HM Government

Marine Strategy Part One:

UK Initial Assessment and Good Environmental Status

December 2012

Northern Ireland Executive
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The Scottish Government

Llywodraeth Cymru
Welsh Government

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An initial assessment for British Gibraltar Territorial Waters is being prepared separately.

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Joint Ministerial Foreword

Our seas are an intrinsic part of our history, our way of life, and our economy, and people across the UK value them very highly. For our seas to continue to play this important role in our lives and livelihoods, a healthy marine environment is vital.

The UK has one of the richest marine environments across Europe, home to a wide variety of marine species and habitats. We are only just beginning to understand the full extent of some of the services which our seas provide us with, such as their critical role in regulating our climate. Although we cannot see what goes on beneath their surface, our marine waters play a major role in all our lives.

Over the last 100 years human activities in our waters have increased dramatically, both in their intensity and in the range of activities taking place. This has placed increasing pressures on the marine environment, including the impacts of fishing and pollution.

We have long recognised the need to manage the impacts of the pressures caused by our activities and we have achieved some significant successes, particularly in controlling point sources of pollution and inputs of nutrients. However, we need to take more action particularly to reduce pressures on seafloor habitats and fish populations, which continue to be adversely affected by our activities, while allowing marine industries to thrive and develop.

These issues were highlighted in recent reports on the state of the UK's marine environment: Charting Progress (2005), Charting Progress 2 (2010), Scotland's Marine Atlas (2011) and Northern Ireland State of the Seas Report (2011). The UK Government and Devolved Administrations have already accepted the findings of these assessments and we are committed to realising our vision of achieving clean, healthy, safe, productive and biologically diverse oceans and seas, which underpins the 2011 UK Marine Policy Statement. They are also recognised in Wales' Sustainable Development for Welsh Seas (2011) and A Living Wales – a new framework for our environment, countryside and seas (2012) consultation documents.

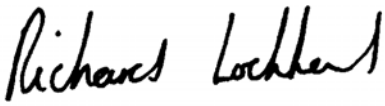
To realise our vision, we are already taking many measures to improve the state of our marine environment, as part of ensuring sustainable development. We are delivering the UK Marine and Coastal Access Act (2009), the Marine (Scotland) Act 2010 and developing the proposed Northern Ireland Marine Bill, as well as seeking radical reform of the Common Fisheries Policy. We are also implementing EU legislation, such as the Water Framework Directive and the Birds and Habitats Directives, which are contributing to improving the state of the UK's marine and coastal environment.

However, we cannot achieve our goals for our marine environment in isolation. Our marine environment does not recognise national boundaries. Many of the most significant activities that impact on our seas, such as fisheries, are managed at a European or international level.

The Marine Strategy Framework Directive, which requires all EU Member States to take measures to achieve Good Environmental Status in their seas by 2020, puts in place a framework to allow co-ordinated action across Europe to improve the marine environment. It gives us the wider tools we need to achieve clean, healthy, safe, productive and biologically diverse oceans and seas for the UK. The requirements of the Directive were transposed into national legislation through the Marine Strategy Regulations 2010 (covering England, Scotland, Wales and Northern Ireland) and the Marine Strategy Regulations 2011 (covering Gibraltar).

The UK Marine Strategy Part 1 is a major step in the implementation of this important Directive. The characteristic, targets and indicators for Good Environmental Status reflect the ambitious agenda that the UK Government and Devolved Administrations are together already pursuing on the marine environment. The Marine Strategy has been developed with help from stakeholders across the UK. We would like to thank everyone for their help so far and we look forward to continuing to work together to secure Good Environmental Status for our seas, both now and for the future.

Richard Benyon
Minister for Natural Environment and Fisheries
HM Government



Richard Lochhead
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Executive Summary

Section 1 – Context for the UK Marine Strategy

1.1 – Introduction

This section sets out the marine policy context and briefly describes the requirements of the Directive and the purposes of this Marine Strategy.

1.2 – Background to the Marine Strategy Framework Directive (MSFD)

The overarching aim of the Directive is for Member States to put in place measures to achieve Good Environmental Status (GES) in their marine waters by 2020. Member States must develop Marine Strategies for their waters consisting of: an initial assessment of their marine waters; characteristics, targets and indicators of GES; monitoring programmes for measuring progress towards GES, and; programmes of measures to achieve or maintain GES. These requirements were transposed into national legislation through the Marine Strategy Regulations 2010 (covering England, Scotland, Wales and Northern Ireland) and the Marine Strategy Regulations 2011 (covering Gibraltar). This document forms the UK Marine Strategy Part One, and meets the Directive's requirements for the first two stages of the implementation process outlined above. This sub-section provides a more detailed summary of the key requirements of the Directive, explaining all key stages in the implementation process. It also sets out the definition of GES provided in the Directive and the 11 Descriptors of GES.

1.3 – The European and Regional context

A key requirement of the Directive is that Member States work together to implement each stage of the Directive in a coherent and coordinated way, in order to ensure comparability across Europe. For the UK, regional coordination is focussed on other Member States in the North East Atlantic region and the OSPAR Regional Sea Convention[1] has been the key forum for the coordination process. Although good progress has been made within OSPAR, further efforts to improve coordination will be made between now and the middle of 2012 and the proposals in this consultation may need to be reviewed in the light of this work. Similar efforts will be carried out for Gibraltar which is located in the Mediterranean region. This section also describes the wider European context for implementation, including a brief summary of the Working Group structure set up by the European Commission to support consistent implementation of the Directive across Europe.

1.4 – What the Marine Strategy covers and how it was developed

This sub-section explains the three key elements of this Strategy and how it has been developed.

The Initial Assessment of the State of the UK's seas Cover Paper – This provides an analysis of the essential features, characteristics and environmental status of UK marine waters, together with an analysis of economic and social use of UK marine waters and predominant pressures and their impacts. The evidence base for the UK Initial Assessment was developed by a wide range of

[1] The OSPAR Convention is the current legal instrument guiding international cooperation on the protection of the marine environment of the North-East Atlantic. Work under the Convention is managed by the OSPAR Commission, made up of representatives of the Governments of 15 Contracting Parties and the European Commission, representing the European Union.

UK experts working in the UK Marine Monitoring and Assessment Strategy (UKMMAS)[2] framework. An initial assessment for British Gibraltar Territorial Waters is being prepared separately.

Characteristics of GES for the UK's seas – these provide a high-level, qualitative description of what the UK marine environment will look like when GES is achieved. The GES characteristics have been developed by policy makers in consultation with experts and key stakeholders. This section describes how the UK characteristics of GES were developed. GES characteristics are being developed separately for Gibraltar.

GES targets and indicators of GES - these build on the high-level characteristics described above, providing a more detailed, quantitative assessment framework for guiding progress towards GES. The GES targets and indicators have been developed on the basis of scientific advice provided by the Centre for Environment, Fisheries and Aquaculture Science (Cefas), the Joint Nature Conservation Committee (JNCC) and a large range of experts, including those involved in the UK Marine Monitoring and Assessment Strategy. This section describes how the GES targets and indicators were developed. GES targets and indicators are being developed separately for Gibraltar.

1.5 – Summary of the implications of the GES targets and indicators

This section summarises the potential implications of the GES targets and indicators. Although this Strategy does not set out proposals for monitoring or management measures, both of which will be subject to specific consultations in due course, an assessment has been made as part of this Strategy of the potential implications of the GES targets and indicators.

There is still significant uncertainty regarding what might be required in order to achieve GES, in particular in relation to how far existing measures will take us and what additional measures might need to be put in place.

The Government and Devolved Administrations have already committed to taking many measures which will improve the state of the UK's marine environment as part of ensuring sustainable development, most notably through the UK Marine and Coastal Access Act (2009), the Marine (Scotland) Act (2010) and the proposed Northern Ireland Marine Bill. Equally, many existing pieces of EU legislation, such as the Water Framework Directive (WFD), the Birds and Habitats Directives, and the Environmental Impact Assessment Directive are also contributing to improving the state of the UK's marine and coastal environments. These existing measures will all support the achievement of GES under this Directive. However, these measures alone are unlikely to be sufficient to achieve GES and some additional measures are likely to be needed, particularly in relation to reducing the impacts of fisheries on the marine environment. This is consistent with the approach the UK is taking to reform of the Common Fisheries Policy (CFP), which calls for better integration of fisheries with wider environmental objectives.

Section 2 – UK Initial Assessment Cover Paper

This provides a summary of the UK Initial Assessment. It includes: an economic and social analysis of the use of UK seas and predominant pressures and impacts; an assessment of the current and predicted status of the features in UK waters; and an analysis of the costs of degradation and the benefits of achieving GES.

[2] The UK Marine Monitoring and Assessment Strategy has over 40 member organisations across the UK and is focussed on coordinating UK marine monitoring and assessment.

An initial assessment for British Gibraltar Territorial Waters is being prepared separately.

Section 3 – GES characteristics, targets and indicators

This section sets out the UK characteristics of GES and associated targets and indicators to guide progress towards GES and describes how these have been developed and why they are being put forward.

Characteristics, targets and indicators for Descriptors 1 (biodiversity), 4 (food webs) and 6 (sea-floor integrity) are set out first and are dealt with together in one sub-section due to the significant degree of overlap between them. The approach for these Descriptors is the most complex to describe due to their wide coverage.

There are then separate sub-sections setting out the characteristics, targets and indicators for Descriptors 2 (non-indigenous species), 3 (commercial fish), 5 (eutrophication), 7 (hydrographical conditions), 8 (contaminants), 9 (contaminants in seafood), 10 (litter) and 11 (noise). Each sub-section covers: background; a summary of current status from the initial assessment; a table setting out the GES characteristics and associated targets and indicators; the approach to developing GES targets for that descriptor; a summary of the anticipated implications, and; a summary of key gaps and development needs.

Section 1 – Context for the UK Marine Strategy

1.1 – Introduction

1. Within Europe marine habitats and species continue to be affected by human activities. The Marine Strategy Framework Directive (2008/56/EC) was developed in response to concerns that although existing legislation protected the sea from some specific impacts, it was sectoral and fragmented. There was also recognition that since some of the activities that impact on the marine environment are managed at a European or international level (e.g. fisheries and shipping) and other impacts can cross national boundaries (e.g. litter, eutrophication, noise), national action to protect the marine environment needs to be supported by a framework to ensure action is taken across Europe.

2. The MSFD requires Member States to put in place the necessary management measures to achieve GES in their marine waters by 2020. GES is defined in the Directive[3] and described in more detail by 11 high-level Descriptors (see p.12) which set out what Member States must achieve in their marine waters. Achieving GES involves protecting the marine environment, preventing its deterioration and restoring it where practical, whilst at the same time providing for sustainable use of marine resources. GES does not require the achievement of a pristine environmental state across the whole of the UK's seas.

3. The MSFD requires Member States to deliver the aims of the Directive through the step-wise development of a Marine Strategy covering the following elements:

a) An Initial Assessment of marine waters analysing the essential features, characteristics and environmental status of those waters (by July 2012, with subsequent assessments carried out on a six-yearly basis);

b) Determination of a set of characteristics for GES, based on the 11 GES Descriptors set out below (by July 2012, reviewed on a six-yearly basis);

c) Establishment of comprehensive environmental targets and indicators to guide progress towards achieving GES (by July 2012, reviewed on a six-yearly basis);

d) Establishment and implementation of a coordinated monitoring programme for the ongoing assessment of GES (by July 2014, reviewed on a six-yearly basis);

e) Development of a programme of measures designed to achieve GES by 2020 (by Dec 2015, reviewed and revised on a six-yearly basis);

f) Implementation of the programme of measures described above (by Dec 2016, reviewed on a six-yearly basis).

