Bates, R., Pinnion, J., Diaz Doce, D., Green, M., Gallyot, J., Georgiou, L., Brutto, D., Marzialetti, S., Hopla, E., Ramsay, E. and Fielding, H. (2011). The Humber Regional Environmental Characterisation. British Geological Survey Open Report OR/10/54. 357 pp.
- Taupp, T. (2022). Against all odds: Harbour porpoises intensively use an anthropogenically modified estuary. *Marine Mammal Science*, 38(1), pp. 288-303.
- Teal, L.R. (2011). The North Sea fish community: past, present and future. Background document for the 2011 National Nature Outlook.
- Tees Valley Nature Partnership (2012). *Priority habitats and species in the Tees Valley – Update January 2012* [Online]. Available at: https://teesvalleynaturepartnership.org.uk/wp-content/uploads/2012/11/Tees-Valley-priority-habitats-and-species-updated-5-jan-2012-pdf.pdf. [Accessed: 04/05/2023].
- Tesch, F.-W. (2003). The eel. 5th edition. Oxford: *Blackwell Science*, pp. 416.
- Thompson, P.M., Mc'Connell, B.J., Tollit, D.J., Mackay, A., Hunter, C. and Racey, P.A. (1996). Comparative distribution, movements and diet of harbour and grey seals from the Moray Firth, N.E. Scotland. *Journal of Applied Ecology*, 33, pp. 1572 – 1584.
- Thompson, P.M., Cheney, B., Ingram, S., Stevick, P., Wilson, B. and Hammond, P.S. (Eds). (2011). Distribution, abundance and population structure of bottlenose dolphins in Scottish Waters. *Scottish Government and Scottish Natural Heritage Funded Report No.354*.

- Thorstad, E.B., Whoriskey, F., Uglem, I., Moore, A., Rikardsen, A.H. and Finstad, B. (2012). A critical life stage of the Atlantic salmon *Salmo salar*: behaviour and survival during the smolt and initial post-smolt migration. *Journal of Fish Biology*, 81(2), pp. 500 – 542.
- UK Biodiversity Action Plan (2012). Priority habitats and species in the Tees Valley – Update January 2012 [Online] Available at: https://teesvalleynaturepartnership.org.uk/wp-content/uploads/2012/11/Tees-Valley-priority-habitats-and-species-updated-5-jan-2012-pdf.pdf. [Accessed: 03/04/2023].
- Waggitt, J. *et al*. (2019). Distribution maps of cetacean and seabird populations in the North-East. *Journal of Applied Ecology*, 57(2), 105 pp.
- Wilson, S.C. (2001). Population growth, reproductive rate and neo-natal morbidity in a re-establishing harbour seal colony. *Mammalia*, 65(3), pp. 319 – 334.
- Wilson, L.J. and Hammond, P.S. (2019). The diet of harbour and grey seals around Britain: Examining the role of prey as a potential cause of harbour seal declines. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 29, pp. 71-85.
- Winslade P. (1971). Behavioural and embryological studies on the lesser sand eel *Ammodytes marinus* (Raitt). PhD Thesis. University East Anglia.