Marine Management Organisation

South West Inshore and Offshore Marine Plans Sustainability Appraisal. Part 2: Scoping Information. Draft Report.

South West Inshore and Offshore Marine Plans Sustainability Appraisal. Part 2: Scoping Information. Draft Report.

Report prepared by: ClearLead Consulting Ltd. in association with WSP UK Ltd. and MarineSpace Ltd.

Project funded by: Marine Management Organisation

Version	Author	Note
1	NWR	First draft
2	NWR/VP	Second draft
3	NWR	Final draft
4	Various	Final
5	Various	Final with amendments

Information about this publication and further copies are available from:

Marine Management Organisation
Lancaster House
Hampshire Court
Newcastle upon Tyne
NE4 7YH

Tel: 0300 123 1032
Email: info@marinemanagement.org.uk
Website: www.gov.uk/mmo

Disclaimer

This report contributes to the Marine Management Organisation (MMO) evidence base which is a resource developed through a large range of research activity and methods carried out by both MMO and external experts.

The opinions expressed in this report do not necessarily reflect the views of MMO nor are they intended to indicate how MMO will act on a given set of facts or signify any preference for one research activity or method over another. MMO is not liable for the accuracy or completeness of the information contained nor is it responsible for any use of the content.

When referencing this publication, please cite as:

MMO (2019). South West Inshore and Offshore Marine Plans Sustainability Appraisal. Part 2: Scoping Information. Draft Report. A report produced for the Marine Management Organisation, August 2019, 101pp.

Contents

Boxes

Tables

Appendices

1. Introduction and Purpose of this Report

1.1 Introduction

The South West Marine Plan has been subject to an integrated[1] Sustainability Appraisal (SA) and Strategic Environmental Assessment (SEA) (hereafter referred to as SA) in line with the requirements of Statutory Instrument 2004 No. 1633: The Environmental Assessment of Plans and Programmes Regulations 2004.

The current document is Part 2 of the SA report. It presents the scoping information that has been used to define the scope and level of detail of the SA and the information that has been used to help judge the effects of the South West Marine Plan. Part 2 of the SA report is drawn from the information provided in the Scoping Report which was published in June 2016. This draft SA report reports on the assessment of the draft South West Marine Plan produced by the MMO; the documents will be finalised after consultation.

The SA has been carried out by ClearLead Consulting Ltd, in association with WSP UK Ltd and MarineSpace Ltd. on behalf of the MMO.

1.2 Purpose and Structure of this Report

For the sake of clarity, the SA report is split into a number of parts. The current document is Part 2 of the SA report: Scoping Information. The other parts of the report are:

- Part 1: Introduction and Methodology
- Part 3: Results of the Assessment.

The format of Part 2 of the SA report is slightly different to the Parts 1 and 3 as it is based on the SA Scoping Report as highlighted above. Part 2 begins with an explanation of the coverage of the scoping information. The main detail of the Part 2 is contained in Sections 3-11, which set out the required information for each SA topic area.

The SA Scoping report is available at the following weblink: https://www.gov.uk/government/publications/sustainability-appraisal-scoping-report-north-east-north-west-south-east-south-west-marine-plans.

All other reports are available at the following weblink: https://www.gov.uk/topic/planning-development/marine-planning.

[1] An integrated SEA/SA refers to the fact that the assessment adheres to the requirements of the SEA regulations but also fully reflects relevant social and economic issues

2. Scope of the SA

2.1 Introduction

The scope of the SA reflects potential environmental, social and economic effects of the draft South West Marine Plan and the characteristics of the environment likely to be affected.

The 2005 UK Sustainable Development Strategy defines the goal of sustainable development as "to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life, without compromising the quality of life of future generations". The Sustainable Development Strategy sets out five guiding principles by which this goal might be achieved. The five guiding principles are reflected in the MPS, and are as follows:

- living within environmental limits
- ensuring a strong, healthy and just society
- achieving a sustainable economy
- promoting good governance
- using sound science responsibly.

Furthermore, the publication of the National Planning Policy Framework (and the National Planning Practice Guidance) go some way to helping to define what 'sustainable development' is in the terrestrial environment.

The topics to be addressed in the SA have been developed with these principles in mind while considering the requirements of the SEA Regulations, which lists a number of aspects that must be considered in an SEA (or SA)[2]. Experiences of the SA of the South and East Marine Plans have also been drawn upon as well as information provided at an SA Advisory Group (SAAG) workshop held in March 2016 to help define the scope.

It should be noted that no single strand of sustainable development is considered more or less important than any other and the topics considered as part of the SA will be afforded equal weight in the appraisal process.

Table 1 identifies the topics covered in this SA and their relationship with the topics listed in Schedule I of the SEA Regulations.

[2] Schedule 2 (6): (a) biodiversity; (b) population; (c) human health; (d) fauna; (e) flora; (f) soil; (g) water; (h) air; (i) climatic factors; (j) material assets; (k) cultural heritage, including architectural and archaeological heritage; (l) landscape; and (m) the interrelationship between the issues referred to in sub-paragraphs (a) to (l).

Table 1: Topics to be covered in the SA and relevant SEA Regulations topics.

Topics to be covered in the South West Marine Plan SA	Relevant topics listed in Schedule I of the SEA Regulations
Communities, Health and Wellbeing	Population; human health
Cultural Heritage	Cultural heritage including architectural and archaeological heritage
Biodiversity, Habitats, Flora and Fauna	Biodiversity; flora; fauna
Economy	Population; material assets
Geology, Geomorphology and Coastal Processes	Soil
Seascape and Landscape	Landscape
Water Environment	Water
Air Quality	Air
Climate	Climatic factors

Many of the SA topics overlap and are interrelated - an effect with respect to one topic may also result in a direct or indirect effect in relation to other topics. The marine environment is particularly sensitive in this respect and attention has been given to the interrelationships between these topics in the SA and information is presented in the topic sections (3 - 11) in this report.

2.1.1 SA Framework

The scoping report outlined an SA Framework (see Table 2) of SA topics and sub-topics which the South West Marine Plan and its alternatives are measured against in order to test their sustainability. The final SA Framework is detailed in Table 2.

The sub-topics provide a 'finer grain' of analysis in the SA. It is these sub-topics against which the draft plan and its alternatives have been assessed in order to identify potential significant effects.

The sub-topics have been developed with a view to help focus the SA on significant issues only. Their development has drawn from:

- an understanding of the issues[3] within the marine plan areas
- an understanding of the targets and objectives of other relevant plans and programmes
- an understanding of what the plans can and cannot achieve
- input from the SAAG workshop in March 2016
- experience from the SA of the South and East Marine Plans
- professional judgement

[3] With reference to the SA of the South West Marine Plan, issues identified encompass both challenges and opportunities which have the potential to occur.

- proposed criteria of Good Ecological Status referred to by the Water Framework Directive (WFD)
- proposed criteria of Good Environmental Status referred to by the Marine Strategy Framework Directive (MSFD).

Table 2: SA Framework.

	Overarching SA topic	SA Sub-Topic
Physical and Chemical Aspects	Cultural Heritage	• heritage assets within marine plan areas • heritage assets adjacent to marine plan areas
	Geology, Substrates and Coastal Processes	• seabed substrates and bathymetry • coastal features and processes
	Seascape and Landscape	• effects on seascape and landscape
	Water	• tides and currents • water temperature and salinity • pollution and water quality • marine litter
	Air Quality	• air pollutants
	Climate	• greenhouse gas emissions • climate change resilience and adaptation
Social and Economic Aspects	Communities, Health and Wellbeing	• health and wider determinants of health • effects on communities • effects on protected equality groups
	Economy	• ports and shipping • fisheries and aquaculture • leisure / recreation • tourism • marine manufacturing • defence • aggregate extraction • energy generation and infrastructure development • seabed assets
Ecological Aspects	Biodiversity, Habitats, Flora and Fauna	• protected sites and species • benthic and intertidal ecology • fish and shellfish • marine megafauna • plankton • ornithology • invasive non-native species

2.1.2 Context and Establishing the Baseline

For all topics included within the SA, it is necessary to understand how the draft South West Marine Plan fits into the existing hierarchy of plans, programmes, strategies and environmental protection. It is also necessary to consider how the draft South West Marine Plan will interact with the broader framework of Government policies and objectives aimed at achieving a sustainable economy. The context of the appraisal is based on this understanding.

Policies, targets and objectives from relevant plans, programmes and legislation which are significant and relevant to the South West Marine Plan have been included in the SA Database, which forms Appendix A. The SA Database has been updated as the SA process has progressed; firstly in August/September 2017 prior to the options assessment and a second time in March/April 2019 prior to the assessment of preferred options / the draft marine plan.

The relationship between policies, targets and objectives from relevant plans, programmes and legislation which are significant and relevant to the South West Marine Plan are discussed in SA Report Part 1 Section 2.4, and have been used to inform the SA Framework (see SA Report Part 1 Section 3.2),

The SA Database also contains baseline data and key issues and opportunities which are pertinent to each of the south west, north west and the north east inshore and offshore marine plan areas and the south east inshore marine plan area, as well as baseline data which is relevant to multiple marine plan areas.

The baseline conditions relating to each of the SA topics is presented in Sections 3 – 11. This information was used to inform the SA Scoping Report and accompanying report cards for each SA topic, all of which can be found here. The information contained within the report cards is referenced to the SA Database via the use of bracketed identifiers. Please note that the SA Scoping Report and accompanying report cards which can be accessed via this weblink draw on the information which was featured within the SA Database at the time of the Scoping Report being undertaken, and as such, do not reflect the most recent updates to the SA Database which were undertaken in 2019.

The report cards which accompanied the SA Scoping Report provided:

- a summary of the baseline and any existing issues specific to the south west marine plan areas
- a summary of key cross cutting baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area
- a summary of legislative and/or policy context relevant to the SA topic
- an overview of the likely evolution of the environment over the South West Marine Plan duration
- the potential for interactions to occur with other SA topics
- the potential for transboundary issues which may occur
- key data gaps.

As the gathering of data into the SA Database is an iterative process, the baseline information which is presented in Sections 3 – 11 has been updated to reflect the SA Database as of April 2019. Key data gaps which remained recorded within the SA Database are detailed in Section 12 of the current document.

In addition to presenting the baseline issues which exist within the north east marine plan areas and those which are ubiquitous to each of the north east, north west and south west inshore and offshore marine plan areas and the south east inshore marine plan area, Sections 3 – 11 also present potential interactions with other SA topics; and the likely Evolution of the Environment over the North East Marine Plan Duration.

3. Cultural Heritage

3.1 Overview

Cultural heritage includes both designated and non-designated heritage assets. In addition to occurring both within the inshore and offshore marine plan areas, terrestrial heritage assets which are adjacent to the inshore marine plan area must be considered, as must heritage assets which are present in adjacent marine plan areas, specifically, in the south or Welsh marine plan areas. The cultural heritage SA topic therefore encompasses both heritage assets within the marine plan areas and those which are adjacent to the marine plan areas. Each of these comprises a separate SA sub-topic, as outlined in Table 2. Baseline Issues are organised under these two sub-topics below.

Assessments must consider the setting of heritage assets as well as effects which may be incurred on the heritage asset itself.

As outlined in the scoping report, heritage assets are an important source of social and economic benefits to coastal communities and sea users.

3.2 Baseline Issues

3.2.1 Heritage Assets within Marine Plan Areas

Baseline information and/or issues which have been identified for the heritage assets within the south west marine plan areas SA sub-topic are detailed in Box 1. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore areas and the south east inshore marine plan area, as presented in the scoping report.

3.2.2 Heritage Assets Adjacent to Marine Plan Areas

Baseline information and/or issues which have been identified for the heritage assets adjacent to marine plan areas SA sub-topic are detailed in Box 2. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

Box 1: Heritage Assets within Marine Plan Areas Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

Undesignated Heritage Assets (known and potential):

- Each marine plan area contains - or has the potential to contain - prehistoric heritage assets (from both prior to and after the Late Glacial Maximum); coastal sites and structures; maritime heritage assets (e.g. the wrecks of ships and boats); and aviation assets (e.g. air crash sites). Heritage assets in marine plan areas include both designated and non-designated assets ranging in significance to include assets of national and international importance (Cultural_84a)
- Maritime heritage assets – especially in vicinity of estuaries and navigational hazards e.g. The Lizard (Cultural_84g).

Designated Heritage Assets:

- There are numerous Scheduled Monuments, Listed Buildings and Registered Parks and Gardens, including in estuaries and tidal rivers within the marine plan area (Cultural_70a-f)
- There are twenty wrecks protected under the PWA 1973 within the south west inshore plan area (Cultural_70d)
- The following World Heritage Site – which encompasses several discrete areas – abuts or overlaps the south west marine plan area:
- Cornwall and West Devon Mining Landscape (Cultural_70e)
- There are wrecks protected under the PMRA 1986 (Cultural_70h)
- All military air crash sites are automatically protected under the PMRA 1986 (Cultural_70j).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- Although there is generally good provision for marine heritage assets in marine licensing procedures, experience of the particular issues associated with each licensing sector may vary both between sectors and between marine plan areas. Specific guidance is available for some sectors (e.g. aggregates; offshore wind; ports; wave and tidal energy) (Cultural_166)
- Public authority functions and decision-making can have major implications for heritage assets. Some public authorities have direct access to in-house historic environment expertise or draw upon the advice of Historic England as the government's adviser on the historic environment. However, public authorities have not always sought or adopted historic environment advice consistently with respect to their functions and decision-making in marine areas (Cultural_82)

- Practice in respect of recording and investigating heritage assets affected by marine activities is increasingly well established. However, examples of this understanding being advanced through scientific literature or shared with the wider public as a result of marine planning are rare (Cultural_60a).
- Various activities in marine plan areas have implications for the conservation of heritage assets but are not subject to licensing or, directly, to public authority decision-making. Depending on circumstances, these may include activities such as anchoring, diving and some forms of fishing. The character and magnitude of effects on the marine historic environment arising from unregulated activities may not have been quantified. Marine plans will need to consider what indirect measures can be taken to conserve heritage assets in respect of activities that are not regulated directly (Cultural_167)
- Processes such as erosion are known to be causing heritage assets to be exposed and degraded in the coastal zone. These processes are likely to be related to changing weather conditions - especially increased storminess - associated with climate change. Comparable changes may be occurring to heritage assets in fully sub-tidal areas, where changes to the seabed can result in hitherto buried material being exposed, causing collapse and prompting decay from a variety of chemical, biological and physical processes. In some cases, seabed erosion may be cyclical, but the exposure of archaeological material that has lain undisturbed for many decades if not centuries suggests that there are long term processes underway that may not reverse naturally (Cultural_168)
- The vast majority of heritage assets in marine plan areas are not designated, for a variety of reasons. For example, statutory heritage provisions may not encompass the particular type of asset (e.g. prehistoric sites without structures), or the area within which the asset is located (e.g. Offshore marine plan areas). Many forms of designation are discretionary so the view may be taken that designation is not appropriate to the management circumstances. It is important for sea-users and decision-makers to be clear that lack of designation does not imply lack of significance (Cultural_66a)
- Previously unknown but highly significant heritage assets continue to be discovered in marine plan areas. In addition, some heritage assets that are already known prove to have much greater significance than might have been assumed. Examples include Palaeolithic flint tools discovered off East Anglia; significant shipwrecks investigated in the Thames and off Poole; and discoveries of rare WWII aircraft; among others (Cultural_63a)
- Applications for marine licences to carry out archaeological investigations that satisfy the requirements of marine plans and heritage advisors ought to be encouraged for their role in recording, advancing understanding, and engaging the public in the conservation of the marine historic environment. Groups licensed to carry out intrusive investigations under the Protection of Wrecks Act 1973 must also obtain a licence under the MCAA (Cultural_56a)
- The marine historic environment is poorly understood, little appreciated and used and reference to it in management systems is low, with the result that benefits and opportunities are rarely taken advantage of. If the marine historic environment is not adequately recognised in the current prevalence in environmental management towards the Ecosystem Approach towards environmental management, it will be further damaged by development and neglect (Cultural_214).

Box 2: Heritage Assets Adjacent to Marine Plan Areas Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- There are very large numbers of heritage assets in the immediate vicinity of the marine plan area. They include both designated and non-designated heritage assets
- Designated heritage assets in the vicinity of marine plan areas include World Heritage Sites (Cornwall and West Devon Mining Landscape), Scheduled Monuments, Listed Buildings, Registered Parks and Gardens and Registered Battlefields
- The setting of such assets, which will extend to marine plan areas in many cases, may contribute to their significance (Cultural_12)
- There are low but nevertheless present levels of coastal erosion putting heritage assets and levels of access at risk, which may accelerate in the long-term due to climate change and sea level rise (Cultural_212)
- There is a remarkable abundance and variety of archaeological remains on the Isles of Scilly from over 6,000 years of human activity. Greatest density of Scheduled Monuments in England, particularly associated with later prehistoric focussed around the island's coastal peripheries, intertidal and now submerged areas (Cultural 211).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- The significance of heritage assets in the immediate vicinity of marine plan areas is susceptible to impacts arising from activities within marine plan areas (Cultural_38a)
- For heritage assets in the vicinity of marine plan areas, marine plans could have an important role in supporting positive strategies on - for example - place-making and marine tourism. Equally, marine plan policies that do not take into account heritage assets in the vicinity of marine plan areas could undermine or detract from such social and economic benefits (Cultural_7a).

3.3 Potential Interactions with other SA Topics

Potential interactions which may occur between this SA topic and other topics considered within the creation of the South West Marine Plan are:

- climate change is having a direct impact on heritage assets on shorelines and in intertidal areas, and may be having indirect impacts on submerged material through biological, chemical and physical changes. These effects concern the climate change, geological and water quality SA sub-topics
- nature conservation measures, for example, the designation of Marine Protected Areas for benthic and ornithology interest, may have implications for cultural heritage through potentially restricting access to heritage assets and/or the conduction of archaeological investigations
- consents for marine development, which may occur under the aggregates, ports and energy SA sub-topics, and other licensable activities, are directly relevant to the sustainable management of the marine historic environment
- fisheries may have an impact on the marine historic environment
- the marine historic environment is an important source of economic and social benefits to coastal communities through the creation of leisure, recreation and tourism opportunities
- the presence of, and access to, heritage assets is increasingly recognised as being important to wellbeing
- there is a close relationship between the presence of heritage assets and the character, value and appreciation of landscape and seascape.

3.4 Likely Evolution of the Environment over the South West Marine Plan Duration

Within the timeframe of the South West Marine Plan implementation, there are likely to be the following changes to the environment:

- erosion of shorelines and of intertidal surfaces will damage or destroy heritage assets of all forms, both designated and undesignated
- changes in sedimentation – especially the movement of bedforms – will result in heritage assets being uncovered and exposed to damage
- increasing sea temperatures may prompt greater damage to submerged heritage assets as a result of biological and chemical changes in their environment
- the marine historic environment is benefitting from improvements in policy provision, particularly with respect to the decisions and actions of public authorities and the pressure of licensable activities – the continuation of this is dependent on continuing investment in regulatory and curatorial capabilities
- streamlined licensing of marine archaeological activities will facilitate investigation and awareness of the marine historic environment, especially amongst volunteer groups
- greater recognition of the value of the marine historic environment in social and economic terms should result in increased benefits being achieved in coastal communities
- restrictive licencing within the expanding network of Marine Protected Areas could curtail archaeological investigations in these areas

- shoreline change will result in some heritage assets being uncovered and exposed to damage, whilst other heritage assets that are currently visible will become buried and inaccessible
- there is likely to be increasing sensitivity to proposed developments within the marine plan areas that affect the setting of heritage assets on the coast
- there will be increasing recognition of the value of coastal heritage assets in social and economic terms, especially in coastal communities.

4 Geology, Substrates and Coastal Processes

4.1 Overview

Geology, substrates and coastal processes encompasses seabed substrates and bathymetry, and coastal features and processes, both of which comprise a separate SA sub-topic, as outlined in Table 2. Baseline issues are combined for these two sub-topics below, as they were on the scoping report score cards.

These sub-topics particularly consider issues relating to physical processes and resultant changes on the coast, seabed and sediments. These are of greatest concern in the dynamic inshore plan area where human activity and development are most capable of influencing marine processes. Equally, geo-conservation and activities which incur physical change on the seabed can have implications on flora and fauna within the marine environment.

The inter-linked issues of coastal squeeze and how to adapt to climate change are both of concern in the inshore plan area.

