



Marine
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North West Inshore and Offshore Marine Plan Areas Sustainability Appraisal Options Assessment Report





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North West Inshore and Offshore Marine Plan Areas

Sustainability Appraisal Options Assessment Report

April 2018

Report prepared by: ClearLead Consulting Ltd, WSP, and MarineSpace.

clearlead 



MarineSpace
Making Sense of the Marine Environment™



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1 Introduction

1.1 The Purpose of this Report

ClearLead UK Ltd, working in association with WSP and MarineSpace were awarded a contract in June 2017 to carry out a Sustainability Appraisal of the Marine Plans for the North East, the North West, the South East and the South West Plan Areas.

This report provides detail on the assessment of the options for the North West Marine Plan Areas. The options were presented as part of the Iteration 2 Stakeholder engagement process in February / March 2018. The options were organised under a series of groupings which are detailed in Section 1.4.

This report is organised in four sections:

- Section 1 sets out the purpose of this report and details on the options being assessed for the Marine Plans;
- Section 2 outlines the methodology of the SA options assessment
- Section 3 summarises the results of the SA options assessment; and
- Section 4 outlines the next steps in the plan making and SA processes.

1.2 Background to the Marine Plans and SA process

The Marine Management Organisation (MMO) was established in 2010 following the publication of the Marine and Coastal Access Act (MCAA) 2009 and one of its delegated responsibilities is to prepare marine plans for the English inshore and offshore waters. Marine plans seek to provide greater coherence of policy and a forward-looking, proactive and spatial approach to the management of the marine area, its resources and the activities and interactions that take place within it. Marine plans and their reflection of the Marine Policy Statement (MPS), form part of a planned regulatory system for marine activities, which is in the early stages of being established. The MMO has now completed marine plans for the East Inshore and Offshore and the South Inshore and Offshore marine planning areas and is currently progressing the seven remaining plan areas simultaneously.

The remaining Marine Plan Areas include the:

- North East Inshore and Offshore;
- North West Inshore and Offshore;
- South West Inshore and Offshore; and
- South East Inshore.

These Marine Plans will set out how the UK MPS will be implemented in these Marine Plan Areas. They will reflect the MPS at the sub-national level, taking into account the social, economic and environmental factors that affect each Marine Plan area and the communities that are dependent on or have an interest in the Marine Plan Areas.

The requirement for SA in the marine plan process is outlined in the Marine and Coastal Access Act 2009, which stipulates that all marine plans are subject to SA, and that it is undertaken in line with the procedures prescribed by the SEA Directive. The first stage of SA (scoping) for the remaining Marine Plans has been completed.

This stage included extensive collation of baseline data into an SA Database, Key issues were recorded into 'Report Cards' for each plan area and an SA Scoping Report.

The SA Scoping Report was published for consultation with statutory consultees for a 5 week period between 11th April and 13th May 2016. Following consultation, the Scoping Report was revised in response to comments received and the final version is available to download from the MMO website, here:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/535172/SA_scoping_report_NE_NW_SE_SW.pdf

The SA Database was updated in August 2017.

1.3 Development of Marine Plan Options

The legal requirement for undertaking the options stage of planning comes from the [Strategic Environmental Assessment Directive](#) and the UK Regulations of this Directive, which requires those developing a plan or programme to consider 'reasonable alternatives taking into account the objectives and geographical scope of the plan'. The Directive requires that plan-makers must look at different ways of achieving the objectives of the plan in a reasonable manner.

The options stage is a significant phase in the planning process; it considers the different ways of delivering the vision and objectives and is the mechanism that determines how marine plans will respond to issues in each marine plan area.

This stage is part of iteration 2, Each option is tested against the SA Framework and potential significant sustainability effects identified. The feedback from the SA at this stage will feed into the work in Iteration 3, 'Preferred Options'. Figure 1.1 below shows this process.

Figure 1.1 Development of Plan Options



This is the first stage where each marine plan area will be considered on its own, because although there may be common responses to issues, these may not be suitable for achieving the different marine plan area visions. A decision was made early in the planning process to not develop specific plan objectives, but to use the

High Level Marine Objectives (HLMOs). Marine plans are expected to deliver the HLMOs through sector/activity specific policy, so there is no need to develop marine plan area objectives. The additional advantage of having static objectives is that the preferred option can be developed around the issues under each of the objectives. The differences in the spread of the issues between the HLMOs within each marine plan area is where the marine plans become area specific.

Prior to options development, key issues were identified within the Issues and Evidence Database and arranged into themes:

- **Economy:** ports, dredging, oil and gas decommissioning, beneficial use of dredged material, blue growth, tidal lagoon development
- **Environment:** coastal squeeze, marine litter, invasive non-native species, water quality, compensatory habitat
- **Governance:** plan integration, monitoring and enforcement, port management, new marine infrastructure
- **Social:** flood protection, tourism opportunities, management of recreational access, social deprivation, fishing industry decline

The issues under these themes are not exclusive and others are included as appropriate when issues and supporting evidence are identified through the planning process.

Once key issues were identified, options for delivering the HLMOs in the context of the issues or groups of issues were raised. From this, realistic and, deliverable alternatives were created, which align with the MPS and other relevant legislation, as well as address current and future issues in marine plan areas. As a result, each of the marine plan areas has a variety of different 'groupings' (eg coastal change) and each 'grouping' has a number of potential options. The groupings and options reflect key issues in each marine plan area, and therefore vary across marine plan areas.

1.4 Groupings & Options

The North West consists of 29 groupings. Four groupings (Cumulative Effects, Governance, Evidence Gaps and Implementation) contain options which are not possible to assess through the SA. The remaining 29 groupings contain 261 individual options which have been assessed. The groupings and number of options assessed are set out in Table 1.1 below.

Table 1.1: Assessment Groupings & Options			
Grouping	Number of Options	Grouping	Number of Options
Access	7	Habitat Loss	15
Air Quality	6	Historic Environment: Threats	12
Aquaculture	7	Historic Environment: Opportunities	10
Cables	5	Infrastructure	7
Climate Change: Environment	9	Litter	9
Climate Change: Industry	3	MPAs and Geodiversity	14
Coastal Change	9	Invasive Species	7
Co-existence: General	9	Ports and Harbours	5
Co-existence: Industrial	10	Renewables	7
Disturbance	14	Seascape	7
Dredge Disposal	6	Shipping	7
Ecosystem Approach	7	Species	9
Employment	16	Tourism and Recreation	9
Energy	8	Water Quality	17
Fisheries	10		

2 Assessment Methodology

2.1 Introduction

This stage of the SA has involved assessment of the options against the SA framework (which was developed at the scoping stage of the SA) (Table 2.1 below), taking into account the evidence base.

The assessment of the marine plan options has been designed to

- Be proportionate;
- Focus on identifying key potential significant effects to inform the decision making between options; and
- Refer to the baseline database to provide quality assured evidence as the basis of the assessment.

Each of the 29 groupings and 261 options for the North West Marine Plan Areas have been assessed to the same level of detail. The assessment has been organised within an Excel workbook which ensures a rigorous, evidenced based approach to the assessment.

Table 2.1: SA framework	
Overarching SA topic	Proposed SA Sub Topic
Physical and Chemical Aspects	
Cultural heritage	<ul style="list-style-type: none"> • Heritage Assets within marine plan areas • Heritage Assets adjacent to marine plan areas
Geology, Substrates and Coastal Processes	<ul style="list-style-type: none"> • Seabed substrates and bathymetry • Coastal features and processes
Seascape and landscape	<ul style="list-style-type: none"> • Effects on seascape and landscape
Water	<ul style="list-style-type: none"> • Tides and currents • Water temperature and salinity • Pollution and water quality • Marine litter
Air quality	<ul style="list-style-type: none"> • Air pollutants
Climate	<ul style="list-style-type: none"> • Greenhouse gas emissions • Climate change resilience and adaptation
Social and Economic Aspects	
Communities, health and well being	<ul style="list-style-type: none"> • Health and wider determinants of health Effects on communities • Effects on protected equality groups

Table 2.1: SA framework	
Overarching SA topic	Proposed SA Sub Topic
Economy	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Protected sites and species • Benthic and inter-tidal ecology Fish and shellfish • Marine mega fauna • Plankton • Ornithology • Non-indigenous species

An assessment spreadsheet was prepared for each marine plan area, which included all the relevant groupings. The assessment of options was undertaken in two stages: screening and assessment of significant effects, with the main focus of the assessment on the identification of significant effects (these steps are described in more detail in Section 2.3).

2.2 Involving the Advisory Group

The SA Advisory Group (SAAG) has been involved with the development and review of the approach to the options assessment. The Iteration 1 SAAG was held on 15th August 2017 at which the group reviewed and commented on the causes and effects relating to issues identified for further validation. The Iteration 2 SAAG was held on the 28th February 2018. As part of this session the SAAG members were invited to comment on the approach being taken to the option assessment and examples of some of the completed assessments of the marine plan groupings were provided.

The advisory group consists of the following members –

- Royal Yachting Association;
- Chamber of Shipping;
- Devon Maritime Forum;
- The Wildlife Trusts;
- Environment Agency;
- The Crown Estate;
- Natural England;
- Historic England;
- Thames Estuary Partnership;
- North West Coastal Forum;
- Wildlife and Countryside Link;
- World Wildlife Foundation;
- Severn Estuary Partnership
- Association of Severn Estuary Relevant Authorities; and
- Durham Heritage Coast Partnership.

2.3 Stages in the Options Assessment Methodology

Screening of SA sub-topics

Prior to the assessment of options, a screening process was carried out to determine whether the SA sub-topic was relevant to the specific grouping.

In order to determine this, assessors carried out a brief review of the SA database for relevant information. Following this, the assessor selected either 'Yes' or No 'to indicate whether each SA sub-topic is screened in or out. This then subsequently greyed out the row within the assessment spreadsheet, to avoid accidental inclusion within the assessment process.

For any sub-topics which were deemed to be irrelevant to the grouping, a justification was entered into the worksheet. In order to ensure consistency, only two justifications were used:

- No key baseline issue of relevance; or
- No potential impact pathway.

Justification was not provided for the sub-objectives screened in, as the assessment process would provide the required validation.

Identifying the Sustainability of the Options

The second step was to identify the potential significant effects and uncertainties of the options. Each option was considered against the relevant SA Framework sub-topics. Expert judgement and the updated SA Database (developed at the scoping stage of the SA process and refreshed prior to this assessment) was used as evidence for the assessment.

Within the assessment spreadsheet there is a separate tab/workbook for each grouping. All options have been listed (A, B, C, D etc.) across the top row. As mentioned previously in Section 1.3, the number of options varies between groupings. Each option was assessed in turn. In order to provide consistency, assessors have used the following significance criteria for the assessment of each option:

- Potential significant positive effects (ie the existing situation would be much improved by the option, resulting in a significant positive outcome);
- Potential significant negative effects (ie an existing negative effect would be made worse by the option, resulting in a significant negative outcome);
- No significant effects (either only minor positive or negative effects, or no effect);
- Uncertain (depending on implementation); and
- Uncertain (lack of evidence).

Justification for significance was provided by reference to the SA Database. Assessors identified relevant issues and baseline data and provided at least one relevant topic identifier (e.g. Cultural_167) from the 'SA Database Topic Identifier'

columns. Justification was not required for options that were deemed 'Not Significant' as there was no baseline data which would give rise to a significant effect.

For each of the groupings, the first option was always 'do nothing' and final option was always 'none of the above'. The 'none of the above' options are all unknown and therefore the assessment records an 'uncertain (depending on implementation)' effect against each SA sub-topic for these options.

Following the completion of the assessment, assessors provided a commentary which justified the assessment and highlighted any potential significant effects resulting from specific options.

Mitigating Potential Negative Effects of Options

At the options assessment stage of the SA the key recommendation is to avoid taking forward options which the SA has identified could result in significant negative effects. It is also recommended that policy authors select the options which enhance the significant positive effects and seek to provide sufficient detail to minimise the uncertainty associated with the implementation of a policy.

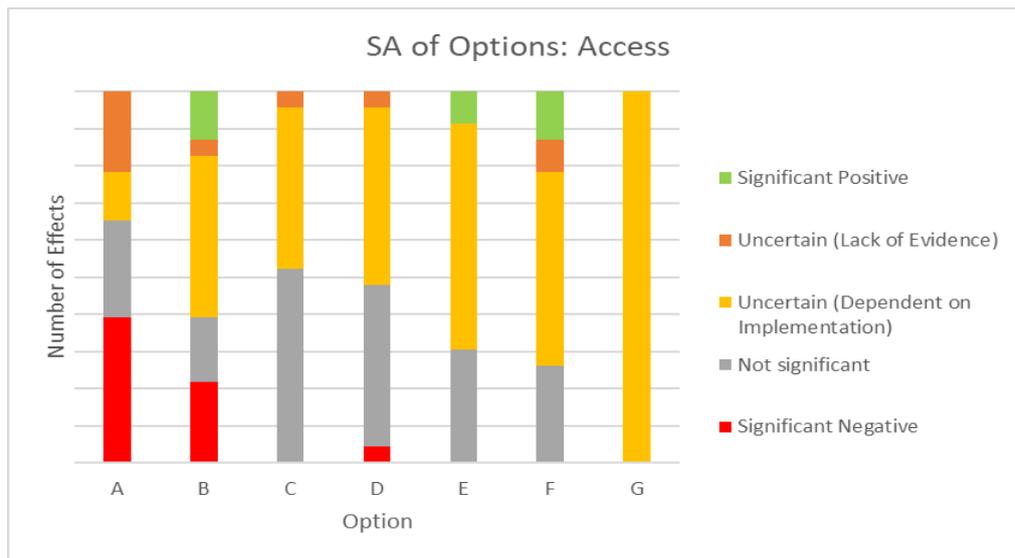
In addition, the assessors have highlighted, where possible, mitigation which can be considered to assist in the identification and development of the preferred options for the North West Marine Plan Areas.

Mitigation for the potential negative and uncertain effects of policies will be dealt with when preferred options have been developed and assessed in detail through the SA.

Assessment Outputs

The assessment spreadsheet has generated a pivot table for each grouping and an interactive graph for each marine plan area. The table counted the number of effects (ie significant positive, significant negative, not significant, uncertain depending on implementation and uncertain lack of data). An example of this is shown in Figure 2.1 below. These graphs provide a quick visual representation of the findings of the assessment for each grouping, allowing a comparison to be made of the relative performance of options.

Figure 2.1: Example Output



3 Results of the Assessment

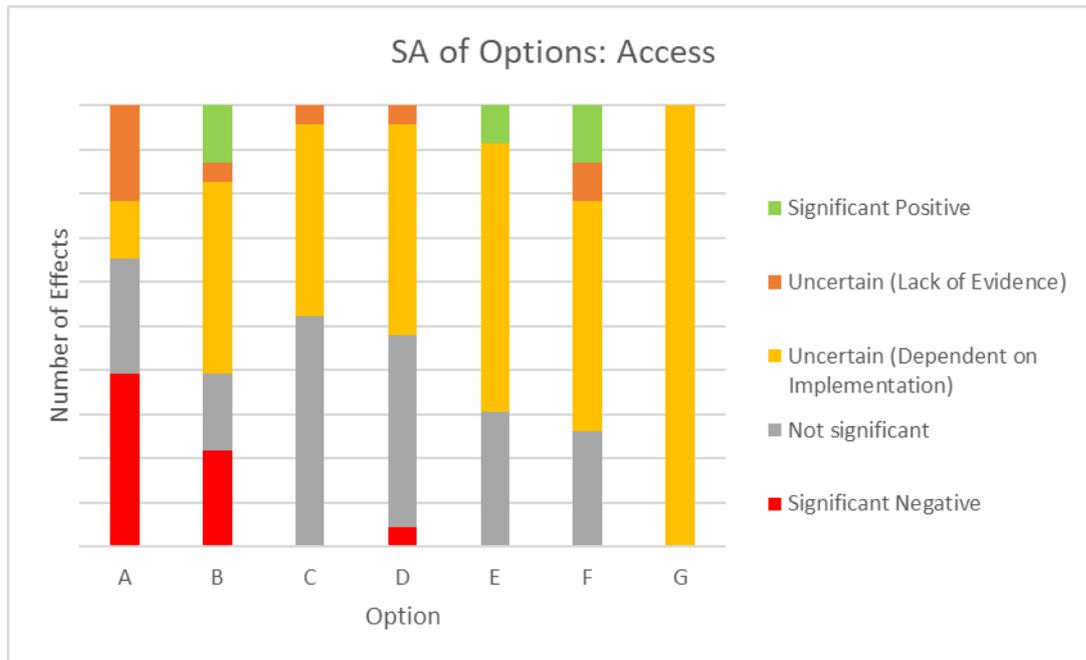
3.1 Introduction

The following sections set out the results of the options assessment for the North West Marine Plan Areas. Each section presents the comparison of the performance of options assessed for each grouping. The assessment has focused on identifying significant positive and negative effects and highlighting where there is a large amount of uncertainty either due to a lack of data or due to how the policy could be implemented.

For each grouping a comparative graph is provided which shows the performance of each of the options. A narrative of the assessment is also provided to aid the interpretation of the graph which makes reference to the relevant SA sub-topics.

For detail on the results of the assessments, including the references to the supporting data which justify the assessment, please see Appendix A: North West Inshore and Offshore Marine Plan Areas Assessment Spreadsheet.

3.2 Access



The assessment of the access grouping of options has identified that there is the potential for significant negative effects with relation to Options A and D, whereas Options E and F have the potential to give rise to significant positive effects. Option B has the potential to give rise to a combination of both positive and negative significant effects depending on the receptors/SA sub-topics being considered.

The management of potential flooding as a result of high tides and inefficiency of surface water pumps is a challenge to low lying areas within the North West Marine Plan Areas, for example, Fylde (Geol_226). Increasing access to the coast as proposed by Options A, B and D may exacerbate this baseline issue, resulting in potential significant negative effects.

Marine litter (Water_234, Water_240, Water_288), air pollution (Air_8) and greenhouse gas emissions (Climate_110) all have existing baseline issues, none of which are addressed by the proposed options. Both doing nothing to address these issues, as per Option A, whilst increasing access, this could result in significant negative effects on these SA sub-topics, particularly in the case of Option B.

Potential significant effects could also occur in relation to climate change resilience and adaptation following the implementation of Options A and B. Again, to 'do nothing' to address these issues whilst also increasing access would exacerbate the detrimental relationship between increased coastal access and both activities to adapt to climate change and the effects of climate change eg coastal squeeze (Climate_129, Climate_131).

Increasing coastal access could have significant positive effects on health and the wider determinants of health, communities and protected equality groups, as highlighted by baseline data (Communities_46). Options G and J could therefore result in significant positive effects. SA database entry 'Communities_158' highlights

the phenomenon by which coastal areas attract and retain an ageing population, which should experience significant positive effects following the implementation of Options B and E.