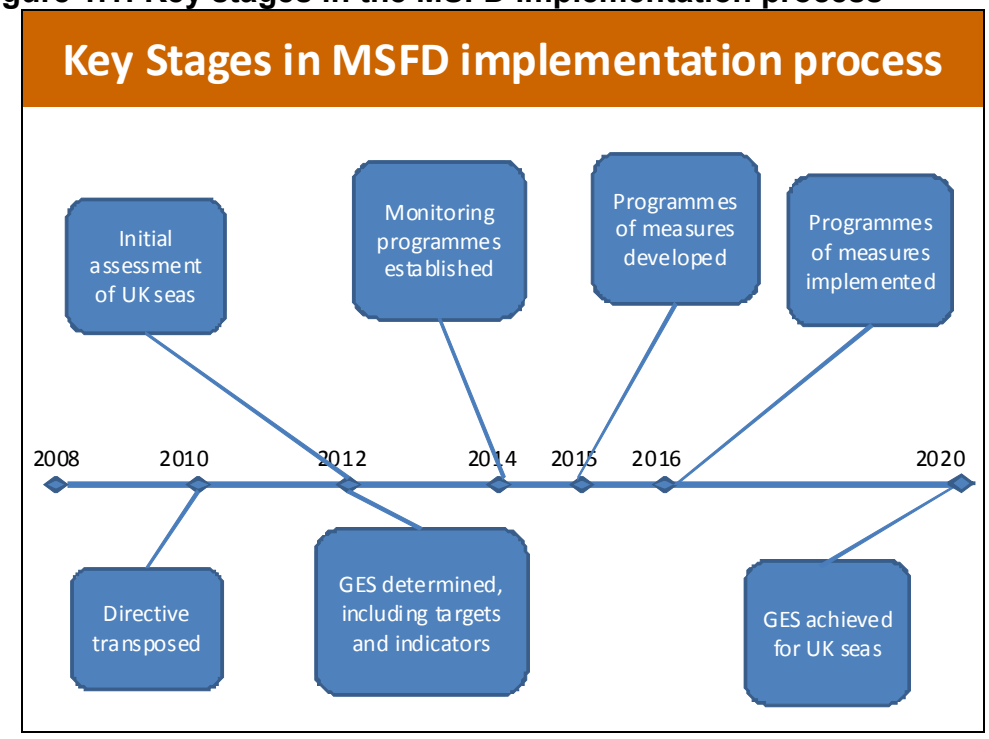
4. These requirements were transposed into UK law through the Marine Strategy Regulations 2010 (covering England, Scotland, Wales and Northern Ireland) and the Marine Strategy Regulations 2011 (covering Gibraltar). This document presents the first stage of the UK Marine Strategy focussing on elements a, b and c above which need to be completed in 2012. The remaining elements will be developed over the coming years and the UK Marine Strategy will be updated accordingly.

[3] MSFD, 2008/56/EC Article 3(5) – Good Environmental Status means the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations. A fuller description is set out at MSFD, 2008/56/EC Article 3(5).

5. The aims of the Directive are consistent with the UK Government and Devolved Administrations' objective of clean, healthy, safe, productive and biologically diverse oceans and seas, as well as with the commitments made in the UK Government's Natural Environment White Paper to be the first generation "to leave the natural environment...in a better state than we inherited it"[4]. Charting Progress 2[5], the most recent assessment of the UK's marine environment, recognised that although many aspects of the UK's marine environment are improving (e.g. the impacts of contamination), other aspects (e.g. seafloor habitats, fish populations) are degraded and continue to be adversely affected by human activity.

6. The Government and Devolved Administrations have already committed to taking many measures which will improve the state of the UK's marine environment as part of ensuring sustainable development, most notably through the UK Marine and Coastal Access Act (2009), the Marine (Scotland) Act (2010) and the proposed Northern Ireland Marine Bill. Equally, many existing pieces of EU legislation, such as the WFD and the Birds and Habitats Directives also contribute to improving the state of the UK's marine and coastal environments. These existing measures will all support the achievement of GES under this Directive.

Figure 1.1: Key stages in the MSFD implementation process



7. This document covers elements a) b) and c) of the Directive's requirements for the Marine Strategy and represents the first stage of the MSFD implementation process, in particular the following:

- **The initial assessment** (as required under Article 8 of the MSFD)– the evidence base for the UK initial assessment was developed by a wide range of UK experts working in the UKMMAS framework. The Initial Assessment is based primarily on evidence from Charting Progress 2 and its feeder reports, as well as evidence from Scotland's Marine Atlas[6] and Northern Ireland's State of the Seas Report[7]. The Initial Assessment also draws on an analysis of predicted environmental status in

[4] Natural Environment White Paper, p.3 http://www.official-documents.gov.uk/document/cm80/8082/8082.pdf
[5] http://chartingprogress.defra.gov.uk/
[6] http://scotland.gov.uk/Topics/marine/science/atlas
[7] http://www.doeni.gov.uk/niea/water-home/state_of_the_seas_ni_report.htm

2020/2030 given business-as-usual[8] and uses this to provide an assessment of the costs of degradation. Section 1.4 of this Strategy describes how the UK initial assessment was developed. The UK Initial Assessment Cover Paper can be found in Section 2**.** An initial assessment for British Gibraltar Territorial Waters is being prepared separately.

- **UK characteristics of GES** (as required under Article 9 of the MSFD) – these have been developed by policy makers in consultation with experts and key stakeholders. They provide a high-level, qualitative description of what the UK marine environment will look like when GES is achieved and cover all 11 Descriptors of GES included within the Directive. Section 1.4 of this Strategy describes how the UK characteristics of GES were developed. The characteristics themselves can be found in Section 3. GES characteristics for Gibraltar are being developed separately.

- **UK targets and indicators of GES** (as required under Article 10 of the MSFD) – these have been developed on the basis of scientific advice provided by Cefas, the JNCC and a large range of other experts, including those involved in the UK Marine Monitoring and Assessment Strategy[9]. The GES targets and indicators build on the high-level characteristics described above, providing a more detailed and, where possible, quantitative assessment framework for measuring progress towards GES. Section 1 of this Strategy describes how the GES targets and indicators were developed (see Section 1.4) and the key implications of the targets and indicators in terms of management measures and monitoring programmes (see Section 1.5). The targets and indicators themselves can be found in Section 3. GES targets and indicators for Gibraltar are being developed separately.

8. Stakeholders have already been involved in the development of this Marine Strategy and have had a chance to shape their development through a series of workshops and meetings held between 2010 and 2012. They have also had the opportunity to provide formal comments on the contents of the Strategy during a public consultation exercised in the Spring/Summer of 2012.

9. Part 1 of the UK Marine Strategy does not cover:

- **The UK monitoring programmes for GES** – although this Strategy gives a broad indication of the monitoring implications associated with the proposed GES targets and indicators, more work will be carried out between now and 2014 to look at what is already delivered by existing monitoring programmes and to define additional monitoring needs. This will be the subject of a specific consultation process in due course and will form part 2 of the UK Marine Strategy.

- **The UK programmes of measures for achieving GES** – although this Strategy gives a broad indication of the kinds of management measures which might be needed to achieve GES, more work will be carried out between now and 2015 to develop the UK Programmes of Measures for GES. All decisions on which measures are taken to achieve GES will be subject to a specific consultation process

[8] Business As Usual Projections of the Marine Environment, to Inform the Implementation of the Marine Strategy Framework Directive, ABPmer 2012, http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=17775&FromSearch=Y&Publisher=1&SearchText=ME5104&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

[9] This advice is summarised in the report, *Proposed UK Targets for Achieving GES and Cost Benefit Analysis for the MSFD*, *Cefas 2012.* Hitherto referred to as the *Cefas CBA report 2012*, http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16817&FromSearch=Y&Publisher=1&SearchText=ME5405&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description.

in 2014/15 which will assess the effectiveness of those measures in achieving GES as well as their socio-economic implications. The Programmes of Measures for GES will form part 3 of the UK Marine Strategy.

1.2 - Background to the MSFD

10. The MSFD establishes a framework within which Member States shall take the necessary measures to achieve or maintain GES in the marine environment by 2020 at the latest. The aims of the Directive are to:

> 'Protect and preserve the marine environment, prevent its deterioration or, where practicable, restore marine ecosystems in areas where they have been adversely affected;'
>
> 'Prevent and reduce inputs in the marine environment, with a view to phasing out pollution, so as to ensure that there are no significant impacts on or risks to marine biodiversity, marine ecosystems, human health or legitimate uses of the sea.[10]'

11. Member States must apply an ecosystem-based approach to the management of human activities. In this context this means ensuring that the collective pressure of human activities is kept within the levels compatible with the achievement of GES, ensuring that the capacity of the marine ecosystem to respond to human-induced changes is not compromised, whilst enabling the sustainable use of the marine environment now and in the future[11].

12. The aims of the Directive are to be delivered through the development of marine strategies covering the elements set out above in the introduction. Each stage of the marine strategy must be reviewed every six years and revised if necessary[12]. As explained in the introduction, part 1 of the UK Marine Strategy covers the Initial Assessment of the UK's marine waters, and the characteristics, targets and indicators for GES.

13. GES is defined in the Directive as follows: 'Good Environmental Status means the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations[13]'.

14. GES is also described in more detail by 11 high-level Descriptors of GES which Member States must use as the basis for their GES targets and indicators[14]. The 11 GES Descriptors are set out in the box below.

MSFD Descriptors of GES

Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions ("Descriptor 1" or "D1").

Non-indigenous species (NIS) introduced by human activities are at levels that do not adversely alter the ecosystems ("Descriptor 2" or "D2").

[10] MSFD 2008/56/EC Article 1(2).
[11] MSFD 2008/56/EC Article 1(3).
[12] As required under Article 17(2) of Directive 2008/56/EC.
[13] MSFD 2008/56/EC Article 3(5) – A fuller definition can be found in this Article.
[14] MSFD 2008/56/EC Annex 1.

Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock ("Descriptor 3" or "D3").

All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity ("Descriptor 4" or "D4").

Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters ("Descriptor 5" or "D5").

Sea floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected ("Descriptor 6" or "D6").

Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems ("Descriptor 7" or "D7").

Concentrations of contaminants are at levels not giving rise to pollution effects ("Descriptor 8" or "D8").

Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards ("Descriptor 9" or "D9").

Properties and quantities of marine litter do not cause harm to the coastal and marine environment ("Descriptor 10" or "D10").

Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment ("Descriptor 11" or "D11").

15. Member States are required to further develop these 11 GES Descriptors by determining a more detailed set of characteristics for GES[15]. In turn, these characteristics must be underpinned by the more specific GES targets and indicators[16]which will be used to assess progress towards the achievement of GES.

16. The Directive covers the extent of the marine waters over which the UK exercises jurisdiction. This area extends from the landward boundary of coastal waters[17] as defined by the WFD (which is equivalent to Mean High Water Springs) to the outer limit of the UK Renewable Energy Zone. It also includes the seabed in the area of the continental shelf beyond the renewable energy zone over which the UK exercises jurisdiction on the basis of a submission to the Commission on the limits of the continental shelf [18]. The area of UK waters over which the MSFD applies is shown below in Figure 2.