Offshore, there are a number of designated sites for conservation which rely on seabed substrates and sediment processes. These have the potential to be affected by activities which occur within the inshore marine plan area, but also have the potential to be affected by some human activity, such as oil and gas extraction, offshore wind developments, the use of certain fishing gear and the potential for carbon dioxide (CO_2) storage. In the south west in particular, there are deep sea habitats which could be adversely affected by mobile fishing gear and marine litter. Marine litter, including discarded fishing nets, is often introduced to the marine environment in inshore areas, which then accumulate offshore in the deep sea.

4.2 Baseline Issues

4.2.1 Geology, Substrates and Coastal Processes

Baseline information and/or issues which have been identified for this SA topic are detailed in Box 3. As highlighted above, the baseline issues for the two SA sub-topics which comprise the overarching SA topic have been combined as per the scoping report. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

Box 3: Geology, Substrates and Coastal Processes Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- Diverse bathymetry including: the Severn Estuary and Bristol Channel complex; part of the southern Celtic Sea (depths up to 200m); the continental shelf edge; and a small portion of the Atlantic abyssal plain (where depths plunge to over 2000m) (Geol_133). Notable coastal features in the south west marine plan area include: steep coastal cliffs broken by estuaries and rias ; sandy beach and dune systems along the Bristol Channel coast; sand spits at the mouth of the Taw-Torrid and Exe estuaries; and shingle structures at Loe Bar, Slapton Sands and Westward Ho! (Geol_207)
- There are some distinct differences in the bedrock underlying the South West inshore plan area: in the Bristol Channel the bedrock is predominantly lower Jurassic Period mudstone and limestone along with Triassic Period mudstone; further east within the Severn Estuary mudstone dominates; off north Cornwall Devonian and Carboniferous Period mud and sandstone dominate; off south Cornwall, Permian and Triassic Period rocks dominate. In the offshore plan area the predominant bedrocks are mudstones and siltstones. It should also be noted that there are also extensive areas of chalk and sandstone (Geol_135)
- In the inshore plan area, the seabed sediment is predominantly gravelly sand, which is interspersed with sandy gravel, sand, rock, gravelly muddy sand and muddy sandy gravel. In the offshore plan area the seabed sediment is mainly slightly gravelly sand, gravelly sand, sand, and muddy sand. There are extensive areas of hard substrate in the south west compared to other plan areas including those within the Bristol Channel and in the offshore plan area (Geol_134). Moribund sand ridges (with more active sand waves forming on top) are present occasionally including the Celtic Banks (a qualifying geological feature of the South west Deeps (West) Marine Conservation Zone) (Geol_206)
- Seven aggregates dredging production licences are in force in the South West aggregates planning area (which is NOT the same as the south west marine plan area) for sand. All of these licence areas are in the Bristol Channel with the majority on the Welsh side. The area licensed for dredging is 101.5km^2 (although much of this is in Wales) with only 5.39% of this area actually dredged in 2014 (Geol_131)
- A notably different coastline exists as the Bristol Channel transitions into the Severn Estuary. The shoreline is fringed by mudflats, saltmarsh and sand beaches (Geol_126). There is a recent history of continuing coastal erosion of beaches and salt marshes which form natural/soft coastal defences. The natural shoreline movements are now largely curtailed by artificial defences and a more mixed Shoreline Management Plan policy environment is present in the estuary (Geol_127)
- The majority of the preferred management options for coastal erosion from the shoreline management plans in the south west marine plan area are no active intervention (NIV). However this is interspersed with small areas of hold the existing defence line (HtL), particularly at Newly in Plymouth and Start Bay in South Devon. (Geol_125).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- The vast majority of the English marine plan area lies on the UK Continental Shelf, the only exception being the furthest south west part of the south west offshore plan area where the shelf edge leads down to the deep ocean. Geological processes, resulting in differing strata, help shape the macro-scale bathymetry of the sea bed with major topographic features including canyons, seamounts and trenches being present along with evidence of past glacial activity. Differing overlying sediment types interact with physical marine processes and seabed energy to help define finer scale bathymetry which can be complex, especially in the coastal zone
- Physical processes that affect the highly dynamic coastal environment (causing either erosion or deposition) include those derived from wind, waves, currents and tides. However, in the absence of human intervention or activity, rapid changes caused by coastal processes are restricted to shallow areas where wave action is strong. The area of greatest change is in the coastal zone with softer coastlines most at risk from rapid change. Coastal erosion is mainly a local to regional process (Geol_193) and erosion is predicted to affect approximately 30% of England's coastline (Geol_175)
- Eroding coasts backed by coastal structures (e.g. hard flood defences) experience a 'coastal squeeze' as the intertidal profile is steepened. Adverse impacts can include reduction in intertidal area and changes to sediment transport and associated physical processes (Geol_194 and Geol_198). Where hard defences (e.g. to achieve Hold the Line policies) are in place long term impacts on sediment supply can result. The issues of coastal erosion and squeeze are of crucial concern around the English coast in general (Geol_176) with loss of saltmarsh and mudflats of particular concern (Geol_179) in certain locations
- Managed realignment of coasts is one measure that can be undertaken which can help with sustainable management of the wider coastline (Geol_213). Some development of innovative concepts and early stage work to promote coastal management using the Dutch sand engine principle is taking place, notably the Crown Estate's sand scaping work (with high potential sites identified in the NW and SW marine plan areas) (Geol_208)
- Sediment transport around much of the UK is dominated by tidal influences. However, areas of wave dominance (with limited transport) are present across much of the offshore NE plan area and inshore NW plan area, and shelf edge transport mechanisms occur in the very south west of the SW offshore plan area (Geol_217). Human intervention is most acute at the coast and developments in this sensitive and dynamic environment, plus offshore developments such as offshore wind farms, can have the potential to affect sediment transport and distribution with potential consequences for marine habitats and species
- Sea level projections to 2300 suggest that UK sea levels will continue to rise over the coming centuries under all representative concentration pathway (RCP) climate change scenarios. The UK is locked into accelerated sea level rise over this timeframe regardless of what we do about greenhouse gas (Geol_256). The scale and implications of future coastal change should be acknowledged by those with responsibility for the coast and communicated to people who live on the coast (Geol_257).

4.3 Potential Interactions with other SA Topics

Potential interactions which may occur between this SA topic and other topics considered within the creation of the South West Marine Plan are:

- coastal and sedimentation processes can operate over large areas spanning UK administrative boundaries (England, Wales, Scotland, Northern Ireland) and UK borders (EU and non-EU countries), requiring the co-ordination between devolved administrations and wider governments. Specific large-scale issues relating to contamination of sediments and the overall functioning of habitats which rely on key sediments and substrates are being tackled through EU Directives such as the Convention for the Protection for the Marine Environment of the North-East Atlantic, 1992 (OSPAR Convention), with implementation at member state level
- there are a number of sites of conservation importance which rely on substrates and sediments for their functioning and character. These span the Severn and Dee estuaries, and as such, are sites which overlap with the Wales national marine plan area. It is arguably these estuarine environments where the greatest transboundary issues have the potential to occur due to their connectivity and sharing of coastal and sediment processes
- existing Shoreline Management Plans (SMPs) and Flood Risk Management Areas, through which managed realignment may take place, may cross boundaries of multiple marine plan areas. Within the inshore south west marine plan area, such instances occur in the case of the Durlston Head to Rame Head SMP, which extends into the south inshore marine plan area, and the Anchor Head to Lavernock Point SMP, which extends into the Welsh inshore marine plan area.

4.4 Likely Evolution of the Environment over the South West Marine Plan Duration

Within the timeframe of the South West Marine Plan implementation, there are likely to be the following changes to the environment:

- geological timeframes are long and it is the dynamic coastal zones which are most likely to change over the plan period where natural processes resulting in erosion/deposition are influenced most strongly by human activity. With both steeping of intertidal profiles and rates of coastal erosion expected to increase in the future, coastal squeeze and associated habitat loss may well be accelerated by continued sea level rise. Local and regional factors, including coastal management strategies (and funding), will also be important considerations in future outcomes. There is only low confidence of any predictions at present
- the majority of the preferred management options for coastal erosion from the SMPs within the inshore south west marine plan area are no active intervention (NIV). However this is interspersed with small areas of hold the existing defence line (HtL), particularly within the Severn Estuary and approaches, the western part of Mounts Bay (Marazion-Penzance-Mousehole), Plymouth, St.Ives, Fistral Bay/Newquay, Appledore, Ilfracombe, Minehead, Bridgewater Bay, Clevedon

and Avonmouth and Start Bay in South Devon. The policy of NIV across many undeveloped sections of coastline will see the dynamic nature of the coast sustained, and likely accelerated due to climate change. Some natural, geological and archaeological assets will be lost to the sea (coastal squeeze), whilst new ones will be revealed

- managed realignment is likely to increase in the future as a key management strategy and although this will result in increased local erosion rates, the enhanced erosion may benefit other sections of coast by reducing erosion or even causing accretion. Adaptation and realignment is emerging as the key coastal management concept to cope with coastal erosion, with novel approaches already being explored in some areas
- there are clear links to economic activity, as increased activity in the coastal zone can potentially lead to changes to coastal and sediment processes in particular. The more notable activities include: dredging for ports (which occurs within the south west, north west and north east marine plan areas, and especially within the south east plan area), aggregate dredging, fishing gear that interacts with the seabed, coastal developments, power generation, growth (or otherwise) of our coastal communities and development of offshore renewable energy projects. Additional economic activities which may affect geological or coastal receptors in the future also include tidal lagoon developments (within the south west and north west inshore marine plan areas) and new nuclear power stations (within the south west, north west, and south east inshore marine plan areas). Predicting such change is extremely difficult and macro-political and economic drivers become important in directing such activity.

5 Seascape and Landscape

5.1 Overview

This SA topic considers the potential effects on the seascape and landscape within the south west marine plan areas as a result of proposals which may occur within the inshore and offshore marine plan areas, as well as those which may occur terrestrially, such as the coastal-based infrastructure associated with offshore development. There are no SA sub-topics for seascape and landscape, as outlined in Table 2.

The visual impacts of developments on the landscape and/or seascape have the potential to influence views in different ways; affect the setting of heritage or cultural assets; and potentially reduce local revenue. Potential sensitive receptors include both residents and tourists of an area of coastline or at sea. The setting of these locations may be affected through development, and therein, the perception of these landscapes or seascapes may also be affected. Alteration of setting may impact designated landscapes, non-designated landscapes and cultural/heritage assets for which there are particular cultural associations.

The present seascape is influenced by a diverse array of fixed and transient activities, for example, shipping, aggregate extraction, gas field infrastructure and other activities. Some of these may have strong cultural associations, such as fishing. The south west inshore marine plan area has designations which overlap both the south and the welsh inshore marine plan areas. Such designations include National Parks, Areas of Outstanding Natural Beauty (AONBs) and Heritage Coasts. Within the south west, the Cornwall and West Devon Mining Landscape World Heritage Site falls within the inshore marine plan area.

5.2 Baseline Issues

5.2.1 Seascape and Landscape

Baseline information and/or issues which have been identified for this SA topic are detailed in Box 4. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

Box 4: Seascape and Landscape Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- Exmoor National Park is adjacent to the coast (Landscape_118)
- AONBs in the south west which are adjacent to, or near to, the coast are South Devon, Tamar Valley, Cornwall, Isles of Scilly, North Devon, Quantock Hills, Wye Valley (partly in Wales). The Gower AONB which is in Wales could also be affected by development in the south west inshore marine plan area (Landscape_119)
- Cornwall and West Devon Mining Landscape is designated as a World Heritage Site by UNESCO (Landscape_81)
- A significant amount of the south west inshore marine plan area is designated as Heritage Coast. The Heritage Coasts are North Devon, Exmoor, Isles of Scilly, Lundy and a large proportion of Cornwall (Rame Head, Gribbin Head – Polperro, The Roseland, The Lizard, Penwith, Godrevy – Portreath, St Agnes, Trevose Head, Pentire Point – Widemouth, Hartland) (Landscape_121)
- Views to industrial and urban development on the South Wales coast impacting on perception of tranquillity, remoteness and dark night skies (the Exmoor international Dark Sky reserve is centred on the moorland core behind the coast) (Landscape_223).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- Seascape encompasses landscapes with views of the coast or seas, and coasts and the adjacent marine environment with cultural, historical and archaeological links with each other (Landscape_166a)
- Any potential development in the marine environment which is inter-visible with the coast (or coastal developments themselves) may influence views in different ways depending on structure type, size, number, type of movement and orientation, coastal form, lighting, aspect and scale, settlement pattern and type. Attitudes of people observing the change and the resultant development typically also vary widely (Landscape_132)
- Visual impacts may arise from developments which are built directly at the coast (such as harbours) or at some distance from the coast, such as offshore wind turbines. With regards to the latter, the visual impact of offshore developments which have surface infrastructure above sea level is generally a function of their visibility from the coast which is dependent on their size, distance from a viewpoint, and the atmospheric conditions (such as contrast and haze) at the time of viewing (Landscape_133)
- Each of the south west, north west, north east and south east inshore marine plan areas have overlapping designations which affect the coast - these include National Parks, AONBs and Heritage Coasts (Landscape_76)
- Several existing and nominated new sites for nuclear power stations which are under consideration fall within the south west, north west, north east and south east inshore marine plan areas. These include Hartlepool (north east inshore), Bradwell (south east inshore), Hinkley Point and Oldbury (south west inshore), Heysham and Sellafield (north west inshore). All nuclear power stations within the United Kingdom are located at marine/estuarine sites and hence have a significant impact on seascape. The National Policy statement for Nuclear Power Generation (Department of Energy and Climate Change, 2011) makes specific reference (paragraph 3.10.3) to Sellafield's impact due to its proximity to the Lake District.

5.3 Potential Interactions with other SA Topics

Potential interactions may occur between this SA topic and most, if not all, of the other SA topics. The interrelationship between this topic and heritage, climate change, economy, geology, tourism and recreation and energy developments may be the most pertinent. More specifically, seascape and landscape are intrinsically linked to other issues including, but not limited to, archaeological sites, heritage sites and historic landscapes, the latter including prehistoric sites.

5.4 Likely Evolution of the Environment over the South West Marine Plan Duration

Within the timeframe of the South West Marine Plan implementation, there are likely to be the following changes to the environment:

- climate change is likely to have an impact on coastal landscapes and this could particularly affect protected landscapes
- the seascape and coastal landscape will continue to be subject to change resulting from development including in relation to energy, industrial and port developments.

6 Water

6.1 Overview

The water SA topic encompasses tides and currents, water temperature and salinity, pollution and water quality (including eutrophication) and marine litter, which comprise four separate SA sub-topics, as outlined in Table 2.

Many activities proposed within both the inshore and offshore south west marine plan areas could potentially have an impact on currents and the tidal regime, and climate change scenarios could exacerbate the impacts of tides and currents on coastal areas. It is predicted that the seas in each of the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area will continue to increase in temperature.

Developments and other activities at the coast and at sea can have adverse effects on transitional waters, coastal waters and marine waters and historical problems exist that also need to be considered within the marine plans.

Marine litter is found in oceanic water, on beaches and in the sediments on beaches. Litter on UK beaches is a particular problem as its geographical location exacerbates the problem, in part due to the English Channel being one of the busiest shipping lanes in the world; proximity to the industrialised nations of northern Europe; and as a result of proximity to the Atlantic gulf stream. Whilst each of the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area all have a problem with marine litter, it appears to be a particular problem within the south west inshore marine plan area. This is largely attributed to pressure from tourism and fishing as well as litter entering UK waters through prevailing currents, such as the Atlantic gulf stream.

6.2 Baseline Issues

The baseline information and/or issues which have been identified for the water SA topic are detailed below. The following information is split into four sections, reflecting the four SA sub-topics within the SA topic.

6.2.1 Tides and Currents

Baseline information and/or issues which have been identified for the tides and currents SA sub-topic detailed in Box 5. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

6.2.2 Water Temperature and Salinity

Baseline information and/or issues which have been identified for the water temperature and salinity SA sub-topic are detailed in Box 6. This includes

information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

6.2.3 Pollution and Water Quality

Baseline information and/or issues which have been identified for the pollution and water quality SA sub-topic are detailed in Box 7. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

6.2.4 Marine Litter

Baseline information and/or issues which have been identified for the marine litter SA sub-topic are detailed in Box 8. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

Box 5: Tides and Currents Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- Most of the south west region has a tidal range of between 1m and 5m. The region around the Bristol Channel has a far higher tidal range, in excess of 12m in places, which is one of the biggest in the world (Water_184)
- Annual mean significant wave heights are some of the greatest around England, with wave heights at the coast of 1m to 1.5m and just offshore 1.5m to 2m. Moving further offshore wave heights reach up to 2.75m. In the winter the wave power is far greater than during the summer. (Water_185)
- The south west region has been identified as having potential for wave, tidal stream and tidal range energy resources. The first tidal range technology has been consented to be developed just outside the south west marine plan areas on the Welsh side of the Bristol Channel system (Water_264)
- Surfing activities occur at various beaches in the inshore area and it is an important sport in this region. Any pressures that cause hydro morphological changes could affect the integrity of the surfing breaks (Water_271).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- The status currently for hydrographic conditions, based on the MSFD Initial Assessment, indicated there are no significant broad scale alterations of hydrographic conditions affecting ecosystems in UK waters beyond those currently covered by provisions of the Water Framework Directive, through classification as heavily modified water bodies, plus the wider application of the Environmental Impact Assessment Directive through the marine licensing process (Water_166)
- Tidal ranges and wave heights vary with region and exploitation of these resources is being considered for energy production (Water_264)
- Whilst unlikely to be directly impacted by climate change, sea level rise and storminess will impact upon hydrological impacts and could exacerbate the impacts of tides and currents on coastal areas.

Box 6: Water Temperature and Salinity Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- Warming within the south west marine plan areas has been identified to be the lowest of all the UK waters at approx. 0.3°C per decade (Water_258)
- The salinity of the upper ocean has been generally increasing since a fresh period in the 1970s. The western English Channel (Region 4) is influenced by North Atlantic Water, tidal currents and local weather conditions. There is no discernible long-term trend in over a century of observations, but in recent years salinity has been higher than average (Water_322).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- Warming is indicated in all regions during all seasons and in all areas. The UK Climate Predictions 2009 (Lowe et al., 2009) indicate that the seas in all of the regions will continue to increase in temperature. In the surface waters, the temperature is predicted to increase by between 1.5-3.5 degrees (relative to the 1961-90) by the 2080s (Water_248)
- The salinity of the upper ocean (0-800 m) to the west and north of the UK (Region 8) has been generally increasing since a fresh period in the 1970s. A minimum occurred in the mid-1990s, and present day conditions are relatively saline. The pattern of change over the last ten years around the UK reflects the conditions of the North Atlantic. Trends in salinity elsewhere are more variable and predictions for the future are unclear (Water_322). There are likely to be effects on commercial fisheries if salinity changes in the future as this will affect the range and distribution of many marine species (Water_328).