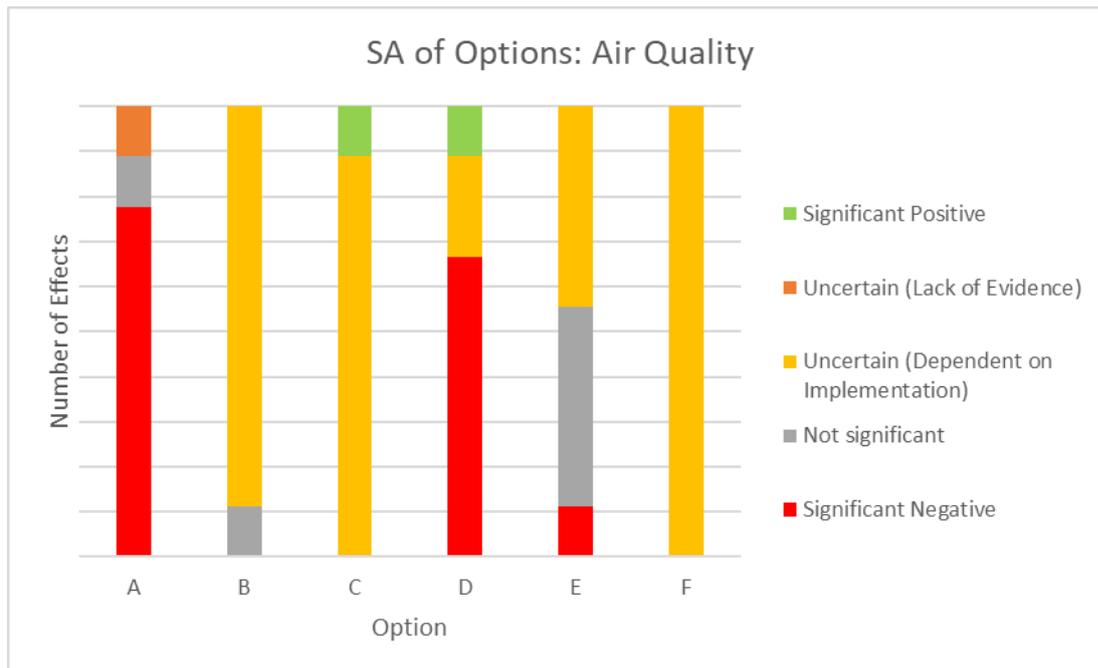
The sea can provide a variety of leisure, recreation and tourism opportunities (Economy_482). Proposals which support enhanced access to the Marine Plan Areas may reduce unrealised ecosystem services (Communities_159). Option A would have significant negative impacts on tourism as it would not combat the silting of rivers such as the estuarine Ribble which is currently affecting access for recreational sailing and inshore lifeboat launching (Economy_771). Option B could have significant positive effects on tourism, whereas Option F could have significant positive effects on both the leisure and recreation and tourism SA sub-topics.

Dune systems are being damaged by cockle/mussel fisheries vehicles accessing the sea (Biodiv_703). Commercial fishing activity, marine eco-tourism, sightseeing and pleasure boats are having impacts on marine mammals (Biodiv_502, Biodiv_503, Biodiv_649, Biodiv_536, Biodiv_537, Biodiv_538, Biodiv_546, Biodiv_547, Biodiv_554, Biodiv_555, Biodiv_556). Most species of waterbird, especially waders, can be expected to be impacted by habitat loss through the construction and extension of marinas or harbour developments amongst other activities (Biodiv_453). The North West Marine Plan Areas have been targeted for the further development of offshore wind, and oil and gas activities, with a risk of disturbance and displacement to the movement of species through the area, particularly wintering and passage waders, seaducks and tern (Biodiv_515). Commercial shipping, recreational boating, aquaculture stock imports are key introduction pathways for invasive species (Biodiv_636). All of these existing baseline issues would continue to worsen if Option A were implemented, resulting in significant negative effects.

Mitigation

- SA database entry 'Geol_208' highlights that opportunities exist in the North West Marine Plan Areas to increase access in tandem with managed realignment of coasts.
- Option C ought to be strengthened if taken forward. To only require 'consideration' of cumulative impacts on highly mobile species and coastal habitats is inadequate to protect against the effects of increased access and associated disturbance of biodiversity, habitats, flora and fauna.
- Option D has the potential to have a significantly negative impact on ornithology as increased access can severely impact ornithological species, especially those within a Marine Protected Area. It seems counterintuitive to increase access and therefore disturbance to sites which have previously been afforded extra protection. The baseline database impacts of recreational disturbance on species are discussed in more detail for the South West Marine Plan Areas.
- None of the options consider the introduction of non-native invasive species as a result of increased access, which is a very real possibility. This ought to be taken into consideration.

3.3 Air Quality



The assessment of the air quality grouping of options has identified that there is the potential for significant negative effects with relation to Options A and E. Option D has the potential to give rise to a combination of both positive and negative significant effects depending on the receptors/SA sub-topics being considered.

Air and sea temperatures have risen over the last 25 years with the largest increases of both sea surface and marine air temperature of all UK waters occurring in the North West Marine Plan Areas. Worsening of air quality is likely to contribute to rising sea temperatures as well as ocean acidification (Climate_117). There are ongoing challenges with air quality from transport emissions which is contributing further to climate change. Climate change is predicted to exacerbate pollution and water quality (Water_300). As a national issue, emissions from ships are estimated to be approximately 3 per cent of global carbon dioxide emissions, projected to rise to approximately 15 to 30 per cent by 2050 due to an expected increase in global trade. UK shipping emissions are estimated between 0.8 and 5 per cent of global shipping emissions (Climate_110).

In light of the issues identified above, Option A would result in significant negative effects in relation to water temperature and salinity, pollution and water quality, air pollutants, greenhouse gas emissions and climate change resilience and adaptation.

Intertidal and estuarine species and habitats are at particular risk from a variety of diffuse atmospheric pollutants. Persistent contamination can reduce biodiversity, resulting in impoverished communities composed of pollution-tolerant organisms (Biodiv_420). There are also localised air quality issues associated with the Stanlow Oil Refinery on the Mersey, which are known to affect the Mersey Estuary Special Site of Scientific Interest (Air_16). To do nothing, as per Option A, would have significant negative effects on protected sites and species and benthic and inter-tidal ecology fish and shellfish.

Option D supports shipping as any policies that may infringe upon key shipping will need to demonstrate that they will either (in order of preference) avoid, minimise, mitigate significant adverse impacts on shipping routes. This is likely to result in significant positive effects for ports and shipping. However, given that shipping is a key contributor to air pollution, this is likely to maintain or possibly worsen air quality in some areas of the North West Marine Plan Areas. For this reason, significant negative effects have been identified in relation to Option D, regarding air pollutants, greenhouse gas emissions, climate change resilience and adaptation, protected sites and species and benthic and inter-tidal ecology fish and shellfish.

There are limited details within the SA database which link air quality and health, however, it is assumed that decreases in air quality are likely to contribute towards deterioration in health. Signposting to Defra's clean air strategy (Option C) could be beneficial as health is a major component of the strategy, however this would be dependent upon implementation and therefore only a minor positive effect has been may result.

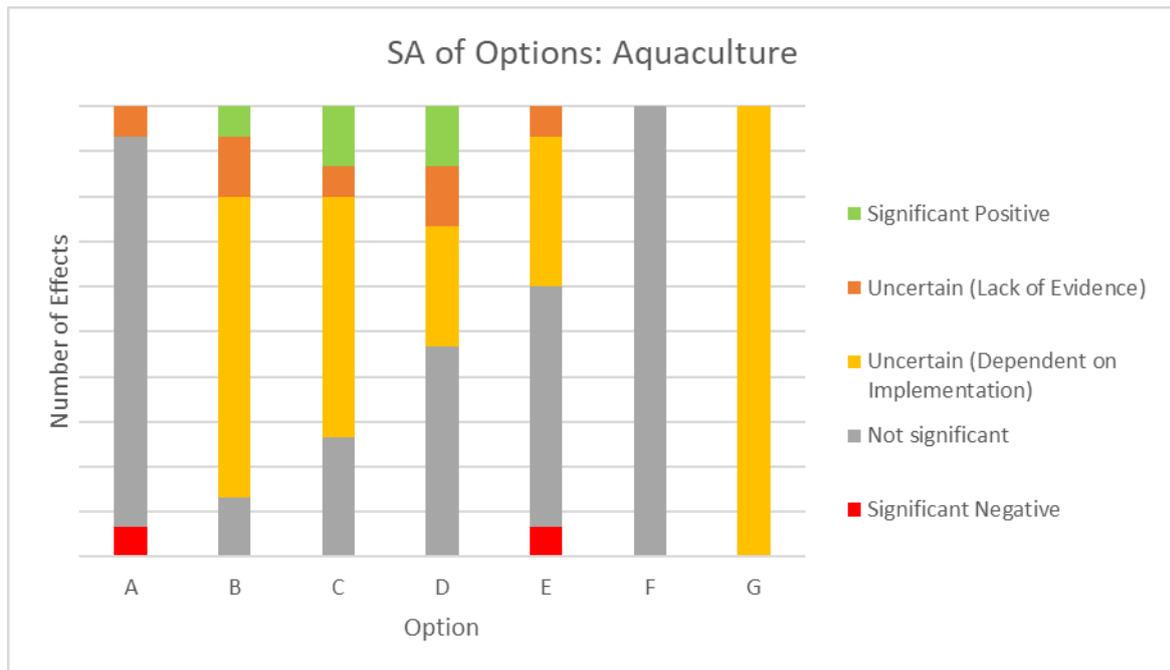
Minor positive effects have been identified with regards to Option E in relation to water temperature and salinity, pollution and water quality, air pollutants and greenhouse gas emissions. This is because it aims to consider the contribution of proposals to air pollution, both directly and arising from unintended consequences on other activities. Shipping is an essential and valuable economic activity in the North West and limits made to emissions could have a negative impact on this sector and, therefore, a significant negative effect has been identified.

It should be noted that none of the options directly address the impact of oxides of nitrogen and sulphur dioxide gases, which also contribute to air pollution.

Mitigation

- Various shipping technologies and techniques could be used to help reduce pollution such as the use of low sulphur fuels, shore-side electricity, scrubbers and internal engine modifications.
- Options need to also address the impact of oxides of nitrogen and sulphur dioxide gases

3.4 Aquaculture



The assessment of the aquaculture grouping of options has identified that there is the potential for significant negative effects with relation to Options A and E, whereas Options B, C and D have the potential to give rise to significant positive effects.

The aquaculture sector is an important producer of marine litter. It is expected that aquaculture developments could generate more waste with a risk of pollutants entering the marine environment. Litter may include that produced by aquaculture and commercial fishing and plastics (Biodiv_467). The SA database reports issues related to ingestion of, or entanglement in, marine litter for marine mammals and turtles (Biodiv_467). For these reasons, Option A, 'do nothing', has resulted in significant negative effects for marine litter and marine mega fauna.

Options B, C and D aim to provide infrastructure for sustainable fisheries and aquaculture, which are likely to boost the development of these sectors. Therefore, these options would have a significant positive effect on fisheries and aquaculture.

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. For most of the options, no significant effects are predicted for water quality or the outcome is deemed to be uncertain due to the lack of information. However, these are likely to not be significant given the environmental benefits of aquaculture and the scale of this type of development.

Uncertainty has been recorded for the assessment against the ports and shipping SA sub-topic. Aquaculture can represent a constraint for eg increased competition for sea space, navigational safety issues (Economy_621) and also opportunities as it can promote economic development for the port and shipping sectors. For small ports, aquaculture could be a proportionately more significant revenue stream than

for larger ports. It is also very geography dependent, as ports only benefit if they are near aquaculture locations.

There are potential interactions identified in the database between aquaculture and recreational stakeholders (Economy_631), which could result in minor trade-offs with recreational activities (Economy_639). Options which entail the development of aquaculture may worsen the current situation with recreational users. Option E aims to limit the impact of activity on the future production of sustainable aquaculture production, which could result in significant negative effects on leisure and recreation.

There is no evidence in the database which suggests that aquaculture represents a key issue for energy generation and infrastructure nor aggregate extraction. However, this grouping may have an impact on the development of energy and aggregate projects at sea and within the coastal environment. The potential effects are unlikely to be significant.

Aquaculture can contribute to the introduction of non-native species and is reported to be among the key pathways (as outlined in Economy_629; Biodiv_636). For this reason, Options B, C and D could result in significant negative effects for non-native species, as they support further development of aquaculture and fisheries.

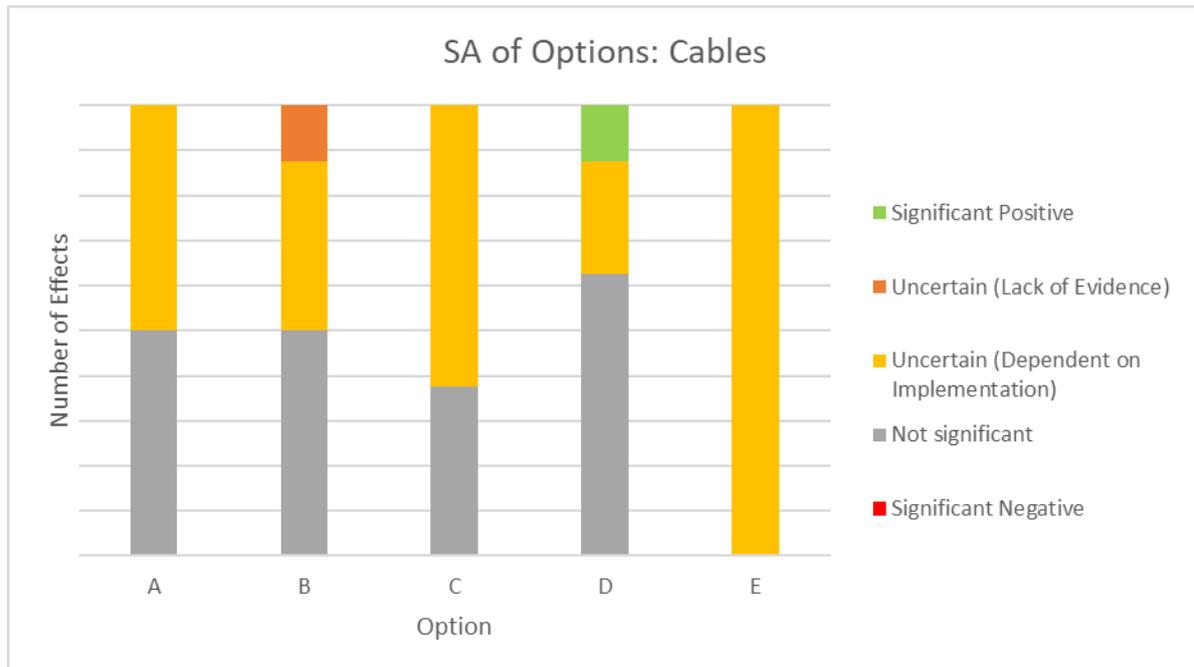
Aquaculture can influence primary and secondary productivity and can start a series of cascade effects on water column, including on benthic species and phytoplankton (Economy_629). Pollution from aquaculture can also affect benthic species and plankton. However, aquaculture can also have positive effects on the marine environment, particularly water quality. Uncertainty has been recorded for the assessment of benthic and inter-tidal ecology fish and shellfish and plankton.

The SA database reports an issue related to the marked reductions in water bird survival as a result of shellfish harvesting (Biodiv_452). It is unclear if this statement refers to commercial or recreational harvesting of shellfish and therefore an uncertain effect is identified. Without specific proposals targeting this issue, the problem could become worse, but uncertainty has been recorded as it is not clear how options will be implemented.

Mitigation

- Aquaculture could generate marine litter and therefore policies are required to control the release of litter and pollutants from aquaculture.
- Refer to marine plan policies which protect birds.

3.5 Cables



The assessment of the cables grouping of options has identified that there is the potential for significant positive effects with relation to Option D. No potential significant negative effects have been identified in relation to any of the options.

Two interconnector cables run through the North West Marine Plan Areas: The Isle of Man Interconnector which became active in 2011 and links the Isle of Man to the UK; and the Western High Voltage Direct Current (HVDC) Link. This is owned by National Grid and Scottish Power and runs between Ardnail on the west coast of Scotland to the Wirral. (Economy_659). The offshore telecommunication industry in the North West Marine Plan Areas is estimated to support 180 businesses and 10,060 jobs (Economy_732).

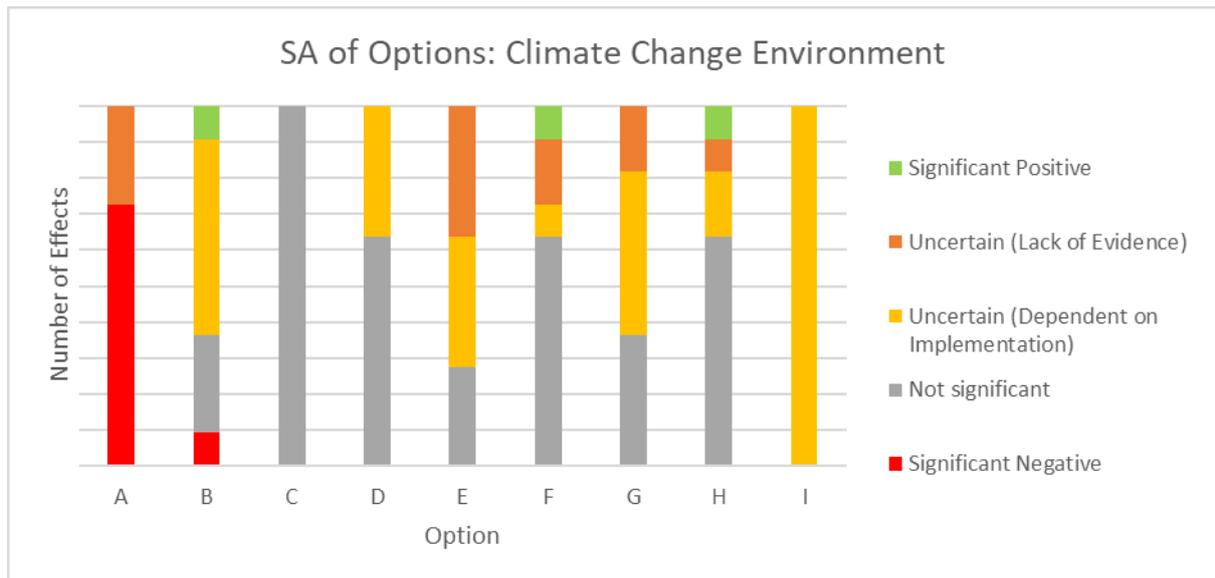
Options do not directly support the development or the protection of cables and other subsea assets and therefore no significant positive effects have been identified in relation to this SA sub-topic. There is a planned subsea cable which will go under Morecambe Bay (and under or around the Duddon Estuary) as part of the North West Coastal Connections project to connect the planned nuclear power plant at Moorside to the National Grid at Heysham. (Economy_591). None of the proposed options have taken this into consideration.