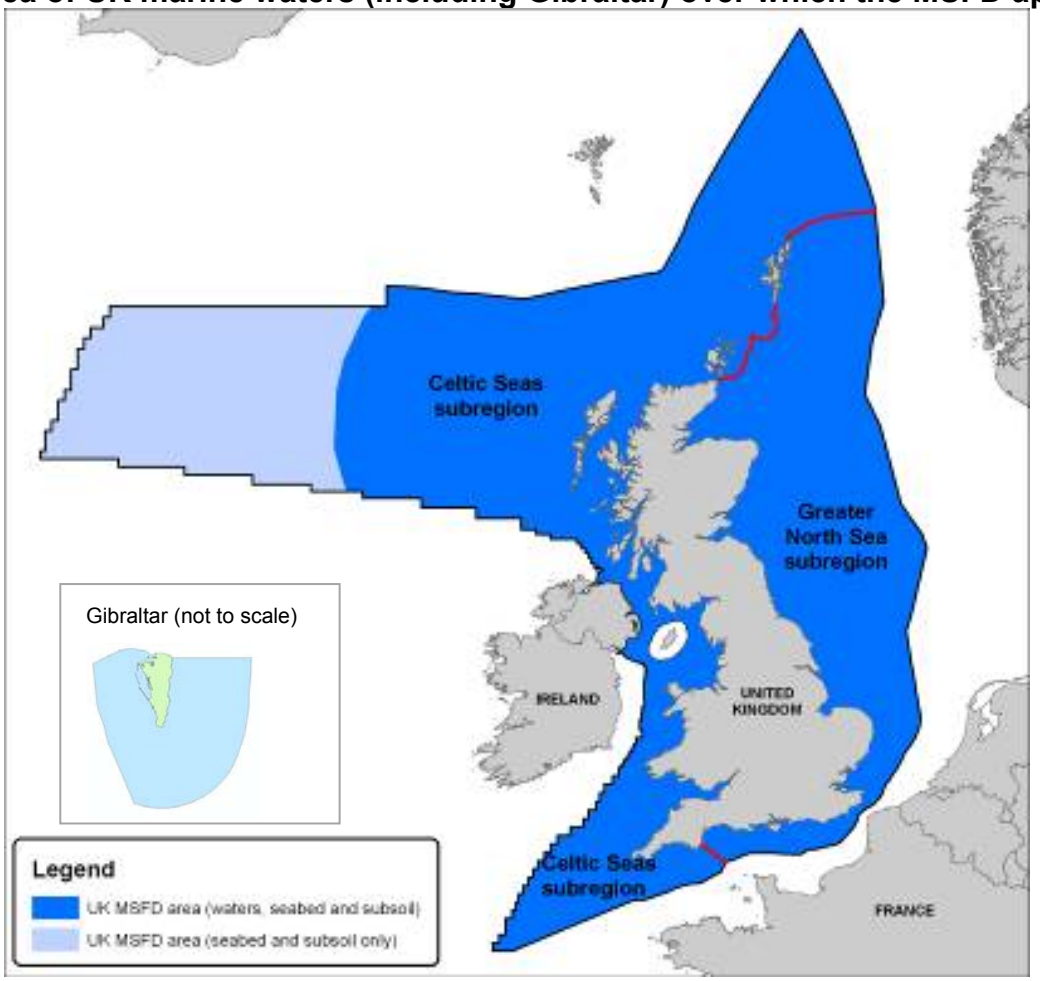
[15] As required by Article 9 of the MSFD.

[16] As required by Article 10 of the MSFD.

[17] The MSFD includes Coastal Waters (as defined by the Water Framework Directive), but does not include WFD Transitional Waters (e.g. estuaries, sea lochs, coastal lagoons).

[18] This area is defined by the Continental Shelf Act 1964. In this area the requirements of the Directive (including the requirement to put in place measures to achieve GES) applies only to the seabed and subsoil and not to the water column.

Figure 1.2: Area of UK marine waters (including Gibraltar) over which the MSFD applies



17. The Directive has been transposed into UK legislation via the Marine Strategy Regulations 2010 which apply to the whole of the UK – including the Administrations in Scotland, Wales and Northern Ireland. Gibraltar has transposed the Directive via the Marine Strategy Regulations (Gibraltar) (2011). The Directive is being implemented in a coordinated way across the UK Administrations and part 1 of the UK Marine Strategy has been developed at a UK-wide scale with input from experts and policy-makers across the UK Administrations. The Devolved Administrations will lead the development of GES monitoring programmes and programmes of measures for their marine waters, working in coordination with one another. Gibraltar has a separate implementation process and is developing an Initial Assessment and GES characteristics, targets and indicators for British Gibraltar Territorial Waters.

1.3 - The European and Regional context

Regional coordination requirements of the Directive

18. A key requirement of the Directive is that European Member States must take a coordinated approach to implementation, cooperating with other Member States in the relevant Marine Region or Subregion to ensure each element of their marine strategies is coherent and coordinated.

19. The Directive splits Europe's waters into four marine regions and associated Subregions set out in the table below.

Table 1.1: MSFD Marine Regions and associated Subregions

Marine Regions	Relevant subregions (if any)
The Baltic Sea	No Subregions specified
The North East Atlantic Ocean	The Greater North Sea, including the Kattegat and the English Channel
	The Celtic Seas
	The Bay of Biscay and the Iberian Coast
	The Macronesian biogeographic region (the waters surrounding the Azores, Madeira and the Canary Islands)
The Mediterranean Sea	The Western Mediterranean Sea
	The Adriatic Sea
	The Ionian Sea and the Central Mediterranean Sea
	The Aegean-Levantine Sea
The Black Sea	No Subregions specified

20. The UK's marine waters are in the North East Atlantic Ocean marine region, with waters to the west of the UK comprising part of the Celtic Seas Subregion, and waters to the east of the UK, including the Channel, forming part of the Greater North Sea Subregion. The UK shares the Celtic Seas Subregion with Ireland and France, and the Greater North Sea Subregion with France, Belgium, the Netherlands, Germany, Denmark, Sweden and Norway. All these countries are contracting parties to the OSPAR Convention[19] for the protection of the marine environment of North East Atlantic and OSPAR has played the primary role in coordinating the implementation of the Directive in this marine region (see further details below). British Gibraltar Territorial Waters are located in the Mediterranean region, and separate arrangements for coordination with other Mediterranean countries will be put in place.

21. Part 1 of the UK Marine Strategy is a single strategy which covers the whole of our marine waters and the UK Initial Assessment, characteristics of GES and associated targets and indicators have been developed at this scale, in coordination with other countries in the North East Atlantic Region. However, where there are significant biogeographical differences between the Greater North Sea and the Celtic Seas Subregions these have been taken into account. The Initial Assessment makes reference to the status of UK waters at the scale of the Subregions and a series of informal assessment areas developed for Charting Progress 2. A separate Marine Strategy is being produced for British Gibraltar Territorial Waters.

European level coordination

22. Coordination between countries is taking place both at a European-wide scale (for generic issues) and within the specific marine regions set out above (for more detailed issues). At a European level, coordination is being carried out through a series of informal Working Groups led by the European Commission.

23. **The Working Group on GES** – this Working Group has been set up to support Member States in developing their characteristics of GES and the associated targets and indicators, with the aim of ensuring a comparability of approaches across the EU. The group has led the development of two key documents:

[19] http://www.ospar.org/

- The Commission Decision on GES[20] - this is a formal document which sets out specific criteria and indicators for each of the 11 GES Descriptors which Member States must follow when developing their national GES targets and indicators.

- The Common Understanding of Articles 8, 9 and 10[21] - this is an informal document jointly drafted by the European Commission and the EU Member States Finland, France, Germany, Greece, Romania, Sweden and the UK. The document provides a common understanding of the development of the initial assessment and GES characteristics and associated targets and indicators (Articles 8, 9 and 10) to aid Member States in implementing the requirements of the MSFD in a comparable and consistent way.

24. This Working Group also has two technical sub-groups, one on litter (Descriptor 10) and one on noise[22] (Descriptor 11) which have a remit to review monitoring methodologies and develop proposals for new monitoring, provide a platform for sharing best practice on the development of GES characteristics, targets and indicators, and recommend proposals for further research.

25. **The Working Group on Economic and Social Analysis** – this Working Group is co-chaired by the UK and has been set up to support Member States in meeting the economic and social assessment requirements of the Directive, with the aim of ensuring comparability of approaches across the EU. It has led the development of an informal guidance document on Economic and Social Analysis for the Initial Assessment[23] which sets out informal guidance for Member States on possible approaches for this assessment.

26. **The Working Group on Data, Information and Knowledge Exchange** – this Working Group has been set up to develop a coordinated approach to MSFD information and data exchange. It developed reporting sheets to capture Member States' data and information associated with the initial assessment, characteristics of GES and associated targets and indicators. The Working Group will also concern itself with the development of the data infrastructures that are needed to facilitate the implementation of the Directive at European and Member State level, working as far as possible to use existing data initiatives and to remove duplication of reporting with related Directives.

27. The UK has played a pro-active role in all the European Working Groups and wherever possible the documents mentioned above have been taken into account in the development of this Strategy.

Regional level coordination

28. At a North East Atlantic regional level, more in-depth coordination is taking place between the UK and other relevant countries. The key forum for regional coordination is the OSPAR Convention which covers all countries in the North East Atlantic. OSPAR has made MSFD implementation a significant element of its work programme. Over the past three years the following key MSFD related actions have been carried out:

- The publication of the OSPAR Quality Status Report 2010[24] as an overarching regional-scale assessment of the environmental quality status of the North-East

[20] Commission Decision of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters 2010/477/EU http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:232:0014:0024:EN:PDF

[21] Copies available on request from Defra.

[22] The noise group is co-chaired by the UK.

[23] Copies available on request from Defra.

[24] The OSPAR Quality Status Report 2012 is available at http://www.ospar.org/content/content.asp?menu=00650830000000_000000_000000

Atlantic. The work to prepare this report and its underlying thematic assessment reports has been carried out jointly by OSPAR member countries and provides the primary basis for coordination of national initial assessments across the region.

- The development of OSPAR advice documents for each of the 11 GES Descriptors, setting out guidance on methodologies for setting GES targets and indicators. OSPAR countries are using these advice documents as basis for ensuring a coordinated approach to the development of national GES targets and indicators.

- A series of OSPAR workshops and events to allow exchange of information between countries in the development of GES characteristics, targets and indicators, with the aim of moving towards a common set of GES targets and indicators across the OSPAR area.

- The publication of the OSPAR report, Finding Common Ground: Towards regional coherence in implementing the MSFD in the North East Atlantic region through the work of the OSPAR Commission[25], which summarises OSPAR's role in regional coordination so far, assesses the degree of alignment across the different Contracting Parties' Initial Assessments and GES characteristics and targets, and sets out future actions for improving the level of coherence.

- In addition to coordination through OSPAR, the UK has also carried out a series of bilateral meetings with other countries for the purposes of improving regional coordination – these include meetings with France, Ireland, the Netherlands, Germany and Belgium.