Box 7: Pollution and Water Quality Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- There are two River Basin Management Plans (RBMPs) in the south west inshore marine plan area, the South West and Severn RBMPs (Water_186)
- The Severn 2015 RBMP: the Severn estuary is a Heavily Modified Water Body (HMWB) of Moderate Ecological Status (MES). Much of the western area of the Severn Estuary is of Poor Chemical Status (PCS), however the Inner Severn estuary is achieving Good Chemical Status (GCS). Small estuaries, such as the Severn River and Avon are achieving GCS (Water_182)
- The South West 2015 RBMP: most coastal areas are Good Ecological Status (GES) and areas on the north coast of Cornwall are of High Ecological Status (HES). Most estuaries are of MES or lower. Estuaries that are MES are the Fal, Helford, Fowey, Erne, Kingsbridge, Camel and Taw. All estuaries and coastal waters are achieving GCS, other than an estuary and adjoining coastal waters in the Falmouth area that is of PCS. The groundwaters are of Good/Poor Chemical Status (gPCS) in most areas. In the South West RBMP, of the 33 classified Shellfish Waters, only 2 are achieving the objectives. 1.3% deterioration of surface water bodies (includes freshwater and water bodies outside of the South West Plan area) occurred between 2009 and 2015 (Water_187)
- There are approximately 126 bathing beaches and approximately 91% are achieving either good or excellent status. Four are classified as poor. There are 10 blue flag beaches and a high level of surfing and water sport activity throughout the year. Water quality is vital for tourism and human health (Water_181)
- There are five problem areas for eutrophication in the south west marine plan areas: Truro; Tresillian estuary; Fal estuary; Taw estuary; and Lower Fal Estuary (Water_208)
- There are just over 1,700 combined sewer overflows (CSOs) and from 2000 to 2010, South West Water invested £75 million to reduce the volume of, and improve the quality of, discharges in the most sensitive areas including bathing and shellfish waters (Water_312
- Large scale farming in the area between Trevose head to Stepper Point can have large scale impacts for example soil run off into the sea in heavy rainfall (Water_39). Devonport is the only defence site in England able to discharge radioactivity into the waters (Water_183).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- Developments and other activities can have adverse effects on transitional waters, coastal waters and marine waters. This includes increased demand for water, discharges to water, adverse ecological effects resulting from physical modifications to the water environment and increased risk of spills and leaks and transmission of invasive non-native species. Movement of water offshore between catchments means that action in one catchment can have a profound impact on water quality in waters at some distance away along the coast. These interactions are important in managing catchment activities (Water_286)
- Most of the areas in UK seas where there are problems from contamination with hazardous substances are local in nature and are particularly in industrialised estuaries and coasts and generally associated with historic discharges and emissions (Water_176)
- Aquaculture is being promoted strongly in the Blue Growth Strategy, the Atlantic Strategy and the reformed Common Fisheries Policy and some UK administrations have also adopted specific aquaculture policies and strategies to encourage or support industry growth and development. Aquaculture has the potential to lead to eutrophication and release chemicals into the water (Water_274)
- Environmental concentrations of monitored hazardous substances in the sea have generally fallen, for example concentrations of TriButyl Tin (TBT) (Water_276) and radioactivity (Water_163) have shown large improvements, however for other contaminants they are still above levels where there is a risk of pollution in many coastal areas (Water_177). Particularly of concern are the Persistent Organic Pollutants (POPs) in water and sediments (Water_237) which may become mobilised, e.g. due to dredging and disposal of dredged material (Water_172, Water_173) and have been demonstrated to bio accumulate in marine organisms (Water_263, Water_171)
- At present, the United Kingdom does not propose implementing measures to reduce persistent legacy contamination in sediments on the grounds that the actions would be disproportionately costly (Water_237)
- Persistent oestrogenic compounds in waters in estuaries have also been indicated as an increasing problem (Water_251)
- There are relatively few eutrophication problem areas in UK waters at present (Water_178). Pressure on eutrophication status is biggest in the East, South and North West of England where nutrients of human origin have enriched coastal waters. Microbial contamination of coastal waters from sewage treatment plants has fallen significantly but some areas still experience problems and climate change and the potential increased storminess may exacerbate this problem (Water_287, Water_300, Water_302)
- The number of ‘Poor’ quality bathing waters has gone up from 20 in 2016 to 21 in 2017 while the number of ‘Excellent’ quality bathing waters has fallen from 411 in 2016 to 389 in 2017 (Water_382)
- Sea level projections to 2300 suggest that UK sea levels will continue to rise over the coming centuries under all RCP climate change scenarios. The UK is locked into accelerated sea level rise over this timeframe regardless of what we do about greenhouse gas emissions (Water_383)
- An increase in the use of chemical fertilisers has resulted in increased nutrient pollution to coastal waters. It is projected that by 2030 global nitrogen input into the sea will have increased by 14% from 1995 levels (Water_391).

Box 8: Marine Litter Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- The south west inshore marine plan area has the highest densities of beached litter, attributed to pressure from tourism and fishing as well as litter entering UK waters through prevailing currents (Water_233). There is evidence to suggest the problem is getting worse (Water_254)
- Marine litter issues have been associated with CSOs in the inshore area, particularly in the south west. The occurrence of overflows may increase in the future (Water_256).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- Over 71% of harbours and marinas surveyed in the UK reported that their users had experienced entangled propellers, entangled anchors, entangled rudders and blocked intake pipes and valves. The total annual cost of removing litter from 34 UK harbours was estimated at approximately £236,000; based on this, it was estimated that marine litter costs the ports and harbour industry in the UK approximately £2.1 million each year (Water_386)
- Analysis of 3,245 beach cleans undertaken by volunteers between 2005 and 2014 showed that plastics accounted for around 80% of the litter on UK shores and that the majority had originated from land-based sources with some of the most frequently reported items being packaging (Water_387)
- The western English Channel and Celtic Sea exhibited the greatest abundance of food and drink packaging and fishing-related debris, as well as having the greatest abundance of items overall whereas the southern North Sea had the greatest abundance of wet wipes, a category of sewage-related debris. Sewage-related debris typically enters the environment when it is not adequately intercepted by sewage treatment facilities; for example when very heavy rainfall results in a sewage overflow (Water_388)
- Compared to shorelines there are fewer data from the seabed or the sea surface. In the North Sea, data from seabed trawls indicate the extensive distribution of plastic litter on the continental shelf (van Hal 2015; Figure 5). While data from the deep sea, including several areas in the northeast Atlantic, indicate substantial accumulations of macroplastics (Galgani *et al*. 2000) and microplastics (Woodall *et al*. 2014) (Water_389)
- Oxo-degradable plastics: These are conventional plastics which include additives designed to promote the deterioration of the material to the point that it becomes brittle and fragments into smaller, microplastic pieces. These fragments may then be biodegradable, as described above. Defra's research and various international studies have concluded that there is currently insufficient evidence to support claims that oxo-degradable plastics will fully biodegrade, or do so within a reasonable timeframe if they are littered, if they are disposed of in landfill, or if they end up in the marine environment (Water_397)

- Recent academic studies have shown levels of micro plastics in mussels are now so high they are making their way into humans via the food chain (Water_399)
- Marine litter is comprised mainly of synthetic material and is found in oceanic water, and as sediments on beaches (Water_252). Marine litter can accumulate in certain areas dependent upon currents and winds (Water_253), however there has only been limited surveying of this. Other problems include issues with ghost fishing gear (fishing gear which has been lost, dumped or abandoned (Water_240, Water_253)
- Microplastics in seawater in Eastern Atlantic and the North Sea have been measured between 0.01 to 0.32 cm^3/m^3, however there are no reliable estimates. Even if all sources of plastic were to immediately stop, the number of microplastics would continue to increase due to fragmentation (Water_320)
- Marine litter on UK beaches is a particular problem because the geographical location of the UK worsens this problem (the English channel being one of the busiest shipping lanes in the world, proximity to the industrialised nations of Northern Europe and the Atlantic gulf stream) (Water_289)
- The Marine Conservation Society's Beachwatch programme reported that, based upon beaches included in the programme, 35% of litter on beaches came from beach users, 14% from fishing activities and up to 40% of litter items remain unassigned each year, either because they are too small or too weathered to identify a source, or because they could have come from a number of sources. Levels of marine litter are considered problematic in all areas where there are systematic surveys of beached litter density (Water_240) and is thought to have almost doubled between 1994 and 2007 (Water_233)
- The main risks to marine life include entanglement and ingestion of marine litter, and transport of invasive non-native species. Impacts have been particularly recognised with regard to marine mammals, seabirds and turtles (Water_231). Additional risks are thought to exist from ingestion of microplastics which can cause physical and chemical toxicity effects (Water_291, Water_321)
- The largest sources of microplastics to the OSPAR catchments are tyre wear and (macro) litter with estimated amounts of around 100,000 tons/year (Water_384). Studies estimate that micro particles from tyres make up 5-10% of microplastics deposited in the oceans, with well documented impacts for marine wildlife and the food chain (Water_377)
- According to the 2018 Great British Beach Clean Survey, 655 items of litter were found per 100m of beach in England, which is a 28% decrease from 2017. The most commonly found items where plastic and polystyrene pieces (0-50cm), which has stayed at a similar level to previous years. The number of glass, cigarette stubs, string cord, cotton buds and fishing nets have risen since 2017. 48.7% of marine litter was non-sourced, 28.6% was thought to of come from the public, 12.1% from fishing, 6.2% was sewerage related debris and 3.2% was from shipping (Water_396)
- The potential for plastics to escape waste management is exacerbated by the diversity of uses which result in a wide range of potential points of entry to the environment, including agriculture, aquaculture, fisheries, tourism, construction, transport and domestic consumers (Water_385)
- It is predicted that there will be a 3-fold increase in the amount of plastic in the sea between 2015 and 2025, with the full implications still unknown (Water_390).

6.3 Potential Interactions with other SA Topics

Potential interactions which may occur between this SA topic and other topics considered within the creation of the South West Marine Plan are:

- sea level rise and coastal flooding may potentially cause an increase in demand for aggregates for building and maintaining sea defences. This may result in hydrological impacts. The removal of energy from the marine system due to wave and tidal energy devices could have impacts upon sedimentation
- the key interrelationships between marine litter and other SA topics are with marine biodiversity, as well as communities and health as litter can affect recreation and tourism. The main risks to marine life include entanglement of, and ingestion by, marine species and the transport of invasive non-native species. Microplastics can become globally distributed and have been found on beaches, in surface waters, seabed sediments and in a wide variety of biota (invertebrates, fish, birds, mammals), from the Arctic to Antarctic. Effects exhibited in marine organisms have been attributed to the direct effects of plastics, but also to chemicals which have been adsorbed to the plastic materials. The effects of marine litter, in particular plastics, are detailed further in the Biodiversity, Habitats, Flora and Fauna SA topic, and particularly the Marine Megafauna sub-topic
- the unsightly nature of litter occurring both in the marine environment and on adjacent coastlines has implications for the seascape and landscape SA topic
- increases in temperature and/or salinity could result in the following effects (both positive and negative), for a range of industries and habitats and species:
    - there may be impacts on the abundance and distribution of species
    - there may be an increased prevalence of diseases and infections in aquaculture species and also nuisance species in aquaculture
    - increased sea temperature rise may increase the numbers of people involved in recreational fishing and visitors to coastal areas and associated recreational use of the water
- the key interrelationships with water pollution and water quality and other SA topics are with marine biodiversity, communities, health and wellbeing, and geology, geomorphology and coastal processes:
    - regarding water pollution and water quality, one of the main potential risks to marine life are from acute pollution events such as oil spills from ships or industrial discharges. Events of this nature can result in the immediate death of organisms. Acute toxicity from low level environmental contamination is also a concern. This can have chronic effects on marine biodiversity. For example, the high bioaccumulation rates of Persistent Organic Pollutants (POPs) in killer whales (*Orcinus orca)* and bottlenose dolphins (*Tursiops truncates*) is thought to have caused impacts on reproduction
    - the potential risks to communities, health and wellbeing are mainly around the potential health effects of using waters for recreational purposes at times when they have dangerous concentrations of microbial contaminants. Monitoring is only carried out at beaches which are designated as recreational, and only occurs during the summer

when recreational usage is at its highest, however some beaches continue to have large numbers of water users all year round
    - the risks associated with geology, geomorphology and coastal processes are due to the linkage between the water environment and the sediment. Many contaminants, having entered the water environment, will enter the sediment environment where they can often remain for long durations. Remobilisation of these sediments back into the water column can occur with potential effects had on other SA topics as previously highlighted.

6.4 Likely Evolution of the Environment over the South West Marine Plan Duration

Within the timeframe of the South West Marine Plan implementation, there are likely to be the following changes to the environment:

- hazardous substances in the sea have shown a general decreasing trend, and it is likely these trends will continue overtime, with the continued implementation of ever more stringent regulatory controls. Exceptions are likely to be chemicals of a particularly persistent nature, such as POPs. Sediment contamination is also likely to remain a problem into the future and may present a risk to the water habitat where it becomes remobilised, for example in the North Sea as a result of oil and gas decommissioning operations or in dredging or extraction operations
- wetter winter weather is expected to result in a greater number of overflows from combined sewer overflows (CSOs) with potential for water quality issues, in particular eutrophication and microbiological blooms
- pollution events resulting from industry and construction are likely to become less significant as the Environmental Damage Regulations (Prevention and Remediation) 2009 will provide tougher penalties and fines for those causing environmental damage
- particular problems are the chemical quality of groundwater, and failure to reach the shellfish waters standards. Remediation of these is likely to be over the long term
- climate change resulting in more frequent extreme storms and waves may exacerbate problems caused by pollutants and contaminants in the marine environment
- it is predicted that there will be a 3-fold increase in the amount of plastic in the sea between 2015 and 2025, with the full implications still unknown.

7 Air Quality

7.1 Overview

This SA topic primarily considers air pollutants, as outlined in Table 2. With regard to inshore effects, ongoing challenges exist with air quality in Air Quality Management Areas (AQMAs) at the coast. These are largely, but not solely, attributable to transport emissions. Increased shipping activity, port expansion and associated industry growth could lead to increased emissions at coastal locations.

With regard to offshore effects, shipping is a key contributor to sulphur dioxide (SO_2) emissions. As such, any proposals within the south west marine plan areas which could affect the length of shipping routes, of which there are several important routes in the south west marine plan areas and island communities to consider, could have an impact on emissions.

7.2 Baseline Issues

7.2.1 Air Quality

Baseline information and/or issues which have been identified for this SA topic are detailed in Box 9. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

Box 9: Air Pollutants Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- The major ports in the south west inshore marine plan area include: Plymouth – defence, fishing, ferry, general cargo; Falmouth - shipyards and maintenance; Avonmouth (and Bristol) - commercial and industrial. None of these port areas are designated AQMAs (Air_12).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- Shipping is a key contributor to SO_2 emissions. EU Regulations will require higher quality fuels to be used to reduce sulphur emissions. Under Directive 1999/32/EC: From July 2010 ships operating in Sulphur Emission Control Areas (ECA) must not use fuel exceeding 1% sulphur. This was reduced to 0.1% from 2015 (Air_8)
- There are Emission Control Areas in place in the Baltic Sea ECA (sulphur oxides only (SOx)), the North Sea ECA (SOx) and North American ECA (SOx, nitrogen oxides (NO_x) and PMs). The marine plan areas have more restrictive emissions standards and this may have transboundary effects on air pollutants (Air_15)
- There is the potential for negative cumulative ecological effects from air quality as a result of new nuclear power stations and other development activities and this will need to be addressed as part of the cumulative effects assessment carried out as part of the SA. The Environment Agency (EA) assesses that non-radioactive aerial emissions (SO_2, NO_x and volatile organic compounds) from nuclear power stations are extremely low compared to other regulated industries. However, this does not equate to no adverse effects (Air_20)
- Ongoing challenges with air quality (from transport emissions amongst others) in AQMAs at the coast and on land could lead to eutrophication of the marine environment and acid deposition effects (Air_23)
- Ports such as Dover do not show 'hotspots' of SO_2 concentrations, indicating it is not necessarily shipping itself that accounts for the peaks but the nearby industry linked to the ports (Air_25)
- In 2016, domestic shipping (ships that start and end their journey in the UK) accounted for 11% of the UK's total domestic NO_x emissions, 2% of PM2.5 and 7% of SO_2. In addition, international shipping (ships that go to or come from international destinations) emissions have a significant impact on air quality in the UK due to shipping lanes and engine operation while at UK ports (Air_46)
- While improvements to fuel efficiency will be essential in addressing both air quality pollutants and greenhouse gas emissions, there has been research which suggests energy efficiency improvements alone will not be sufficient to achieve absolute reductions in shipping's carbon dioxide emissions, whilst transport demand increases (Air_49)
- This hive of maritime activity witnessed in recent years has come with an environmental footprint. International shipping is responsible for 2.2% of global carbon dioxide emissions and, unless action is taken, this figure is expected to rise (Air_50)
- There is increasing pressure upon the maritime sector to reduce its carbon and pollutant emissions. In 2020 a sulphur cap will come into force. The IMO has recently agreed ambitious global targets for at least 50% carbon reduction by shipping by 2050. The need to meet new environmental targets will require the use of new, innovative technologies (Air_51).

7.3 Potential Interactions with other SA Topics

Potential interactions which may occur between this SA topic and other topics considered within the creation of the South West Marine Plan are:

- there are potential interactions with air quality and several sectors of the economy, for example, tourism, aggregate extraction and defence but particularly ports development, shipping and industrial emissions. As detailed within the baseline issues above, shipping is a significant contributor to SO_2 emissions which can contribute to poor air quality
- interactions exist between air quality and human health.

7.4 Likely Evolution of the Environment over the South West Marine Plan Duration

Within the timeframe of the South West Marine Plan implementation, there are likely to be the following changes to the environment:

- agreed amendments to MARPOL will help improve air quality at ports. There have been quite substantial reductions in NO_x emissions during the last few decades in Europe. From 1990 to 2009 the NO_x emissions in Europe decreased by 31%. The reductions were in the first decade mainly caused by a change from burning of coal and gas to nuclear power
- NO_x emissions from traffic especially in Western European have also decreased, even though fuel consumption increased
- increased shipping activity, port expansion and associated industry growth could lead to increased sulphur oxides and nitrous oxides emissions at certain coastal locations, which in turn could contribute to the breach of national objectives for air quality.
- there is likely to be a mixed picture in terms of the likely evolution of the environment, dependent on location.

8 Climate

8.1 Overview

This topic encompasses greenhouse gas emissions and climate change resilience and adaptation. This comprises two SA sub-topics, as outlined in Table 2.

Over the next 20 years, renewable energy generation could contribute to a decrease in greenhouse gas emissions from energy generation. The majority of renewable energy activity currently occurs in the inshore marine plan area. Within the south west inshore marine plan area, marine renewable energy activities are now limited to wave energy with current lease sites including the North Cornwall Wave Demonstration Zone (Wave Hub) and Falmouth Bay Test Site (FabTest).

Additionally, any plan policies which affect the length of shipping routes will affect greenhouse gas emissions including SOx and NO_x.

The impacts of climate change are already being observed, and impacts are predicted to continue. The main focus for climate change resilience and adaptation is the inshore marine plan area and will address issues such as coastal inundation and flooding, loss of intertidal habitat and improving resilience of existing coastal defences and developments. However, there are some issues which may affect the offshore marine plans including ensuring offshore wind energy development (and any other offshore development) is resilient to the effects of climate change.

8.2 Baseline Issues

8.2.1 Climate

Baseline information and/or issues which have been identified for this SA topic are detailed in Box 10. The baseline issues for the two SA sub-topics which comprise the overarching SA topic have been combined. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

Box 10: Climate Baseline Issues

Baseline issues specific to the inshore and offshore south west marine plan areas:

- Increase in the magnitude of winter flash floods due to increased winter rainfall and reduced summer rainfall (Climate_176)
- Mean summer temperatures are projected to increase by 3-5 °C in the eastern parts of the region, though by less than this in most of Devon and Cornwall (Climate_176)
- The risks of tidal flooding on good quality agricultural land are expected to be high in the south west region (Climate_176)
- Projections of central estimates of average summer precipitation change in the south west get larger over time. Projected changes in average summer precipitation are -13% by the 2040s and -23% by the 2080s (Climate_202)
- Seasonal mean and extreme waves are expected to increase (Climate_194)
- The peatlands of Bodmin, Dartmoor and Exmoor support internationally important mires, and heaths provide 70% of local drinking water and are a significant carbon sink (Climate_177).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- Direct economic damages from flooding and erosion exceed £260 million per year. Transport, energy and waste infrastructure and cultural assets are also exposed to coastal flooding and erosion. Approximately 7,500 km of road, 520 km of railway line, 205,000 ha of good, very good or excellent agricultural land, and 3,400 ha of potentially toxic historic landfill sites are currently at 0.1% or greater risk of coastal flooding in any given year. Power plants, ports, gas terminals and other significant assets are also at risk. The benefits of protecting these different assets are not prioritised in the government's coastal defence spending at present, which focuses on properties (Climate_231)
- To minimise these risks, global greenhouse gas emissions need to fall dramatically, which would slow sea level rise in the long term. In parallel, the UK needs to strengthen its policies to manage the risks of coastal flooding and erosion. By the 2080s, in a 2°C world and under an ambitious adaptation scenario, the number of people living in England in areas at 0.5% or greater chance of coastal flooding in any given year is projected to increase from 0.95 million to 1.10 million. In a 4°C world with low levels of adaptation, this number could increase to 1.55 million people. Ambitious climate change mitigation and adaptation efforts could therefore protect an additional 400,000 - 500,000 people in England from coastal flooding over the course of this century (Climate_232)
- The impacts of climate change are already being observed, and impacts are predicted to continue (Climate_115)
- The UK is likely to experience hotter, drier summers and warmer, wetter winters (Climate_127)
- For the UK's marine environment, the impacts of climate change include relative sea level rise, increased seawater temperatures, ocean acidification and changes in ocean circulation (Climate_127)
- Without any further investment in flood defences, the number of properties at medium or high risk could rise from 0.75 million to 1.29 million in 50 years (Climate_226)

- A Special Report on Global Warming of 1.5°C (SR15) was published by the Intergovernmental Panel on Climate Change (IPCC) on 8 October 2018. The SR15 Report includes over 6,000 scientific references, was prepared by 91 authors from 40 countries and is considered to be one of the most important publications on climate change. The report finds that that "limiting global warming to 1.5°C compared with 2°C would reduce challenging impacts on ecosystem, including sensitive marine species and habitats. Conversely, a 2°C temperature increase would exacerbate extreme weather, rising sea levels and diminishing Arctic sea ice, coral bleaching, and loss of ecosystems. Modelling shows that to limit global warming to 1.5°C, "Global net human-caused emissions of carbon dioxide would need to fall by about 45% from 2010 levels by 2030, reaching 'net zero' around 2050." Its key finding is that meeting a 1.5°C (2.7°F) target is possible but would require "deep emissions' reductions" and "rapid, far-reaching and unprecedented changes in all aspects of society" (Climate_236).
- Average UK temperatures have risen since the mid 20th century, as have average sea level and sea surface temperatures around the UK coast. There has been an approximate 14 cm rise in mean sea-level since the beginning of the 20th century, which has significantly increased (as much as doubled) the risk of flooding at many locations around the coast. Taking account of the vertical movement of land, this gives slightly larger sea level rise projections in the southern UK where land is subsiding, compared to the northern UK.(Climate_121)
- Between 1750 and 2009, the atmospheric concentration of carbon dioxide increased from 280 to 387 parts per million (ppm), causing average surface ocean pH to decrease from 8.2 to 8.1. If carbon emissions continue unchecked, surface ocean pH will decrease to between 7.6 and 7.8 by the year 2100 (Climate_118)
- Emissions from ships are estimated to be approximately 3% of global carbon dioxide emissions, projected to rise to approximately 15 to 30% by 2050 due to expected increase in global trade. UK shipping emissions are estimated between 0.8 and 5% of global shipping emissions (Climate_110)
- Management and adaptation to these impacts should be a priority for terrestrial planning on the coast (Climate_6) for example protecting and restoring marine habitats, using natural means of flood defence using ecosystem-based approaches and ensuring that that inappropriate types of development are not permitted in those areas most vulnerable to coastal change (Climate_132)
- In the absence of adaptation or mitigation (which may become prohibitively expensive) some beaches will narrow and habitats such as dune systems (Climate_129), mudflat and saltmarsh (Climate_193) may be lost
- In particular it is important to note that climate impacts have wider environmental and social implications, and are derived from both inundation processes, and anthropogenic action including coastal defence and other coastal infrastructure (such as cable and pipe landfall, new port infrastructure) and sea-level change (Climate_134)
- Green technology can help to mitigate the environmental impact of maritime, but its effectiveness could be limited by slow uptake for costly or unproven technologies (Climate_222)
- Climate change related storm surges, sea level rise and coastal erosion collectively have the potential to increase the complexity of chemical mixtures, which may impact on marine life and contaminate UK fisheries and seafood supplies (Climate_229)
- In England, 520,000 properties (including 370,000 homes) are located in areas with a 0.5% or greater annual risk from coastal flooding and 8,900 properties are located in areas at risk from coastal erosion, not taking into account coastal defences (Climate_230).