Fishing is of importance in the North West (Economy_526) and marine developments have the potential to prevent, displace or encourage fishing activities (Economy_628). Option D could have a significant positive impact on fisheries and aquaculture in the Morecombe Bay area.

Mitigation

No specific mitigation has been identified.

3.6 Climate Change – Environment



The assessment of the climate change environment grouping of options has identified that there is the potential for significant negative effects with relation to Option A. Options F and H have the potential to give rise to significant positive effects. Option B has the potential to give rise to a combination of both positive and negative significant effects depending on the receptors/SA sub-topics being considered.

Coastal erosion is widespread in the UK and Ireland and is a complex process with a variety of causes, including sea level rise as a result of climate change (Geol_193). Implementation of Option B X-CC-3 would significantly reduce adverse impacts on coastal change, and therefore seabed substrates and bathymetry, resulting in a significantly positive impact.

The extensive coastal erosion and decrease in the intertidal area seen around the UK is partially as a result of coastal squeeze caused by the presence of 'hard' coastal defences (Geol_179, Geol_208), and will increase as a result of increased storminess and sea level rise as a result of climate change (Geol_179, Geol_208, Geol_227). Option A would have significantly negative impacts on geology, substrates and coastal processes, as does not address the issues as highlighted within the SA database.

Climate change is predicted to exacerbate pollution and water quality as more frequent and intense storm events lead to an increased frequency of potential storm and/or sewer overflows, fluvial flows and flooding (Water_300, Water_338). Option A does not address these key baseline issues regarding pollution and water quality, so its implementation would have a significantly negative impact. Conversely, Option H would have a significantly positive impact, as proposals which demonstrate life-time resilience to the effects of climate change will likely reduce the degradation of water quality as a result of climate change.

Despite some potentially positive opportunities surrounding employment (Climate_208), Option A would have significant negative impacts on climate change resilience and adaptation as does not address the key baseline issues regarding:

- increased rate of coastal erosion with implications for buildings, infrastructure, activities and development on the coast (Climate_116, Climate_127);
- realignment of infrastructure and housing as erosion and inundation become uneconomic or undesirable to stop (Climate_131);
- coastal squeeze increase and narrowing of beaches leading to loss of both dune systems and intertidal foraging habitat, which may already be evident in the North West Inshore Marine plan area (Climate_126, Climate_129, Climate_140); and
- overall damage to a wide range of social, economic and environmental assets.

Option F could have a significantly positive impact on climate change resilience and adaptation as it supports 'proposals which enhance the resilience of local activities to the effects of climate change'.

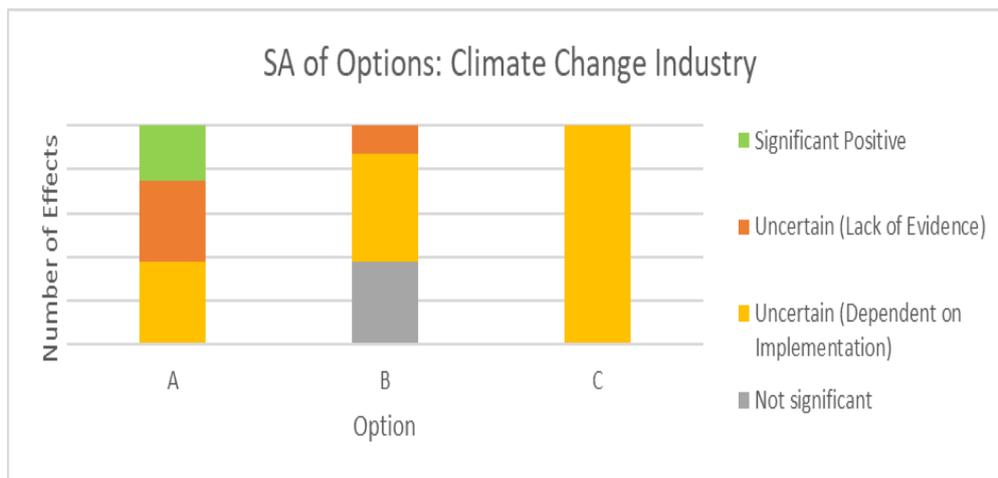
Climate change and associated increasing sea temperature, sea level rise, ocean acidification, coastal squeeze, storm events and creation of coastal defences is leading to broad-scale changes in habitats and species. This includes the alteration and/or loss of habitat; reduced prey availability and trophic mismatch for all marine species due to the changing community structure of plankton and wider food web implications; declining biodiversity both generally, and more specifically on calcifying and associated organisms; increased risk of harmful algal blooms; range shift of native species including marine mega fauna and increasing abundance and distribution of non-indigenous species, all of which ultimately alter the structure of communities and ecosystem processes (Biodiv_412, Biodiv_417, Biodiv_421, Biodiv_422, Biodiv_428, Biodiv_429, Biodiv_430, Biodiv_435, Biodiv_436, Biodiv_437, Biodiv_449, Biodiv_504, Biodiv_543, Biodiv_548, Biodiv_558, Biodiv_622, Biodiv_623, Biodiv_646, Climate_126). Implementation of Option A would have significant negative impacts on all SA sub-topics within the biodiversity, habitats, flora and fauna SA topic, as fails to address all relevant key baseline issues regarding both the direct and indirect effects of climate change.

Mitigation

- It should be noted that throughout this assessment, Options D, E, F and G have been understood to mean that both 'proposals...should be supported' and 'proposals...shall be supported', equate to 'proposals...will be supported', as per Option H. Reassessment of this grouping should be considered if this is not the case.
- Option G could provide mitigation to the effects of sea defence installation on marine habitat resilience as highlighted by Climate_209, if it were to state that proposals must actively avoid the likely movement of species due to the impacts of climate change rather than simply having to '...show a clear evaluation of the likely movement of species due to the impacts of climate change'.

- If more stringent, Options B, D and G could have significant positive impacts on benthic, inter-tidal ecology, and fish and shellfish.
- If more stringent, Option D would have direct significant positive impacts on plankton and thereby indirect significant positive impacts on marine mega fauna. For example, if Option D were to state, 'proposals must not increase carbon dioxide concentrations in seawater', rather than 'proposals that reduce or buffer carbon dioxide concentrations in seawater should be supported'.
- Option B policy X-NIS-1, to 'avoid or minimise significant adverse impacts on the marine area that would arise through the introduction and transport of non-indigenous species' is currently inadequate, as it does not avoid the spread of non-native invasive species.

3.7 Climate Change – Industry



The assessment of the climate change industry grouping of options has identified that there is the potential for significant positive effects with relation to Option A, and none of the options have the potential to give rise to significant negative effects.

The melting of sea ice is opening up new transport routes which offers opportunity for the development of northern ports (Climate_214). As an indirect effect of climate change, ports and shipping are essential in supporting emerging industries such as renewable energy development (Economy_620). Implementation of Option A would exacerbate climate change and would, according to the baseline database, positively impact ports and shipping.

There are likely to be effects on commercial fisheries as a result of both sea temperature and salinity change, which will affect the range and distribution of many marine species (Water_328). This redistribution presents both opportunities for aquaculture and fisheries, and challenges around predator-prey interactions, competition and population level impacts (Climate_206). Trophic mismatch between phytoplankton, zooplankton and fish larvae as a result of sea temperature rise and ocean acidification has led, and will continue to lead, to fish recruitment failure (Biodiv_412), which will impinge on currently active fisheries. A relatively high level of uncertainty surrounds the effects of the climate change on fisheries and aquaculture, and existing data as included within the baseline database is contradictory. Implementation of any options must account for this uncertainty and allow for future flexibility as new data comes to light.

Climate change is expected to cause increases in sea and air temperatures, sea levels, and precipitation as well as the severity of storms. The tourist season is extending and there is likely to be associated growth in the leisure industry, which requires careful management to ensure sustainability and the avoidance of negative impacts on the natural environment (Economy_747, Economy_763). As above, climate change may offer both positive and negative impacts on tourism, and option implementation must take this into account.

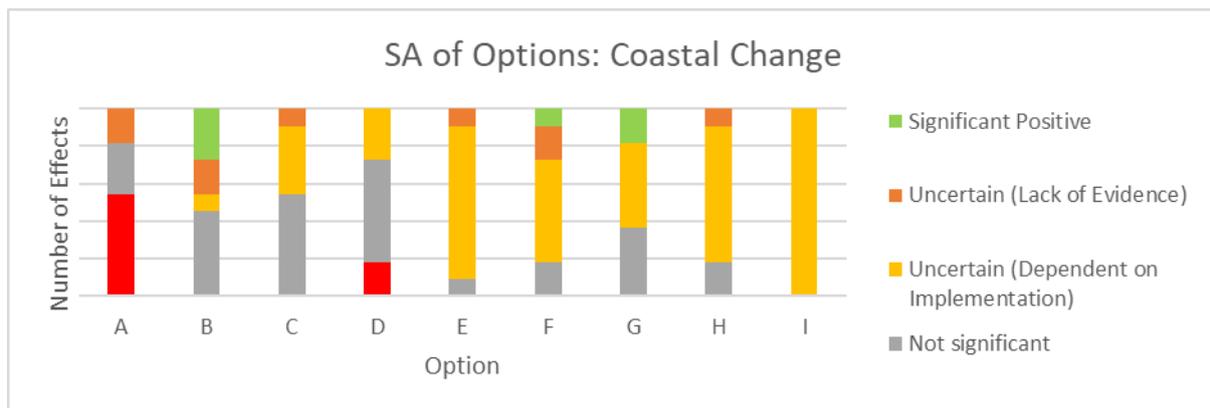
In the North West Marine Plan Areas, Barrow and Fleetwood ports currently service the UK offshore wind industry (Economy_537), and the requirement for such ports will increase with the expansion of offshore wind and its associated supply chain. To

'do nothing', as per Option A, would therefore have a significantly positive effect on marine manufacturing as it would see an increase in marine manufacturing in order to negate climate change, resulting in the securement of investment and creation of industrial hubs (Economy_533).

Mitigation

No specific mitigation has been identified for this grouping.

3.8 Coastal Change



The assessment of the coastal change grouping of options has identified that there is the potential for significant negative effects with relation to Options A and D, whereas Options B, F and G have the potential to give rise to significant positive effects.

There is extensive coastal erosion around the UK and decrease of the intertidal area, at least in part caused by the presence of ‘hard’ coastal defences. This in turn is causing loss of land and properties and loss of habitat, particularly saltmarsh and mud flats, which are also bird feeding grounds (Geol_179). The issues of coastal erosion and squeeze of coastal environments are of crucial concern. Steepening of the intertidal profile is occurring on UK coasts, particularly those defended against erosion, which represents 46% of the English coastline (Geol_176).

In light of the issues identified above, Option A ‘do nothing’ would result in significant negative effects in relation to effects on seascape and landscape, climate change resilience and adaptation, benthic and inter-tidal ecology fish and shellfish and ornithology. Climate and coastal change is also having a direct impact on heritage assets on or close to shorelines (Cultural_174), and therefore further significant negatives have been identified in relation to cultural heritage, with regards to Option A.

Existing policy X-FISH-1 within Option B aims to support the diversification of a sustainable fishing industry and or enhance fishing industry. The fishing industry is in decline and requires support to prevent further deprivation because it provides essential social, cultural and economic benefits (Economy_762). Therefore, significant positive effects have been identified in relation to fishing and aquaculture.

Other existing policies within Option B aim to consider the contribution to greenhouse gas emissions, impacts on coastal and climate change and habitats as well as demonstrating the long-term resilience to the effects of climate change. This would result in significant positive effects for climate change resilience and adaptation, benthic and inter-tidal ecology fish and shellfish and ornithology.

Due to the negative impacts of recreational disturbances on vulnerable habitats and birds, it has been assumed that Option D, which aims to increase public access,

could result in a significant negative effect on benthic and inter-tidal ecology fish and shellfish and ornithology.

There is potential for conflict as some onshore Ministry of Defence 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 (Economy_633). The options do not take this into account, and some options may result in negative effects on the defence sector, however, it is assumed that these would be minor. Increasing access could also conflict with restricted access areas.

There is some uncertainty regarding Option E as it aims to provide alternative methods of sea defence which reduce erosion or flooding, show resilience to changes in coastal processes, and promote tourism should be supported. It is uncertain what coastal defences these options could include. There is potential for conflict between natural processes and sea defences as this can have broader negative impacts on the coastline further along the coast.

It is expected that coastal change and coastal flooding are likely to be exacerbated by climate change, with implications for activities and development on the coast. Options F and existing policy X-CC-2 within Option B both consider the long-term projections of climate and coastal change, and therefore significant positive effects have been identified in relation to climate change resilience and adaptation.

The North West Marine Plan Areas cover an area of coastline and sea that is incredibly important for seabirds. The impacts of soft coastal defences is unknown. Option G supports and aims to give priority to proposals to coastal developments which demonstrate greatest environmental benefit both in terms of local habitats and wider ecosystem effects. For this reason, significant positive effects have been identified in relation to benthic and inter-tidal ecology fish and shellfish and ornithology.

It has been assumed that protection against coastal change will generally have a positive effect on the seascape and landscape but is dependent upon the how this is approached. Option H proposes the use of soft engineering approaches which could be more beneficial to the seascape and landscape than harder engineering defences. The use of soft defences in preference of hard ones, could also be more sympathetic to the historic environment. Due to the unknown nature of development, uncertainty has been recorded in the assessment.

Changes in habitat condition and habitat loss through sea level rise, coastal squeeze, coastal change, storm events from climate change and creation of coastal defences are occurring within the North West Marine Plan Area. There is extensive coastal erosion in the North West which is causing a decrease in the intertidal area, some of which is caused by the presence of 'hard' coastal defences (Geol_179). Softer engineering solutions are likely to be more beneficial to biodiversity than hard defences, however, this would ultimately be dependent upon the size, location and nature of the developments that come forward.

Dredging regimes around ports in the North West Marine Plan Areas need to be sustained to maintain access and safe navigation to ports to ensure continued

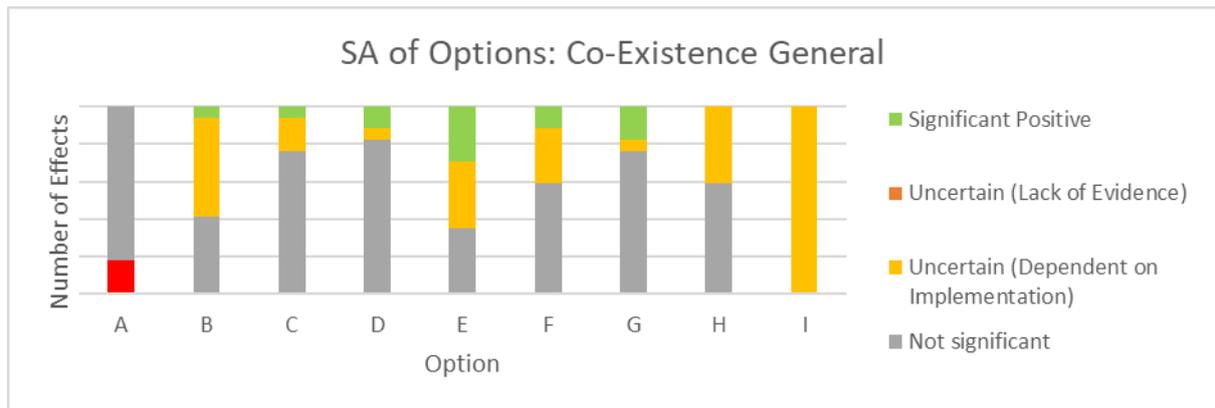
competitiveness. It is assumed that options which focus on resilience to changes in coastal processes and protection of the natural environment will not support aggregate extractions. For this reason, Options B, G and H have been identified as having potential minor negative effects.

The oil and gas industry make a significant contribution to the UK economy. Minor negative effects have been identified in relation to Options B and G as they could potentially limit oil and gas extraction. It is assumed that Option E would include tidal lagoons, which could provide coastal and climate change resilience as well as energy generation.

Mitigation

- Mitigation would be needed to ensure that development is sensitive to the historic environment. Any exposed assets would need to be carefully handled and preserved as much as possible.
- Potential negative effects of enhanced public access on biodiversity would need to be minimized.

3.9 Co-Existence General



The assessment of the co-existence general grouping of options has identified that there is the potential for significant negative effects with relation to Option A, whereas Options B, C, D, E, F and G have the potential to give rise to significant positive effects.

In the absence of adaptation, and with increasing coastal squeeze, beaches will narrow, and some dune systems may be lost (Climate_129). This would be worsened by Option A, with significant negative effects occurring on coastal features and processes. Whilst the co-existence of various marine developments may both enhance and prevent coastal squeeze, the implementation of Option E would likely have significant positive effects on coastal features and processes, as is supported by Landscape_171.

The combined effects of marine developments and other sea users has documented effects on the seascape and landscape (Landscape_170) and are especially relevant for large scale developments located within or near the coastal areas. Options C and E may have significant positive effects on the seascape and landscape SA sub-topic, as could significantly minimise and reduce the potential effects of these combined developments.

To 'do nothing' as per Option A would incur significantly negative impacts on the climate change resilience and adaptation SA sub-topic. The SA baseline identifies a range of physical changes which interact each other, including sea level rise, storm events, and changes in the availability and movement of sediment, affecting beach structure, dune systems and saltmarsh habitat (Climate_129, Climate_193).

Due to a lack of space both inshore and offshore, conflicts need to be carefully managed and co-existence taken into consideration. In the North West Marine Plan Areas, this is particularly relevant at the Port of Liverpool (Community_172). Options B, E and G may have significant positive effects on health and wider determinants of health and effects on communities as they seek to either promote social benefits or reduce significant adverse of proposals on social benefits.

Competition exists surrounding marine resources and sea space (Economy_621), which affects ports and shipping. Implementation of Option F may have significant positive effects on ports and shipping, as it supports activities within the marine area.

There are issues related to non-port related developments such as housing being approved next to ports and marine industry sites.

Cumulative visual impacts of multiple existing and new activities and developments exists within the North West Marine Plan Areas, with implications for tourism, recreation, wellbeing and cultural values both within and outside of the Marine Plan Areas (Landscape_170). There are also combined effects of marine development on recreational activities (Economy_631), including boating. Implementation of Options D, E and G may have significant positive effects on leisure, recreation and tourism.

Implementation of Option F could have significant positive effects on energy generation and infrastructure development, as illustrated by the combined positive effects of the Solway Energy Gateway (Economy_592).

Seabed assets comprise a part of the energy and communication scheme and are essential to support the operation and development of renewables. Cumulative effects exist at landfall locations (Economy_627), and competition for space exists between seabed assets and other sectors (Economy_727 and Economy_779). To 'do nothing', as per Option A would have a significant negative effect on seabed assets as the existing baseline issues would worsen over time as relevant infrastructure increases.