29. In developing the draft UK initial assessment and the proposals for GES characteristics and associated targets and indicators significant efforts have been made to coordinate the UK approach with that of other countries in the North East Atlantic. In addition to the coordination within OSPAR described above, the UK has also carried out a series of bilateral meetings with other countries (including France, Ireland, the Netherlands, Germany and Belgium) for the purposes of improving regional coherence. Based on an analysis of the proposals being put forward by other key Member States in the North East Atlantic, we believe that the UK's proposals are relatively well aligned with what is being put forward by other countries. For most of the Descriptors the overall approach being taken across OSPAR countries is quite similar, particularly for those Descriptors such as eutrophication and contaminants where OSPAR has a long history of working on these issues, and commercial fisheries where the CFP provides a common framework. For the other Descriptors, although the overall approaches across different countries are broadly consistent, the detailed approach to GES targets and indicators varies. However, OSPAR has put in place a strong framework for further coordination on these issues and further work is planned between now and 2018 with the aim of agreeing a common set of GES indicators across OSPAR.

1.4 - What the Marine Strategy covers and how it was developed

30. The UK Marine Strategy Part 1 covers the following three elements:
    - The initial assessment of the state of the UK's seas cover paper.
    - Proposals for characteristics of GES for the UK's seas.
    - Proposals for more detailed GES targets and indicators, through which we will measure progress towards achieving GES.

[25] http://www.ospar.org/documents/dbase/publications/p00578_msfd%20report.pdf.

31. This section explains how the different elements of the Marine Strategy were developed and guides the reader to the appropriate sections in Part 2 where more detail can be found.

The UK Initial Assessment

Requirements of the Directive

32. The Directive requires Member States to carry out an Initial Assessment of their marine waters covering three key elements:

- An analysis of the essential features and characteristics and current environmental status of their waters;
- An analysis of the predominant pressures and impacts (including human activity) on their waters;
- An economic and social analysis of the use of their waters and the cost of degradation of the marine environment[26].

33. The Initial Assessment must be based on existing data, taking into account other relevant assessments such as those carried out for the WFD and Habitats Directive, or those carried out in OSPAR (e.g. the OSPAR Quality Status Report 2010).

Approach to developing the UK Initial Assessment

34. The MSFD Initial Assessment Cover Paper (hereafter "the Cover Paper") summarises the overall conclusions of the UK MSFD Initial Assessment. The Initial Assessment has drawn on a substantial evidence base to provide an assessment of the current environmental status of UK seas and their uses by different economic and social sectors, by reference to the indicative lists of characteristics, pressures and impacts set out in Annex III of the Directive and the eleven GES Descriptors in Annex 1 of the Directive, with the key aspects of regional variation highlighted. The Initial Assessment also includes an analysis of the cost of degradation of the UK marine environment based on an assessment of likely changes in the value of ecosystem goods and services, which is presented in the Cover Paper.

35. A comprehensive assessment of the current environmental status of UK seas and their uses by different economic sectors has been provided by Charting Progress 2 and its four thematic feeder reports published in 2010. Charting Progress 2 was a milestone evaluation prepared by the UKMMAS community which has over 40 member organisations. It was based on a robust, peer-reviewed evidence base and provided key findings from UK marine research and monitoring for use by policy makers and others. Where relevant, the Charting Progress 2 assessments have used and built on assessments and methodologies used in related EU Directives, including the WFD, the Habitats Directive and the Birds Directive, and within the framework of the OSPAR Convention. Charting Progress 2 has been supplemented by Scotland's Marine Atlas[27] and the Northern Ireland State of the Seas report[28]. The evidence base supporting the assessment was extensively peer reviewed and consulted on during the development of Charting Progress 2, Scotland's Marine Atlas and Northern Ireland's State of Seas Report.

36. An additional assessment of the costs of degradation of the UK marine environment has also been carried out and is presented in the Cover Paper. The cost of degradation has been assessed by valuing the difference in societal welfare when we compare the expected state of the marine environment if GES is achieved with the expected state of the marine environment without

[26] Directive 2008/56/EC Article 8(1)

[27] http://scotland.gov.uk/Topics/marine/science/atlas

[28] http://www.doeni.gov.uk/niea/water-home/state_of_the_seas_ni_report.htm

the MSFD (i.e. under a Business as Usual (BAU) scenario). This is the same as valuing the forgone benefits from not achieving GES.

37. A key input to the assessment of costs of degradation was a Business As Usual Report[29] (BAU Report) produced by ABPmer with guidance from UK Government officials. Building on Charting Progress 2, the report describes the predicted status of UK waters in 2020/2030 if the MSFD was not implemented. It identifies how the drivers and pressures which impact on the marine environment may change over time in the absence of MSFD targets, leading to changes in environmental state.

38. An initial assessment for British Gibraltar Territorial Waters is being prepared separately.

Key findings of the UK Initial Assessment

39. The UK Initial Assessment is summarised in the Cover Paper. The Initial Assessment cover paper was made available, as a summary of the Initial Assessment, as part of the public consultation on the marine strategy between April and June 2012 in accordance with Art 19 (2a) of the Directive and takes into account comments received from civil society. The key findings of the UK Initial Assessment are set out below.

Biological characteristics (Descriptors 1, 4 and 6)

40. **Fish**. All parts of the marine fish community have been impacted by human activities, and improvements in key status indicators for fish communities on or close to the sea bed and fish communities in estuaries need to be viewed in this context. Improvements have predominantly been in response to reductions in fishing pressure, but there is some way to go before the majority of commercial fish stocks are at safe levels. There are particular concerns over the status of threatened and vulnerable species such as sharks, skates and rays and deep sea species, which are especially vulnerable to fishing pressure, as well as for diadromous fish species, that move between fresh water and salt water during their life cycle. There is a need for improved information on the causes of declines in diadromous fish species and highly migratory fish, such as oceanic sharks.

41. **Cetaceans.** Populations of whales and dolphins were severely affected by whaling before the international moratorium in 1980's, but have remained relatively stable in UK waters in recent years. The main anthropogenic pressure is the by-catch of cetaceans, especially dolphin and harbour porpoise, in commercial fisheries. Overall assessments of cetacean status in UK seas are mainly of low confidence, a classification of few or no problems only in the Northern North Sea and Southern North Sea where the assessments are of higher confidence.

42. **Seals.** Grey seals are generally experiencing few problems, but the reasons for declines in some harbour seal populations on the East Coast of Scotland and in the Northern Isles, as well as the slow recovery of harbour seals from the most recent phocine distemper virus[30] outbreak in the Southern North Sea, need to be more fully understood.

43. **Seabirds**. Although numbers of seabirds breeding in the UK as a whole increased from the late 1960s to the end of the 1990s as a direct result of increased protection from hunting and persecution in the UK and overseas, there is concern over recent trends in breeding success of seabirds in the Greater North Sea and the northern Celtic Seas. Substantial declines have been

[29] Business As Usual Projections of the Marine Environment, to inform the Implementation of the Marine Strategy Framework Directive, ABPmer 2012. Hitherto referred to as the *Business As Usual Report, APBmer 2012*.
http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=17775&FromSearch=Y&Publisher=1&SearchText=ME5104&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

[30] A virus causing laboured breathing, fever and nervous symptoms in seals.

seen in both offshore feeding species, such as black-legged kittiwakes, and inshore feeding species, such as herring gull and arctic skua. These trends have been linked to the impacts, of a range of pressures, which often act cumulatively. These include climate change, fishing activity (on prey species) and the introduction of non-indigenous mammal species, such as North American mink, near breeding colonies.

44. **Waterbirds.** Average numbers of waterbirds wintering in, or migrating through, marine areas in the UK doubled between the mid-1970s and the mid-1990s, as a result of protection from hunting and persecution. Since then average numbers have declined being 85% higher in the winter of 2006/07 than in the mid-1970s, when co-ordinated monitoring began. However, there have been significant declines in numbers of some diving species and estuarine waders since the mid-1970's (e.g. goldeneye, dunlin, bar-tailed godwit). There is also evidence of a shift in aggregation areas in response to climate change, with estuaries and coasts to the north-east being favoured by some species. Further research is needed to determine the cause of the declines seen in some species with contamination by hazardous substances, removal of species, habitat damage and habitat loss all being relevant pressures.

45. **Seabed habitats.** Impacts on seabed habitats are widespread and the composition of seabed habitats has been altered over large areas. In general, sediment habitats are more extensively degraded than rocky habitats. Subtidal habitats close to shore are generally impacted by a greater variety of pressures than habitats further offshore. The areas impacted by the greatest number of human activities, and associated pressures, are the Southern North Sea, the Western Channel/Celtic Sea and the Irish Sea. For most activities the intensity of pressures has been relatively stable over the past ten years; however, the distribution of some pressures may have changed.

46. **Pelagic habitats.** Although there is clear evidence of regional-scale change in the composition and abundance of plankton communities, which has been linked to rising sea temperatures, plankton as a whole are considered healthy and subject to few direct anthropogenic pressures. The changes in plankton community composition as a result of rising temperatures may have consequences for other species groups in the pelagic food web (fish, cephalopods (e.g. squid, cuttlefish and octopus), birds) and it is still unclear to what extent natural variability, climate change, ocean acidification and cascading effects from fishing may be contributing to change. The role of microbial communities in the pelagic food web and the way they respond to environmental change is only beginning to be revealed.

Non Indigenous Species (Descriptor 2)

47. Around 60 Non Indigenous Species (NIS) are known to have become established in UK seas, but there is no consensus on the proportion that have an adverse impact. The impacts of most concern are those on intertidal and shallow subtidal habitats, particularly around the south and south-western coasts of the UK, where studies suggest there are far more NIS compared to the rest of the UK.

Commercial fish stocks (Descriptor 3)

48. There has been a substantial increase in the number of fish stocks that are harvested sustainably over the period 2000-2011. However, a significant proportion of indicator stocks (>60%) continue to be harvested at rates that are unsustainable and/or have reduced reproductive capacity. Further reductions in fishing pressure on around half of stocks in UK waters would be needed to ensure levels expected to provide the highest long term yield. There is a lack of consistent and quality data for most shellfish species which means that robust stock assessment is not available at regional level.

Eutrophication (Descriptor 5)

49. There are relatively few eutrophication problem areas in UK waters at present. These are of limited size (i.e. small estuaries and harbours) and measures have been put in place to address the main sources of nutrient inputs to UK waters in these areas.

Hydrographic Conditions (Descriptor 7)

50. There are no significant broad scale alterations of hydrographic conditions affecting ecosystems in UK waters beyond those currently covered by provisions of the WFD, through classification as heavily modified water bodies. However, the impacts of human developments at local or Subregional scales need to be set against increasing evidence of wider regional scale shifts in hydrographic conditions as a result of changing climate and increased levels of atmospheric CO2.

Contaminant levels and effects (Descriptors 8 and 9)

51. Environmental concentrations of monitored hazardous substances in the sea have generally fallen, but are still above levels where there is a risk of pollution effects in many coastal areas, especially where there have been historical discharges, emissions and losses from high population densities or heavy industry. Levels of persistent organic pollutants found in marine species have declined following the regulation of the substances concerned, but additional man-made chemicals are still being found in marine samples, and there is a need to keep gathering data to assess their potential impacts and the need for further controls. Regarding Descriptor 9, monitoring of fish and other seafood for human consumption indicate that contaminant levels rarely exceed maximum levels specified in the legislation. However, this monitoring is not generally related to specific geographical areas in UK waters, but based on surveys of marketed fish and seafood.