8.3 Potential Interactions with other SA Topics

Potential interactions which may occur between this SA topic and other topics particularly concern biodiversity, ecosystem services, economy, ports and shipping, renewable energy and communities. A number of examples are listed below, however please refer to the relevant topics elsewhere in the report for further examples and specific detail:

- renewable energy offers the potential for mitigating greenhouse gas emissions from energy production. It could also provide opportunity for socioeconomic benefits including employment, energy security and export business
- rising air and sea temperatures and associated sea level rise could have implications for the majority of marine ecology receptors identified within the biodiversity report cards. For instance, the loss of intertidal habitat through coastal squeeze and the effect on foraging bird species. The loss of intertidal habitat and impacts on benthic species is covered in the benthic and intertidal ecology SA topic
- ocean acidification which is occurring through the uptake of carbon dioxide from the atmosphere is predicted to have negative impacts on calcifying organisms, including numerous plankton taxa, molluscs and echinoderms. The effects of this will resonate at higher trophic levels
- ocean acidification could affect the behaviour and bioavailability of contaminants in the marine environment
- marine aggregates are required for the maintenance of coastal defences required for climate change adaptation. Marine aggregates can present reduced impacts on local communities compared to the extraction of land-won aggregates, including the provision of skilled, stable employment and the generation of income through the construction industry supply chain. Potential adverse impacts could however include changes to the hydrodynamic regime which may alter coastal processes; loss of seabed habitat and heritage assets; impacts on fisheries and secondary impacts to marine life and habitat associated with sediment plumes; disturbance of fish spawning, migration routes, nursery and overwintering areas; overspills from dredging vessels and impacts on geodiversity.

8.4 Likely Evolution of the Environment over the South West Marine Plan Duration

Within the timeframe of the South West Marine Plan implementation, there are likely to be the following changes to the environment:

- the realignment of some coastal infrastructure and housing may be expected. This is a national issue. Around 700 properties could be lost to coastal erosion over the next 20 years, and 2,000 in the next 50 years
- future effects of climate change are also likely to include increased storm intensity, increased rainfall, increase in seawater temperature and acidity leading to ecological impacts. This could have practical implications for licensing and exploration. The rate of coastal erosion is likely to increase as sea levels rise

- climate change could lead to deeper water in near shore areas, which would in turn cause an increase in wave energy reaching the coast. Impacts of coastal erosion on buildings and infrastructure located along the coast are therefore likely to increase
- over the next 20 years, there is a need to reduce greenhouse gas emissions in order to meet UK climate legislation. It is envisaged that further development of renewable energy generation including offshore wind farms and wave and tidal energy generation, could contribute to this reduction. There are also a number of important ports within the south west inshore marine plan area and marine planning can make a contribution to climate change mitigation and adaptation in line with United Kingdom national policies (such as those detailed in Maritime 2050, Navigating the Future) and recent International Maritime Organization measures.

9 Communities, Health and Wellbeing

9.1 Overview

The communities, health and wellbeing SA topic encompasses health and wider determinants of health and effects on communities, which comprise one SA sub-topic, and effects on protected equality groups, which comprise a second SA sub-topic. This is outlined in Table 2. The former has been scoped in for SA of the south west, north west and north east inshore and offshore marine plan areas and for the south east inshore marine plan area. The latter has been scoped in for the four inshore marine plan areas only.

9.2 Baseline Issues

Baseline information and/or issues which have been identified for this SA topic are detailed in Box 11. This combines the baseline issues for the two SA sub-topics which comprise the overarching SA topic and includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

9.2.1 Health and Wider Determinants of Health and Effects on Communities

Coastal communities are particularly dependent on the marine environment as a means of employment or other income generation: the south west has the highest employment dependency on fishing; a large maritime skills sector exists in the north west; the south east has the highest employment rates in the ports and shipping sector; and there is high tourism employment dependency across all plan areas, although this is most significant in the south west of England.

Potential receptors which may be affected as a result of changes within the south west marine plan areas include:

- declining fishing and other traditionally skilled communities
- low paid, low skill workers, unemployed and under-employed people in coastal communities
- households affected by multiple forms of deprivation.

Communities dependent on fisheries and tourism are particularly vulnerable to change, largely due to the current decline in fisheries as well as the seasonal nature of tourism. There is also a need to address socioeconomic deprivation of coastal communities.

The defence and maritime renewables sector are also vulnerable to change within the south west marine plan areas, with the potential existing for associated employment and economic opportunity to incur resultant change.

9.2.2 Effects on Protected Equality Groups

As explained above, this SA sub-topic has been scoped in for the south west, north west, north east and south east inshore marine plans but scoped out for the three offshore marine plan areas.

Potential receptors which may be affected as a result of changes specifically within the inshore marine plan areas include:

- ageing coastal communities
- disabled people
- people with long term health conditions.

Health deprivation and disability tends to be higher on the coast relative to the rest of England. This is also true regarding deprivation in relation to income; income deprivation affecting children and older people; and deprivation with regards to employment and education is higher. In addition, the overall trend of an ageing population is likely to continue and could increase the proportion of households who are particularly vulnerable to flooding and other adverse climate change risks facing coastal communities. Therefore, it is important that any activities promoted in the marine plans are assessed against this topic.

Box 11: Communities, Health and Wellbeing Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- Aquaculture is a growing marine activity and is seen as the means to increase seafood supplies and in turn increase employment (Communities_92)
- Protection of Plymouth's waterfront is needed to support the local economy (Communities_57)
- Tourism appears to be most important in Torquay, Newquay and Bristol (Communities_61)
- Fishing appears to be most important in the following settlements (although it should be noted these are the ports into which catches are taken and not necessarily where boats are registered): Newlyn; Plymouth and Ilfracombe (Communities_60)
- Coastal communities in the south west region are benefitting from a number of projects awarded significant funding via the Coastal Community Fund including the Penzance Coastal Community Team for investment in Jubilee Pool and regeneration of key sites across Penzance (Communities_125).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- Generally, there is often isolation of coastal towns due to lack of infrastructure (Communities_15). There is high tourism employment dependency across all plan areas. The highest percentage contribution of recreational employment is held by Yorkshire and the Humber as well as the south east at 1.69% of total employment, this is followed by the south west at 1.61%. Whilst jobs numbers have grown in coastal economies, the jobs created tend not to be well paid, and are frequently part time (Communities_27). There are also high levels of transience and an ageing population (young people migrating out and older people migrating in; countered in some localities by increasing immigration by young migrants to the UK) (Communities_37)
- Deprivation in relation to income, income deprivation affecting children and older people, employment and education (2015 Indices of Multiple Deprivation) (IMD) shows some more deprived Lower Super Output Areas (LSOA) on the coast compared to the rest of England (Communities_16,17,18,19). Living environment domain (2015 IMD) also shows some more deprived LSOA on the coast, especially in the south west, the north east rural areas and the north west in some more rural areas as well as urban coastal areas (Communities_40)
- It is important to take account of the effect of the amount and type of employment on communities, health and well-being (Communities_134)
- It has been announced that the Coastal Community Fund is to be extended to 2020/2021 and at least a further £90 million will be available to help seaside towns revitalise areas, create jobs, and boost local economic growth. Seaside towns will have a chance to bid for the funding. Launched in 2012, the Coastal Communities Fund has already invested nearly £119 million on 211 projects local infrastructure and economic projects across the UK. This is helping to create almost 13,700 jobs and provide more than 10,280 training places and apprenticeships (Communities_42)
- Climate change (sea level rise, temperature rise and increased storminess) is leading to coastal squeeze with adverse social effects on local communities. This is particularly important in nationally designated landscapes (Communities_44). Climate change may bring an increase in the numbers of visitors to coastal destinations, longer tourism seasons, increase in infrastructure and demand on the natural environment (Communities_48)

- There is a need to achieve a balance between the costs and benefits that tourism brings to coastal communities, such as increased revenue, infrastructure development, protection of the natural environment, second home ownership, house prices, community cohesion, character, population structure and control of tourism development (Communities_47). The highest tourism employment dependency is in the south west of England at 8.63% followed by London at 7.03%, south east England at 6.62% and north west at 6.48%. Additionally, the south west of England is most dependent on tourism for Gross Value Added (GVA) (3.53%) followed by London (3.12%) (Communities_66)
- Decline in fisheries due to overfishing and the implementation of the quota system under the Common Fisheries Policy (CFP) has made fishing as a livelihood and way of life difficult in recent years (Communities_49). Decline in employment in fish catching sector and improvement in education promotes employment in other sectors or migration of younger generation from local fishing communities (Communities_52)
- Fishing activities can help support communities by providing direct employment and employment along the supply chain (Communities_51). Crew members are likely to come from settlements distributed over a wider geographical area making social networks weaker and more dispersed (Communities_53). Fishing and interaction with the marine environment provides more than an economic role; it specialist skills, identity, solidarity and status which spill over into fisher families and communities by creating distinct characteristics, culture and values (Communities_62)
- In 2014, 408.5 people were employed within the British marine aggregates industry, based on data collected from British Marine Aggregate Producers Association (BMAPA) members. Numbers of office staff in 2014 were 57.5 representing a 3.4% reduction compared to 2013. Sea staff have reduced from 375 in 2010 to 351 in 2014 but figures increased by 4.8% between 2013 and 2014 (Communities_148). A significant part of the ready-mix concrete and concrete product sectors, and their associated employment, infrastructure and turnover are entirely dependent upon the continued supply of marine aggregate materials – particularly in London and the south east (Communities_150)
- Research undertaken by The Crown Estate has identified 3,151 direct UK jobs have been created in the manufacture, construction, operation and maintenance of offshore wind turbines. An estimated 7,000 indirect jobs have also been created along the offshore wind supply chain and there has been considerable investment in knowledge generation through research and development (Communities_152). Research undertaken by The Crown Estate has identified that jobs created in the offshore wind industry are reported to be high skilled. These skills are in demand outside the UK, allowing the export of skills and knowledge transfer. A number of dedicated training courses have been developed to meet the rising demand to appropriate skills (Comunities_153)

- Although relatively small in terms of the national economy, the fishing sector plays a significant role in local economies, particularly in terms of helping to address the socio-economic difficulties faced by a significant number of our coastal communities. In England, the largest fishing ports are in the south west, at Newlyn, Brixham and Plymouth. After leaving the EU, the UK will be an independent coastal state, which will enable the control of who may fish in UK waters and on what terms (Communities_188)
- The Government' 25 Year Environment Plan aims for more people, from all backgrounds, to engage with and spend time in green and blue spaces in their everyday lives (Communities_189)
- Patterns of employment vary around the country and according to coastal settlement size; however rates of employment are, on average, lower in coastal communities than elsewhere (Communities_192). The economic gap between coastal and non-coastal communities has widened over time. GVA in coastal communities is on average 26% lower than non-coastal communities. 10 of the bottom 20 local authorities in terms of GVA were in coastal communities (Communities_193)
- Health problems are more prevalent in coastal communities. Of the 20 local authorities in England and Wales with the highest proportion of individuals in poor health, 10 are in coastal communities (Communities_194)
- Six of the 10 local authority districts in England and Wales with the highest rates of heroin- and/or morphine-misuse deaths are coastal holiday resorts (Communities_196).

9.3 Potential Interaction with other SA Topics

Potential interactions which may occur between this SA topic and other topics considered within the creation of the South West Marine Plan are:

- climate change could increase risks to the wellbeing of people living near the coast. Water quality, air quality and pollution could affect people's health at the coast, including both residents and visitors
- there are strong links between leisure, recreation and tourism at the coast with the health and wellbeing of residents in these areas. Good health is most prevalent in areas close to the coast and this could be a result of individuals being able to partake in activities to reduce stress and increase physical exercise. However, research findings are uncertain, and it is suggested that a "healthy migrant effect" could exist, whereby healthy (and wealthy) individuals move to the coast, showing a higher ratio of good health to proximity to the coast. This effect should be noted in connection with recreation and leisure
- there is a strong connection between maintenance of "natural" seascape character areas, protecting historic heritage, maintaining and enhancing biodiversity with recreation/leisure and health and wellbeing and Natural England survey results have found that respondents felt refreshed, relaxed and enjoyed their time in nature
- employment and skills levels can be connected to the wellbeing of communities in that higher levels of employment and educational achievement could correlate with people's health, such as the proportion of the population who describe their health as 'good' in census returns. Part of this effect could be related to the higher level of physical activity in more affluent groups. Effects on Protected Equality Groups can relate to employment inequalities and patterns relating to gender and age groups
- levels of employment are closely linked to the economy, investment, national policy and market forces which dictate growing and waning industries
- work forces can be influenced by national and international policies.

9.4 Likely Evolution of the Environment over the South West Marine Plan Duration

Within the timeframe of the South West Marine Plan implementation, there are likely to be the following changes to the environment which may affect communities, health and wellbeing:

- climate change leading to coastal squeeze could have adverse effects on local communities
- existing issues of isolation of coastal towns due to lack of infrastructure, transience, ageing populations and deprivation relating to income and employment in coastal communities may continue in the future but efforts are being made to address these issues through the funding of projects via the Coastal Community Fund. With this investment, jobs numbers and the quality of jobs could improve

- the Blue New Deal[4], a campaign designed and implemented by the New Economics Foundation, aims to deliver stronger economies for UK coastal communities, whilst protecting the natural environments which they rely on. This is likely to have a positive impact on employment in all plan areas.

[4] New Economics Foundations: Blue New Deal (see: http://www.bluenewdeal.org/)

10 Economy

10.1 Overview

The economy SA topic encompasses ports and shipping, fisheries and aquaculture, leisure / recreation and tourism, marine manufacturing, defence, aggregate extraction, energy generation and infrastructure development (renewables, carbon capture and storage, nuclear and fossil fuels) and seabed assets. Each of these comprises a separate SA sub-topic, as outlined in Table 2.

Ports and shipping, fisheries and aquaculture, leisure / recreation, defence, energy generation and infrastructure development (renewables and fossil fuels only) and seabed assets have been scoped in for SA of the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area.

Tourism, marine manufacturing and energy generation and infrastructure development (nuclear) have been scoped in for SA of only the inshore marine plan areas of the south west, north west, north east and south east.

Aggregate extraction has been scoped in for SA of the inshore south west, north west and north east marine plan areas, plus the north west offshore marine plan area.

Energy generation and infrastructure development (carbon capture and storage) has been scoped in for all marine plan areas.

The following overview is split into seven parts, reflecting the seven SA sub-topics. The last SA sub-topic, energy generation and infrastructure development, is split into a further four sections.

10.2 Baseline Issues

10.2.1 Ports and Shipping

Shipping is an essential and valuable economic activity for England, including significant ship movement around the English coastline in addition to ship movement into and out of English ports. There are also significant levels of passing traffic, for example through the English Channel and other ships using the navigable seas adjacent to England.

Baseline information and/or issues which have been identified for this SA sub-topic are detailed in Box 12. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

10.2.2 Fisheries and Aquaculture

Whilst this sub-topic has been scoped in for all of the marine plan areas under consideration, aquaculture is applicable to the inshore areas only. It is anticipated that there could be an increase in aquaculture in the future, with associated employment and economic benefit. This could be significant to otherwise deprived or peripheral communities.

Fisheries are applicable to the south west inshore and offshore marine plan areas considered within this SA.

Baseline information and/or issues which have been identified for this SA sub-topic are detailed in Box 13. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

10.2.3 Leisure / Recreation and Tourism

Whilst a large proportion of leisure and recreation activities occur within the south west inshore marine plan area, it is recognised that some activities such as wildlife watching and boating do cross into the offshore marine plan area. It is for this reason that leisure and recreation have been scoped in for SA of both the inshore and offshore south west marine plan areas.

With regard to recreation, effects on the different types of recreational boating facility need to be considered. This will include harbours, marinas, moorings, anchorages, clubs and training centres. Each of these facility types have differing needs and requirements, and provide different services to the community which benefit from them.

Tourism has been scoped in for only the inshore south west marine plan area as the largest potential economic effects which may occur as a result of proposals will be those which affect the coastal settlements which rely on tourism.

Baseline information and/or issues which have been identified for this SA sub-topic are detailed in Box 14. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

10.2.4 Marine Manufacturing

This SA sub-topic addresses industry which may affect the coastal zone in addition to securing manufacturing investment and the associated supply chain for all offshore renewable energy in the UK. The latter is an important government objective with regard to marine manufacturing. It is also important to secure energy supply and communications via cables manufacturing and installation equipment.

Baseline information and/or issues which have been identified for this SA sub-topic are detailed in Box 15. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

10.2.5 Defence

Baseline information and/or issues which have been identified for this SA sub-topic are detailed in Box 16. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

10.2.6 Aggregate Extraction and Seabed Assets

The south west inshore marine plan area currently has a small amount of licenced aggregate, and a number of wharves where aggregate resource is landed. There could be future technical opportunities in the south west inshore marine plan area.

Baseline information and/or issues which have been identified for this SA sub-topic are detailed in Box 17. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

10.2.7 Energy Generation and Infrastructure Development

Baseline information and/or issues which have been identified for the energy sub-topic are detailed in Box 18. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

This sub-topic is broken down further into consideration of renewables, carbon capture and storage, nuclear and fossil fuels.