Mitigation

- Regarding coastal features and processes as well as climate change resilience and adaptation, proposals should ensure that the most vulnerable sections of the coastline will not be affected by existing and new marine developments nor users of coastal areas and should consider the implementation of options in context of climate change and associated impacts.
- Proposals should encourage stakeholders to seek opportunities for cooperation to enhance the resilience of existing projects and infrastructure to climate change.
- Proposals should include appropriate measures to manage baseline issues surrounding seabed assets and competition for space with other sectors. This is likely to require a change in policy wording in order to ensure avoidance of potential future cumulative effects between seabed assets and other marine developments.

3.10 Co-Existence Industry



The assessment of the co-existence industry grouping of options has identified that there is the potential for significant negative effects with relation to Option A, whereas Options D, F, G, H and I have the potential to give rise to significant positive effects.

In the absence of adaptation, and with increasing coastal squeeze, beaches will narrow, and some dune systems may be lost (Climate_129). To 'do nothing', as per Option A, would see this baseline issue worsen over time as infrastructure increases.

The combined effects of marine developments and other sea users has documented effects on the seascape and landscape (Landscape_170) and are especially relevant for large scale developments located within or near the coastal areas. Options D and G may have significant positive effects on the seascape and landscape SA sub-topic, as could significantly minimise and reduce the potential effects of these combined developments.

The lack of space inshore and offshore, particularly at the Port of Liverpool, and resulting conflicts between sectors, requires careful management and consideration of co-existence (Community_172), this includes concerning the shoreside development of ports. Options D, G and I may have significant positive effects on health, wider determinants of health and communities, as they seek to mitigate the potential impacts of developments on other receptors, including communities, thereby providing a potential positive response to existing co-existence baseline issues.

Whilst there is a reduction of import and export activity due to reductions in manufacturing (Economy_713), competition remains for marine resources and sea space (Economy_621). Implementation of Option G would likely have significant positive effects on ports and shipping.

There is general competition between marine developments and fisheries and aquaculture, as highlighted by Economy_628. There is also an opportunity for aquaculture products being used not only for food source but also biofuel and cosmetics (Economy_768). Implementation of Options D and G would have significant positive effects on fisheries and aquaculture and can contribute to the development of these two sectors.

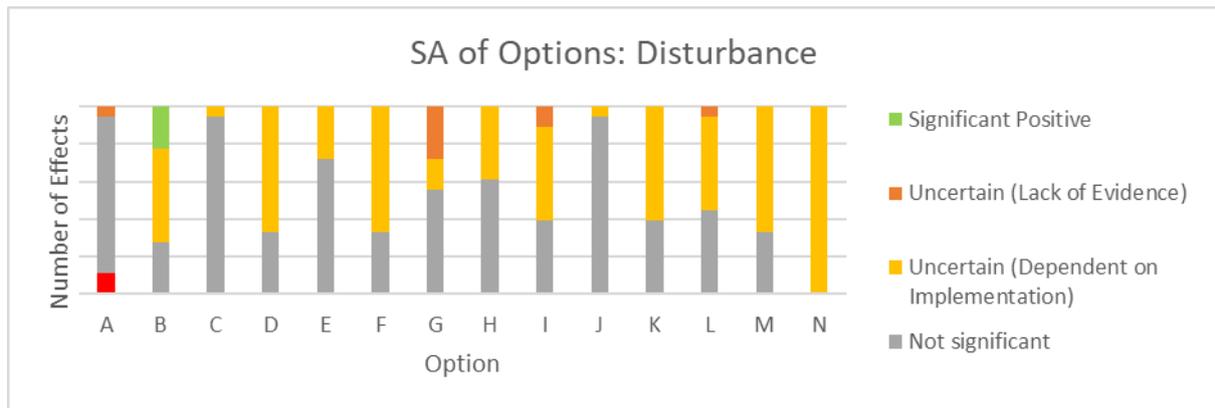
Option H may have significant positive effects on energy generation, infrastructure development and associated industry as illustrated by the combined positive effects of the Solway Energy Gateway (Economy_592).

Competition for space exists between seabed assets and other sectors (Economy_727, Economy_779), and cumulative effects exist at landfall locations (Economy_627). To 'do nothing', as per Option A would have a significant negative effect as the existing baseline issues would worsen over time as industry and associated infrastructure increases. Implementation of Options D, F and G may have significant positive impacts on seabed assets through promoting their development and could contribute to offsetting the cumulative effects currently observed at landfall locations.

Mitigation

- Regarding coastal features and processes as well as climate change resilience and adaptation, proposals should ensure that the most vulnerable sections of the coastline will not be affected by existing and new marine industry nor developments and should consider the implementation of options in context of climate change and associated impacts.
- Proposals should include appropriate measures to manage baseline issues surrounding seabed assets and competition for space with other industrial sectors. This is likely to require change in policy wording in order to ensure avoidance of potential future cumulative effects between seabed assets and other marine developments.

3.11 Disturbance



The assessment of the disturbance grouping of options has identified that there is the potential for significant negative effects with relation to Option A, whereas Option B has the potential to give rise to significant positive effects.

The North West Marine Plan Areas have been targeted for further development of offshore wind, and oil and gas activities, with a risk of disturbance and displacement to the movement of species through the area. This is particularly relevant to the movement of wintering and passage waders, seaducks and terns. There are several proposals for estuarine barrages and coastal lagoons across the North West Marine Plan Areas (Biodiv_515). The baseline indicates negative trends in terms of benthic ecology (Biodiv_420, Biodiv_425, Biodiv_470, Biodiv_542) and ornithology (Biodiv_240, Biodiv_449, Biodiv_450, Biodiv_515) in the north west based upon existing policy, and therefore significant negative effects have been identified.

Option B, which uses existing policies in combination, aims to improve coherence or connectivity of protected sites and has been scored significant positive, with regards to protected sites and species, benthic and intertidal ecology, fish and shellfish and ornithology.

Protection of priority habitats could prevent disturbance to heritage assets, seabed substrates and coastal features as a by-product, but effects are judged to be uncertain (dependent on implementation) due to the difference in spatial scale.

The only option which is explicitly relevant to heritage is Option H, 'relevant local authorities will make best efforts to inform coastal access users about potential negative effects on habitats, species and heritage assets and promote considerate access in areas of ecological or historical importance'. However, it is not clear as to how this will be implemented, so uncertainty has been recorded in the assessment.

Fleetwood, Heysham, Liverpool, Manchester are major ports in the North West and most important interactions are potential noise and visual disturbance to highly mobile species and contamination to benthic habitats and water (Economy_377). There is also an interaction between increasing access to the marine area for recreation and tourism and protection of heritage and conservation sites. The extent to which these interactions impact the economy will be dependent on specific implementation, but there is potential for trade-offs within these SA sub-topics.

The North West is an important area for shellfish production (Economy_299, Economy_300) and there is a significant presence of UK and non-UK fishing vessels that are impacting benthic habitats and Marine Protected Area (Biodiv_345, Biodiv_526).

Areas of manufacturing / heavy industry that affect the coastal zone in the north west include Barrow, Fleetwood, and Heysham (Economy_536, Economy_537, Economy_539). The main focus in this area is the chemical industry and energy industry. There is a potential interaction here between manufacturing and all biodiversity components. Aggregate wharves within the north west are Barrow, Eastham, Glasson, Heysham, Liverpool Wharves (Economy_586). Aggregate dredging has the potential to interact with all biodiversity components, the extent of this interaction for several options will depend on specific implementation, however there is potential for trade-offs.

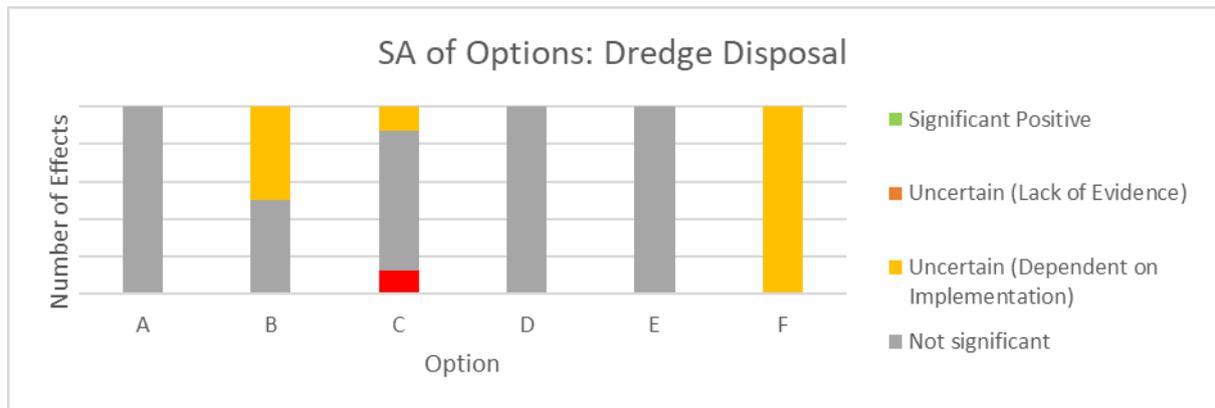
Defence activities that utilise the marine environment, directly or indirectly, in support of operational capability are diverse but include operational vessels and aircraft, Her Majesty's Naval bases, surface and sub-surface navigational interests, underwater acoustic ranges, maritime exercises, amphibious exercises, coastal training ranges and coastal test and evaluation ranges (Economy_484). There are also two large shipyards within the North West Inshore Marine Plan Area: BAE Systems Maritime Submarines at Barrow-in-Furness and Cammell Laird at Birkenhead, Merseyside (Economy_651). Although there is a potential interaction here it was felt that the proposed responses were unlikely to affect military activities due to their autonomy.

The North West is an area of offshore wind (Energy_347), nuclear (Energy_361), and oil (Energy_348) energy generation. These projects have the potential to interact with all biodiversity components. The north west has a number of existing and planned pipelines, cables and interconnectors, connecting developments with the onshore grid and the UK with Ireland (Economy_298, Economy_527, Economy_591). These projects have the potential to interact with all biodiversity components.

Mitigation

No specific mitigation has been identified.

3.12 Dredge Disposal



The assessment of the dredge disposal grouping of options has identified that there is the potential for significant negative effects with relation to Option C. None of the Options have the potential to give rise to significant positive effects.

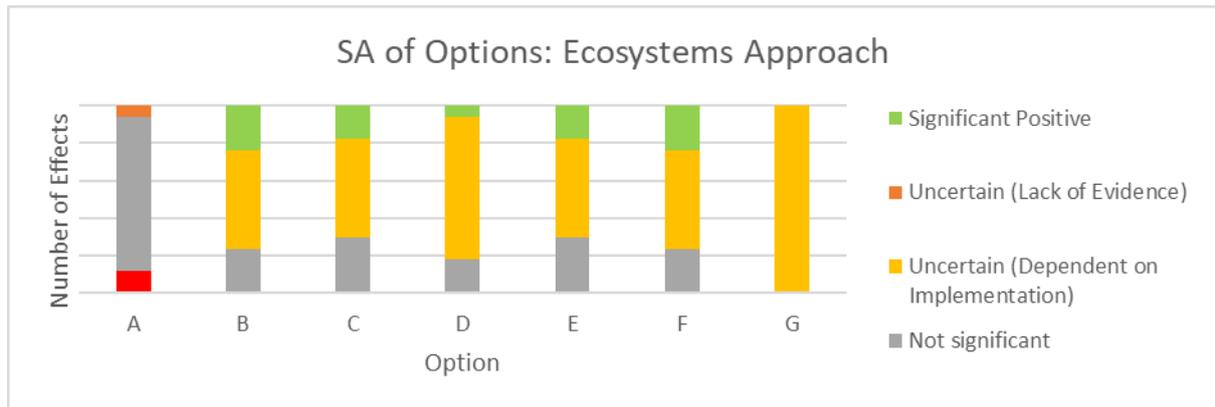
Dredging and disposal can have implications for the setting of heritage assets at the coast (Cultural_176, Cultural_183); cause changes in coastal features and processes; cause changes in seabed substrate and bathymetry (Economy_706); and cause release of contaminants into the water column with subsequent effects occurring on both benthic and pelagic marine organisms (Water_171). However, none of the proposed options would have significant effects on the associated SA sub-topics within the North West Marine Plan Areas.

Disposal activities are important for ports (Economy_719), and the use of disposal sites provides a space to dispose of dredged material at sea at a competitive cost compared to the alternative of bringing large amounts of dredged material for on-land treatment, management or disposal. Option C could have significant adverse effects on ports as may delay activities (trying to match material to reuse project), and may potentially increase costs regarding dredging method, testing, treatment and transport. It should be noted that not all dredged materials are suitable for reuse.

Mitigation

- Potential opportunities exist for the reuse of dredged materials which could benefit coastal features and processes.
- The wording 'must' in Option C can represent a significant constraint on ports, as the re-use of dredged materials is not always possible, depending on grain size, reception site characteristics etc.

3.13 Ecosystem Approach



The assessment of the ecosystem approach grouping of options has identified that there is the potential for significant negative effects with relation to Option A, whereas Options B, C, D, E and F have the potential to give rise to significant positive effects.

Options B and F aim to enhance or facilitate biodiversity adaptation, migration, connectivity and net environmental gain and therefore have been scored significant positive. The baseline indicates negative trends in terms of benthic ecology (Biodiv_420, Biodiv_425, Biodiv_470, Biodiv_542) and ornithology (Biodiv_240, Biodiv_449, Biodiv_450, Biodiv_515) in the north west based upon existing policy, and has therefore resulted in significant negative effects, with regards to Option A.

Option D specifically states that strategic plans and programmes must consider long-term projections of climate and coastal change and build in measures to avoid or minimise long-term risks to people, infrastructure and components of the marine ecosystem that generate natural capital.

There is no specific relevant option for plankton within this grouping, but an ecosystem approach could benefit all levels of the ecosystem (dependent on implementation).

Areas of manufacturing / heavy industry that affect the coastal zone in the north west include Barrow, Fleetwood, and Heysham (Economy_536, Economy_537, Economy_539). The main focus in this area is the chemical industry and energy industry. There is a potential interaction here between manufacturing and all biodiversity components. Aggregate wharves within the North West are Barrow, Eastham, Glasson, Heysham, Liverpool Wharves (Economy_586). Aggregate dredging has the potential to interact with all biodiversity components, the extent of this interaction for several options will depend on specific implementation.

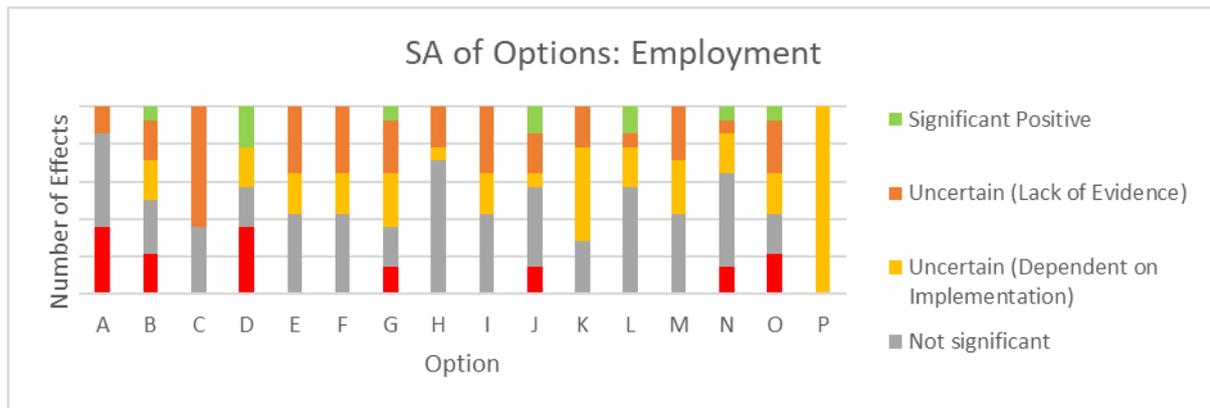
The North West is an area of offshore wind (Energy_347), nuclear (Energy_361), and oil (Energy_348) energy generation. These projects have the potential to interact with all biodiversity components. The north west has a number of existing and planned pipelines, cables and interconnectors, connecting developments with the onshore grid and the UK with Ireland (Economy_298, Economy_527,

Economy_591). These projects have the potential to interact with all biodiversity components.

Mitigation

No specific mitigation has been identified.

3.14 Employment



The assessment of the employment grouping of options has identified that there is the potential for significant negative effects with relation to Option A, whereas Option L has the potential to give rise to significant positive effects. Options B, D, G, J, N and O have the potential to give rise to a combination of both positive and negative significant effects depending on the receptors/SA sub-topics being considered.

Marine employment activities in the North West Marine Plan Areas, such as shipping, fishing, aggregate extraction and oil and gas production are having negative impacts on biodiversity. Significant negative effects have been identified for protected sites and species, ornithology, mega fauna and benthic and inter-tidal ecology, fish and shellfish, for Option A.

Impacts on subtidal sediments from offshore industry such as aggregate extraction, dredging and offshore energy production is an issue for the North West Marine Plan Areas. At various locations near large ports, subtidal rocky habitat has been lost due to construction, infrastructure (mainly coastal) or via smothering from dredged deposits (Biodiv_542). Existing Policies X-INF-1 and X-AGG-3 within Option B aim to increase land-based infrastructure and aggregate extraction, and so has resulted in significant negative effects for protected sites and species, ornithology, mega fauna and benthic and inter-tidal ecology, fish and shellfish. Subsequently, Option B X-INF-1 and X-AGG-3 could result in significant positive effects for aggregate extraction.

The Solway Energy Gateway is a sustainable, renewable energy project to create an “electric bridge” across the Solway Firth. It will harness tidal energy to generate green electricity, whilst creating a new pedestrian and cycle route between England and Scotland, a tourist attraction and a multi-use asset for the benefit of local communities (Economy_592). Option D aims to support the provision of diverse and sustainable energy. Significant positive effects have been identified in relation to energy generation and infrastructure. Due to the potential tourism and recreational opportunities that the Solway Energy Gateway could provide, significant positive effects have been identified in relation to leisure, recreation and tourism.

There is potential for negative effects in response to Option D with regards to the defence sector, as wind turbines can cause navigational and radar interference.

However, this would be dependent upon the location, size and nature of the energy projects that come forward.

Potential for tidal lagoon development is being considered in the north of Workington in West Cumbria. Impacts may include habitat loss or change, introduction of hard substrate as artificial reefs and localised change in hydrodynamics affecting intertidal organisms (Biodiv_501). The North West Marine Plan Areas have also been targeted for the further development of offshore wind, and oil and gas activities (Biodiv_515). There is potential for significant negative effects on biodiversity, however, due to the unknown nature of development, uncertainties have been recorded.

Deprivation in relation to income, employment, education (2015 Index of Multiple Deprivation) shows some more deprived lower super output areas on the coast compared to the rest of England (Communities_19). Poor health is linked to social and economic disadvantages. It is assumed that the supply of further employment opportunities will help to improve health and deprivation and promote equality in the north west. Providing more employment opportunities would also work towards strengthening the local economy and provide further prosperity to coastal areas. None of the proposed options make reference to this, so their effects would be dependent upon implementation.