Oil pollution (Descriptor 8)

52. Over the period 2002 - 2008, the volume of oil discharged in produced water from the offshore oil and gas installations in UK waters has reduced by about 50%, in response to regulatory controls. The volume of oil accidentally spilled varies widely from year to year and is generally small and of relatively minor significance unless there is a major spill. In recent years the main incidents of note have been the loss of oil from the container ship MSC Napoli in 2007 (302 tonnes) which affected the Devon/Dorset coast and the leak from the pipeline to the Gannet platform in the Northern North Sea in 2011 (218 tonnes), both of which led to significant remedial actions.

Marine litter (Descriptor 10)

53. Levels of marine litter are considered problematic in all areas where there are systematic surveys of beached litter density. There has only been limited surveying of litter on the seabed and in the water column, which has demonstrated that litter tends to accumulate in certain areas as a result of wind and currents. There is limited information from the northern part of the Celtic Seas Subregion.

Underwater noise (Descriptor 11)

54. There is currently not enough evidence to provide a quantitative assessment of the current status and trends of underwater noise in UK seas due to a lack of available information from

monitoring studies. However, increases in construction levels are likely to have contributed to localised increases in noise levels, whilst it remains unclear whether changes in shipping activity have resulted in an increase in ambient noise levels.

The UK Characteristics of GES and associated targets and indicators

Requirements of the Directive

55. The Directive requires Member States to determine a set of characteristics for GES, by reference to the Initial Assessment, and on the basis of the 11 GES Descriptors set out in Annex 1 of the Directive. The characteristics of GES should also take into account the elements and pressures set out in Annex III of the Directive[31].

56. The Directive also requires Member States to establish a comprehensive set of environmental targets and associated indicators for their marine waters in order to guide progress towards achieving GES. These should be based on the Initial Assessment and should also take into account the list of elements and pressures set out in Annex III of the Directive[32].

57. In developing the characteristics of GES and the associated targets Member States must also follow the criteria and indicators for each of the 11 GES Descriptors set out in the Commission Decision on GES 2010.

Approach to developing the UK characteristics of GES and associated targets and indicators

58. The definition of GES and the 11 qualitative Descriptors of GES are already set out in the Directive. They are generic across Europe and describe, at the highest level, what GES means and what the European marine environment should look like when GES is achieved.

59. The determination of characteristics of GES is the next stage in the process of establishing what achieving GES means in practice, building on the 11 Descriptors of GES and the conclusions of Member States' Initial Assessments. The UK has interpreted this stage of the implementation process as a high-level, qualitative description of what GES looks like for UK waters, in the context of the wider North East Atlantic region. GES characteristics have been developed for each of the 11 GES Descriptors.

60. The qualitative characteristics of GES are then underpinned by the more detailed (and where possible quantitative) GES targets and indicators, which will be used to guide the development of monitoring programmes and assess progress towards the achievement of GES. This process is summarised in Figure 3 below.

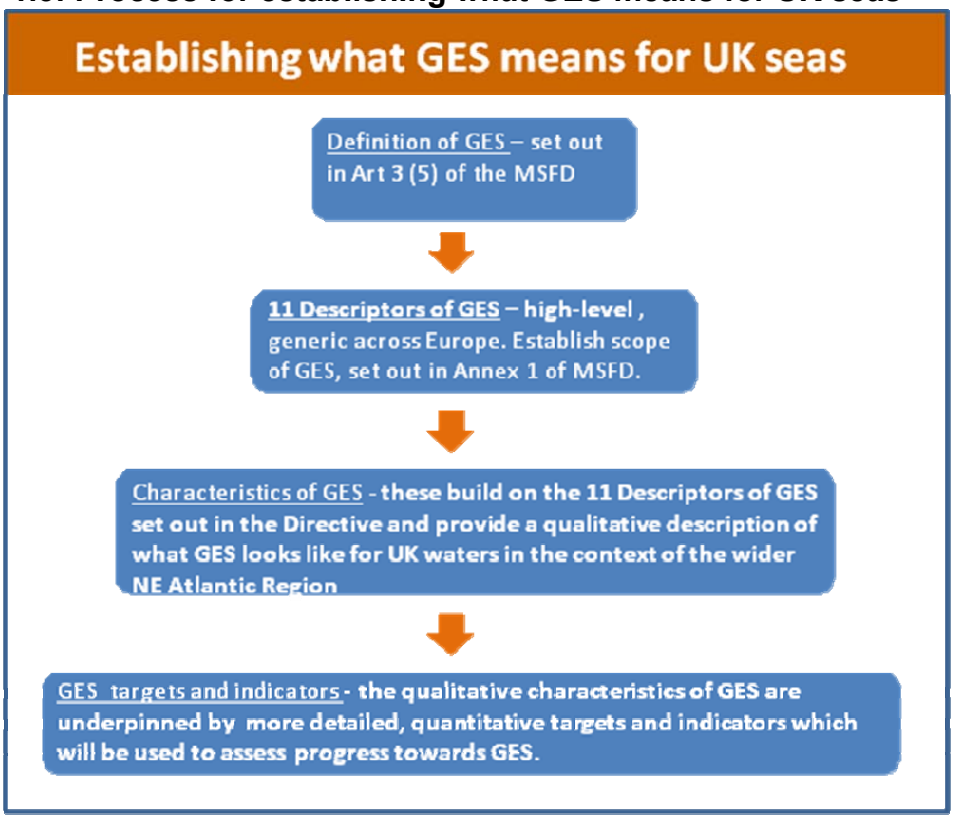
61. The EU Working Group on GES has developed advice to Member States on the approach to developing GES characteristics and associated targets and indicators, which is summarised in the Common Understanding of Articles 8, 9 and 10[33]. The advice recognises that the approach to developing GES characteristics, targets and indicators varies across Member States. However, the different approaches are all considered to be legitimate and broadly comparable in terms of outcomes. The different approaches are summarised in the Common Understanding document.

[31] Directive 2008/56/EC Article 9.

[32] Directive 2008/56/EC Article 10(1).

[33] Available on request from Defra.

Figure 1.3: Process for establishing what GES means for UK seas



UK Characteristics of GES

62. The UK characteristics of GES have been developed by policy makers in consultation with experts and stakeholders[34]. The proposals reflect the definition of GES as set out in the Directive, and use the 11 high-level Descriptors of GES as their basis. The proposals are also heavily based on the criteria set out in the Commission Decision on GES[35], which must be followed by Member States when developing their national proposals for GES characteristics.

63. The GES characteristics also take into account the following criteria which have been developed by UK policy makers and are consistent with the advice in the EU Working Group on GES Common Understanding of Articles 8, 9 and 10. The characteristics of GES should:

- refer to the desired condition of the marine environment or the appropriate level of pressure/impact on it when GES is achieved;
- take into account prevailing environmental conditions and the resilience and recoverability of the ecosystem;
- be consistent with sustainable use of the marine environment;
- be relatively high level and mainly qualitative – but providing enough detail to set the context for the more detailed GES targets and indicators which underpin them;
- be compatible with other existing national, EU or international objectives;
- take into account the links between the different GES Descriptors;
- be developed on the basis of current evidence and in reference to the initial assessment;
- be transparent about areas of uncertainty due to gaps in the knowledge base;

[34] Defra held a number of workshops and meetings with experts and stakeholders to develop the proposed UK characteristics of GES. This included an MSFD Policy-Expert workshop on 11th-12th October 2010, and an MSFD stakeholder workshop on 8th February 2011.

[35] Commission Decision of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters 2010/477/EU http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:232:0014:0024:EN:PDF

- be coordinated with other countries in the NE Atlantic.

64. The UK characteristics of GES are set out Descriptor by Descriptor in Section 3 alongside the associated targets and indicators.

Proposals for UK targets and indicators of GES

65. The UK characteristics of GES are underpinned by more specific, and where possible quantitative, targets and indicators which will be used to assess UK progress towards achieving GES. The UK targets and indicators are informed by the Initial Assessment and based on the 11 GES Descriptors and the criteria and indicators set out in the Commission Decision on GES 2010.

66. The targets and indicators also take into account the following criteria which have been agreed by the EU Working Group GES in its advice on the Common Understanding of Articles 8, 9 and 10. The GES targets and indicators should:

- be sufficient to achieve or maintain GES, recognising that interim targets may be appropriate to reflect barriers to achieving or maintaining GES;
- be quantitative where at all possible and qualitative when this is not possible;
- include state, pressure, impact or operational targets;
- address the criteria and the indicators in the Commission Decision on GES (COM Decision 2010/477/EU) where appropriate;
- be measurable in order to allow for monitoring and assessment by way of the associated indicators;
- specify reference points where appropriate (target and limit reference points);
- include, as appropriate, and be compatible with existing targets already in place at a national, Community or international level;
- give due consideration to social and economic implications;
- be internally consistent, with no conflicts existing between them;
- be developed to apply at an appropriate scale;
- include timescales for achievement and, if appropriate, include interim targets;
- pay regard to the Precautionary Principle.

67. The main evidence base for the development of the UK GES targets and indicators has been scientific advice provided by Cefas, the JNCC and a large range of additional experts, particularly those involved in the UKMMAS. Socio-economic input to the advice was provided by Eftec[36], Cefas and Marine Scotland economists. The criteria and indicators in the Commission Decision on GES were used as the basis for the advice, which is summarised in the Cefas Cost Benefit Analysis Report 2010[37]. The development of the report was overseen by a Steering Group, including representatives from Defra and the Devolved Administrations, who consider the advice in the report to be robust and transparent. The report was also independently peer reviewed prior to publication.

68. In developing the Cefas CBA Report, Cefas, working with a range of other experts, led the development of advice on targets and indicators for Descriptor 2 (non-indigenous species), Descriptor 3 (commercial fish), Descriptor 5 (eutrophication), Descriptor 7 (hydrographical conditions), Descriptor 8 (contaminants), Descriptor 9 (contaminants in seafood), Descriptor 10 (marine litter) and Descriptor 11 (underwater noise). The advice is set out Descriptor by Descriptor – but linkages between the different Descriptors have been drawn out.

[36] Economics for the Environment Consultancy - http://www.eftec.co.uk/

[37] This advice is summarised in the Cefas CBA Report 2012.

69. JNCC, working closely with experts in the Healthy and Biologically Diverse Seas Evidence Group[38], led the development of advice on targets and indicators for Descriptor 1 (biodiversity), Descriptor 4 (food webs) and Descriptor 6 (seafloor integrity). The advice on GES targets and indicators for these three Descriptors has been developed on the basis of three species components (fish, birds and mammals) and three habitat components (sediment habitats, rock & biogenic reef habitats and pelagic habitats), rather than Descriptor by Descriptor. This reflects the fact that there is significant overlap between the three Descriptors and tackling them on the basis of key groups of species and habitats has allowed experts to use many of the same targets across the Descriptors, minimising duplication.

70. Defra and the Devolved Administrations used the advice provided in the Cefas CBA Report 2012 as the basis for the proposals for GES targets and indicators set out in this Strategy. In most cases, the options for targets and indicators set out in the scientific advice have been put forward with no changes. However, in some cases the options recommended in the report have not been taken forward because they were not felt to be relevant, or they were modified slightly to improve their consistency with existing policy commitments. Where the targets in this Strategy differ from the scientific advice provided in the Cefas CBA Report 2012 this has been made clear and the reasons explained.