Box 12: Ports and Shipping Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- There is an inshore shipping route running along the south coast linking two way traffic to a point off Land's End, from which two distinct traffic routes can be seen heading in a North-South orientation for traffic transiting into the Irish Sea. Clearly defined routes can be seen into the Severn Estuary, and vessels bound for Milford Haven in Pembrokeshire (Economy_437)
- The south west region has 22% of English ports handling mainly passenger and fishing traffic (Economy_382)
- There is an IMO Traffic Separation Schemes in the plan area around the Isles of Scilly (Economy_446)
- According to Department for Transport statistics, there are three major ports in the south west plan area: Bristol, Falmouth and Plymouth. None of these are in the top ten list of busiest ports but ferry services to the Isles of Scilly from Penzance are important (Economy_383)
- Her Majesty's Naval Base (HMNB) Devonport and Dockyard is a major component of the UK's strategic defence capability (Economy_289)
- There have been some issues in relation to dredging activity at HMNB Devonport and disposal of material at the Rame Head South disposal site. The issue is focused on the effects of contamination on a nearby Marine Conservation Zone. Characterisation work is taking place through CEFAS and Marine Licensing. Two licences have been agreed over the next two years to dispose at that site so disposal can carry on (Economy_588).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- The UK ports sector comprises a variety of company, trust and municipal ports, although much of the tonnage handled is concentrated in a small number of ports, with the top 15 ports accounting for almost 80% of the UK's total traffic (Economy_429)
- The location of ports in England and Wales has changed over time, in response to changes in global markets, in the size and nature of ships, and in the transport networks which support them. Currently, the largest container and roll-on/roll-off terminals (ro-ro) are in the south east, while the west coast has naturally been best placed to meet the needs of transatlantic and Irish traffic (Economy_430)
- Environmental impacts from the ports and shipping sector can be through accidental pollution from ships in the course of navigation or lawful operations, pollution caused by unlawful operational discharges by ships, such as oil, waste or sewage, or physical damage caused by groundings or collisions. Other pressures on the environment from shipping and ports relate to noise, airborne emissions and the introduction and spread of invasive non-native species (transported on the hulls of ships or in ballast water) (Economy_421)

- Shipping is an essential and valuable economic activity for the UK. There are significant movements of ships around the UK coast and into and out of UK ports serving the UK's economic interests. As highlighted by the 2011 Marine Policy Statement (HM Government, Northern Ireland Executive, Scottish Government, and Welsh Assembly Government), there are also significant levels of passing traffic, for example through the English Channel and other ships using the navigable seas adjacent to the UK (Economy_425).
- Navigational dredging and disposal of marine sediment needs to be facilitated in line with the objective to prevent, reduce and eliminate where practicable pollution caused by dredging operations and the disposal of dredged sediments. All the ports listed undertake navigational dredging and the impacts of this activity may need to be assessed as part of the SA. For example, in the Port of London three types of dredging are undertaken: Water Injection Maintenance Dredging, Trailing or Trailing Suction Hopper Dredger Maintenance Dredging and Plough Maintenance Dredging (Economy_452)
- Confusion surrounds the requirement for ports in England to submit air quality strategies, with uncertainty over the ports affected, their obligations and even the deadlines for compliance (Economy_812)
- There are plans for several thousand offshore wind turbines, in farms of ever increasing size, and increasing numbers of wave and tidal energy installations. There are an increasing number of aquaculture sites and a trend towards establishing such sites in deeper water than was traditionally the case. These developments, as well as the restrictions associated with area designated for marine conservation, will add further complexity to our already challenging coastal waters. As highlighted by the General Lighthouse Authorities (GLA) (2030 - Navigating the Future, 2018), over the period of this strategy there is likely to be a continuing reduction in available sea room and the various National Marine Spatial Plans around the United Kingdom are likely to further influence the free movement of shipping. These many factors are increasing the pressure on shipping and mariners and constraining the sea area available (Economy_824)
- Non-IMO designated navigation routes are not fixed. For a number of reasons, navigation routes will vary in both position and traffic density over time. A particular navigation route that might be identified as a constraint during the planning-phase of an offshore windfarm could become redundant by the time that development would be due to progress into the offshore construction-phase (Economy_835).

Box 13: Fisheries and Aquaculture Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- In 2011 39% of landings into English ports by UK vessels landed into Plymouth (south west marine plan area), Brixham (south marine plan area), and Newlyn (south west marine plan area), with Plymouth landing the most (Economy_384)
- Plymouth and Newlyn have a large proportion of high value catch, caught by a few large vessels over 15m in length (Economy_314)
- Fishing appears to be most important in the following settlements (although it should be noted these are the ports into which catches are taken and not necessarily where boats are registered): Newlyn, Plymouth, Ilfracombe (Communities_60).Fishing activity occurs in both the inshore and offshore marine plan areas but inshore vessel activity is particularly high
- Non UK fleet fishing in the south west marine plan areas include: Spanish long line activity targeting hake, and Spanish bottom trawler targeting hake, megrim and monkfish (Economy_319)
- The percentage of plan area utilised by shellfish production is as follows: south west inshore: 8.8%, south west offshore: 0%. In the south west, there are several important shellfish beds, including pacific oyster in Salcombe, blue mussel and pacific oyster in the Dart, Fowey and Yealm Estuaries, pacific oyster in Bigbury and Avon and native oyster, blue mussel and pacific oyster in Truro, Tresillian and Fal (Economy_300).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- The south west has the highest number of employed persons in fishing both full-time and part-time totaling 900 people, followed by Yorkshire and the Humber with 400 people. The highest GVA, however, is associated with the catch in the East of England region amounting to £90m followed by the south west with £84m. Decline in fisheries due to overfishing and the implementation of the quota system under the Common Fisheries Policy (CFP) has made fishing as a livelihood and way of life difficult in recent years (Communities_26)
- The majority of marine aquaculture in England consists of shellfish farming, particularly mussel farms. Other species include scallops as well as pacific and native oysters (Economy_299). The farming of seaweed as a food or fuel is a growing part of this sector. Currently, this is mainly in Scotland but there is some small scale activity in Cornwall and this could spread to other areas of the UK (Economy_469).

Box 14: Leisure/Recreation and Tourism Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- Of the top 20 towns and cities visited in the Great Britain by UK residents in 2013, two of them are in the south west plan area: Newquay (ranked 13th) and Bristol (ranked 15th) (Economy_301)
- The south coast (including the south west) dominates participation in boating activities (Economy_572)
- Surfing is of major significance in Cornwall, Devon and Dorset in England and the Gower Peninsula in Wales (Economy_315)
- The revenue from leisure and small commercial marine activities in the UK is recorded, the most recent available data shows in the south west annual turnover was £711.6 million (Economy_320)
- Recreational marinas in the south west inshore marine plan area include Dart and Darthaven, Mayflower, a number around Plymouth Sound, Southdown, Torpoint, Mylor Yacht Harbour, Falmouth, Padstow, Watchet, Portishead Quays, Victoria Basin (Glos), Bristol, Porthaven, Saltford and Bath (Economy_578)
- Scuba diving is particularly popular in Plymouth and the Isles of Scilly (Economy_359)
- Recreational and sport fishing is widespread although participation rates are highest in the south west, south east and north east regions (Economy_370)
- The south west is an important destination for wildlife watchers with a number of small boat operators around the coast (Economy_524).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- All of the plan areas include a number of Royal Yachting Association cruising routes, sailing areas and racing areas and these extend through to the offshore area (Economy_571)
- Seaside tourism makes an important contribution to overall tourism. It supports some 21,000 jobs and contributes £3.6bn to the economy. A similar picture exists for recreation where, for example, the estimated economic contribution of recreational boating to the UK economy was £1.042 billion in 2009/10 and employed nearly 35,000 in this sector (Economy_481)

- The sea can provide a variety of tourism and recreational opportunities. These will vary from area to area but will include visiting the beach, dog walking, and walking, pleasure boating, sailing, recreational diving (including diving on wrecks), sea angling, kayaking and surfing, as well as exploration of underwater and coastal heritage assets. The coast also provides inspiration for a range of artistic and cultural activities and food-based tourism. There is also growing interest in eco-tourism and wildlife experiences. All these activities can generate a considerable amount of income for the economy and can be a mainstay for many coastal towns, supporting their quality of life, and providing health and well-being benefits. These activities will be enhanced by a well-managed and healthy marine environment, attractive and well-maintained beaches, seashore and clean bathing water (Economy_482).
- There is high tourism employment dependency across all plan areas (Communities_20). The highest percentage contribution of recreational employment to total employment number is held by Yorkshire and the Humber as well as the south east at 1.69%, this is followed by the south west at 1.61%. However, with regards to GVA contribution London has the highest GVA contribution to total income (1.83%), followed by the east midlands (1.68%) and the south east (1.61%) (Communities_27)
- With regard to tourism, each of the inshore plan areas have coastal settlements which are in the top 20 towns and cities visited within Great Britain by UK residents. In the north west inshore marine plan area, examples include Blackpool (ranked 3rd) and Liverpool (ranked 6th); in the north east inshore plan area, Scarborough (ranked 2nd) and Berwick-upon-Tweed (ranked 17th); in the south west, Newquay (ranked 13th) and Bristol (ranked 15th); and in the south east, London (ranked 1st) (Economy_301)
- The south west is particularly important for boating, with the south coast generally dominating boating activity. However, the Merseyside and Thames areas as well as the north east coastal region are also popular for boating. In addition, each of the plan areas include multiple Royal Yachting Association cruising routes, sailing areas and racing areas. These cross both the inshore and offshore areas. Other examples of recreational activity which occur within the marine plan areas include recreational and sport fishing which, although are widespread, have the highest participation rates in the north east, south west and south east. The effects on all recreational activities will need to be considered (Economy_572)
- In the marine and leisure sector, there is continued opportunity for growth in ‘blue tourism’ but this will require requisite infrastructure: at marinas to drive commercial endeavours; more widely to develop training facilities to allow casual and leisure mariners of tomorrow the opportunity to learn new skills; and at harbour fronts and in coastal communities to facilitate other recreation activities such as powerboating, surfing and sailing (Economy_793).

Box 15: Marine Manufacturing Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- The main area in the south west for marine manufacturing is Avonmouth. Industries in Avonmouth employ a large number of people in a wide range of processes, from making pharmaceuticals to smelting zinc. The industries make vital products such as anaesthetics and agricultural fertilisers and provide important services such as gas storage (Economy_530).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- With regards industry in the coastal zone, the north west and north east inshore marine plan areas are particularly important. Although the south east marine plan area is not a significant area for industry in the coastal area, ports such as Port of London are key in exporting UK manufactured goods overseas
- With regard to the supply chain for offshore wind, this requires ports which have the required facilities and commercial land. Such ports could provide an industrial hub for wind turbine manufacturers and their supply chain. Examples include Barrow in the north west, Newcastle upon Tyne and Hartlepool in the north east and Ramsgate and Medway in the south east. There are no ports suitable in the south west inshore marine plan area
- The Industrial Strategy set out the goal of helping communities prosper and thrive across the UK. This is a UK-wide sector, with opportunities to create growth and economic benefits, particularly in coastal areas adapting to economic change. Regional clusters are already emerging, generally located close to windfarms or areas with a strong, pre-existing manufacturing base, oil and gas or research and development presence, such as the Humber and East Anglia. Linking the clusters with educational institutions, centres for innovation, manufacturing bases, can provide the conditions for local incubation of innovation, drive competitiveness, increase economies of scale and productivity (Economy_811).

Box 16: Defence Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- Sea training is carried out within defined military practice and exercise (PEXA) training areas. Each of the marine plan areas have PEXA areas or another form of military presence within them. The percentage of the south west marine plan areas covered by PEXA is as follows: south west inshore: 60%, south west offshore: 94% (Economy_292)
- HMNB Devonport and Dockyard is a major component of the UK's strategic defence capability (Economy_289)
- In Plymouth, the Devonport Naval base generates approximately 10% of the income for the city, employs 2,500 people and creates business opportunities for around 500 firms (Economy_317).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- Defence activities that utilise the marine environment, directly or indirectly, in support of operational capability are diverse but include operational vessels and aircraft, HMNBs, surface and sub-surface navigational interests, underwater acoustic ranges, maritime exercises, amphibious exercises, coastal training ranges and coastal test and evaluation ranges (Economy_484)
- There are PEXA in each of the marine plan areas (Economy_292)
- Land support for military training comes from training establishments: Britannia Royal Naval College (BRNC), HMS Raleigh, HMS Excellent, HMW Collingwood, HMS Sultan, HMS Temeraire. HMS Raleigh is in the south west region, whilst the remainder are in the south of England (Economy_316)
- Naval bases in England include HMNB Portsmouth (south) and HMNB Devonport (south west). The Royal Navy employs approximately 38,600 people and 5,200 civilians, which benefits local coastal economies. (Economy_316).

Box 17: Aggregate Extraction and Seabed Assets Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- 0.03% of the south west inshore plan area is covered by aggregate extraction licence (Economy_293)
- Based on 2011 figures, 7km^2 of the south west inshore marine plan area was subject to extraction (Economy_294)
- Aggregate wharves in the south west include Dunball Wharf, Plymouth, Appledore, Avonmouth and Bristol (Economy_587)
- The length of cable in the south west marine plan areas is as follows: south west inshore: 1,939km, south west offshore: 682km (Economy_297)
- The number of pipelines in the south west marine plan areas are as follows: south west inshore: 196km, south west offshore: 0km (Economy_298)
- The south west coast acts as a landing point for a substantial number of economically important cable connections across the Atlantic to North America (for example Cornwall is the landing point for one of the world's fastest high-speed transatlantic fibre optic cables) (Economy_528).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

- Marine sand and gravel makes a crucial contribution to meeting the nation's demand for construction aggregate materials (Economy_476)
- Marine aggregates are particularly important in England, accounting for 38% of the total regional demand for sand and gravel in the south east (80% in London), 46% in the north east and 22% in the north west. Land-based and marine-based construction aggregate resources are unevenly distributed and many regions are heavily dependent on supplies from other areas. Marine sand and gravel is delivered to specialised marine aggregate wharves in 35 ports around England and Wales for use by the construction industry (Economy_476)
- Submarine telecommunication cables carry more than 95% of the world's international traffic including telephone, internet and data, as well as many services for the UK's local communities, major utilities and industries. The transatlantic cables landing in the UK carry more than 70% of Europe's transatlantic internet traffic. The UK Government has established a new offshore electricity transmission regime to help ensure that the substantial investment required to connect offshore generation projects to the onshore grid is delivered in a cost effective manner to maximise the benefits to consumers and renewable energy developers. In addition, potential new sub-sea cabling to reinforce and better connect certain sections of the onshore grid is a key part of supporting the growth of renewable and low carbon generation (Economy_471).

Box 18: Energy Generation and Infrastructure Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

Renewables:

- There are currently no operational or approved offshore wind farms in the south west marine plan areas (Economy_321). Whilst the main focus has been on wave and tidal energy, Pulse Tidal Limited have been liquidated and the associated lease in the Bristol Channel has been terminated. Marine renewable energy activities within the south west marine plan areas are now limited to wave energy. Current lease sites include the North Cornwall Wave Demonstration Zone (Wave Hub) and Falmouth Bay Test Site (FabTest) (The Crown Estate, 2019). These are both within the inshore marine plan area (Economy_318)
- The South West Marine Energy Park, the country's first, serves the wider south west peninsula, and offers direct access to physical assets and resources including the north Devon and north Somerset marine energy coasts for opportunities in wind, tidal and nuclear energy (Economy_602)
- Tidal Lagoon Power are considering the potential of Bridgwater Bay, Somerset to develop a tidal lagoon (Economy_387).

Carbon Capture Usage and Storage (CCUS):

- The south west marine plan areas are unlikely candidates for gas storage or CCUS.

Nuclear:

- A Development Consent Order was granted for Hinkley Point C in 2013 but there is uncertainty surrounding the future of the development. The Final Investment Decision has been delayed; however, preliminary works have commenced on site.

Fossil Fuels:

- A large portion of south west marine plan areas is designated as a restricted area. There are no oil or gas fields, no oil or gas terminals and no currently licenced areas. The remaining blocks in the areas could potentially be licensed in future licensing rounds run by the Oil and Gas Authority within the marine plan period, especially if further strategic seismic programmes are undertaken (Economy_322).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

Renewables:

- In the medium to long term there is a drive to lower and zero emission energy creation, enabling opportunity in an estimated $260bn industry (Economy_797)
- In 2016, 47% of the UK's electricity came from low carbon sources, around twice the level of 2010. The UK now have the largest installed offshore wind capacity in the world (Economy_799).

Carbon Capture Usage and Storage:

- The UK Offshore Energy SEA3 states that existing offshore oil and gas infrastructure in mature fields provide the potential for re-use as storage facilities where structure design life and modifications allow. Proven sealing structures and an abundance of historical geological well and seismic data make the East Irish Sea (which covers the north west marine plan areas) and Regional Seas 1 and 2 (which cover the north east and the south east marine plan areas) highly prospective for gas storage and CCUS projects. This could potentially affect both inshore and offshore marine plan areas.

Nuclear:

- Each of the inshore marine plan areas contain nuclear power stations which affect the inshore zone:
  - north west: Heysham 1 and 2. Additionally, uGen's Moorside project aims to develop a new generation nuclear power station of up to 3.6GW on land in West Cumbria
  - north east: Hartlepool
  - south west: Hinkley Point
  - south east: potential construction of a nuclear power station at Bradwell-on-Sea in Essex.

Fossil Fuels:

- With regard to fossil fuels, the main focus is the north west inshore and offshore marine plan areas and the north east offshore marine plan area
- The UK Offshore Energy SEA3 states that comparatively smaller geological understanding make these areas unlikely candidates for gas storage or CCUS compared with North Sea and East Irish Sea prospects (Economy_607).

10.3 Potential Interactions with other SA Topics

Potential interactions which may occur between the Economy SA topic and other topics are considered below, by SA sub-topic.

Potential interactions which may occur between the ports and shipping SA sub-topic and other topics include:

- dredging is an enabling activity which is essential to the functioning of ports and marinas and can have impacts on water and sediment pollution. Current safeguards have significantly improved the chemical status of the sediments around our coasts. This is due to reductions in the tonnage of contaminants which have been permitted to be disposed of at sea
- ports and shipping can have positive interactions with economic and social topics including job creation and benefits to local fishermen, as well as wider benefits to national, regional or local economies (including tourism and recreation). Despite continuing advances in efficiency, ports remain substantial employers in their own right and they generate and facilitate economic activity in trade-related sectors. In addition, they are essential to support emerging industries such as renewable energy development. Sea ports also play an important role in the tourism and leisure industries, supporting many different forms of economic and social activity, including passenger cruise liners, channel ferries, sea going yachts and dinghies
- ports and shipping can have some negative interactions with other sustainability topics including the effects of dredging on water quality and biodiversity. Particular impacts might include: impacts to the local hydrodynamic and sedimentary regime including from increased pollution risk (oil spill) and disposal of spoil; increased collision risk or barrier to movement; loss of or disturbance to intertidal habitats; disturbance of historical contamination during capital works; impacts on migratory and juvenile fish; marine mammals, impacts on important bird populations, accidental introduction of invasive non-native species via shipping, and impacts on heritage assets. There may also be potential interactions with protected sites, existing or proposed (for example, the harbour porpoise and basking shark). Please see Section 11.2.4 and Box 19 for more detail
- ports and shipping also have key interactions with other users of marine space including biodiversity for example, displacement of species can result from shipping and has potential consequences to SPAs and SACs, particularly with regards to mobile features
- increased competition for marine resources may affect the sea space available for the safe navigation of ships
- marine plan authorities and decision makers should take into account and seek to minimise any negative impacts on shipping activity, freedom of navigation and navigational safety and ensure that their decisions are in compliance with international maritime law
- there are particular issues with regard to shipping and offshore renewable energy installations. Navigational safety around such installations is essential and the Government have issued various guidance notes on this issue. There are also issues with regard to keel clearance and tidal stream devices. There are

a number of management measures in place to manage interactions between ports, shipping, dredging and other activities

- interactions exist between ports and energy. Ports have a vital role in the import and export of energy supplies, including oil, liquefied natural gas and biomass, in the construction and servicing of offshore energy installations and in supporting terminals for oil and gas pipelines. Port handling needs for energy can be expected to change as the mix of our energy supplies changes and particularly as renewables play an increasingly important part as an energy source. Ensuring security of energy supplies through our ports will be an important consideration, and ports will need to be responsive both to changes in different types of energy supplies needed (and to the need for facilities to support the development and maintenance of offshore renewable sites) and to possible changes in the geographical pattern of demand for fuel, including with the development of power stations fuelled by biomass within port perimeters.