Option G is likely to result in significant positive effects for ports and shipping, as it supports the diversification of port facilities and infrastructure. This could work well with the planned Atlantic Gateway Initiative in Liverpool and along the River Mersey (Economy_716).

Effects of pollution from marine activities including aquaculture, shipping, oil and gas, and marine construction are occurring on benthic and intertidal habitats and species, including cumulative impacts from increasing levels of contaminants and risk of high level mortality from oil spills. 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 (Biodiv_420). Key introduction pathways for invasive species include commercial shipping (Biodiv_636). For these reasons significant negative effects have been identified in relation to Option G, with regards to non-native species and benthic and intertidal ecology fish and shellfish. The diversification of port facilities and infrastructure could also lead to more traffic on the water and further disturbance of marine mega fauna.

Option J aims to prolong the tourist season, which has resulted in significant positive effects on leisure and recreation and tourism. Conversely, due to the negative impacts of recreational pressures, the assessment has identified a potential significant negative effect on marine mega fauna and ornithology.

Fishing and aquaculture is in decline within the North West Marine Plan Areas. There are significant wild shellfish beds and spawning and nursery areas for fish within the North West Marine Plan Areas (Economy_300). Options L and N aim to protect fishing and spawning and nursery areas, so have resulted in significant positive effects on fishing and aquaculture. It has been assumed that options that aim to diversify marine related skills could include the fishing industry.

Option L aims to avoid adverse impacts on spawning and nursery areas and any associated habitats within the North West Marine Plan Areas. This is likely to have a positive effect on both fish and shellfish.

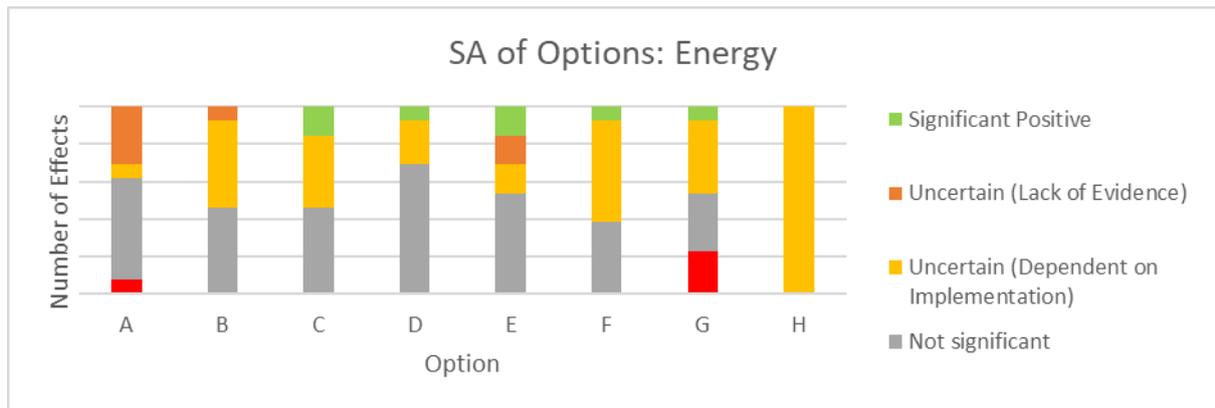
Option O supports aggregate activity and therefore significant positive effects have been identified. It is assumed that options that propose increases in marine employment and technology could include the aggregate industry, but this would be dependent upon implementation. There is potential for Option O to result in negative effect on fishing and aquaculture, however, there is limited information within the baseline to support this.

Significant negative effects have been identified with regards to Option O with regards to benthic and inter-tidal ecology fish and shellfish, as it is likely that continued extraction will lead to the further losses to the valuable subtidal rocky habitats.

Mitigation

- Proposals which aim to provide a renewable energy source, should give full consideration to their potential impacts on both coastal processes and biodiversity to ensure that no negative impacts occur on important areas for marine fauna and flora.
- Access to protected sites needs to be carefully controlled in order to ensure that the species and habitats they are designated for are protected.
- Measures needed to control disturbance of bird species, particularly in key locations such as Special Protected Areas.

3.15 Energy



The assessment of the energy grouping of options has identified that there is the potential for significant negative effects with relation to Option A whereas Options C, D and F have the potential to give rise to significant positive effects. Option G has the potential to give rise to a combination of both positive and negative significant effects depending on the receptors/SA sub-topics being considered.

Impacts on subtidal sediments from offshore industry including aggregate extraction, dredging, offshore energy production is an issue within the North West Marine Plan Areas. At various locations near large ports, subtidal rocky habitat has been lost due to construction, infrastructure (mainly coastal) or via smothering from dredged deposits (Biodiv_542). For this reason, significant negative impacts have been identified in relation to Option A, 'do nothing', with regards to benthic and inter-tidal ecology fish and shellfish.

Option C aims to support the provision of diverse and sustainable energy, therefore significant positive effects have been identified in relation to greenhouse gas emissions and energy generation and infrastructure development. Options D and E could also have a significant positive impact on greenhouse gas emissions. Any option which would decrease the amount of oil and gas activity or increase sustainable energy would have a positive effect on greenhouse gases through reducing carbon dioxide emissions.

The UK Offshore Energy Strategic Environmental Assessment 3 states that existing offshore oil and gas infrastructure in mature fields provides 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 area highly prospective for gas storage and carbon capture and storage projects. Large industrial emitters in the Merseyside area also provide significant potential carbon dioxide sources (Economy_605).

Option E supports the use of carbon storage. This is likely to result in significant positive effects on energy generation and infrastructure development and reduction of greenhouse gas emissions. Leakage from a properly selected storage site is extremely unlikely. 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 either widespread or long-term, taking into account the dilution and buffering capacity of oceans (Economy_622). Therefore, minor negatives have been identified in relation to ornithology and benthic and inter-tidal ecology fish and shellfish.

The North West Marine Plan Areas have also been targeted for the further development of offshore wind, and oil and gas activities, with a risk of disturbance and displacement to the movement of species through the area. This is particularly relevant to the movement of wintering and passage waders, seabirds and terns. There are several proposals for estuarine barrages and coastal lagoons across the North West Marine Plan Areas (Biodiv_515).

Option G supports further oil and gas activity in the North West Marine Plan Areas, which has resulted in significant negative impact on ornithology and benthic and inter-tidal ecology fish and shellfish. It is assumed that greenhouse gas emissions will increase if oil and gas activity is supported. This has resulted in further significant effects on greenhouse gas emissions. Conversely, this option has resulted in a significant positive effect on energy generation and infrastructure.

Mitigation

- Proposals which aim to provide a renewable energy source, should give full consideration to the potential impacts on both coastal process and biodiversity to ensure they do not negatively impacts important areas for marine fauna and flora.

3.16 Fisheries



The assessment of the fisheries grouping of options has identified that there is the potential for significant negative effects with relation to Option A, whereas Options D, F, H and I have the potential to give rise to significant positive effects.

The SA database identified fishing activities as a key contributor to marine litter in all of the Marine Plan Areas (Water_253, Water_233). This can be generated through discarded fishing gear or waste from the fishing industry. It is likely that this situation will not improve without the implementation of specific measures to tackle this problem, hence the potential significant negative effect for Option A.

It is assumed that fishing may contribute positively to the development of ports and shipping activities within the North West Marine Plan Areas, and as such, any option which has the potential to promote fisheries may in theory increase opportunities for ports and shipping, however no significant effects of the proposed options have been identified in relation to the ports and shipping SA sub-topic.

A number of interactions between fisheries and marine developments have been identified, including future offshore wind development, tidal wave development and oil and gas activities (Economy_681, Economy_675, Economy_778). Option I may have significant positive effects on energy generation and infrastructure development as it promotes effective collaboration with other sectors prior to project development, so provides a response to the co-existence issues highlighted within the baseline database. This interaction usually considers the potential impacts of wind farm development on fisheries however, fisheries and aquaculture activity also pose a number of constraints on development within the windfarm sector.

Fishing trawlers and anchors are known to be the main cause of submarine cable faults, and it is likely that the frequency of incidents will increase in the future (Economy_627). It is very unlikely that the effects of fisheries on seabed assets will improve without the implementation of specific measures to tackle this problem, hence the potential significant negative effect for Option A. Conversely, Options F and I may have significant positive effects on seabed assets.

There is a lack of understanding of the purpose of marine conservation zones within the fishing sector (Biodiv_702), and fisheries pose a threat to vulnerable or rare species (Economy_628). To 'do nothing', as per Option A, and given the current

constraints on marine fauna, it is likely that this issue will become severely worsened into the future, hence the potential significant negative effect for Option A. Implementation of Options F and I would have significant positive effects on protected sites and species.

Due to the impacts on subtidal sediments from mobile fishing gear such as bottom trawls and dredges, commercial fishing is resulting in the loss of benthic habitats and species (Biodiv_425). Without action, as is proposed by Option A, this key baseline issue will not be addressed and so will become exacerbated into the future with significant negative effect. Conversely, Options F, H and I may have significant positive effects on benthic and inter-tidal ecology.

Key baseline issues exist concerning the ingestion of, or entanglement in, marine litter by marine mammals and turtles. As highlighted above, the fishing sector is a prominent producer of relevant marine litter, particularly through its resulting in 'ghost fishing'. Interaction also occurs between marine mammals and commercial fishing activity, largely through competition for food resources (Biodiv_536). To 'do nothing' would allow these baseline issues to become exacerbated into the future, resulting in a significant negative effect.

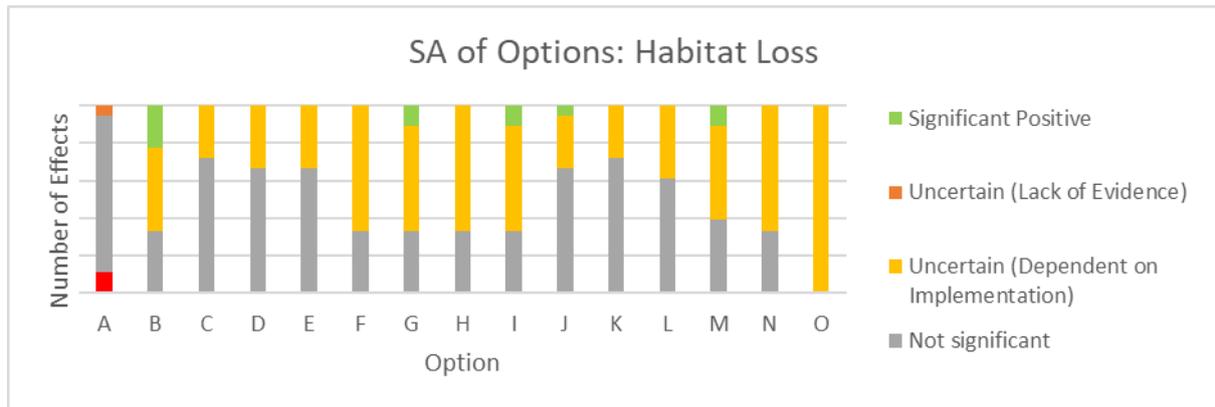
Mitigation

- Further consultation and engagement with stakeholders is recommended in order to find solutions to address the contribution of the fishing sector on marine litter. Proposals may consider:
 - (1) Education and awareness actions and campaigns. These should apply to the fishing sector and be received by both existing and future staff, for example through training or education modules
 - (2) Measures to ensure compliance with the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex V.
- Proposals should include collaboration with key stakeholders/authorities to prevent and/or avoid the issue of fishing activities causing detriment to seabed assets. Such proposals may advocate use of zoning and marks at sea amongst others. Seabed assets are already clearly marked on marine charts and the likes of Kingfisher cable awareness charts. Cable protection is designed to reflect the risks posed by fishing. Seabed infrastructure may prove attractive to fish (as aggregation areas) and therefore attractive to fishermen. Other potential solutions could include restriction of fishing in some areas, or certain fishing methods, near infrastructure, but this is likely to be resisted by fishermen.
- Proposals should involve further consultation between regulators in charge of Marine Protected Area and key representatives of recreational and commercial fisheries to find solutions to increase awareness and prevent/avoid potential effects of fishing activity on vulnerable or rare species.
- Proposals should involve further consultation between regulators in charge of fisheries and key representatives of recreational and commercial fisheries to prevent/avoid over-fishing and to find ways of better regulating these

activities. The sustainability objectives of fisheries should be aligned with those defined for biodiversity.

- Proposals should involve further consultation between regulators in charge of fisheries and key representatives of commercial fisheries to raise awareness about marine litter and potential effects on marine mega fauna.
- Proposals should consider key feeding grounds for marine mammals and adapted protection measures to prevent/avoid competition between this receptor and commercial fishing activity.

3.17 Habitat Loss



The assessment of the habitat loss grouping of options has identified that there is the potential for significant negative effects with relation to Option A, whereas Options B, C, G, I, J, and M have the potential to give rise to significant positive effects.

Changes in habitat condition and habitat loss are being caused by sea level rise, coastal squeeze, storm events from climate change and the creation of coastal defences. This is particularly a concern in sensitive intertidal areas (Biodiv_423). The baseline indicates further negative trends in terms of benthic ecology (Biodiv_420, Biodiv_425, Biodiv_470, Biodiv_542) and ornithology (Biodiv_240, Biodiv_449, Biodiv_450, Biodiv_515) in the north west based upon existing policy. For these reasons, significant negative effects have been identified with regards to Option A, 'do nothing'.

Options B, G, I, and M all aim to enhance priority coastal habitats and ecosystem services and have been scored significant positive as a result for benthic and intertidal ecology fish and shellfish.

Option J stipulates that all proposals that are capable of affecting coastal processes must demonstrate that they will not cause significant adverse coastal change. This is likely to result in a significant positive for coastal processes. This in turn could help to coastal habitats become more resilient to coastal and climate change.

Protection of priority habitats will prevent disturbance to seabed substrates and coastal features as a by-product, but effects are judged to be minor positive due to the difference in spatial scale.

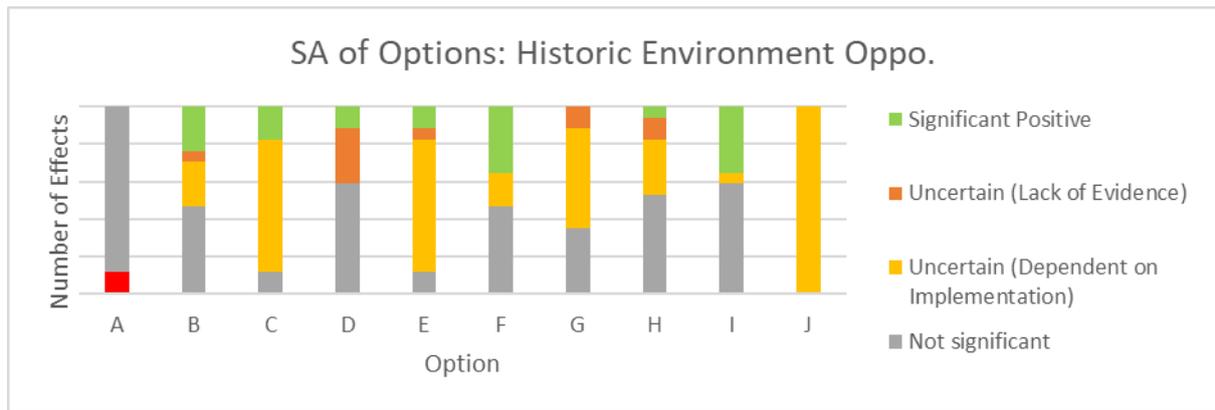
Fleetwood, Heysham, Liverpool, Manchester are major ports in the north west and most important interactions are potential noise and visual disturbance to highly mobile species and contamination to benthic habitats and water (Economy_377). There is also an interaction between increasing access to the marine area for recreation and tourism and protection of heritage and conservation sites. The north west is an important area for shellfish production (Economy_299, Economy_300) and there is a significant presence from UK and non-UK fishing vessels which are impacting benthic habitats and Marine Protected Area (Biodiv_345, Biodiv_526). The extent to which these interactions impact the economy will be dependent on specific implementation, but it could result in trade-offs.

Areas of manufacturing / heavy industry that affect the coastal zone in the north west include Barrow, Fleetwood, and Heysham (Economy_536, Economy_537, Economy_539). The main focus in this area is the chemical and energy industry. There is a potential interaction here between manufacturing and all biodiversity components. Aggregate wharves within the north west are Barrow, Eastham, Glasson, Heysham and Liverpool Wharves (Economy_586). Aggregate dredging has the potential to interact with all biodiversity components, the extent of this interaction will depend on specific implementation, but again could result in trade-offs.

Mitigation

No specific mitigation has been identified.

3.18 Historic Environment Opportunities



The assessment of the historic environment opportunities grouping of options has identified that there is the potential for significant negative effects with relation to Option A whereas Options B, C, D, E, F, H and I have the potential to give rise to significant positive effects.

Significant negative effects on heritage assets within and adjacent to marine plan areas may be anticipated by doing nothing (Option A), as important assets will continue to be lost to natural and anthropogenic driven change. This would represent a missed opportunity to utilise marine planning to enhance protection and access to heritage.

Significant positive effects may be anticipated arising from the implementation of Options B, C, D, E, F and I as these options have the potential to result in increased access, protection or enhancement of the significance of heritage assets. In turn, this would lead to development of greater understanding, awareness and protection. As such, a combination of options providing, protection, recording and enhanced access should be supported.

Broadly speaking, options which are beneficial to the historic environment are mutually beneficial to the seascape and landscape, owing to the contribution of heritage assets to the historic character of an area. Significant positive effects to landscape and seascape are therefore anticipated from the implementation of Options C, F, H and I.

Significant positive effects may be anticipated from Options F and I with regards to leisure and recreation, tourism and health and wellbeing. These options will have positive benefits by increasing access as well as tourism and recreation, which could lead to health benefits for local communities. Potential significant positive effects have also been identified for Option B, with regards to leisure, recreation and tourism. It is likely that Option B would lead to additional protection, enhancement, and access to heritage which will be of subsequent benefit to leisure, recreation and tourism. For example, submerged heritage assets could be used as a focal point for scuba diving.