71. The UK GES targets and indicators, and the thinking behind them, are set out in detail in Section 3**.**

72. The GES targets and indicators cover all 11 GES Descriptors. However, it has not been possible to cover all the criteria and indicators included in the Commission Decision on GES due to gaps in the current knowledge base. These gaps are identified, Descriptor by Descriptor in Section 3. Action will be taken between now and 2018 to look at ways of filling these gaps, working closely with other countries in the North East Atlantic.

1.5 - Summary of the implications of the GES targets and indicators

73. The GES characteristics and associated targets and indicators set out in this Strategy have a number of implications, both through the implementation of associated monitoring programmes, which have to be in place by 2014, and through the implementation of a programme of management measures to achieve the targets, which has to be developed by 2015 and in place by 2016. The UK Marine Strategy Part 1 does not set out proposals for actual monitoring or management measures. These will be subject to specific consultations in due course and will form parts 2 and 3 of the UK Marine Strategy respectively. However, as part of this stage of the UK Marine Strategy an assessment has been made of the potential implications of the proposed GES targets and indicators. This analysis of implications is set out in the MSFD Impact Assessment[39] published alongside this document, and is summarised in this section as follows:

- Role of existing policies and management measures in supporting the achievement of the proposed GES targets and indicators.
- Assessment of potential additional management measures necessary to achieve the proposed targets and indicators.
- Assessment of the potential additional monitoring implications.

[38]The Healthy and Biologically Diverse Seas Evidence Group is one of the UK Marine Monitoring and Assessment Strategy's evidence collection groups, set up to coordinate information that can demonstrate whether the UK's seas are healthy and biologically diverse. It includes a wide range of experts from organisations across the UK which are involved in the monitoring and assessment of the state of the UK's seas.
[39] The Impact Assessment can be found at www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

74. Assessing the implications of the GES targets and indicators in this Strategy is an on-going process and there is still a significant amount of uncertainty about exactly what might be required in order to achieve GES. This comes from a number of factors:

- Uncertainty about how existing policies will be implemented and how effective they will be in achieving their stated objectives – a number of current marine environment policies (e.g. marine planning, Marine Protected Areas (MPAs)) are still in the early stages of implementation and it is not always clear exactly how the marine environment will respond to these measures;
- Uncertainty about how the marine environment will change over time due to natural variability – although our understanding of the marine ecosystem is improving we still do not understand all the natural variables and how these will change;
- The fact that there may be a number of different ways to achieve the GES characteristics and targets set out in this Strategy – more work is needed to assess the most cost effective way of achieving the targets.

75. The Directive accepts that there may be some exceptional circumstances where it is not possible to achieve GES and includes a number of legitimate reasons[40] why a Member State might fail to meet their GES targets. The UK will consider the application of these exceptions if and when the relevant circumstances arise.

76. In addition to these exceptions, Member States do not need to take measures to achieve the GES targets where the costs of taking action relative to the benefits are considered to be disproportionate taking into account the risks to the marine environment, and provided there is no further deterioration[41]. The UK Government and Devolved Administrations have already started to consider the development of criteria for applying the disproportionate cost exception and this has been discussed in the EU Working Group on Economic and Social Analysis. The UK will implement this exception at the stage of developing the UK programme of measures.

Role of existing policies in supporting the achievement of GES

77. The MSFD is a framework Directive covering a wide range of existing policies and legislation associated with the protection of the marine environment. The Government and Devolved Administrations have already committed to taking many measures which will improve the state of the UK's marine environment as part of ensuring sustainable development, most notably through the UK Marine and Coastal Access Act (2009), the Marine (Scotland) Act (2010) and the proposed Northern Ireland Marine Bill. Equally, many existing pieces of EU legislation, such as the WFD, the Birds and Habitats Directives, and the Environmental Impact Assessment Directive are also contributing to improving the state of the UK's marine and coastal environments. These existing measures will all support the achievement of GES under this Directive. This section provides a brief summary of the role that key policy measures are expected to play in supporting the achievement of the GES targets and indicators set out in this Strategy.

Common Fisheries Policy

78. Fisheries are still considered to have a significant negative impact on the marine environment, both through over exploitation of commercial stocks and through the wider impact that certain fisheries gears can have on seafloor habitats. Appropriate fisheries management measures will be critical to the achievement of the GES targets proposed for Descriptor 1

[40] Directive EC/56/2008 – Article 14(1) The exceptions in the Directive include: action or inaction for which the Member State concerned is not responsible; natural causes; force majeure; where meeting targets would go against the over-riding public interest; and natural conditions which do not allow the timely improvement in the status of the marine waters concerned.

[41] Directive EC/56/2008 – Article 14(4).

(biodiversity), Descriptor 3 (commercial fisheries), Descriptor 4 (food-webs) and Descriptor 6 (sea-floor integrity).

79. The need to improve fisheries management has already been acknowledged by the UK Government and Devolved Administrations in their stated aims for reform of the CFP, which explicitly call for genuine reform of fisheries management to achieve healthy fish and shellfish stocks, a prosperous fishing industry and a healthy marine environment. The GES characteristics and associated targets and indicators contained in this Strategy are consistent with the UK's approach to CFP reform.

80. The CFP will continue to be the principal legal mechanism for managing fish stocks in EU waters. We expect a reformed CFP to play a critical role in supporting the achievement of GES and ensuring consistency across European waters, promoting sustainable stocks and fishing practices. The kinds of measures which might be necessary to achieve this, many of which are already in place across our fisheries, include technical measures on gear selectivity, eliminating discards, spatial restrictions and limits on landings. These measures will be focussed both on achieving targets for Maximum Sustainable Yield in commercial fisheries where possible, taking into account the complexity of mixed fisheries and interactions between stocks and on achieving sustainable use of the marine environment outside the Marine Protected Area network.

81. Stocks outside the CFP, including shellfish, will also be considered as part of the overall achievement of GES. For many of these species there are currently no agreed exploitation rates due to limited availability of data on stocks. It is possible that some additional national or local measures may need to be taken to protect non CFP stocks, including shellfish (excluding nephrops). Any additional measures that may be required would be delivered through relevant Government and Devolved Administration policies and local byelaws.

Marine Planning and Licensing

82. The UK marine planning system was set up under the UK Marine and Coastal Access Act 2009 and the Marine (Scotland) Act (2010) to ensure the sustainable development of marine resources - this includes applying an ecosystem-based approach to the management of human activities. Marine plans will help ensure that the pressures from activities do not compromise the marine ecosystem, as part of their wider objective of enabling the sustainable use of the marine environment. This is consistent with the requirements of the MSFD, which explicitly acknowledges the importance of wider social and economic uses of our seas and calls for the sustainable use of our marine environment for current and future generations.

83. The development of marine plans is informed by the Marine Policy Statement (MPS). The MPS provides the framework for preparing marine plans, bringing together and clarifying UK marine policies and reflects European legislation and wider international commitments in achieving sustainable development.

84. Marine planning is in its early stages and is being implemented in a phased approach between now and 2021, led by the Marine Management Organisation (MMO) in English waters, Marine Scotland in Scottish waters, the Welsh Government in Welsh waters and the Department of Environment in Northern Ireland for Northern Irish waters. Marine Plans will contribute towards the achievement of GES as part of their objective of achieving sustainable development, particularly through clarifying marine objectives, priorities for the future, and directing regulators towards more consistent, evidence-based decision making and more sustainable use of marine resources. As marine plans are developed, the policies for each marine plan area will take into account the GES targets and indicators once established. Monitoring arrangements for marine plans will use the monitoring programme being put in place for GES as far as possible. The

nature and scale of the contribution that marine planning will make towards the achievement of GES will develop as marine planning matures and as the contribution of other key policies (including CFP reform and the Marine Protected Area network) becomes clearer.

85. Marine plans will be subject to the Strategic Environmental Assessment Directive. Marine licensing decisions which are made under the Marine and Coastal Access Act 2009 and the Marine (Scotland) Act 2010 must also be compliant with the Environmental Impact Assessment Directive and existing nature conservation regimes, where appropriate. In England, nationally significant infrastructure project applications, including larger ports and offshore renewable energy projects, will be decided in accordance with the relevant National Policy Statement, subject to certain exceptions, and having regard to the Marine Policy Statement.

86. Continued close working between Defra, UK Government Departments (including DECC), the Devolved Administrations and the MMO will ensure that marine planning and licensing will contribute to the achievement of GES as well as wider social and economic objectives.

Marine Protected Areas

87. The UK's network of MPAs will play a significant role in supporting the achievement of a number of the GES characteristics and targets set out in this Strategy – in particular for Descriptor 1 (biodiversity) and Descriptor 6 (sea-floor integrity).

88. The UK MPA network will form an integral element of the UK's programme of measures for GES, meeting the Directive's requirements to put in place spatial protection measures which contribute to a coherent and representative network of MPAs[42].

89. When completed, the UK MPA network will include Natura 2000 sites designated under the Birds and Habitats Directives, as well as sites designated under national legislation in each of the UK administrations. These will cover both predominant habitats and special habitats and species and may include some highly protected sites. At this stage it is difficult to say exactly what contribution the network will make towards the achievement of GES because the extent of the network is still being finalised and the management measures needed to achieve the site conservation objectives, in many cases, still under development. However, once completed, we expect the network to provide a representative and ecologically coherent set of sites across the UK. Whilst these sites alone will not be sufficient to achieve GES across the whole of the UK's marine environment, they will certainly play a critical role in improving the status of the UK's marine habitats and species, helping move us towards the targets for Descriptor 1 and Descriptor 6 outlined in this consultation.

90. Defra and the Devolved Administrations will work closely with those organisations involved in developing the proposals for management measures for the UK MPA network over the next few years to ensure that those measures achieve the specific conservation objectives of the relevant site and also contribute to the wider targets and indicators for GES set out in this consultation. For offshore sites the CFP will be an important management tool and we will work with the Commission and other Members States to secure appropriate and fair management measures.