Potential interactions which may occur between the fisheries and aquaculture SA sub-topic and other topics include:

- there are links between fisheries and biodiversity. The MSFD has been incorporated into the UK Marine Strategy, part three of which constitutes the UK Programme of Measures. The UK Programme of Measures outlines the measures that contribute towards Good Environmental Status (GES) in UK seas. GES requires populations of all commercial fish and shellfish stocks to be exploited within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock
- achieving good environmental status will also involve better managing and mitigating the impact of fisheries on the wider marine environment, such as wider biodiversity impacts. It is however recognised that fisheries management does not fall within the remit of marine planning
- as well as over-exploitation of commercial fish stocks, fish stocks can have wider environmental impacts, including threats to vulnerable or rare species, including bycatch, and extensive damage or destruction to habitats. Such impacts can often be associated with particular gear types and the intensity of fishing activity
- fishing can impact on the historic environment. As above, the extent of damage can be dependent on gear types
- there are links with communities as fishing helps to shape the identity of many coastal communities
- fishing activity is sensitive to changes in other sea uses. Interactions between fishing activity and marine developments and their consequent impacts on fish stock and the environment are complex and need to be considered. Marine developments have the potential to prevent, displace or encourage fishing activities. There are potential social, economic and environmental impacts of displacement of fishing activity caused by other sea uses, particularly if from well-established fishing grounds
- with regard to aquaculture, the impacts are diverse, reflecting the broad scope of the industry. The precise nature of impacts will vary depending on the nature of the activity and local conditions
- shellfish and algal culture can improve local water quality as these activities require good quality water if sold for food and the industry recognises the importance of being neutral or positive regarding water quality. Negative water

quality impacts are generally lower for shellfish production than finfish production (which is present in Scottish waters but not English waters) as shellfish do not require supplementary feed or antibiotics and are generally low density cultures. However, it should be recognised that shellfish are considered keystone species and therefore they have the ability to affect the surrounding environment in both negative and positive ways. They influence primary and secondary productivity and can start a series of cascade effects on water column and sediment population and dynamics. Effects can include phytoplankton modification, reduced turbidity, increase ammonium and metals concentration, increased deposition, modification of topography and introduction of invasive non-native species. However, bivalves also have the potential to change topography and provide novel habitats that would not normally occur and can provide for a diversity of species

- there are potential conflicts between aquaculture and recreational boating associated with competition for space
- there are links with climate change and the potential effects of ocean acidification. The effects of ocean acidification will make it harder for commercial shellfish species to create their calcium carbonate shells. This could potentially result in a lower quality product being produced although the likely responses of different species to ocean acidification is unclear.

Potential interactions which may occur between the leisure / recreation and tourism SA sub-topics and other topics include:

- leisure, recreation and tourism are dependent on a well-managed and healthy marine environment, attractive and well-maintained beaches, seashore and clean bathing water. There are clear links to water quality and the water database discusses bathing water quality
- tourism can have negative environmental impacts, which may include the removal of marine fauna and flora, the physical or visual disturbance of wildlife, pollution from waste water and litter and pressures from increased visitor numbers in environmentally sensitive areas
- tourism can also provide environmental benefits through helping to enhance understanding and appreciation of the marine environment through activities such as ecotourism and nature watching
- socioeconomic benefits of tourism, leisure and recreation include positive economic benefits through increased visitor numbers and improved access
- outdoor recreation and enjoyment of the coast can provide benefits to physical and mental wellbeing
- designations of Marine Protected Areas can affect boating activity through potential restrictions on speed, anchoring, mooring and facility development
- there are potential interactions between recreational stakeholders and other economic sectors and without adequate early consultation with recreational stakeholders, development of sectors such as wind, wave and tidal energy, and aquaculture can impact upon the recreational sector
- unmarked fishing gear can cause a recreational hazard, as can buoys and lines in busy boating areas

- cable installations can be an issue in terms of maintaining navigable depth on recreational boating routes where cables come close to the surface, and where obstructions are inevitable
- seasonality of employment in the tourism sector is a long-term issue and links to deprivation in coastal communities and various social issues.

Potential interactions which may occur between the marine manufacturing and defence SA sub-topics and other topics include:

- the socioeconomic benefits from the defence sector should be recognised, particularly employment. In some coastal locations, particularly within the south west inshore marine plan area, the Ministry of Defence (MoD) is the major employer in the region
- there are a variety of environmental benefits and risks associated with national defence and national security activities. These include activities affecting intertidal habitats and water quality, protecting areas of sea bed from potentially damaging activities and concerns about noise and disturbance from maritime activities. MoD has well established systems to manage the risks arising from its activities
- non-defence activities in the marine area have the potential to impact the MoD elsewhere. Some inshore coastal defences such as aerodromes, transmitter sites and explosive stores have safeguarding zones extending over the marine area to regulate development that may otherwise affect their operation
- there are potential effects of future wind turbines on radar interference
- military training can have negative effects on habitats and wildlife
- with regard to manufacturing, heavy manufacturing which has a coastal or estuarine location can potentially have a number of impacts on the environment, including impacts on the water environment
- coastal developments or developments which occur within the marine environment, usually the inshore marine plan area, can have adverse effects on transitional waters, coastal waters and marine waters
- during the construction, operation and decommissioning phases of such marine or coastal developments, there can be increased demand for water, discharges to water and adverse ecological effects resulting from physical modifications to the water environment. Equally, inland developments may impact the marine environment through polluted water discharges which may have ecological consequences
- of the English waters which have problems arising from contamination with hazardous substances, most occurrences are local in nature. Such occurrences are particularly apparent in industrialised estuaries and coasts and generally associated with historic discharges and emissions from industry.

Potential interactions which may occur between the aggregate extraction and seabed assets SA sub-topics and other topics include:

- marine aggregates contribute to energy security and economic development through provision of fill for major coastal infrastructure projects, for example ports, renewable energy and nuclear energy projects

- marine aggregates can present reduced impacts on local communities compared to the extraction of land-won aggregates, in particular with regard to the extraction process and transportation
- substantial volumes of marine aggregates are landed on wharves close to where they are needed and locally distributed by rail, water (through barges) and road. Wider social and economic benefits include skilled, stable employment and the generation of income through the construction industry supply chain
- potential adverse impacts of aggregate extraction include changes to the hydrodynamic regime that may alter coastal processes; loss of seabed habitat and heritage assets; impacts on fisheries and secondary impacts to marine life and habitat associated with sediment plumes; disturbance of fish spawning, migration routes, nursery and overwintering areas; overspills from dredging vessels and impacts on geodiversity
- potential new sub-sea cabling to reinforce and better connect certain sections of the inshore grid is a key part of supporting the growth of renewable and low carbon generation
- impacts from cable installations on the seabed are low and spatially minor and tend to occur due to the physical disturbance involved during installation. The main impact will be where cable protection, for example, rock armour or concrete mattresses, is required where cable burial is not feasible and potentially in the intertidal area where the cable lands
- impacts may also occur if the cable runs through any site designated as being of national or international nature or cultural heritage conservation importance or other sensitive areas such as designated shell fisheries, spawning or nursery ground for economically important fish species. Other potential impacts could include disturbance to known or undiscovered archaeological sites
- cables are buried deep in the seabed where possible and installers and operators promote marine safety and protection. However, cable installations on the UK continental shelf and surrounding waters can be subject to damage. Although this can be through natural causes, human activity is the main cause of submarine cable faults due to damage caused by fishing trawlers and anchors. Given the increased activity in English waters, there is a risk that the number of incidents may increase
- there are issues around the cumulative effects of submarine cabling with other sectors specifically in certain areas where multiple cables utilise the same grid connection/landfall location meaning several cables can be located in close proximity
- there are likely to be potential interactions between areas licenced for aggregates and those offered (currently or in the future) through oil and gas licensing rounds and this may result in conflict.

Potential interactions which may occur between the energy SA sub-topic and other topics include:

- there are a number of potential environmental risks and potential impacts associated with oil and gas extraction, the most notable being the risk of oil spill, noise from exploration (such as a seismic survey) and production, historical oil based cuttings piles, and inputs of exploration and production chemicals. Oil

discharges in produced water have fallen in English waters and the majority of oil spills are now of less than one tonne

- dependent upon the location, manner of installation and size of the pipeline there are potential impacts from pipeline installation on habitats. However, these are generally spatially minor with short-term noise and disturbance impacts
- use of existing storage features and infrastructure is likely to result in negligible additional impacts although the production of salt caverns may result in significant local impacts and interference with other users of the area
- decommissioning at the end of life can cause impacts including ecological impacts and potential pollution impacts
- renewable energy developments can potentially have adverse impacts on marine fish and mammals, primarily through construction noise, and may displace fishing activity and have direct or indirect impacts on other users of the sea, including mariners
- certain bird species may be displaced by offshore wind turbines, which also have the potential to form barriers to migration or present a collision risk for birds
- marine renewable energy deployments may pose potential risks to the environment if inappropriately sited. The level of risk and ecological significance is largely unknown since, particularly so for tidal stream and wave technologies, as marine renewables as a whole are at a relatively early stage of development
- there is the potential for existing fields to be included within the boundaries of future protected areas with implications for both maintenance and decommissioning activities
- renewable projects, depending on substructure type, can also cause habitat damage or loss. Studies of tidal range technologies, including barrages, have indicated that these structures can have adverse impacts on migratory fish and bird species and on the hydrodynamics of the estuarine environments and can impact on intertidal and subtidal habitats
- decommissioning of renewable projects can also cause impacts but these impacts are less well understood because of the relative immaturity of some of the technologies
- there are also potential issues with any other sector requiring open access to marine areas (fishing/shipping/aquaculture). However, please note that there are potential co-existence opportunities with compatible sectors. Cumulative effects have been considered as part of the SA, as presented in Part 3 Section 15
- with regard to CCUS, leakage from a properly selected storage site is extremely unlikely. Once injected into a formation, a number of physical and chemical trapping mechanisms will retain carbon dioxide within the formation. It is possible that leakage of carbon dioxide from the injection process could take place, for example through failure of infrastructure, such as pipelines and wellheads. This could have some localised impact on benthic marine communities and possibly cause minor localised seawater acidification. However, such impacts are unlikely to be widespread or long-term, taking into account the dilution and buffering capacity of oceans.

10.4 Likely Evolution of the Economy Baseline over the South West Marine Plan Duration

Within the timeframe of the South West Marine Plan implementation, there are likely to be the following changes to the environment which may affect the economy:

- shipping will continue to provide the only effective way to move the vast majority of freight in and out of the UK, and the provision of sufficient sea port capacity will remain an essential element in ensuring sustainable growth in the UK economy. UK Government port forecasts show a continued strong growth in the ports sector. There are a number of recent developments in the south west inshore and offshore marine plan areas which will see further development at certain ports. For example, Bristol port was granted consent in September 2010, allowing an estimated further 1.5m twenty foot equivalent units (teu) per annum
- wider changes to the nation's energy mix arising from decarbonisation are affecting the ports industry. For example, coal shipments passing through UK ports were reduced by 78% in the period 2007 to 2017, while crude oil port traffic fell by 38% over the same period. Changes in energy commodity flows will surely continue, albeit in uncertain ways, but what can be sure is that the English maritime sector will have to remain vigilant and agile if it is to take advantage of the global move to decarbonisation
- the number of English fishing vessels has been declining since the 1990s and levels of fishing effort have therefore fallen dramatically. However, the capability of vessels is increasing. Fisheries are generally in recovery (although this is certainly not universal). In terms of aquaculture, trends in the industry are closely tied in with changes in wild fisheries, the availability of investment, and site availability. There is evidence that the aquaculture industry across Europe has stagnated, despite some areas of the UK experiencing growth in the sector. This has led to an increased reliance on fish products from outside the EU. However, aquaculture is being promoted strongly in the Blue Growth Strategy[5], the Atlantic Strategy[6] and the reformed Common Fisheries Policy (CFP). Therefore, the likely evolution of this sector is currently uncertain. Extra uncertainty is afforded at present due to EU Exit, which poses the possibility that the CFP may no longer apply to English waters should the UK no longer be an EU Member state
- participation in boating activities has been decreasing and this is highlighted in the RYA Watersports Participation Report 2016. However, in light of the poor weather conditions and an overall downward trend experienced across recreational sports within 2015, boating outperformed many of its counterparts observing only a minimal decline of 0.6% in UK participation. In addition, 2015 saw a continued steady rise in the frequency of boating participation since 2013. The same report found that although 2014 saw a decline in domestic tourism, it was the end of a downward trend spanning back to 2011. The projected end of year total for domestic holidays (based on the YTD numbers) shows a 10% rise in trips. Ageing populations may have an effect on coastal recreational activities

[5] European Commission: EU Blue Growth Strategy https://ec.europa.eu/maritimeaffairs/policy/blue_growth_en

[6] European Commission: Atlantic Action Plan https://atlanticstrategy.eu/en

in the future as older participants retire from activities and are not replaced. Boat ownership trends are fairly stable. However, recent years have seen a shift in popularity with inland boating becoming more popular and coastal boating less popular. Therefore, there is a mixed picture with regard to future levels of recreation and tourism

- under climate change scenarios sea level rise, more frequent extreme storms and waves, sea temperature rise, and changes to fluvial inputs may affect ecotourism (access to sites in bad weather, decrease in some bird species populations); safety of recreational fisheries during bad weather; coastal tourism during bad weather; integrity of coastal tourism infrastructure; loss or degradation of beaches; decrease in suitable conditions for scuba diving and decrease in bathing water quality during storms and operation of CSOs. However, air and sea temperature rise may create benefits through increased ecotourism, increased recreational fishing, increased coastal tourism and improved conditions for scuba diving; and more extreme storms and waves, air and sea temperature rise and coastal flooding creating benefits through increased opportunities for some water sports such as sailing and surfing
- in December 2015, Directorate-General for Maritime Affairs and Fisheries commissioned a study on detailed aspects of the maritime and coastal tourism market. The purpose of the Nautical Tourism Study[7] is to provide evidence on the performance of specific aspects of the market and opportunities to aid development of maritime tourism through additional EU support. It should however be recognised that EU support may no longer be applicable as a result of EU Exit. The study included boating and marina development, marinas as hubs for regional development and combined nautical and coastal tourism products. In 2017 the Commission published a Staff Working document on Nautical Tourism[8] which followed on from the work undertaken previously
- the current strategy of the Ministry of Defence is to have an estate of fewer, larger sites in the UK, which better supports military capability. This will be through the development of defence communities, for example in Base Ports, Super Garrisons, Main Operating Bases or Permanent Joint Operating Bases. These will deliver efficiencies and either greater functional or formation coherence as well as offering greater stability to personnel and increased integration with local economies and civil society. This will mean larger bases which could potentially have bigger impacts, both negative and positive
- the future of the manufacturing sector is very much dependent on government subsidies and the performance of the UK and the global economy and this is uncertain
- the relative importance of dredging areas changes as reserves become depleted and new reserves are developed. For example, there is potential to increase dredging activity in the future within the Bristol Channel due to the unexploited resources present here

[7] European Commission: Nautical Tourism https://ec.europa.eu/maritimeaffairs/sites/maritimeaffairs/files/swd-2017-126_en.pdf

[8] European Commission: Shaping a prosperous future for nautical tourism in Europe https://ec.europa.eu/maritimeaffairs/content/shaping-prosperous-future-nautical-tourism-europe_en

- potential new sub-sea cabling to reinforce and better connect certain sections of the inshore grid is a key part of supporting the growth of renewable and low carbon generation. The UK has signed up to the European Supergrid plan (North Seas Offshore Grid Initiative). The UK is working with nine other European countries as part of the North Seas Offshore Grid Initiative. Some uncertainty surrounds the EU Supergrid plan as a result of EU Exit
- although the UK plans to reduce its reliance on fossil fuels, transition will take a significant time and gas will continue to play an important part in the UK fuel mix for years to come. The UK will remain heavily dependent on gas and is expected to rely on imports to meet around half of its net gas demand in 2020. Consequently, significant investment in new gas infrastructure will be required and unconventional fossil fuel technology will also start to contribute towards supply. In February 2016, five-year life extensions were announced for Hartlepool Power Station, taking operation to 2024
- English waters, and the UK as a whole, have some of the best wind resources in the world. Offshore wind will play an important and growing part in meeting renewable energy and carbon emission targets and improving energy security by 2020, and afterwards towards 2050. Initiatives like the Offshore Renewable Energy Catapult (a UK based innovation and research centre for offshore wind, wave and tidal energy) is playing its part in this development. The technology to enable wave and tidal energy generation is at an earlier stage of development than offshore wind. However, it is anticipated that the amount of wave and tidal energy being generated will increase markedly up to and beyond 2020. On 10th February 2016 the Government announced an independent review into the feasibility and practicality of tidal lagoon energy in the UK. This review was published[9] in January 2017 and concluded that tidal lagoons can play a cost effective role in the UK's energy mix.

[9] The Role of Tidal Lagoons - https://hendryreview.files.wordpress.com/2016/08/hendry-review-final-report-english-version.pdf

11 Biodiversity, Habitats, Flora and Fauna

11.1 Overview

The biodiversity, habitats, flora and fauna SA topic encompasses protected sites and species, benthic and intertidal ecology and fish and shellfish, marine mega fauna, plankton, ornithology and invasive non-native species. Each of these comprises a separate SA sub-topic, as outlined in Table 2. Each of these SA sub-topics has been scoped in for SA of the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area .

The text below provides an overview for each of the seven sub-topics which is then followed by baseline issues for all of the sub-topics combined.

11.2 Baseline Issues

Baseline information and/or issues which have been identified for this SA topic are detailed in Box 19. The baseline issues for the seven SA sub-topics which comprise the overarching SA topic have been combined. This includes information which is pertinent only to the south west inshore and offshore marine plan areas as well as information ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area, as presented in the scoping report.

11.2.1 Protected Sites and Species

Sites in the marine plan areas which are protected by legislation include SACs, SPAs, Ramsar sites, Sites of Special Scientific Interest (SSSIs) and Marine Conservation Zones (MCZs). SACs, SPAs and MCZs can be designated in both inshore and offshore plan areas, while SSSIs are only located in inshore areas, with most confined to the intertidal area. Features of Conservation Interest (FOCI) are another designation type, which works to identify and protect characteristics which are threatened, rare or declining.

As of 31 July 2015, over 4 million hectares of England's sea out to the limit of the UK continental shelf (over 17%) was covered by the above protected sites designations.

On 31 May 2019, Defra announced the designation of a third tranche of 41 MCZs to complete the Marine Protected Area network in Secretary of State waters, and further contribute to an ecologically coherent network of Marine Protected Areas in the North East Atlantic. Within the south west inshore and offshore marine plan areas, this saw the addition of 18 new MCZs.

Connectivity and the creation of a coherent network of protected sites is a key aim of national and international legislation and conventions, including the MCAA, MSFD and OSPAR Convention.

A number of protected sites straddle marine plan boundaries or cross boundaries with adjacent marine planning authorities. Many protected species are highly mobile and/or widespread, with populations extending beyond individual plan boundaries,

UK administrative boundaries and UK marine space. Management of protected sites and species therefore requires cross border cooperation with other marine plan areas, other UK administrations, other EU countries and countries beyond the EU.

Marine plans can potentially affect protected sites or species (positively or negatively) by influencing the type, intensity, timing or location of activities within the plan area that could potentially affect features of protected sites or protected species.

Protected sites may incorporate benthic and intertidal areas and many sites rely on the maintenance of geomorphological, sedimentary, coastal and ocean processes to retain their special character, which could be affected by decisions within marine plans. Protected species may interact with a wide variety of economic activities at the coast and in both the south west inshore and offshore plan areas, for example, dredging, aggregates, energy and shipping. Decisions about where, when and how such activities take place are central to the development of marine plans and link with other topics within this report.

There are also links to other areas of the biodiversity topic, as numerous species of fish, birds, marine megafauna and other organisms are protected in their own right and/or are features of protected sites.

11.2.2 Benthic and Intertidal Ecology

A wide variety of habitats and species are found within the south west inshore and offshore marine plan areas, many of which are of conservation importance or can be found within areas designated for protection. There are numerous influences on the varying species and habitat types, including damage or disturbance from marine energy developments, interactions with fishing and pollution to name but a few. Consideration must be given to large scale and widespread increases in proposed coastal and offshore developments, increasing effects predicted from climate change and ongoing designation of protected areas.

11.2.3 Fish and Shellfish

Regarding fish and shellfish, the specific species and issues requiring consideration vary depending on the marine plan area. For example, the south west marine plan areas contain high numbers of sea lamprey and twaite shad. Fish stock health is generally only monitored for commercially fished species, with little information on non-target species. Estuaries and coastal areas are important for migratory fish species, such as sea lamprey, as well as providing important nursery and spawning habitat for many other fish and shellfish. Large areas of inshore and offshore plan areas provide important nursery and spawning habitat for a range of species. There is a notable interaction with commercial and recreational fishing, such as the decline in mackerel for recreational fishing in the South West due to commercial fishing of mackerel for fish meal production. However, other economic activities have the potential to interact with this topic, including dredging, aggregate extraction, energy generation and distribution through subsea cables, shipping and water quality in particular.