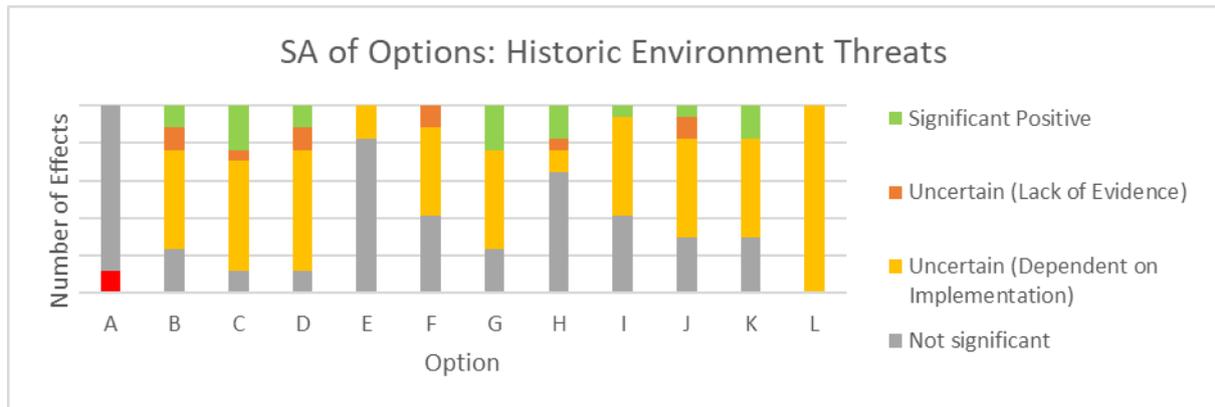
Options supporting access to marine heritage assets must be implemented with due consideration of the potential impacts upon benthic and intertidal ecology. Options

promoting greater protection for heritage assets may have indirect benefits for the natural environment.

Mitigation

- Support options which enable greater protection, management, and enhancement of understanding of the marine historic environment.
- Mitigation and management of heritage assets will be of particular importance in any instances where the public benefits resulting from proposals are found to outweigh the compromise or harm which may be subjected upon discovered heritage assets, for example, as in Options B and H.

3.19 Historic Environment - Threats



The assessment of the historic environment threats grouping of options has identified that there is the potential for significant negative effects with relation to Option A whereas Options B, C, D, E, G, H, I, J and K have the potential to give rise to significant positive effects.

Significant negative effects are anticipated to occur on heritage assets within and adjacent to the North West Marine Plan Areas if nothing is done, as per Option A, as important assets will continue to be lost to natural and anthropogenic driven change. This would represent a missed opportunity to utilise marine planning to enhance protection and access to heritage.

Significant positive effects may be anticipated arising from the implementation of Options C, D, G, and K as these options have the potential to result in increased access, or to enhance the significance of heritage assets, leading to the development of greater understanding, awareness and protection. As such, a combination of options providing protection and enhanced access should be supported.

Existing policy X-CC-3 within Option B will not support proposals in and adjacent to the North West Marine Plan Areas which are likely to have a significant adverse impact on coastal change. This has resulted in significant positive effects for coastal features and processes.

Broadly speaking, options that are beneficial to the historic environment are mutually beneficial to the seascape and landscape, owing to the contribution heritage makes to the historic character of these areas. As such, significant positive effects to seascape and landscape may be anticipated through the implementation of Options G, I, J and K.

Option G aims to enhance the resilience of heritage assets to climate change and therefore enhance their contribution to the historic environment record. Significant positive effects have been identified for climate change resilience and adaptation as it will deliver positive mutual benefits for the historic environment and coastal change resilience alike.

Implementation of heritage options enhancing access can have added value benefits for local communities, health and well-being, including through access to high quality open space, and promote the importance of historic character to local tourism and sense of place. Heritage options which increase access should be supported, and therefore significant positive effects have been identified for Options C and H.

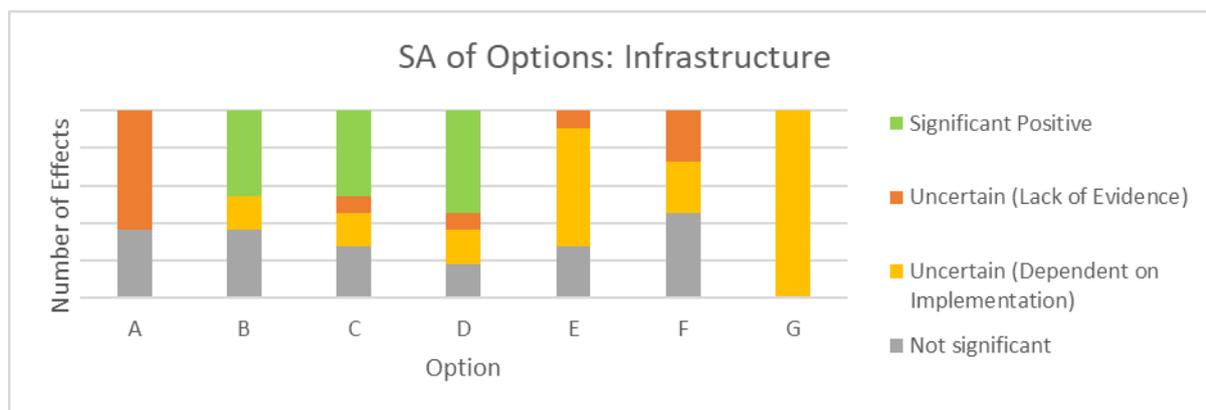
Significant effects to tourism have been identified from Options B, C and H, which have the potential to deliver positive benefits to tourism through enhanced access to the historic environment.

Significant positive benefits may be anticipated for Option H which will deliver mutual benefits to the historic environment and protected sites and species at the coast through greater understanding and considerate access. In general, options which ensure the avoidance, protection and mitigation of the historic environment are likely to be delivering similar measures and benefits for the natural environment.

Mitigation

- Support options which enable greater protection, management, and enhancement of understanding of the marine historic environment.
- Mitigation and management of heritage assets will be of particular importance in any instances where the public benefits of proposals are found to outweigh the compromise or harm which may be subjected upon discovered heritage assets, for example, as in Options I and J.

3.20 Infrastructure



The assessment of the infrastructure grouping of options has identified that there is the potential for significant positive effects with relation to Options B, C and D, whereas none of the options have the potential to give rise to significant negative effects.

The Coastal Communities 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 (Communities_42). 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. Implementation of Options B and D may therefore have significant positive impacts on health and wider determinants of health and effects on communities

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. The west coast of the United Kingdom meets the needs of transatlantic and Irish traffic. It is not possible to anticipate future commercial opportunities as new shipping routes and technologies emerge and the needs of trading partners change as their economic circumstances develop. Capacity needs to be provided at a wide range of facilities and locations, to provide the flexibility to match the changing demands of the market, possibly with traffic moving from existing ports to new facilities generating surplus capacity (Economy_430).

Options B, C and D all support infrastructure which sees the facilitation, development and/or diversification of marine activity, and so would have significant positive impacts on ports and shipping. Equally, these options would have a significant positive impact on marine manufacturing through the facilitation of marine activity and associated infrastructure requirements. Whilst the North West Marine Plan Areas already have a strong recent history of marine manufacturing, further renewable energy projects and any future carbon capture and storage projects may require additional onshore marine manufacturing facilities (Economy_536, Economy_537, Economy_539).

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 (Economy_479), and as such, increased infrastructure projects would require increased aggregate extraction, hence implementation of Options C and D could have significant positive effects.

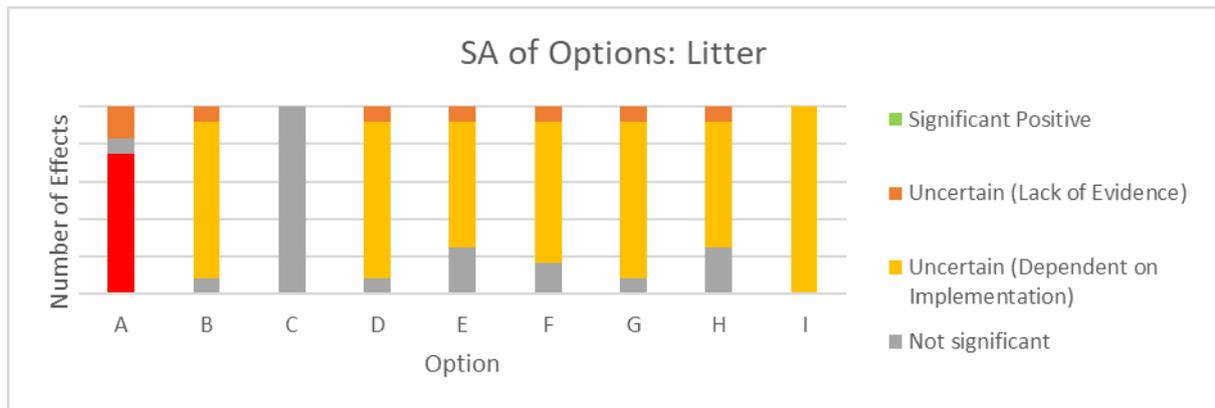
Several proposed energy projects would benefit from the implementation of Options B, C and D, with significant positive effect. This includes, for example, the Solway Energy Gateway (Economy_348, Economy_592, Economy_605, Economy_548).

There is a planned subsea cable which is to pass under Morecambe Bay as part of the north west Coastal Connections project to connect the planned nuclear power plant at Moorside to the National Grid at Heysham. There are also seabed assets relating to gas fields, offshore wind, and other developments in relation to marine renewables (Economy_591, Economy_473). These projects would be supported by the implementation of Options B, C and D with significant positive effects identified on associated seabed assets.

Mitigation

No mitigation has been identified for this grouping.

3.21 Litter



The assessment of the litter grouping of options has identified that there is the potential for significant negative effects with relation to Option A, whereas none of the options have the potential to give rise to significant positive effects. It should be noted that implementation of either Option D or G would incur the same effects.

The marine historic environment promotes increased leisure, recreation and tourism (Cultural_178). The associated effects of this, including litter generation, are detailed under the leisure, recreation and tourism SA sub-topics below, which would see the same significant negative effects as if Option A were implemented.

Marine litter acts as a source of persistent pollutions, other chemical derivatives, and adsorption surfaces which lead to biomagnification within marine organisms and have the potential to cause sublethal toxicological effects and endocrine disruption (Water_263). Option A does not alleviate the key issues as highlighted in the baseline database regarding pollution and water quality, hence would have a significantly negative impact.

It is recognised that there is little understanding of marine litter, biodegradability and toxicity (Water_244). Densities of beached litter, especially plastics, recorded in the UK have increased since monitoring commenced in 1994, and, in all areas in which surveys are systematically completed, are recognised as problematic by the Marine Strategy Framework Directive Good Environmental Status targets (Water_233, Water_240, Water_289). Microplastics have been found globally on beaches, in surface waters, sediment and a wide range of biota (Water_252), it is therefore recognised that both primary and secondary microplastics have the potential to pass into cells (Water_321). Evidence is missing regarding the bioaccumulation of microplastics along food chains, including from seafood to humans (Water_321). Chemical additives both contained within the plastic and adsorbed to the plastic can biomagnify with chronic effects occurring on marine organisms (Water_291). Option A does not address the key baseline issues regarding marine litter, and as such, its implementation would have significantly negative implications.

Marine litter includes ghost fishing gear, so its generation is directly connected to fisheries and aquaculture (Water_234). Option A does not address the contribution of fisheries and aquaculture to marine litter, and so its implementation would have significantly negative impacts.

The sea can provide a variety of tourism and recreational activities, which generate a considerable amount of income for the economy and many coastal towns. All coastal activities are enhanced by a well-managed and healthy marine environment, attractive and well-maintained beaches, seashore and clean bathing water, of which marine litter is a key driver (Economy_482). Enhanced tourism, population growth, the extension of the tourist season and associated growth in the leisure industry will have environmental impacts including pollution from litter, and so will have social and amenity impacts if not managed sustainably (Economy_630, Economy_746, Economy_762, Economy_763, Water_273). Option A does not ensure the sustainable management of leisure, recreation and tourism activities regarding marine litter, and so would have profound negative impacts.

Effects from fishing activities are seen on protected sites and species (Biodiv_474), which could include ghost nets (Biodiv_553, Biodiv_554). Option A does not address this key issue regarding protected sites and species, and as such would have significantly negative implications if it were implemented.

Ingestion of, and entanglement by, marine litter can cause damage and death of marine species as well as reproductive and population impacts (Biodiv_476). Intertidal sediment habitats are deteriorating due to cumulative effects including beach litter (Biodiv_470, Biodiv_471). Option A does not address key baseline issues regarding the impacts of marine litter on benthic and inter-tidal ecology nor fish and shellfish, and so its implementation would have significant negative impacts.

At present, ingestion of, or entanglement in, marine litter is considered a potential issue for marine mammals and turtles as although both ingestion of plastic by cetaceans has been recorded and plastic debris is commonly found in the turtle gut during post-mortem examinations, data is currently insufficient to adequately assess the impacts of this, and so impacts of marine litter on marine megafauna is not currently considered to be a significant pressure in United Kingdom waters (Biodiv_467, Biodiv_468, Biodiv_469, Biodiv_650). Entanglement and bycatch of seals can be caused by both active fishing nets and discarded or storm-damaged ghost nets (Biodiv_553, Biodiv_554). Option A does not address key issues surrounding marine litter and its impacts on marine mega fauna, and so its implementation would have significant negative impacts.

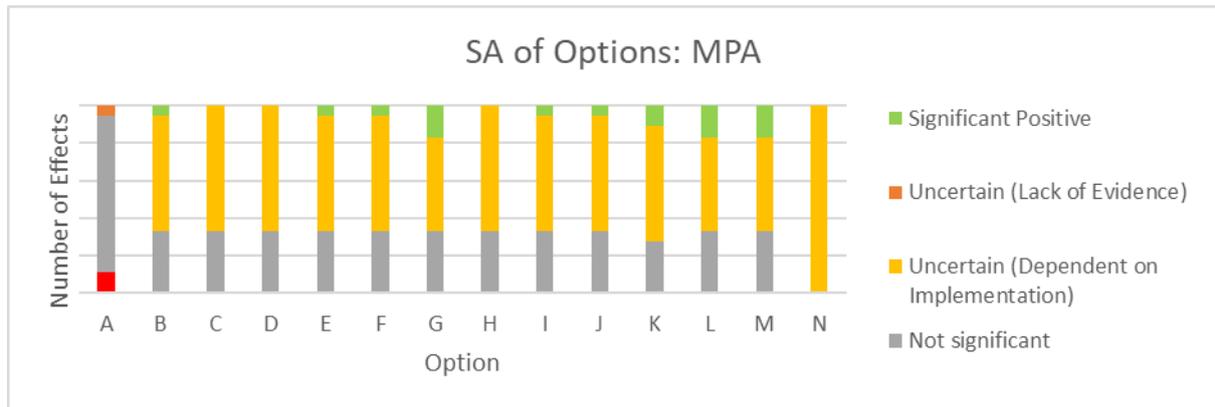
Impacts on seabirds from litter are considered low at present (Biodiv_451) but have the potential to become exacerbated into the future, in which case Option A would have the potential to have significant negative effects on ornithology.

Mitigation

- It is recognised that further action may need to be taken regarding marine litter should the Marine Strategy Framework Directive Programme of Measures for achieving Descriptor 10 show that the effect of the combined measures will not deliver Good Environmental Status in line with expectations (Water_244).
- If more stringent, Options B, D, G and H would have a greater positive impact on the heritage assets within the marine plan areas SA sub-topic.

- If more stringent, Options B, D, F, G and H would have a greater positive impact on the marine mega fauna SA sub-topic.
- If more stringent, Options B, D, E, F and G would have a greater positive impact on both the fisheries and aquaculture and protected sites and species SA sub-topics.
- If more stringent, Options B, D, E, F, G and H would have a greater positive impact across the heritage adjacent to the marine plan areas; pollution and water quality; marine litter; health and wider determinants of health, effects on communities; leisure and recreation; tourism; and benthic and inter-tidal ecology and fish and shellfish SA sub-topics.

3.22 Marine Protected Areas



The assessment of the Marine Protected Area grouping of Options has identified that there is the potential for significant negative effects with Option A, whereas Options B, E, F, G, I, J, K, L, and M have the potential to give rise to significant positive effects.

The North West Marine Plan Areas are some of the most designated and notified sections of the English coast. Most notable is Liverpool Bay Special Protection Area, one of the UK’s largest SPAs supporting over 50,000 wintering birds including red-throated diver and common scoter. The area also includes Morecambe Bay, which supports over 200,000 wintering waders and wildfowl and 60,000 breeding seabirds. In addition to Duddon Special Protection Area/Special Area for Conservation, Solway Special Protection Area/Special Area for Conservation and the Ribble and Alt Estuaries Special Protection Area are also important (Biodiv_320).

The baseline indicates negative trends in terms of benthic ecology (Biodiv_420, 425, 470 and 542) and ornithology (Biodiv_240, 449, 450, and 515) in the north west based upon existing policy, and has therefore resulted in significant negative effects with regards to Option A.

Options B, E, F and J aim to improve or enhance coherence or connectivity of protected sites, with specific mention to the Ribble, Alt, Mersey and Dee rivers and estuaries. This has resulted in significant positive effects for protected sites and species, as it is assumed that these Options will lead to increased protection of designated sites, within the North West Marine Plan Areas.

Option M aims to develop opportunities to support a collaboration between authorities and organisations to maintain and enhance the numbers of species and condition of habitats for internationally important birds on the Ribble, Alt, Dee and Mersey. Specific mention to internationally significant bird species within the Ribble, Alt, Dee and Mersey rivers and estuaries along with the intention to bring about enhancement measures, has resulted in significant positive effects for both ornithology and protected sites and species.

Options G and L have resulted in significant positive effects for protected sites and species, ornithology and benthic and intertidal ecology, fish and shellfish. Both options aim to support proposals that will either protect or enhance the resident

colonies of internationally significant bird species inhabiting the Ribble, Alt, Mersey and Dee rivers and estuaries and/or their supporting habitat.

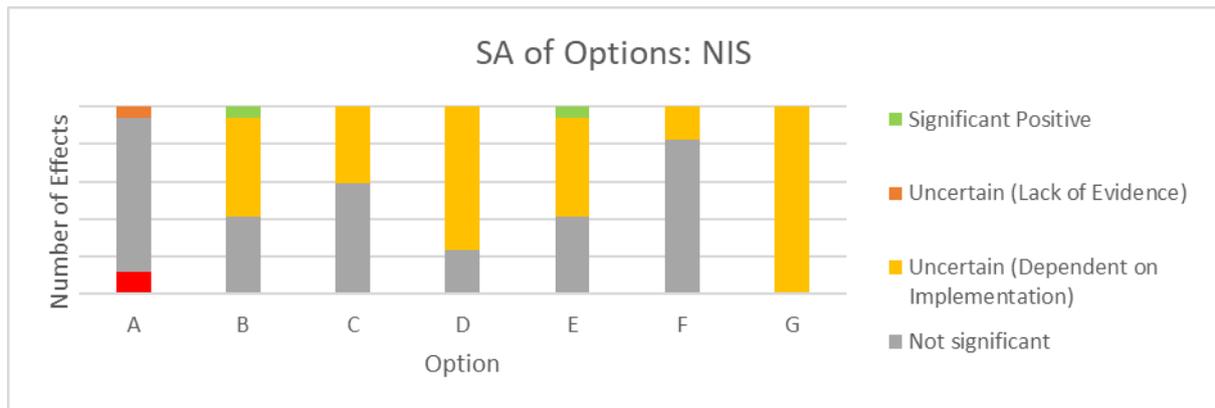
Option I has resulted in significant positive effects for protected sites and species. This option states that all proposals, either alone or in combination, that could have adverse impacts on the objectives of marine protected areas within or adjacent to the North West Marine Plan Areas and the ecological coherence of the marine protected area network as a whole must demonstrate that they will, either avoid, minimise, or mitigate any adverse impacts, with due regard given to statutory advice on an ecologically coherent network. It is assumed that this will result in increased protection of protected sites and species within the North West Marine Plan Areas.