Water Framework Directive

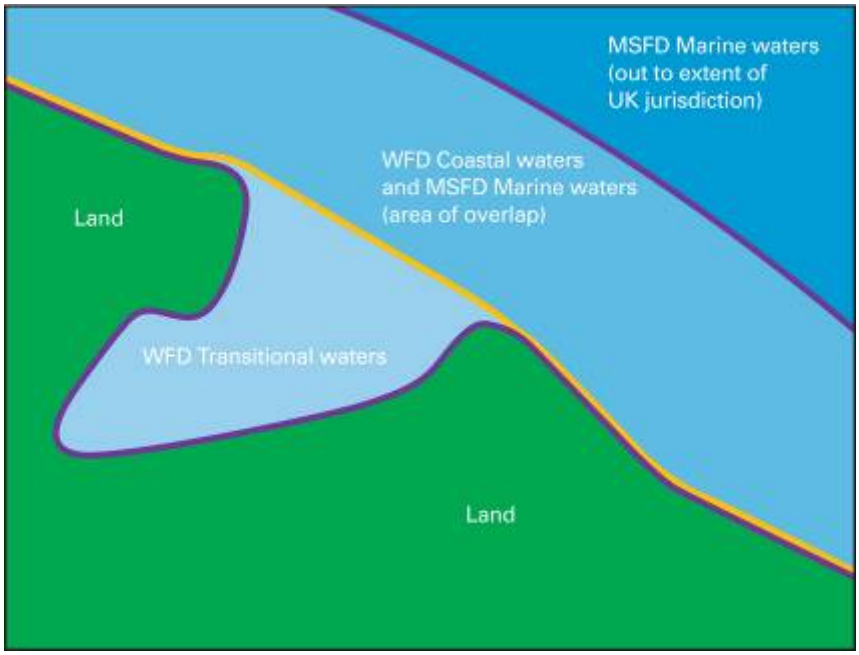
91. There are strong links between the MSFD and the WFD. WFD relates to improving and protecting the chemical and ecological status of surface waters throughout a River Basin from Rivers, Lakes and Groundwaters through to Estuaries (Transitional) and Coastal Waters to 1

[42] Directive 2008/56/EC, Article 13(4).

nautical miles out to sea (3nm in Scotland) and overlaps with MSFD in coastal waters[43]. They also have comparable objectives, with MSFD focussed on the achievement of Good Environmental Status in marine waters, and WFD aiming to achieve Good Ecological and Good Chemical Status. Whilst Good Environmental Status is not exactly equivalent to Good Ecological/Chemical Status there are some significant areas of overlap, particularly in relation to chemical quality, the effects of nutrient enrichment (eutrophication) and some aspects of ecological quality and hydromorphological quality.

92. The main difference between the Directives is that the scope of Good Environmental Status under the MSFD is broader, covering a greater range of biodiversity components and pressures which are not included for coastal water bodies under the WFD. These include noise, litter, most commercial fish species and some other aspects of biodiversity (e.g. marine mammals[44]). The assessment scales are also different, with the MSFD requiring the achievement of Good Environmental Status at the level of the relevant subregions (the Greater North Sea and the Celtic Seas) whereas the WFD assesses the chemical and ecological status of each individual coastal water body.

Figure 1.4: MSFD/WFD boundaries



93. Given the degree of overlap, both geographically and in terms of objectives, there is the potential for significant synergies between the targets and measures across the two Directives. However, there is also the potential for mixed messages, and care will be needed to ensure that the two Directives and their associated assessments are implemented in a way which makes the links between them clear and avoids inconsistency or unnecessary duplication.

94. The MSFD recognises the overlaps with the WFD and makes it clear that in coastal waters, the MSFD is only intended to apply to those aspects of GES which are not already covered by the WFD (e.g. noise, litter, aspects of biodiversity). This means that in coastal waters measures being taken under the WFD and its related Directives (e.g. the Nitrates Directive and Urban Waste Water Treatment Directive) should be sufficient to achieve the GES targets for pressures such as contaminants (Descriptor 8), euthrophication (Descriptor 5). Measures being taken under WFD

[43] WFD coastal waters extend from Mean High Water (Springs) out to 1 nautical mile offshore in England, Wales and Northern Ireland, and 3 nautical miles offshore in Scotland.

[44] In terms of biodiversity the WFD covers a) benthic invertebrates, b) macroalgae, c) angiosperms (seagrass and saltmarsh), d) phytoplankton and, e) estuarine fish. WFD does not cover zooplankton, seabirds, coastal water fish, etc.

will also play a role in supporting the achievement of GES targets for hydrographical conditions (Descriptor 7).

95. It is more difficult to say how far the WFD and its related Directives will support the achievement of GES for these Descriptors in wider marine waters that are not covered by the WFD. For contaminants and eutrophication, given that most of the anthropogenic activities which cause these pressures are either terrestrial in nature, or are taking place in the coastal zone, it is considered highly likely that measures taken under the WFD and its related Directives will be sufficient to achieve GES for these Descriptors across the UK's marine area. For Descriptor 7, it is considered that the application of WFD in the coastal area, plus the wider application of the Environmental Impact Assessment Directive through the marine licensing process, will be sufficient to achieve GES for this Descriptor across the UK's marine waters.

96. In order to improve the consistency of approaches across the two Directives, the GES targets and indicators in this Strategy have been aligned as far as possible with similar assessment tools under the WFD. In particular, WFD assessment tools will be used in relation to contaminants, eutrophication and the assessment of certain seafloor habitats, and applied more widely to the marine environment where this is appropriate. This will help ensure a comparability of monitoring and assessment across the two pieces of legislation, and will help avoid the situation where one set of targets and indicators apply in the coastal zone, and a dramatically different set apply in the wider marine environment.

97. Although the timetables for the two Directives are not entirely consistent efforts will be made to align the implementation of the Directives as far as possible.

Birds and Habitats Directives

98. Significant habitat and species protection is also already provided in UK waters through the implementation of the EU's Habitats and Birds Directives. The spatial protection aspects of these Directives have already been mentioned under the section on MPAs, but these two Directives also set a number of specific conservation objectives for particular species and habitats. Measures taken under the Habitats Directive are designed to achieve Favourable Conservation Status[45] (FCS) for the species and habitats listed. The aims of the Birds Directive relate to the conservation of all species of naturally occurring birds in the wild state in the European territory of the member state to which the Treaty applies.

99. Although the broad aims of GES and FCS are similar, it would be wrong to say that they are equivalent. Unlike the Birds Directive, which covers all wild birds, the Habitats Directive is aimed at protecting particular species and habitats which are threatened or declining, whereas GES is something which must be achieved for species and habitats across the whole of the UK's seas. For this reason, it was not considered appropriate under GES to apply the FCS targets that are used under the Habitats Directive to all UK species and habitats.

100. Instead, an approach has been taken which ensures comparability of targets between the Directives for listed species and habitats, but recognises that a different approach is needed for wider marine habitats and species not covered by the Habitats Directive. For more details on this approach see **Section 3 of the Cefas CBA Report 2012**[46].

[45] As defined in Article 1 of the EC Habitats Directive EC/92/43.

[46] http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16817&FromSearch=Y&Publisher=1&SearchText=ME5405&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

101. Due to the strong links made between MSFD and these two Directives it is likely that the management measures to achieve the Birds and Habitats Directives will play a significant role in achieving the GES targets for Descriptors 1 (biodiversity), 4 (food webs) and 6 (sea-floor integrity). However, some additional measures may be needed to achieve GES targets in relation to those species and habitats not covered by the Birds and Habitats Directives.

Potential additional management measures needed to achieve GES

102. The programme of measures to achieve the GES characteristics and targets must be developed by 2015 and implemented by 2016. This Strategy does not cover the programmes of measures needed to achieve GES, however, in order to understand the potential implications of the proposed GES targets, the Impact Assessment, set out in Part 2, Section 4, provides an assessment of the potential additional management measures which may need to be put in place to achieve GES. This analysis has been carried out based on an assessment of a range of **illustrative** management measures which are examples of the types of additional measures which may be needed to achieve the GES targets.

103. As explained above, this is not an easy assessment to make. A number of key measures to improve the marine environment are in the very early stages of implementation (e.g. marine planning, MPAs) and there is uncertainty about the effectiveness of current policy measures in achieving their stated objectives. There are also significant uncertainties about the way in which the marine environment will change over time due to natural variability. This makes it extremely difficult to assess exactly what additional measures might be needed to achieve the GES targets set out in this Strategy and is one of the main reasons why the Directive advocates a system of adaptive management – adjusting management regimes overtime based on improved understanding of their effectiveness.

104. Further work will be carried out between now and 2015 with involvement from all key stakeholders to define the exact range of additional measures. These will be subject to a full consultation process in due course and will form Part 3 of the UK Marine Strategy. A summary of the GES targets for each Descriptor and the need for potential additional management measures (as set out in the impact assessment) is set out below.

Descriptors 1 (Biodiversity), 4 (food webs) and 6 (sea-floor integrity)

105. GES targets for these three Descriptors are set out together because of the significant overlap between them. Targets have been developed for three species groups (marine mammals, birds and fish) and three habitat groups (pelagic habitats, sediment habitats and, rock and biogenic reef habitats). We have high confidence that other countries within OSPAR will follow the same broad approach to biodiversity targets as the UK, however, more work is planned over the next few years to improve coordination of targets and indicators across countries.

106. For the proposed GES targets and indicators for **species** (birds, fish and mammals) existing targets have been used wherever suitable (e.g. from the Habitats Directive, OSPAR) and the proposals have been based as far as possible around existing indicators and monitoring programmes.

107. There are numerous measures already in place, or planned which are expected to make a significant contribution to achieving the proposed targets – these have been outlined above. However, it is not clear at this stage whether these measures alone will be sufficient to achieve the GES targets and it is considered possible that some additional management measures may be needed, particularly in relation to further reducing the impacts of fisheries on seabirds and reducing the impacts of non-indigenous mammals on island seabird colonies.

108. For the proposed GES targets and indicators for **seafloor habitats** (rock and biogenic reef and sediment habitats) existing targets under the Habitats Directive and WFD have been used wherever possible, but new targets have been developed in relation to broad scale sediment habitats which are not covered by the Habitats Directive. For **pelagic habitats**, there are no suitable targets in existing legislation and all the proposals for targets are new.

109. As with the targets for species, there are numerous measures already in place, or planned (e.g. MPAs) which are expected to make a significant contribution towards the proposed targets. For those seafloor habitats that are covered by the Habitats Directive it has been assumed that measures taken under that Directive will be sufficient to achieve the targets. For those seafloor which are not covered by the Habitats Directive (primarily sediment habitats) MPAs created under national legislation will play a key role, but additional management measures may be needed particularly in relation to reducing the impacts of fisheries. For pelagic habitats it has been assumed that the targets will be achieved through measures taken to achieve the targets for Descriptor 3 (commercial fish) and Descriptor 5 (eutrophication).

110. As explained above, these proposals are in line with the UK's approach to reform of the CFP, which calls for closer integration of the CFP with wider environmental objectives. The CFP would remain the main mechanism for taking any fisheries measures necessary to achieve GES – with the exception of those fisheries which are managed on a local or national basis.

111. For further detail on the GES targets for Descriptors 1, 4 and 6 and their implications see Section 3.2 Biodiversity.

Descriptor 2 (non-indigenous species)

112. The GES targets for this Descriptor are new as there are no specific targets for NIS in existing legislation. The approach is risk based and the targets require the implementation of management measures to reduce the risk from key pathways and vectors of introduction and spread of NIS, and the development and implementation of management plans for dealing with key high risk species should they arrive in UK waters. Other Member States are taking a variety of approaches to targets for this Descriptor but the UK's approach is well aligned with a number of countries including the Netherlands and Denmark.

113. A number of voluntary and legislative measures are already in place to support the achievement of GES for this Descriptor. Further action to reduce the risks of introduction associated with international shipping, one of the key pathways of NIS introduction, is also planned by the International Maritime Organization. However, it is considered likely that further additional measures will be needed to support the achievement of GES, both to reduce the risk of introduction and spread from other key pathways, and to implement action plans to control the spread of the highest risk species. As the approach to achieving GES for this Descriptor will be risk based it is hard to assess exactly what additional measures might be needed at this stage and a range of possible measures have been considered in the Impact Assessment, the costs of which would fall primarily on Government, marinas and small vessel owners. Further work to implement this risk based approach will be carried out in consultation with stakeholders between now and 2015 as part of the development of the programmes of measures.