11.2.4 Marine Megafauna

Numerous sensitive marine megafauna receptors can be found in the south west marine plan areas, including harbour porpoise, harbour seals, grey seals and leatherback turtles. There are numerous strategic level concerns for cetaceans, seals, turtles and basking sharks in the south west marine plan areas, with drivers including climate change, anthropogenic influence from offshore developments, fishing and marine vessel activity, marine pollution and litter.

11.2.5 Plankton

Long term observations suggest that plankton are generally healthy and subject to few anthropogenic disturbances. Increasingly effects are predicted on plankton from climate change due to increasing sea temperatures and ocean acidification. With an increase in large scale and widespread coastal and offshore developments, plankton may be considered increasingly at risk, while changes to marine legislation mean that plankton has become increasingly important as a proxy for assessing the condition of pelagic habitats.

11.2.6 Ornithology

The effects of the South West Marine Plan on ornithology are likely to be more significant in the inshore marine plan area. However, activities within the offshore area can affect migration routes and feeding areas of various species. In addition, seabirds group together forming rafts when moulting. They are flightless during this time, making them vulnerable.

Each of the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area are important for seabirds in their own right, with a host of international and national designations demonstrating the areas importance. All of the marine plan areas are under pressure from various forms of development and these could have impacts on bird habitat and species. Activities associated with leisure and recreation can also impact on some seabird species, largely through disturbance to nesting sites or disturbance to feeding birds by recreational boat traffic.

11.2.7 Invasive Non-Native species

Invasive non-native species are found in all four inshore marine plan areas with information relating to the offshore area being limited. Pathways for the introduction and/or spread of invasive non-native species are present in all seven marine plan areas, hence it is a potential risk and an important consideration for the development of all marine plans. Notable introduction pathways for invasive non-native species are commercial shipping, recreational boating, aquaculture stock imports and natural dispersal.

Box 19: Biodiversity Baseline Issues.

Baseline issues specific to the inshore and offshore south west marine plan areas:

- The south west inshore marine plan area contains numerous records of species FOCI, including lagoon sand shrimp *(Gammarus insensibilis)*, starlet sea anemone *(Nematostella vectensis),* lagoon sea slug (Tenellia adspersa), tentacled lagoon worm *(Alkamaria romijni),* pink sea fan *(Eunicella verrucosa),* maerl *(P. calcareum),* short-snouted seahorse *(Hippocampus hippocampus)*, long snouted seahorse *(Hippocampus guttulatus),* peacock's tail algae *(Padina pavonica),* sunset cup coral *(Leptopsammia pruvoti),* stalked jellyfish *(Lucernariopsis campanulata),* lagoon sea snail *(Paludinella littorina)* and ocean quahog. Habitat FOCI include blue mussel beds, and estuarine rocky habitat (e.g. in the Tamar estuary), maerl beds and seagrass beds (e.g. around Falmouth Bay) and areas of potential Sabellaria spinulosa reef (e.g. north coast of Devon), fragile sponge and anthozoan communities on subtidal rocky habitat, intertidal boulder communities, native oyster beds, honeycomb reef, seapens and burrowing megafauna, sheltered muddy gravel, subtidal sand and gravels and tide swept channels (Biodiv_262)
- Species FOCI for the south west offshore marine plan area include ocean quahog and fan mussel. Habitat FOCI are largely made up of subtidal sands and gravels (Biodiv_259)
- UK principal habitats of importance include extensive areas of coastal saltmarsh (Biodiv_648)
- Deep sea habitats (e.g. biogenic reefs, boulder habitats or sponge aggregations) are vulnerable to impacts such as habitat loss or damage from mobile fishing gear (bottom trawling) and smothering of sediment or habitat damage from marine litter (mainly discarded nets). Expansion of deep sea fisheries will increase the likelihood of such impacts (Biodiv_487)
- Potential for impacts from large scale coastal development including tidal lagoons (i.e. Bridgwater Bay, Somerset). Impacts in the inshore marine plan area may include habitat loss or change, introduction of hard substrate as artificial reefs and changes in hydrodynamics affecting marine organisms (Biodiv_501, 514)
- Shellfisheries impact on intertidal and subtidal rocky and estuarine habitats within the inshore marine plan area, including removal of non-target species and habitat damage or loss, including sensitive reefs and maerl beds (Biodiv_562-564)
- Coastal lagoons within the inshore plan area have been particularly impacted by infilling and marine construction (Biodiv_574)
- The rich waters of the Bristol Channel Approaches provide ideal conditions for a diverse mix of 17 cetacean species which frequent the area, including common dolphin and long-finned pilot whale (Biodiv_762)
- Ongoing management of the cliffs' characteristic woodland cover, tackling issues such as a spread of invasive non-native species (including rhododendron), replanting with broadleaves, and conserving areas of historically important exotics associated with the Luttrells' 19th century landscape enhancements. This includes replanting with exotic species where appropriate and the use of climate resilient species, such as Coastal Redwood (Biodiv_763).

Baseline issues ubiquitous to the south west, north west and north east inshore and offshore marine plan areas and the south east inshore marine plan area:

Protected Sites and Species:

- Marine Protected Areas are an important tool for protecting marine habitats. Sustainable Development Goal 14 states that 10% of the sea should be protected by 2030, while OSPAR set the goal of establishing a network of Marine Protected Areas across the North East Atlantic. Marine Protected Areas can be important biodiversity reservoirs, providing habitats for species at risk from overfishing, and acting as buffers for climate-related stress. While currently only approximately 3% of global seas are protected, the UK has taken a leading role: 23% of UK waters are protected (Biodiv_771)
- 98% of SACs, 99% of SPAs and 87% of SSSIs intersected with records of invasive non-native species. Higher risk invasive non-native species, were found to intersect with 90% of SACs, 96% of SPAs and 75% of SSSIs. A lower level of recording was thought to account for the differences between SSSIs and the other protected sites (Biodiv_776).

Benthic and Intertidal Ecology:

- Effects of pollution from marine activities (aquaculture, shipping, oil and gas, marine construction) are had on benthic and intertidal habitats and species, including cumulative impacts from increasing levels of contaminants. Intertidal and estuarine species and habitats are at particular risk from a variety of pollutants entering the marine environment through point discharges, diffuse atmospheric and riverine pathways and accidental spillages. Contaminants such as heavy metals, pesticides and organochlorines (such as polychlorinated biphenyl) can reach sublethal to lethal effects in marine organisms and lead to bioaccumulation in higher trophic levels. Persistent contamination can reduce biodiversity, resulting in impoverished communities composed of pollution-tolerant organisms (Biodiv_420)
- Reduced prey availability for some benthic and intertidal organisms due to impacts of ocean acidification on plankton increasingly affecting food webs (Biodiv_421)
- Change in habitat condition and habitat loss through sea level rise, coastal squeeze, storm events from climate change and creation of coastal defences. This is particularly a concern in sensitive intertidal areas, such as the Severn Estuary which is facing significant habitat loss due to coastal squeeze. Risk also includes insufficient habitat creation (Biodiv_423)
- Impacts to subtidal sediments from mobile fishing gear (such as bottom trawls and dredges) can cause damage and create disturbance resulting in loss of benthic habitats and species (Biodiv_425-427)
- Increasing levels of pollution and nutrient enrichment within benthic and intertidal sediments, particularly in the north west, south east and south west marine plan areas (Biodiv_571)

- Deteriorating intertidal sediment habitats in all inshore plan areas due to cumulative effects associated with historical land claim, presence of coastal structures, the presence of invasive non-native species and beach litter (Biodiv_470-471).Impacts on subtidal sediments from offshore industry (e.g. aggregate extraction, dredging, and offshore energy production) is an issue. At various locations near large ports, subtidal rocky habitat has been lost due to the provision of infrastructure (mainly coastal), other construction or via smothering from dredged deposits (Biodiv_542).

Fish and Shellfish:

- As novel consumer products, nanomaterials and pharmaceuticals are introduced to the UK economy and healthcare system, there is a future potential for increasingly complex chemical mixtures to enter coastal and estuarine ecosystems adding to the legacy chemicals residing in marine sediments (Sheahan et al. 2013). The potential impacts of these diverse chemical mixtures on marine life and fisheries warrants further monitoring (Biodiv_772)
- Further work is required to address the potential long-term impact of light pollution on commercial fish species and marine life in general. Considering the stress aspect of such physical factors, together with other physical stressors (e.g. noise) and chemicals, the cumulative health impacts need to be addressed for marine life in coastal regions (Biodiv_774)
- In the UK, new fishing opportunities could arise due to increased abundances of warm-water species (e.g. red mullet), while cold adapted species (e.g. cod) may move northward or decline in their abundance within UK waters. Ocean acidification could also damage shellfish stocks (Biodiv_775).

Marine Megafauna:

- Impulsive sound sources have been observed to cause temporary displacement of small cetaceans (e.g. harbour porpoise), increased physiological stress in some fish species (e.g. European seabass), and developmental abnormalities in invertebrate larvae. While effects on individual animals have been shown for a number of species, there is uncertainty over whether and how the effects of sound on individuals are translated to the population or ecosystem scale (Biodiv_792)
- Underwater noise from human activities can affect marine organisms from fish to marine mammals in a variety of ways, from masking sounds used to communicate and find food, to physical injury and even death (Biodiv_799).

Non-Indigenous Species:

- The proliferation of invasive non-native species can also prompt unwelcome changes in the wider ecosystem that climate change might further exacerbate. Quagga mussels are an example of a successful invader. These filter feeders multiply at such a rate that they strip phytoplankton and nutrients from freshwater systems, significantly altering the food web and habitat. They also block pipes and filters, causing problems that water companies must pay to resolve (Biodiv_745)

- Broad-scale changes in habitats and species are increasingly likely, resulting from rising sea temperatures due to climate change. Effects include loss of habitat, declining biodiversity and increasing abundance of invasive non-native species, ultimately altering the structure of communities and ecosystem processes (Biodiv_428).
- In some areas of the north west, south east and south west marine plan areas, invasive non-native species such as common cordgrass (*Spartina anglica*) have led to widespread changes to saltmarshes and mudflats (Biodiv_511-512).

Ornithology:

- The UK seabird indicator stands at 22% below the 1986 baseline, with most of this decline occurring since the mid-2000s. Three species – Arctic terns (mainly in England), guillemots and razorbills – have increased since the beginning of the index and two species have strongly declined (kittiwakes and Arctic skuas). The remaining eight have shown no change or a weak decline (Biodiv_765)
- Climate change is considered to be one of the primary causes of seabird declines, through indirect effects via changes in prey availability and abundance, and through direct effects such as increased mortality from the increasing frequency and intensity of extreme weather events. These processes will interact with current drivers such as unsustainable fisheries, pollutants, marine renewables and disease. Overall negative relationships between temperature and the productivity of seabirds has been shown for kittiwakes, fulmars and puffins, as well as common, Arctic and little terns (Biodiv_766)
- Habitat suitability around the UK for seabirds is projected to shift northward over the next century and birds' distributions may shift with changing conditions. Declines in European ranges are also predicted – with Leach's storm petrels and Arctic skuas projected to come close to or reach UK extinction by 2100 (Biodiv_767)
- Seabirds undergo their moult whilst out on the water. During this time, they are completely flightless and therefore their ability to move out of the way of danger is restricted. Some species, such as razorbills and guillemots, will stay with their young on the water during this time – should they become separated due to disturbance, the youngster's chance of survival is significantly reduced (Biodiv_796).

11.3 Potential Interactions with other SA Topics

Potential interactions which may occur between this SA topic and other topics considered within the creation of the South West Marine Plan are considered below, separated by SA sub-topic.

Potential interactions which may occur between the protected sites and species SA sub-topic and other topics include:

- there are links to other areas of the biodiversity SA topic, as several species of fish, birds and marine megafauna are protected species and/or are protected as part of the protected sites network
- protected sites incorporate benthic and intertidal areas and many sites rely on the maintenance of geological and/or coastal and metocean processes so links to the water and geology, substrates and coastal processes topics are also directly relevant
- activities far inland may affect protected species, particularly birds and migratory fish, if they affect migration, breeding or feeding areas or water quality
- there is the potential for invasive non-native species to directly impact protected sites and species by competing with native species for habitat, food sources or directly through predator-prey, disease or parasite interactions
- marine litter has widespread implications for fish, birds, marine mammals, turtles and other protected species in terms of ingestion and entanglement. The impact of microplastics on marine food webs and the marine environment in general is also an increasing concern
- potential interactions with climate change and associated physical changes (including coastal processes, sea level rise and coastal squeeze) is a key interaction potentially affecting sites and species. Climate change could have a number of impacts including altering predator and prey dynamics due to a change in the timing of key life cycle events or the distribution of species
- changes in the geographic range or distribution of species may affect competition for food and habitat, as more southerly species move northwards. Climate change may alter the distribution or extent of key habitats or alter food webs
- ocean acidification is linked to climate change and there has been an observed decrease in seawater pH; this will have impacts on marine food webs, with possible impacts had on shellfish biology as a result of altered shell formation
- coastal squeeze may affect the extent or quality of protected habitats and/or the species which rely on them
- many protected species are highly mobile and/or widespread and may interact with a wide variety of economic activities at the coast and within inshore and offshore plan areas. These might include, for example, dredging, aggregates, energy, shipping and commercial fishing
- protected sites provide resources for a variety of economic activities such as fishing (commercial and recreational), birdwatching, diving, ecotourism, and recreational sea uses
- designated sites may have implications for access to heritage assets and/or the conduct of archaeological investigations.

Potential interactions which may occur between the benthic and intertidal ecology SA sub-topic and other topics include:

- one of the key controlling factors in the formation of benthic and intertidal habitats is the underlying sediment composition. Sediments are discussed more fully in the Geology, Substrates and Coastal Processes section and geo-conservation is an important consideration
- there are wide-reaching implications of climate change driving changes in habitat range and species distribution, including effects of increasing sea surface temperature and changing coastal processes influencing habitat conditions, plus sea level rise and coastal squeeze
- indirect impact of ocean acidification as a result of climate change on plankton causes issues with prey availability for all higher trophic levels
- marine pollution, nutrient enrichment and other changes to water quality (both positive and negative) could have widespread implications for benthic and intertidal habitats and knock-on effects on higher trophic levels including fish, birds and marine mammals
- effects from pollution and marine activities, for example, fishing and dredging, are closely linked to levels of economic activity and wider market forces
- benthic and intertidal areas provide important goods and services which support a wide range of economic activities, including fishing, aquaculture and tourism
- economic activities such as fishing, dredging, drilling, offshore development, flooding and erosion risk management may also adversely affect benthic and intertidal habitats and ecology through, for example, habitat damage or loss, and pollution
- areas of landscape importance may include intertidal areas whilst underwater seascapes interact with benthic habitats and ecology
- historic and cultural assets may be located in benthic or intertidal areas. Efforts to protect and conserve benthic and intertidal areas may have benefits for historic assets, and vice versa
- invasive non-native species have an impact on species abundance and distribution as they can outcompete native species
- benthic and intertidal ecology interact with fish, shellfish, marine megafauna, birds and other biological factors through food webs and the provision of habitats for all life cycle stages
- inshore areas may be particularly important during key life cycle stages for certain species of fish, shellfish, birds and marine megafauna. These key life cycle stages include, but are not limited to, during periods of migration, breeding and calving
- some benthic and intertidal areas are contained within protected sites as part of the Marine Protected Area network and reference should be made to the Protected Sites section for further information.

Potential interactions which may occur between the fish and shellfish SA sub-topic and other topics include:

- fish and shellfish most directly interact with the fishing industry (commercial and recreational) and aquaculture. Fishing and fish stock health have an

interdependent relationship. This includes the fish stock health of both target and non-target species
- other economic activities also interact with fish and shellfish, including dredging, aggregates, energy and shipping
- aquaculture may lead to the escape of native and invasive non-native species, both of which can interact with other native species
- aquaculture of native shellfish species may also affect wild populations through, for example production of pseudofaeces, smothering of benthic habitats and through competition for habitats and food
- fish and shellfish interact with benthic and intertidal ecology, which provide food sources and important habitats for all life cycle stages
- fish and shellfish interact with plankton, which provide food sources both directly and indirectly. Fish and shellfish also comprise a substantial component of the plankton community as eggs, larvae and during early life stages
- inshore areas may be particularly important during key life cycle stages, for example, during migration and breeding. Some protected sites are important to fish stocks, while specific fish species are protected under legislation which protects a wide range of marine species
- water quality may directly affect fish and shellfish health, or indirectly affect prey species or habitat quality. Improvements to water quality will have beneficial impacts
- fish may ingest marine litter, or impacts from marine litter may affect prey species
- invasive non-native species may affect fish and shellfish directly through competition, predation or by bringing disease/parasites, or indirectly by affecting food sources or the availability of habitat. The occurrence and effects of this can be exacerbated by climate change.

Potential interactions which may occur between the marine megafauna SA sub-topic and other topics include:

- wide-reaching implications of climate change driving changes in marine megafauna distribution, including effects of increasing sea surface temperature on habitat conditions and prey availability, such as plankton and fish, the latter has been particularly evident in the declining availability of sandeels
- indirect impact of ocean acidification on plankton causing issues with prey availability for all higher trophic levels
- marine litter also has widespread implications for fish and birds in terms of ingestion and entanglement
- effects from underwater noise on cetaceans is closely linked to economic activity in coastal and marine areas
- there are social and economic interactions with marine megafauna, including economic and wellbeing benefits from wildlife tourism and recreation. The benefits of experiencing the natural world on peoples' wellbeing and mental health ('ecotherapy') is endorsed by a number of organisations and the ability to watch cetaceans and seals can be seen within this context, bringing people into contact with both the sea in its broadest context whilst observing impressive marine mammals and providing niche local income and employment opportunities

- commercial fisheries have a direct impact on marine megafauna through entanglement and bycatch in fishing nets and collisions with commercial fishing vessels. There are also indirect impacts through competition for food resources between marine megafauna and commercial fish species.

Potential interactions which may occur between the plankton SA sub-topic and other topics include:

- changes in plankton abundance and distribution are directly linked to rising sea temperatures, resulting in effects on higher trophic levels including benthic and intertidal ecology, fish, birds and marine mammals. Effects may be linked to changes in fish distribution and potential fish breeding / foraging success
- future warming is likely to alter the geographical distribution of primary and secondary pelagic production, affecting ecosystem services such as oxygen production, carbon sequestration and biogeochemical cycling
- the impact of ocean acidification on plankton will also reduce or change prey availability for higher trophic levels, increasingly affecting food webs
- harmful plankton / algal blooms may in turn change ecosystem food web and nutrient cycling dynamics. Possible impacts include oxygen depletion in the water column, arising from stimulation then die-off of phytoplankton blooms. This could have lethal and sublethal impacts on fish and invertebrates, and increase turbidity in the water column. Subsequently, the photic zone may be reduced and other photosynthetic organisms shaded out. Oxygen levels in surface sediment could also be depleted. This could result in anoxia, which could have lethal impacts on invertebrates and higher trophic levels, such as birds
- nuisance or potentially toxic species, for example, *Dinophysis,* which form harmful algal blooms can lead to increasing ecotoxicity in shellfish, which can cause widespread mortality for birds and can lead to health issues among human consumers of shellfish
- harmful algal blooms can have a direct commercial impact on the aquaculture industry (shellfish and fish farms) and this is likely to become more of an issue as these food sources become of increasingly greater importance in the future. This may also lead to strengthening of shellfish toxin regulatory levels which will have a large impact on shellfish harvesting activities.