Protection of priority habitats will prevent disturbance to seabed substrates and coastal features as a by-product, but effects are mostly judged to be minor positive due to the difference in spatial scale. Option K specifically mentions that public authorities should ensure adequate provision, for removal and recycling of beach and marine litter on amenity beaches, which has resulted in significant positive effects for both protected sites and species as well as marine litter.

Mitigation

No specific mitigation has been identified.

3.23 Invasive Non Native Species (INNS)



The assessment of the non-native species grouping of options has identified that there is the potential for significant negative effects with relation to Option A, whereas Options B and E have the potential to give rise to significant positive effects.

There is currently a risk of breeding populations of Pacific Oysters establishing within the North West Marine Plan Areas, with increases in sea temperature increases and climate change. These species can form dense groups, sometimes forming reefs, which can alter the environment (waves, currents, sedimentation, etc.), with knock-on effects to native species. They compete with native benthic species for space and resources (Biodiv_504). Due to this and further implications for biodiversity, significant negative effects, in relation to Option A, 'do nothing' in relation to benthic and intertidal ecology, fish and shellfish, marine mega fauna and ornithology have been identified.

Non-native species are one of the biggest threats to biodiversity (including birds). Without suitable bio-security 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-incursion. There are also a number of non-native marine species that are colonising our shores as a result of inadvertent introduction as a result of boat traffic (Biodiv_274).

Options B and E specifically mention biosecurity measures that will avoid or minimise the introduction, spread and transportation of non-indigenous species. This has resulted in significant positive effects for ornithology and benthic and intertidal species, fish and shellfish and ornithology. Other more indirect Options (C, F and H) have been scored uncertain as their effectiveness depends on the detail of how they are implemented.

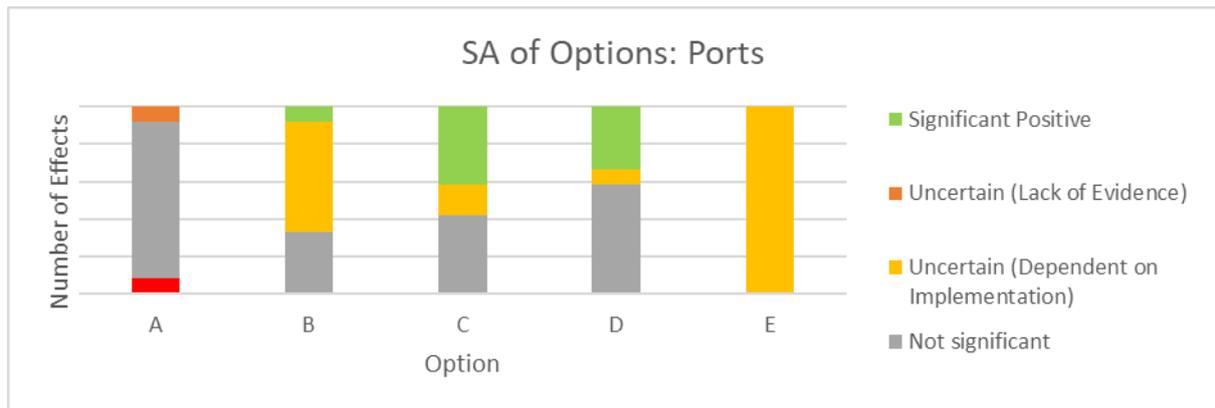
Shipping and recreational boating are all key introduction pathways for invasive species. It is assumed that Options B and E which support the use of biosecurity measures, could result in negative tradeoffs for ports and shipping and tourism and recreation. However, as options do not explicitly limit these activities, uncertainties have been recorded.

The North West Marine Plan Areas are an important area for shellfish production (Economy_299, 300) and there is a significant presence of UK and non-UK fishing vessels that are impacting benthic habitats and Marine Protected Areas (Biodiv_345, 526). Aquaculture is understood to be a key introduction pathway for invasive species. Option F states that all aquaculture developments must either avoid, minimise or mitigate the escape of non-native species to the UK marine environment. This could result in limitations of the aquaculture sector within the North West Marine Plan Areas, however, the option does not specifically aim to limit aquaculture, and has therefore resulted in uncertainty being recorded in the assessment.

Mitigation

No specific mitigation has been identified.

3.24 Ports & Harbours



The assessment of the ports and harbours grouping of options has identified that there is the potential for significant positive effects with relation to Option A, whereas none of the Options B, C and D have the potential to give rise to significant positive effects.

Increased shipping activity, port expansion and associated industry growth could lead to increased sulphur oxides and nitrous oxides emissions at coastal locations (Air_19), which in turn could contribute to the breach of local and national objectives for air quality. Emissions from international shipping have increased more rapidly than expected and are expected to surpass the total emissions from land-based sources of sulphur oxides and nitrous oxides by 2020 (Air_33). Therefore, Option A, 'do nothing' could result in a significant negative effect on air quality.

Option C aims to support proposals for infrastructure which facilitates expansion and development of sustainable marine industries. It is not clear as to whether this would result in more shipping activity and would be dependent upon the proposals that come forward. If port capacity is significantly increased this could result in a significant negative effect on air quality. However, moving from freight by road to freight by water, could also result in improved air quality.

The Port of Liverpool and the smaller ports along the River Mersey are seen as key to economic activities in the future through the Atlantic Gateway initiative which is seeking to create 250,000 new jobs and generate £14 billion of new investment by 2030. Plans for the Atlantic Gateway include upgrades of port facilities and other port infrastructure such as Superport Liverpool (Economy_716). At a smaller scale, ports like Workington are strategically important to their hinterlands and communities and would be more sustainable if there was more freight by water, and if local/regional developments were encouraged to favour the use of local/regional ports. Options C and D support port expansion and development and could therefore result in a significant positive effect.

Options B, C and D could have significant positive impacts on energy generation and infrastructure development, including support for the construction and operations of renewables. Ports are essential to support emerging industries such as renewable energy development. They can provide a useful base for logistic boats which support operation and maintenance activities (Economy_620).

Option C could have significant positive impacts on aggregate extraction. 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.

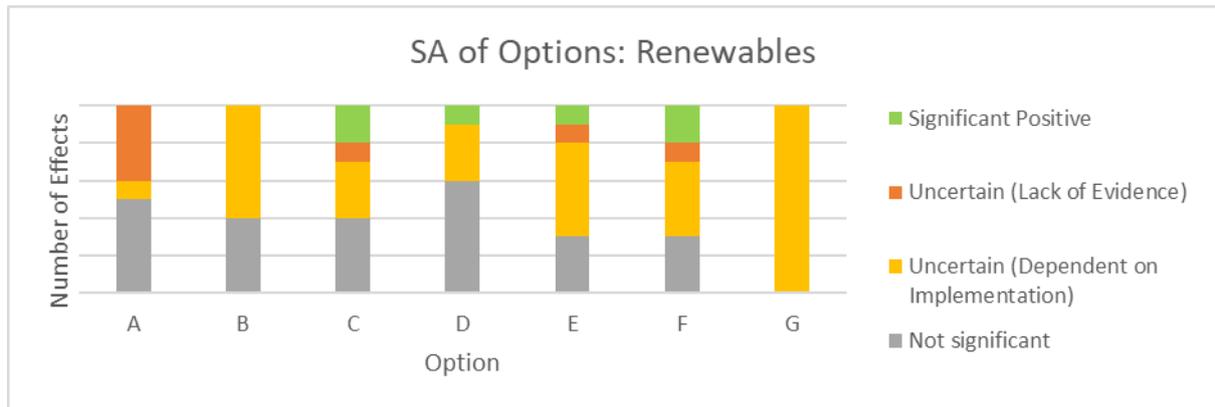
Poor health is linked to social and economic disadvantages. It is assumed that Option D will result in further marine related employment opportunities which could help to improve health and deprivation in the North West Marine Plan Areas. Significant positive effects have been identified.

Options C and D could have significant positive effects on defence, however, there are no key issues reported in the database between ports and this sub-topic. There are two large shipyards within the North West Inshore Marine Plan Areas: BAE Systems Maritime Submarines at Barrow-in-Furness and Cammell Laird at Birkenhead, Merseyside which relate to defence (Economy_651). Any changes to port infrastructure and/or operations could affect these activities. Option C would be particularly beneficial if these facilities wanted to expand as well as encourage new facilities to co-locate.

Mitigation

- Options need to address the impact of sulphur oxides and nitrous oxides emissions.

3.25 Renewables



The assessment of the renewables grouping of options has identified that there is the potential for significant positive effects with relation to Options C, D, E and F, whereas none of the options have the potential to give rise to significant negative effects.

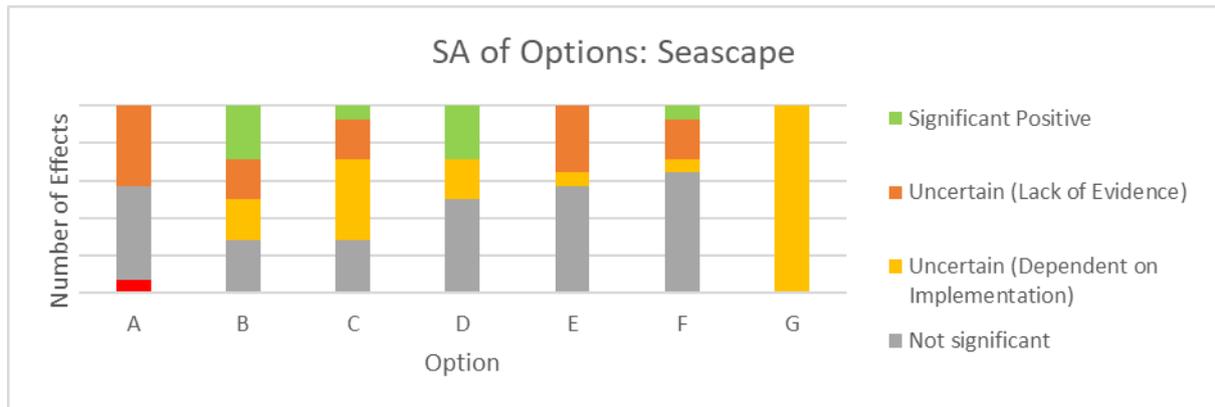
There are no key baseline issues regarding greenhouse gas emissions in the North West Marine Plan Areas. However, any option which either decreases the amount of oil and gas activity or increases sustainable energy will reduce anthropogenic carbon dioxide emissions, with subsequent positive effects on greenhouse gas emissions. Implementation of Options C and F would therefore have a significant positive effect on greenhouse gas emissions as they support proposals for renewable energy exploitation and offshore wind farms.

Whilst the technology to enable wave and tidal energy generation is at an earlier stage of development than offshore wind, it is anticipated that the amount of wave and tidal energy being generated will increase markedly up to and beyond 2020 (Economy_542). Options C, D, E and F would therefore have a significant positive effect on energy generation and infrastructure development.

Mitigation

No specific mitigation has been identified.

3.26 Seascape



The assessment of the seascape grouping of options has identified that there is the potential for significant positive effects with relation to Options B, C, D, and F, whereas Option A has the potential to give rise to significant negative effects.

Densities of beached litter recorded in the United Kingdom have increased since monitoring commenced in 1994, with an average of around 1000 items per kilometre in 1994 having almost doubled by 2007 (Water_233). It is assumed that by doing nothing the situation is likely to worsen, therefore, Option A, 'do nothing', is likely to exacerbate the existing situation and could result in a significant negative effect.

None of the options directly address the issue of marine litter. Option D encourages participation of the local population in the preservation and enjoyment of their cultural and natural heritage, which could include reducing litter, but would be dependent on implementation. Option B aims to minimise the effects on the landscape and seascape from social impacts which could include marine litter. Again, this is uncertain and would be dependent upon implementation.

There is a close relationship between the presence of heritage assets and the character, value and appreciation of landscape and seascape. Options B and D have resulted in significant positive effects, as they take into account the need to protect heritage assets, as well as the positive contribution they can make to seascape and aims to engage with the community and support the preservation and enjoyment of cultural heritage. However, Option B would not fully prevent proposals from having significant negative effects on heritage assets because of its use of 'minimise' and 'mitigate'.

Opinions on changes to the landscape and seascape are often subjective. However, it is assumed that by protecting it from adverse effects of development and climate change (through managed realignment rather than new hard defences) will be beneficial to both the landscape and seascape. Options B, C and E all do this, and could therefore result in significant positive effects.

Seascape can provide a number of benefits to both physical and mental health. It is assumed that options that provide a positive contribution to seascape will have a positive contribution on health and wellbeing. Option D encourages participation of

the local population in the preservation and enjoyment of their cultural and natural heritage, which could result in a significant positive effect.

Improving seascape and landscapes is likely to have a positive effect on leisure, recreation and tourism. Existing policy X-SOC-1 in Option B aims to minimise the effects on activities that generate social benefits, which could be beneficial, but would be dependent upon implementation. A minor positive effect has been identified. Options B and C directly benefit seascapes and have therefore, resulting in significant positive effects for recreation and leisure activities and tourism being identified in the assessment.

There are potential for improvements in seascapes which could conflict with ports and shipping, aggregates, energy and marine manufacturing activities. The seascape and coastal landscape will continue to be subject to change resulting from development including in relation to energy, industrial and ports developments. Attitudes of people observing the change and the resultant development typically also vary widely. (Landscape_132). However, impacts are likely to be minor and therefore, no significant effects have been identified.

Fishing is in decline within the North West Marine Plan Areas, and so further limitations due to seascape and landscape could be damaging to the industry. It is unclear how policies which protect seascapes (Options B and C) could affect fisheries and aquaculture. The potential effects, particularly on aquaculture, are dependent on implementation and the types and locations of developments / proposal which comes forward. It is unlikely that fishing and aquaculture will enhance or facilitate the natural habitat, and a minor negative effect has been identified with regards to Option F.

No significant effects have been identified, however, there is potential for conflict between defence activities and enhancements of seascape. Defence activities could require limitations of activities/access to coastline and could create noise which would reduce tranquillity.

Protected sites and species can play an important role in seascape quality. Option F is the only option to make a direct link between seascapes and habitats and species and therefore significant positive effects have been identified.

Mitigation

- Options do not take into account relevant seascape assessments. Signposting to these should be considered.
- Any potential developments will need to be assessed for visual impact and designed well to avoid any negative effect on heritage assets.
- Any potential developments will need to be assessed for visual impact and designed well to avoid any negative effect on the seascape and landscape.
- Measures are needed to control litter.
- As Option B utilises the words 'minimise' and 'mitigate', its implementation would not totally prevent proposals from having significant negative effects on heritage assets – more stringent wording would however achieve this.

3.27 Shipping



The assessment of the shipping grouping of options has identified that there is the potential for significant negative effects with relation to Options A and F whereas Options B, D and E have the potential to give rise to significant positive effects.

Greenhouse gas emissions are recognised as a national issue and affect all marine plans. These include emissions from the shipping sector. Shipping is recognised as a key contributor to nitrogen dioxide, sulphur dioxide, nitrate, sulphate aerosol and ozone (Air_31). Emissions from ship is expected to increase significantly by 2050 due to increase in global trade (Climate_110). Without any actions, as per Option A, these adverse effects are likely to get worse due to the predicted increase in shipping activities, therefore significant negative effects have been identified for this option in relation to air pollutants and greenhouse gas emissions.

Option E aims to support proposals that promote short sea shipping and the use of inland waterways and canals. Short sea shipping could reduce air polluting emissions; however, new traffic going through canals and waterways could increase air emissions in town and city centres, which are more sensitive to air pollutant increase and would therefore have adverse effects. In general, a move from freight by road to freight by water could result in an overall reduction in emissions, albeit more nationally / regionally than locally, hence the overall potential effect could be significant positive for Option E for air pollutants and greenhouse gas emissions.

Shipping can contribute to the introduction of non-native species and is reported to be among the key pathways (Biodiv_636). Given the importance of the issue, Option A, 'do nothing', is likely give rise to significant negative effects for non-indigenous species. Option E could have positive effects and contribute to improve the current situation (eg reduce road traffic), but it could also have a negative effect due to an increase of ships movement in the same geographical area with the subsequent effects of increased emissions as well as traffic. Without further detailed information on the implementation of such an option, the outcome is judged to be uncertain due to a lack of evidence. The options do not take the impact on non-indigenous species into account and therefore no significant positive effects have been identified in to this SA sub topic.

Shipping is having negative environmental impacts on water quality and marine litter through accidental or unlawful operational discharges including that of oil, waste or

sewage (Economy_421). The shipping sector is also identified as a potential contributor to offshore litter such as rope, polypropylene twine and hard plastics (Water_253) and also beach litter in general. This can have adverse effects on coastal and marine waters (Water_286) in the short and long term. Option A, 'do nothing', is likely to continue to worsen the current situation, and for this reason significant negative effects have been identified in relation to water quality and marine litter.

Most of the options proposed will have positive effects, either directly (eg port expansion) or indirectly (eg boosting the regional economy) on the ports and shipping sectors. Options B and D could support further expansion of the ports and shipping sectors, and therefore significant positive effects are identified in the assessment. Option F could have both positive and adverse effects on ports and shipping. The restriction of other developments on navigation routes could be positive and ease the port operation and vessel movements to from the port. However, other developments in and adjacent to ports could impact on shipping and thereby constrain the ports. Given the strict wording, a worst case scenario is assumed, hence a potential significant negative effect has been identified for Option F.

Ports and shipping have positive interactions on regional or local economies including through facilitating tourism and recreation (Economy_620). Option D supports the diversification of current activity and future opportunity for expansion of port and harbour activities and marine related employment, which has been assumed would include benefits to tourism and recreation. Therefore, significant positive effects have been identified for leisure and recreation and tourism. There is potential for conflicts between shipping and tourism and recreation, such as the risk of collision with recreational users of the sea, although this specific issue is not reported in the database and has been deemed 'not significant'.

Competition from other sectors and the requirement for mitigation applied to aggregate licenses to manage vessel traffic is impacting on aggregate extraction operations (Economy_773). The SA database identifies an adverse interaction between shipping and aggregate which relates to the requirement for mitigation for aggregate licenses to manage vessel traffic during operation. The role of shipping in this restriction on aggregate is not fully known. It is assumed that the growth of the shipping activity could increase this adverse effect, however, due to the lack of further baseline evidence, uncertainty has been recorded.

A number of interactions between shipping and marine developments have been identified, including future offshore wind development, tidal wave development and oil and gas activities (Economy_681, Economy_675, Economy_778). There are particular issues with regard to shipping and offshore renewable energy installations. Navigational safety around these installations is essential. It is assumed that appropriate navigational safety measures are currently in place or will be put in place for future windfarm development.