Potential interactions which may occur between the ornithology SA sub-topic and other topics include:

- there are notable interrelationships with water and coastal processes, economic and recreational activities and climate change. As the climate around the UK changes, the distribution of habitats and bird species is likely to change. Climate change has already led to a substantial shift in the distribution of waders, for example, with clear evidence of a south westward to north-eastward shift in the centres of abundance of some wader species. Seabird breeding failure in the North Sea has been linked to variations in food availability as a result of increased sea temperatures
- changes in salinity may also affect waterbirds using estuaries
- there are key interactions with coastal processes including flooding. There is likely to be loss of intertidal feeding resource through coastal squeeze

- shorebirds such as waders which feed on mudflats, sandy beaches and rocky shores are at risk of negative changes from modification of coastal processes. Additionally, breeding common terns (for example, on the Isles of Scilly) are sensitive to flooding as they nest on rocky islets that can be flooded out during thunder storms or storm surges
- there are clear interrelationships between economic activity and bird habitat and species, and there is the potential for cumulative impacts to occur across industry. Resultant impact interactions, for example, increased shipping and offshore wind farms, could cause significant impacts
- impacts from a variety of economic activities such as renewable energy and shipping include population level impacts of displacement and collision risk
- potential threats exist in relation to seabird bycatch from driftnet and gillnet fisheries in English waters; the effects of bait digging on the food chain; collision effects from structures in the sea such as windfarms; and habitat disturbance and effects on birds due to depletion of prey species
- positive examples include marine birds providing an important source of income for local economies since many species have a wide appeal to people, such as Atlantic puffins which draw visitors
- there are also negative interactions with relation to aquaculture, with marked reductions in waterbird survival being shown to occur as a result of shellfish harvesting
- most species of waterbird, but especially waders, can be expected to be affected by habitat loss due to activities such as coastal defence, land claim, construction of tidal barrages, and the construction and extension of marinas or harbour developments
- activities associated with leisure and recreation can impact on some seabird species, largely through disturbance to nesting sites or disturbance to feeding birds by recreational boat traffic
- Little terns are particularly susceptible to disturbance from people as they nest on beaches used for recreation
- invasive non-native species are one of the biggest threats to biodiversity. This specifically applies to islands where species are less well adapted to sudden introductions. For example, the south west inshore marine plan area supports a number of burrow nesting birds, including Manx shearwater, storm petrel and Puffin, which are vulnerable to predation from invasive non-native species, especially rats
- without suitable biosecurity measures, developments or proposals within the marine environment could potentially increase boat traffic within close proximity to these sites putting them potentially at risk from re-introduction
- there are also a number of non-indigenous marine species which are colonising the UK coastline as a result of their inadvertent introduction as a result of boat traffic.

Potential interactions which may occur between the invasive non-native species SA sub-topic and other topics include:

- invasive non-native species can have adverse environmental, economic and social impacts by competing with native species for habitat and food sources or directly through predator-prey interaction, and transmission of disease or

parasite interactions. This can impact aquaculture as well as both commercial or recreational fishing

- invasive non-native species may also cause fouling of marine structures such as ports, marinas, and intakes and outfalls
- economic and social activities are also pathways for the introduction or spread of invasive non-native species. This may occur at marinas, through activities such as angling, or through ejection of ballast water
- whilst the UK is currently recognised as being free of *Gyrodactylus salaris* (a parasite of salmon, trout and other freshwater fish), evidence suggests that this species presents one of the biggest threats to the wild salmon population. The likely sources of introduction of this parasite to UK waters are via aquaculture (through imported fish) and on vessels or gear used by recreational anglers and/or boaters who have visited infected areas. There are therefore potential links between this SA sub-topic and fish and shellfish, fishing and aquaculture, recreation, and ultimately, the economy.

11.4 Likely Evolution of the Environment over the South West Marine Plan Duration

Within the timeframe of the South West Marine Plan implementation, there are likely to be the following changes to the environment which may affect biodiversity:

- increasing anthropogenic carbon dioxide levels will result in changes in plankton abundance and distribution, having negative consequences for higher trophic levels, including to benthic and intertidal ecology, as the distribution and reproduction of benthic and intertidal species is often linked to plankton either due to a planktonic larval stage or because plankton forms a significant part of their diet
- increasing pressure from climate change - most notably changes in sea temperature influencing species distribution (although it is still unclear how this will affect subtidal habitats in particular). As temperature increases, some warm water, rocky shore species will continue to advance northwards and native cold water species will be lost from southern areas where their upper thermal tolerance levels are exceeded, such as the warm water limpet *Patella depressa* which is now more common than the cold-water species, *Patella vulgata,* at many locations in southern England
- establishment of invasive non-native species which are likely to further expand their range in UK waters, such as the barnacle (*Elminius modestus*) and wireweed (*Sargassum muticum* colonising) intertidal rocky habitats and the non-indigenous common cordgrass (*Spartina anglica*), which changes the habitat structure of saltmarsh and mudflat habitats
- high levels of coastal erosion and the resulting construction of hard coastal defence structures have led to reduced sediment input and intertidal sediment habitats being increasingly confined in estuarine areas. Such coastal squeeze is likely to increase as climate change results in increasing rates of sea level rise. Intertidal habitats such as saltmarsh, mudflats and rocky habitats continue to be at risk

- impacts from mobile demersal fishing activities, such as trawling, have severely impacted, and continue to impact, subtidal and shelf habitats, and to a lesser extent, rocky habitats. Such activities have caused damage to these habitats and led to the disappearance of many large slow-growing and/or fragile invertebrate species, including biogenic reefs such as horse mussel beds and *Sabellaria* reefs
- there is continued pressure on marine habitats (although the intensity and likely distribution of anthropogenic effects are not clear) – for example, bottom trawling and aggregate extraction, in addition to current and predicted levels of construction in the offshore renewable energy sector.

12 Data Gaps

The following table highlights the key data gaps which are recorded within the SA Database.

Table 3: Key Data Gaps.

SA Sub-Topic	Key Data Gaps
Cultural Heritage	
Heritage Assets Within Marine Plan Areas	There is currently no publicly-accessible, comprehensive and authoritative mapping of the following: • heritage assets in offshore marine plan areas • potential presence of pre-Late Glacial Maximum heritage assets in inshore or offshore marine plan areas • potential presence of post-LGM heritage assets in inshore or offshore marine plan areas. Partial and/or non-mapped coverage is provided by the results of Marine Aggregate Levy Sustainability Fund Regional Environmental Characterisation surveys and secondary sources. Previous attempts at national mapping, such as Waterlands, have demonstrated problems and limitations • shipwrecks subject to the Protection of Military Remains Act (PMRA) 1986 • known air crash sites subject to the PMRA 1986 • discoveries of marine heritage assets since the introduction of MCAA 2009. Partial coverage could be derived from reports made under sector- and scheme-specific Protocols for Archaeological Discoveries • heritage assets recorded, investigated or published as a result of licenses issued by the MMO • the role of the marine historic environment is rarely identified specifically in the official statistics presented in Taking Part and Heritage Counts. This prevents quantification of the baseline for this issue and impedes the identification of actions through which marine planning could augment the social and economic benefits of the marine historic environment.
Heritage Assets Adjacent to Marine Plan Areas	• there is an absence of comprehensive data on the social and economic value of the marine historic environment and coastal heritage assets, especially where aspects of value are attributable to the character of marine plan areas.
Geology, Substrates and Coastal Processes	
	• despite some progress in recent years, there is relatively little information on seabed composition from very shallow waters and gaps still exist in coverage. However, the

Table 3: Key Data Gaps.

SA Sub-Topic	Key Data Gaps
	coastal zone is so important in relation to erosion, flooding, habitats, and commercial uses, that this is a key area for future work • coastal response to sea level rise is strongly determined by site-specific factors and usually it is these factors that determine the coastal response, rather than a global change in sea level or a regional change in wave climate. Predictions of general coastal response due to climate change therefore have low confidence, and more detailed local or regional studies of coastal response to climate change will increase confidence in predictions • understanding the rates and distribution of coastal erosion and changes to beach dynamics in response to climate change and sea level rise will be an area for new research and monitoring. The importance of the coastal zone in terms of coastal erosion and flooding, habitats and commercial uses, make this a key area for future work • more information is needed on how sea level rise will affect both sediment supply, and sediment transport on UK coasts, and the implications for coastal margin habitats • local responses to climate change will vary in relation to climate change factors, for example, sea level rise and changes to wave heights and directions. There is only low confidence of any predictions at present • whilst not strictly a data gap, it should be noted that there is no consistently adopted practice for how to assess impacts on geological features through marine planning.
Seascape and Landscape	
	• no key data gaps identified.
Water	
Tides and Currents	• data gaps exist for the hydrodynamics, particularly related to climate change, and the interactions between the rivers draining the Somerset levels and the Bristol Channel.
Marine Litter, Water Temperature and Salinity	• seabed litter has been surveyed at only a few sites and data is sparse, limiting the possibility for assessments of changes observed in quantities of litter over time or between regions. The available data indicates that there is a generally low, but variable, abundance of litter on the seabed ranging from 0 to 17 items per hectare. Surveillance of seafloor litter has been included in the UK Programme of Measures. This data should be used to drive targets in the future

Table 3: Key Data Gaps.

SA Sub-Topic	Key Data Gaps
	• there are currently no agreed assessment tools to quantify the impacts on marine life at the population level from the presence of marine litter. Impacts have been particularly recognised on marine mammals, seabirds and turtles. Surveillance of litter in the stomach of fulmars has been included in the UK Programme of Measures. This data should be used to drive targets in the future • evidence regarding the potential for effects on organisms from microplastics is uncertain at present, including the potential for toxicity effects of chemicals associated with the plastics relative to chemical exposure from other sources, for example, in sediments and the water phase • data on the trends in salinity indicate very variable patterns and predictions about what will occur in the future are unclear • microplastic shedding, released when clothes are washed: whilst the impacts are not yet fully understood, the UK Government have commissioned research to better understand how plastic particles from a range of sources including synthetic materials enter waterways and the marine environment, and to analyse their impact.
Water Pollution and Water Quality	• current spatial resolution of water quality monitoring is inadequate to assess impacts on all features in Natura 2000 Transitional and Coastal (TRaC) waters.
Air Quality	
	• air quality is not routinely monitored at offshore sites so it is difficult to predict the future trends of air quality within offshore plan areas. There is currently a paucity of data from which to generate a strategic understanding of where particular air quality sensitivities exist. As a consequence, it will be difficult to determine plan impacts on particular areas for air quality • a lack of data is available regarding Natura 2000 sites which are sensitive to air pollution.
Climate	
	There are a number of key data gaps, relating to current knowledge gaps as well as uncertainties in climate change predictions and impact: • knowledge of the impacts of ocean acidification on marine species and their ability to adapt to increased acidity is limited • coastal responses to changes in sea level, extreme storms and waves are complex and localised – Shoreline Management Plans (SMPs) in the UK provide a large-

Table 3: Key Data Gaps.

SA Sub-Topic	Key Data Gaps
	scale assessment of the risks associated with coastal processes that result in both flooding and erosion and presents a policy framework to reduce these risks • regional variability of sea-level changes are poorly addressed at the current resolution of Global Climate Models used for climate projections • an increased frequency in storms and storm surges (including an increase in wave height) which can be directly attributed to climate change, remains unproven in the most recent probabilistic projections for the UK • a lack of long-term records from deep sea habitats means that there is no baseline against which to assess climate change impacts • improved knowledge of how regional patterns in rainfall and winds will change over the next century is needed to understand potential changes to stratification in shelf seas • there is a lack of information on the potential effects of climate change and ocean acidification on fish.
Communities, Health and Wellbeing	
Health and Wider Determinants of Health and Effects on Protected Equality Groups	• no key data gaps are identified, however, it should be noted that data and issues relating to coastal communities are difficult to map, particularly at the scale of the marine plans and this is a difficulty identified within the collation of data.
Effects on Communities (Including Employment and Skills)	• although some data is available for employment in the fisheries, marine aggregates, offshore wind and tourism, most employment data is collected from a terrestrial perspective which can make it difficult to isolate marine influences on data metrics • it should be noted that data and issues relating to coastal communities are difficult to map, particularly at the scale of the marine plans and this is a difficulty identified within the collation of data.
Economy	
Ports and Shipping	• automatic identification system (AIS) data should be cross checked against radar data from ports' Vessel Traffic Service as AIS data alone can contain errors and misleading information. More details of the error typology can be found in the MMO produced documentation on mapping shipping from AIS data.

Table 3: Key Data Gaps.

SA Sub-Topic	Key Data Gaps
Fisheries and Aquaculture	• none specifically identified through the evidence base work completed so far although the future of both the fishing and the aquaculture industries is uncertain.
Leisure / Recreation and Tourism	• there is a lack of recreational activity data in general – where activities occur, participation levels, activity intensity and frequency. Improving this both for management and marine planning would be useful.
Marine Manufacturing and Defence	• no key data gaps identified.
Aggregate Extraction and Seabed Assets	• the aggregate resources on the UK continental shelf are being mapped by the British Geological Survey on behalf of the Crown Estate. However, this process is still ongoing (the first reports have been produced by the British Geological Survey covering the Scottish coasts, Welsh coasts, South English coasts and East English coasts) and is not complete.
Energy	• further research is needed to develop a better understanding of the potential impacts that newer renewable energy technologies might have on potentially sensitive environmental features. The cumulative impact of tidal lagoons at multiple locations is unknown and extensive additional work is needed before the effect on flooding, biodiversity and sedimentation transport is fully understood. The Offshore Renewables Joint Industry Programme is a UK-wide collaborative programme of environmental research with the aim of reducing consenting risks for wave, tidal stream and tidal range projects. Their Forward Look report[10] (third version) dated November 2017 includes a prioritised list of strategic research projects to address key Environmental Impact Assessment (EIA)/HRA issues. This research programme and its findings is likely to be useful evidence that can be used as part of the SA assessment stage. On 10 February 2016 the Government announced an independent review into the feasibility and practicality of tidal lagoon energy in the UK. This review was published[11] in January 2017 and concluded that tidal lagoons can play a cost effective role in the UK's energy mix • the wide scale introduction of hard structures into soft sediment environments could have cumulative impacts of

[10] ORIJIP (2017) Ocean Energy Forward Look 3 – November 2017
[11] The Role of Tidal Lagoons - https://hendryreview.files.wordpress.com/2016/08/hendry-review-final-report-english-version.pdf

Table 3: Key Data Gaps.

SA Sub-Topic	Key Data Gaps
	this on the seabed and these potential impacts are not well understood • the Scottish Government have given permission for a pilot project of five floating wind turbines to be installed in the North Sea off the coast of Peterhead. The first of the wind turbines was put in place in 2017 • the extraction of inshore shale gas may require some coastal or marine infrastructure but the scale and potential locations of this infrastructure is yet unknown • information on over 500 potentially prospective storage structures is available through the CO_2 Stored database, which makes available some of the information on the UK Storage Appraisal Project commissioned by the Energy Technologies Institute, and which is now being updated by The Crown Estate and the British Geological Survey.
Biodiversity, Habitats, Flora and Fauna	
Protected Sites and Species	• information on the condition of protected sites and species may not be up to date. Legislation requires condition assessments to be carried out every six years, but the environmental condition could alter within that time.
Benthic and Intertidal Ecology	• the extent of marine litter within the UK seas and the effects of such litter on the marine environment are not presently robustly characterised • there is still a lack of understanding of the long term national habitat and population (species) level effects of climate change • charting Progress 2 reports that only 10% of the UK continental shelf has been mapped and indicates that many of the available habitat descriptions have been modelled rather than directly observed/ground truthed. Greater accuracy, resolution and scope are needed for future habitat mapping to reduce uncertainty and better describe habitat extent, distribution and status. Tools are being developed to assist with this, such as MSFD Habitat Area Indicator Development (ME5318) • the level of vulnerability and recoverability of habitats will differ and are not always fully known, so worst case scenario is generally employed for conservation policy and in site-specific impact assessment • some uncertainty over which habitats are at risk from fishing methods which physically affect the seabed, including gaps in data on where fishing activity takes place • over the longer term there will be a need to understand the energy flows within food web and the structure of food

Table 3: Key Data Gaps.

SA Sub-Topic	Key Data Gaps
	webs (size and abundance), development of detailed baseline information and understanding of natural variation, for assessing the quality/condition of benthic habitats as well as habitats resilience towards pressures exerted upon them • thresholds for habitat and population level (species) quality status should be regularly reviewed and adapted at a strategic level to contribute to meaningful targets for good environmental status under the MSFD • more work is needed to define the ecological value of areas in order to make strategic policy level and individual development level decisions.
Fish and Shellfish	• data relating to Maximum Sustainable Yield (MSY) or stock health / status is usually only available for commercially fished species (unless a species is also a protected species, such as some sharks) • the extent of marine litter within the UK seas and the effects of such litter on the marine environment are not robustly characterised. Ingestion of or entanglement with marine litter may lead to damage or death of individuals and possible reproduction / population impacts • lack of understanding of the effects of climate change on fish and shellfish stock distribution, spawning, reproduction and populations • further work is required to address the potential long-term impact of light pollution on commercial fish species and marine life in general. Considering the stress aspect of such physical factors, together with other physical stressors (such as noise) and chemicals, the cumulative health impacts need to be addressed for marine life in coastal regions.
Marine Megafauna	• lack of survey data for the offshore south west marine plan area means that information on the presence of deep diving species, such as sperm whales and beaked whales, may be incomplete for this large and in places deep plan area • large-scale surveys have provided key data on distribution and total abundance for certain species. However, more information needed on the ecology of most cetacean species in order to identify trends in populations and detect changes in distribution and abundance of cetacean species • the extent of marine litter within the UK seas and the effects of such litter on marine megafauna are not robustly

Table 3: Key Data Gaps.

SA Sub-Topic	Key Data Gaps
	characterised, including increasing levels of microplastics in the oceans • a lack of understanding of the long term population level effects of climate change • lack of information on current distribution and abundance of leatherback turtles in UK waters • need for more evidence of impacts relating to disturbance to cetaceans and seals from vessel activity in terms of severity and longevity of behavioural changes • uncertainty over the nature of any impacts highlights the need to evaluate potential interactions between seals and cetaceans and various tidal, wind and wave devices. Studies in the Wash during wind farm construction suggest that seals were not excluded from the vicinity during this phase, and that half of the seals exceeded published auditory damage thresholds during piling. Analysis of tagged seals in proximity to tidal operations at Strangford Narrows suggests no statistically significant change in behaviour during operation, although there may be potential for collision risk. However, there is minimal data on interactions between seals and wave energy devices • uncertainty surrounding the spread of phocine distemper virus amongst seal populations • a lack of understanding of impacts from background noise and cumulative noise on marine megafauna, particularly at the population level.
Plankton	• there are major gaps in the coverage of physical, chemical and biological measurements in pelagic ecosystems in the global oceans • the MSFD has identified the need for more information regarding zooplankton in inshore areas. Better understanding is needed of the links between warming, plankton and fisheries (and other higher trophic levels such as seabirds) to form a predictive capacity for rapid and abrupt ecosystem shifts relating to climate change • the understanding of climate effects on nutrient concentrations and eutrophication in the North Sea, and its resulting effects on plankton, is poor. There are insufficient data on changes in nutrients with time and over sufficiently large areas. More information is needed on the consequences of changing climate (rainfall and temperature) and fluvial input for nutrient discharge to the sea in order to better understanding nutrient cycling

Table 3: Key Data Gaps.

SA Sub-Topic	Key Data Gaps
	• increased storminess will increase concentrations of nutrients at the ocean surface, but insufficient research has been carried out in this area, predominantly using models with few direct observations • the majority of harmful algal bloom (HAB) monitoring is in coastal areas, leaving offshore areas with sparse data. There is a need for more information on the role of wind and density driven transport at the boundary between the coastal and offshore regions, which is likely to be affected by climate change, leading to a greater frequency of coastal blooms.
Ornithology	• sources of information at the detailed assessment stage are likely to include European Seabirds at Sea (ESAS) Database and the Seabird Monitoring Programme • seabird breeding success and survival have reduced due to food shortages possibly caused by fishing and climate change. There is as yet no data on how many seabirds from UK colonies are killed as a result of becoming entangled in fishing nets or taking the baited hooks of long-line fisheries operating within and outside UK waters • Natural England's and the RSPB's responses to the online engagement for the SA Database 2019 update have highlighted some further data gaps including lack of up to date counts of seabird at breeding sites and at a national scale; lack of demographic data on seabirds (survival / productivity); lack of data on connectivity of seabirds between nesting sites and feeding sites; and lack of clarity on effects of some marine operations, for instance displacement of puffins, razorbills and guillemots from offshore wind farms. A Seabird Count census is currently underway for the period 2015-2019 to update the last Seabird Census in 2000. Once the census is complete, it should provide an accurate baseline of the current state of UK seabirds (informing the marine plan and associated activities) • climate change has led to a substantial shift in the distribution of waders, but there is little known about the long-term implications of this range. There is clear evidence of a south westward to north-eastward shift in the centres of abundance of some wader species.
Non-Indigenous Species	• there is no unified routine survey programme for invasive non-native species that targets locations at high risk of introduction of invasive non-native species, such as at ports and marinas – information is currently gathered from statutory and non-statutory (and volunteer) sources

Table 3: Key Data Gaps.

SA Sub-Topic	Key Data Gaps
	• the GB Non Native Species Information Portal (BG NNSIP) may not always be up to date, as information from several databases is used to populate it. An example of a source database is the Marine Recorder • more research is needed as to the distribution, abundance and pathways for introduction of invasive non-native species • lack of evidence and information about the environmental and socioeconomic impacts that invasive non-native species have in specific marine plan areas and the UK as a whole.