Ports and shipping are essential to support emerging industries such as renewable energy development (Economy_620). Option D supports the diversification of current activity and future opportunity for expansion of port and harbour activities and marine

related employment, which has been assumed could support the energy sector. A significant positive effect has been identified.

Displacement of species can result from shipping and this activity can have potential consequences to special protection areas and special areas of conservation mobile features (Biodiv_621). No significant effects are expected from the proposed options on this issue due to the mobility of a wide range of species.

Mitigation

- Define options which are more targeted to reduce air pollutants generated by this sector. Further consultation with the shipping and ports stakeholders are recommended to consider their point of view on this approach (opportunities and constraints).
- Proposals should also promote the application of operational measures and implementation of technologies to reduce ships' emissions of pollutants.
- Need for stronger incentives to move from road to water (or disincentives to use road).
- Promote the application of operational measures and implement existing technologies to reduce ships' energy consumption and carbon dioxide emissions (eg https://ec.europa.eu/clima/policies/transport/shipping_en).
- Proposals should incorporate a mitigation process to ensure that shipping activity will not be adversely impacted by the options.
- Option wording should remain flexible.
- Proposals should consider appropriate measures to be developed in coordination with ports, shipping organisations and relevant stakeholders (eg authorities, International Maritime Organisation, etc) to prevent the spread of invasive species. This would target the pathways for the transfer of aquatic invasive species including via vessel ballast water and hull fouling.

3.28 Species



The assessment of the Species grouping of Options has identified that there is the potential for significant negative effects with relation to Option A, whereas Options B, D and E have the potential to give rise to significant positive effects.

Recent downward trends in breeding success of seabirds in the Greater North Sea and the northern Celtic Seas are of concern. Of the seabirds breeding in the UK, only northern gannet and great skua have sustained a positive trend in population size since 1969. The biggest declines have been seen in numbers of herring gulls and roseate terns – by more than 50% and 90% respectively since 1969 (Biodiv_240). This negative trend has resulted in significant negative effects in relation to Option A, ‘do nothing’, in relation to ornithology.

Deterioration of intertidal sediment habitats is occurring in the North West Marine Plan Areas, due to cumulative effects associated with historical land claim, presence of coastal structures, non-native species and beach litter. Impacts on subtidal sediments from offshore industry (e.g. aggregate extraction, dredging, offshore energy production) is also an issue in the North West Marine Plan Areas. At various locations near large ports, subtidal rocky habitat has been lost due to construction, infrastructure (mainly coastal) or via smothering from dredged deposits (Biodiv_542). The state of the current situation within the marine plan areas, has resulted in significant negative effects on benthic and intertidal ecology, fish and shellfish, with regards to Option A.

Options B and E propose to support proposals that enhance connectivity of marine ecosystems have been judged to have a significant positive impact on ornithology. Option B also states that proposals that enhance a marine protected area’s ability to adapt to climate change and so enhance the resilience of the marine protected area network will be supported, which has resulted in significant positive effects on protected sites and species and benthic and intertidal ecology and fish and shellfish. There is an interaction between increasing access to the marine area for recreation and tourism, particularly in regard to disturbance. Increased disturbance to marine mammals from sightseeing and pleasure boats, including visiting breeding/haul-out sites. Such disturbance from vessel activity (including propeller or engine noise) may result in vessel avoidance and increased dive time. This can cause increased energy expenditure, reduced resting time and could cause cetaceans to abandon or not use

ideal habitats, potentially resulting in a reduction of energy reserves which could affect foraging efficiency, overall fitness and reproductive capacity (Biodiv_546).

Existing policy X-DIST-1, within Option B, aims to either avoid, minimise and mitigate the cumulative adverse effects of adverse physical disturbance or displacement impacts on highly mobile species in relation to tourism and recreation. This has resulted in significant positive effects for marine mega fauna, as it could provide more protection for mobile species within the North West Marine Plan Areas. However, there is potential for negative trade-offs with regards to tourism and recreation, and the extent to which this impacts the economy will be dependent on specific implementation.

Option D states that proposals for the decommissioning of existing energy infrastructure within the marine plan area shall a) avoid, b) minimise, c) mitigate significant adverse impacts on the marine environment and relates to a specific ornithology issue. This has resulted in significant positive effects for ornithology. Other responses that aim to minimise disturbance but don't refer to protected sites and species have scored uncertain (dependent on implementation) as there is a lack of detail as to how this will be managed.

Mitigation

No specific mitigation has been identified.

3.29 Tourism & Recreation



The assessment of the tourism and recreation grouping of options has identified that there is the potential for significant negative effects with relation to Options A, F and H whereas Options B, C, D, E and G have the potential to give rise to significant positive effects.

A reduction in the quality of seascapes is being caused by the cumulative visual impact of multiple existing and new activities and developments within the marine plan area. This has implications for tourism, recreation, wellbeing and cultural values within and outside of the marine plan area (Landscape_170). Therefore, significant negative effects have been identified in relation to Option A, 'do nothing' with regards to seascape and landscape. Existing policy X-SCP-1 within Option B aims to avoid, minimise or mitigate significant adverse impacts on seascape, but within the same option existing policy X-ACC-2 aims to increase access, which could contribute to the worsening of both landscape and seascape.

The development of sea defences which reduce erosion and/or flooding and promote tourism, as included in Options F and H, have been deemed to be large scale projects such as tidal lagoons. This is likely to change the landscape and seascape. For some this may result in a significant negative effect, however views on seascape are subjective. Uncertainty has been recorded within the assessment.

Tourism and recreational disturbances are having adverse impacts on biodiversity. Physical damage to cetaceans and seals through collision with vessels and other recreational activities (Biodiversity_559) are common in the North West Marine Plan Areas. Recreation is also a key introduction pathway for invasive species (Biodiversity_636). Birds provide popular recreational activities within the North West Marine Plan Areas however, recreational disturbances are regularly recorded. Disturbances are often caused by dogs, walkers, boats, surfers, canoes and paddle boards. For these reasons, significant negative effects have been identified for protected sites and species, marine mega fauna, ornithology and non-indigenous species with regards to Option A.

Changes in habitat condition and habitat loss through sea level rise, coastal squeeze, storm events from climate change and creation of coastal defences (Biodiv_423) is occurring in the North West Marine Plan Areas. Potential for tidal lagoon development is being considered for Workington in West Cumbria. Impacts

may include habitat loss or change, introduction of hard substrate as artificial reefs and localised changes in hydrodynamics affecting intertidal organisms (Biodiv_501).

Options F and H both support proposals for alternative methods of sea defence which reduce erosion or flooding, show resilience to changes in coastal processes, and promote tourism. It has been assumed that these will be large scale projects such as tidal lagoons, which are likely to have significant negative effects on protected sites and species, marine mega fauna and ornithology.

Increased visitor numbers are likely to put more pressure on the water supply which could affect the quality and call for more infrastructure to support it. Increased levels of tourism and recreational activity could also increase the amount of marine litter which in turn has potential to deter people away from water based recreational activities. Options do not make specific mention to pollution, marine litter or water quality. Existing policy X-SCP-1 within Option B aims to either avoid, minimise or mitigate significant adverse impacts on seascape which could include water quality and marine litter. Within the same option, existing policy X-ACC-2 encourages further access, which could, in turn, worsen the problem.

Option G aims to support, promote or facilitate eco-tourism. This has the potential to be beneficial to water quality and marine litter, however, it is not clear what this would entail and how it would be implemented. Uncertainty is therefore recorded in the assessment.

High density shipping in the North West Marine Plan Areas, along with oil and gas production, is contributing to decreasing air quality within the region. Ongoing challenges with air quality (from transport emissions amongst others) in Air Quality Management Areas at the coast and on land could lead to eutrophication of the marine environment and acid deposition effects (Air_23). Attracting more visitors to the coast could increase the amount of traffic which will contribute to a reduction in air quality. An eco-tourism approach, as proposed by Option G, could help to address this issue, but it is not clear how this will be implemented.

Tourism can offer a number of benefits and costs to individuals and local communities specifically in terms of development, town characteristics and well-being effects (Communities_47). It has been assumed that increases in tourist activities and facilities could lead to health benefits. Option C makes specific mention to health and wellbeing as it aims to increase awareness of the character within the North West Marine Plan Areas and its important role for health and wellbeing, and therefore significant positive effects have been identified.

Deprivation in relation to income, employment, education (2015 Index of Multiple Deprivations) shows some more deprived lower super output areas on the coast compared to the rest of England (Communities_19). Option D aims to support and increase marine related employment particularly where they are in line with the skills available in and adjacent to the North West Marine Plan Areas. This could help to tackle deprivation in relation to income in the marine plan area.

Ports and harbours can provide tourist attractions in themselves. However, increasing the number of tourists could conflict with ports and shipping activities eg

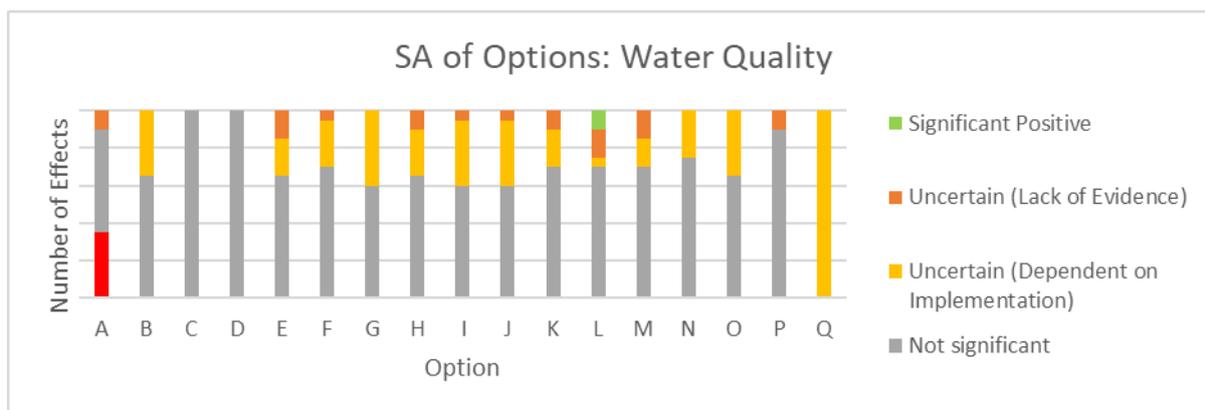
boat trips. Options H and F may see a rise in the number of sea defences which could interfere with shipping within the North West.

Most options will increase the number of tourists in the region and therefore significant positive effects have been identified for B, C and E in relation to tourism, leisure and recreation. Option G, which proposes an eco-tourism approach has been deemed to have a significant positive effect on just tourism, as there are potential conflicts between recreational activities, such as pleasure boats. The effects of the building sea defences which promote tourist activity is unknown and would be dependent upon what was included within the development, particularly with regards to recreational activities.

Mitigation

- Any development near or adjacent to heritage assets would need to be sensitively designed in order to avoid and adverse impact.
- Any potential developments will need to be assessed for visual impact and designed well to avoid any negative effect on the seascape and landscape.
- Measures are needed in order to limit the pressure on water supplies and its effect on the overall quality.
- Measures are needed to control litter.
- Access to protected sites needs to be carefully controlled in order to ensure that the species and habitats they are designated for are protected.
- Existing issues of disturbance from sightseeing and pleasure boats needs to be improved.
- Measures are needed to control disturbance of bird species, particularly in key locations such as special protection areas.

3.30 Water Quality



The assessment of the water quality grouping of options has identified that there is the potential for significant negative effects with relation to Option A, whereas Option L has the potential to give rise to significant positive effects.

Water quality is vital for tourism and human health (Water_176). The North West Marine Plan Areas have the lowest number of beaches classified as bathing waters in the United Kingdom, and the highest number of beaches classified as poor, with over 35 per cent being poor or sufficient (Water_195). There are relatively few eutrophication problem areas in UK waters at present. These are of limited size, and the main sources of nutrient inputs into UK waters is being addressed (Water_178). Policy A would have a significant negative effect on pollution and water quality as does not address issues as highlighted in the baseline database, nor the issues covered by the option document.

Chemicals existing in the marine environment such as polychlorinated biphenyls (PCBs), dichlorodiphenyldichloroethylene (DDE) and nonylphenol have the potential to adsorb onto plastics which themselves contain chemical additives including phthalates and parabens and can become introduced into the marine food web and/or have chronic effects on marine organisms (Water_291). Issues 832NW and 824NW highlight this relationship between persistent organic pollutants and degradation to marine mammal health. Option A does not prevent the introduction of litter into the marine environment, and would therefore not alleviate these key baseline issues, hence its implementation would have a significantly negative impact.

Shellfish and algal culture require good water quality. Water quality is usually improved in order to support shellfish and algal culture rather than vice versa (Economy_629). Although bathing water quality has improved in the North West Marine Plan Areas, a challenge exists around sewage pollution impacting water quality, which in turn prevents shellfish harvesting from shellfish and mussel beds in Morecambe Bay and Lune Estuary (Water_356). Option A would have a significantly negative impact on fisheries and aquaculture as does not address issues highlighted within the baseline database. Option B X-WQ-1 and X-WQ-2 could improve water quality for aquaculture, but those species that can improve water quality, ie shellfish, are also those that are farmed.

Bathing water quality is important for the local economy through leisure, recreation and tourism, and this could be improved by effective linkages being made between marine planning and existing regimes (Water_371). Improvement of clean bathing waters in tourist areas such as Lytham St. Annes, improving coastal defence and reducing the risk of surface run-off will provide benefits for ecosystems, local populations and the economy (Water_372). It appears that bathing water quality within the North West Marine Plan Areas could be improved, with benefits occurring on leisure, recreation and tourism, however a lack of baseline data means that the extent of these benefits, and whether or not a significant effect would occur, is uncertain.

Contaminants from historic and current industrialisation of the Mersey catchment have reduced sediment quality, which poses a risk if the sediment is disturbed because this will lead to resuspension and reintroduction of pollutants (Water_355), this is highlighted by issue 832NW. Implementation of Option A would have a significantly negative impact as does not address key baseline issues, nor issue 832NW.

Effects of pollution from marine activities are witnessed on benthic and intertidal habitats and species, and fish and shellfish. 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, tributyltin, pesticides and polychlorinated biphenyls 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). Option A would have a significant negative impact on benthic and inter-tidal ecology as well as fish and shellfish as does not combat issues highlighted in the baseline database. Option L could have significant positive effects on benthic and intertidal habitats and species, and fish and shellfish as seeks to prevent the escape of hazardous material into the marine environment.

Impacts on marine mammals due to habitat degradation from pollution are identified within the baseline. Persistent organic pollutants such as polychlorinated biphenyls and flame retardants can disrupt endocrine systems resulting in susceptibility to disease and reduced reproductive success (Biodiv_432, Biodiv_433, Biodiv_434). Option A would not alleviate issues as highlighted in the baseline database regarding marine mega fauna, hence would have a significantly negative impact if implemented. Option L could have significant positive impacts on marine mega fauna as seeks to prevent the escape of hazardous material into the marine environment.

There is a risk of harmful algal blooms due to the influence of anthropogenic nutrient enrichment of coastal waters and climate change (Biodiv_623). Option A does not address this key baseline issue, and so would have significant negative implications if it were implemented.

Mitigation

- Option L does not consider a wide range of issues but is the most stringent of all the proposed options for this grouping, and as such has the greatest potential to be successfully enforced.
- If more stringent, Option G would have significantly positive impacts, ie if it were to state that marine plans 'must include measures to avoid the introduction of nutrients, plastics and pollution' rather than 'avoid or minimise'.
- If more stringent, Option M would have significantly positive impacts, ie if it were to consider all adverse impacts on the viability of saltmarsh habitat rather than just the significant adverse impacts. This holds especially true for the benthic and intertidal habitats and species, and fish and shellfish SA sub-topic.
- If more stringent, Option O would have significantly positive impacts, ie if it were to state that 'Proposals which prevent the release of contaminants...will be supported', rather than '...which restrict the release of contaminants...'.

4 Cumulative Assessment - North West Marine Plan Areas

The potential for cumulative effects has been difficult to consider at the options assessment stage as it is unclear which policies are likely to be taken forward and in which combination. Cumulative effects will be assessed in more detail at the next stage of the marine plan development as the preferred options are being developed. However, as part of the development of the marine plans, the MMO have been considering the potential for cumulative effects and have been considering options as to how this could be addressed.

These options include discussing the assessment of cumulative impacts in the introductory text of the marine plan, including the consideration of cumulative effects of certain proposals or in relation to, for example, seascape, in some options, or signposting to the MMO Marine Information System or the MMO Report 1127 Futures analysis.

The SA would recommend the inclusion of specific wording within an appropriate overarching policy to ensure that cumulative effects as part of proposals are addressed as part of the consideration of applications or the granting of licenses. The larger applications which will be subject to separate processes such as Environmental Impact Assessment (EIA) will address the potential for cumulative effects, however the concern is that the smaller piecemeal developments may not take account of the potential for cumulative effects with other small developments.

5 Next Steps

The next steps for the development of the North West Marine Plans and the Sustainability Appraisal are described below. The work which will be undertaken to conclude the Iteration 2 marine plan development following the completion of the workshops will be:

- Collating the responses from the on-line stakeholder engagement and the workshops engagement;
- Reviewing the outputs from the Sustainability Appraisal of the options;
- Editing the draft vision for the North West Inshore and Offshore Marine Plan Areas;
- Developing and analysing the preferred options using the information from the sustainability appraisal and the stakeholder engagement; and
- Undertaking a compatibility testing of preferred options.

The output of the Iteration 2 work will be an improved vision for the North West Marine Plan Areas, and the identification of a preferred option for each group of issues that is compatible at marine plan level and across marine plan boundaries. This work will be fed into the next stage of marine plan products, which is Iteration 3.

Iteration 3 development will take place during 2018 and 2019 culminating in an engagement in early 2019. During this stage the following activities will be undertaken:

- The draft policies will be refined;
- Iteration 3 Stakeholder engagement will take place which will involve a discussion on refinement of policies; and
- The Marine Officers will continue to engage throughout the process.

A Sustainability Appraisal will be undertaken of the preferred options and the draft North West Inshore and Offshore Marine Plans plus the Sustainability Appraisal (SA Report) will be produced.

The outputs of Iteration 3 will feed into the production of a North West Draft Marine Plan and accompanying SA Report ready for public consultation in 2019-2020.

There are several other supporting activities that will be taking place alongside the development of the Marine Plan. These include:

- Implementation work;
- Developing a monitoring approach and data gathering;
- Continued monitoring of the effectiveness of the East and South Marine Plans in achieving high level marine objectives and planning how best practice for monitoring can be applied in the North West/North East/South West/South East Plan Areas;
- Continuing data and evidence gathering; and
- Undertaking European Maritime and Fisheries Fund (EMFF) projects.