114. For further detail on the proposed GES targets for Descriptor 2 and their implications see Section 3.3.

Descriptor 3 (commercial fish)

115. The GES targets for this Descriptor are based on the approach taken to stock assessment in the CFP and require fishing rates to be at levels which can produce Maximum Sustainable Yield by 2020 at the latest. It is likely that most other Member States will take a similar approach based on recent advice developed by the International Council for the Exploration of the Sea (ICES) on methodologies for GES targets for commercial fish.

116. As described above, the proposed targets are consistent with the UK's approach to reform of the CFP and achieving GES for this Descriptor is dependent on the successful reform of the CFP.

117. For further detail on the proposed GES targets for Descriptor 3 and their implications see Section 3.4.

Descriptors 5 (eutrophication), Descriptor 8 (contaminants), Descriptor 9 (contaminants in seafood)

118. The GES targets for these Descriptors are based on existing targets within OSPAR or within existing EU legislation (e.g. the WFD, the Nitrates Directive, the Urban Waste Water Treatment Directive, the revised Bathing Waters Directive and the Hazardous Substances Directive).

119. The targets for Descriptor 5 (eutrophication) require nutrient concentrations, and the direct and indirect effects of nutrient enrichment to be at levels which do not lead to an undesirable disturbance to the balance of organisms present in the water or to the quality of the water.

120. The targets for Descriptor 8 (contaminants) require concentrations and effects of contaminants in the marine environment to be kept within levels agreed in existing legislation and international commitments. Similarly, the targets for Descriptor 9 (contaminants in seafood) require levels of contaminants in fish and shellfish for human consumption to be kept within existing regulatory levels.

121. There is a high-level of regional coordination on the approach to assessment for eutrophication and contaminants and it is likely that other countries in OSPAR will follow a similar approach to the UK.

122. It is considered likely that measures being taken under existing legislation will be sufficient ensure the GES targets for these Descriptors are achieved. The only exception to this is in relation to Descriptor 8, where the presence in a few areas of persistent legacy contaminants in sediments could affect the UK's achievement of GES. Measures to remove these contaminated sediments would not be practical and the costs would almost certainly be disproportionate taking into account the risks to the marine environment. The UK does not propose to take these types of measures. Therefore, it is considered unlikely that there will be any additional management measures associated with the target proposals for these Descriptors, although work will be carried out as part of the development of the programme of measures to ensure that the implementation of existing policies and legislation is carried out in a way which also meets the needs of MSFD.

123. For further detail on the GES targets for Descriptor 5 and their implications see Section 3.5. For further detail on the proposed GES targets for Descriptor 8 and their implications see Section 3.7. For further detail on the proposed GES target for Descriptor 9 and their implications see Section 3.8.

Descriptor 7 (hydrographical conditions)

124. The GES target for this Descriptor requires developers and regulators to continue to comply with existing legislative requirements through the current marine licensing regime.

125. As the target is based on the application of the existing regulatory regime it is considered unlikely that there will be any additional management measures associated with this target, assuming there is currently compliance with all the relevant existing legislation.

126. For further detail on the GES targets for Descriptor 7 and its implications see Section 3.6.

Descriptor 10 (marine litter)

127. The target for litter levels on coastlines requires an absolute reduction in litter items reaching UK beaches and is consistent with existing Government commitments on terrestrial litter. Surveillance indicators are also being put in place to monitor levels of litter on the seafloor and in the water column.

128. Terrestrial sources of litter are considered to be the main component of marine litter, and existing policies to tackle terrestrial litter and waste will play a large part in supporting the achievement of GES for this Descriptor. Current litter and waste policies, such as the 'Love Where You Live' campaign in England[47] and Scotland's Zero Waste Plan, involve a strong focus on action being taken across society (e.g. by communities and businesses) rather than centralised action by Government, and could include measures such as public campaigns to raise awareness and promote changed behaviour on waste and littering, and encouraging and promoting community clean-up activities. There is also a need to address marine sources of litter, for example through the extension of voluntary codes of practice with the fishing industry. Further work on this will be carried out as part of the development of the programmes of measures.

129. For further detail on the proposed GES targets for Descriptor 10 and their implications see Section 3.9.

Descriptor 11 (underwater noise)

130. The targets for noise cover both impulsive sounds (e.g. those caused by seismic surveys and pile driving) and ambient sounds (e.g. those caused by shipping). All the targets are new because there are no targets for underwater noise in existing legislation. Other Member States are taking a variety of approaches to setting targets for noise, but the UK's targets are based on advice produced by the EU Technical Sub-Group on Noise, which was created to consider methodologies for noise targets and monitoring[48], and is consistent with the approach being taken by a number of other Member States (e.g. the Netherlands and Denmark).

131. It is anticipated that activities causing impulsive sounds will increase between now and 2020. However, our current understanding indicates that it is unlikely that there would be any significant adverse effects on marine animal populations, provided appropriate measures continue to be taken through the current licensing regime to manage the potential physical impacts near to individual noise generating activities. For ambient sounds, shipping activity is likely to increase between now and 2020, but existing measures to make ships more efficient should also make

[47] *Love Where You Live* is a new campaign designed to inspire everyone to take action to reduce litter. The campaign is led by Keep Britain Tidy, with support from Defra. The campaign is about everyone taking responsibility for litter, and to change the way people think and act about littering. We all love something about where we live and this campaign is about everyone working together to make change happen.

[48] The EU Technical Sub-Group on Noise is a sub-group of the EU Working Group on Good Environmental Status and forms part of the Commission's Common Implementation Strategy for MSFD.

them less noisy. It is unclear how this would affect overall ambient sound levels, or what impact ambient noise has on marine animals at a population level.

Impulsive sounds:

132. The GES target for impulsive sounds requires the establishment and maintenance of a 'noise registry' which would record in space and time activities generating noise in order that they can be analysed to determined whether they may potentially compromise the achievement of GES. This approach reflects the conclusion by experts that estimated future levels of activity do not currently appear to pose a significant threat to marine animal populations. The noise registry will be managed by Government regulators and discussions with stakeholders on its development will take place as part of the development of the MSFD programmes of measures.

Ambient sounds:

133. A specific target for ambient sound levels is not being established and instead a surveillance indicator is has been developed, with the UK determination of GES for noise being used as a generic, qualitative target. No additional management measures are envisaged at this stage, but monitoring programmes will be put in place to gather data, and the need for a target will be reviewed as more information becomes available.

134. For further detail on the proposed GES targets for Descriptor 11 and their implications see Section 3.10.

Additional monitoring requirements

135. Monitoring programmes to assess progress towards the GES targets and indicators must be in place by the middle of 2014. The UK Marine Strategy Part 1 does not cover monitoring programmes and proposals for UK monitoring for GES will be developed over the next two years with input from relevant stakeholders, in particular with the involvement of organisations involved in the UKMMAS[49] and with industries which gather data in UK marine waters.

136. UKMMAS was established in 2005 with the remit of coordinating monitoring across all the UK's marine monitoring organisations, and already carries out a significant amount of monitoring of the UK's marine environment. Over 40 organisations participate, including Government and Government Agencies, Marine Institutes, independent academic institutions and several NGOS.

137. Much of the monitoring is carried out in order to meet statutory requirements and EU/International obligations or in order to provide a better understanding of the structure and functioning of the marine environment. Private industries, which carry out monitoring in order to assess commercial exploitation activities and to fulfil marine licensing requirements, are also becoming involved with the UKMMAS community. Two significant assessments of the state of UK waters have been carried out by UKMMAS in recent years, Charting Progress (in 2005) and Charting Progress 2 (in 2010), on the basis of the significant UK marine monitoring data already available.

138. This means the UK has a strong foundation on which to develop the monitoring programmes to assess the achievement of GES, and much of the work will involve building on, or adapting existing monitoring arrangements rather than starting with a blank slate.

[49] UKMMAS, co-chaired by Defra and Scottish Government, is made up of the main organisations who control and monitor the UK marine environment (over 40 including Government Departments and Agencies, Research institutes, and laboratories) . It consists of 4 main Evidence Groups (Ocean Processes, Healthy and Biodiverse Seas, Clean and Safe Seas, and Productive Seas). Its main aim is to carry out the required UK-wide monitoring and assessment programmes to determine the extent to which the UK vision of Clean, Safe, Healthy, Biodiverse and Productive seas , used sustainably, has been achieved .

139. Cefas and JNCC, in collaboration with members of the UKMMAS and other key experts, have undertaken a broad initial assessment of the possible additional monitoring costs implied by the proposed UK GES targets and indicators. This assessment was included in the Cefas CBA Report 2012, but has since been updated following a more in depth assessment of monitoring needs carried out by UKMMAS in the first half of 2012. The results of that analysis are summarised the MSFD Impact Assessment, although these should be treated as a very rough initial estimate. The actual monitoring costs will be highly dependent on the design of monitoring (e.g. how regular or spatially intense it is). Work is on-going within the UKMMAS community to determine how MSFD monitoring can be designed to focus on key risks and how the use of resources can be optimised by sharing facilities (e.g. ships). In some cases the need to develop a properly informed basis for these approaches and the need to develop new indicators to address some of the targets will mean that monitoring programmes will be established in a staged approach, with it not being possible to establish effective monitoring for some aspects of GES until after 2014.

140. The MSFD requires Member States within the same marine region or subregion to ensure that their monitoring programmes are well coordinated so that monitoring results can be compared effectively. The UK Government and Devolved Administrations will work closely with other Member States in the North East Atlantic to develop MSFD monitoring programmes that are consistent across the region.

Section 2 – UK Initial Assessment Cover Paper

2.1 Introduction and approach

Introduction

141. The European Union Marine Strategy Framework Directive (MSFD) (2008/56/EC) requires co-ordinated action by Member States to put in place measures to achieve Good Environmental Status (GES) in their seas by 2020. This report provides a summary of the UK's Initial Assessment of its marine waters in accordance with Article 8 of the Directive (for key requirements see Box 1). The Initial Assessment is a reference point against which Member States are to determine the characteristics of GES and establish targets and indicators for measuring progress towards. The evidence in this report has therefore guided the development of the proposals and targets and indicators presented elsewhere in the UK Marine Strategy. The Initial Assessment will also be used to inform the work by Member States to establish and implement monitoring programmes for the on-going assessment on environmental quality status.

142. UK seas extend to some 867 400 km^2, which is more than three and a half times the UK land area. These seas stretch from the coastal seas and estuaries, through the shelf seas and down to the deep sea beyond the continental slope, which can be thousands of metres deep. The UK has over 19 000km of coastline[50] and there are a myriad of offshore islands. This extensive seascape encompasses a huge variety of physical and chemical conditions, which form the transition between sub-polar waters and the temperate waters found along most of the coasts of Western Europe. For this reason UK Seas are particularly important at a European scale for their exceptional variety of seabed habitats and high overall biodiversity.

143. Gathering together existing knowledge on the state of these varied seas represents a formidable challenge, which has been tackled through the development of Charting Progress 2 and its peer-reviewed feeder reports by the UK Marine Monitoring and Assessment Strategy (UKMMAS) community. The underlying evidence compiled to support the UK's Initial Assessment for the MSFD represents the most comprehensive assessment of the current status of UK's seas to date, and provides a framework which we will look to build on in our future management of the seas.

Box 2.1: MSFD Article 8

In respect of each marine region or subregion, Member States shall make an initial assessment of their marine waters, taking account of existing data where available and comprise the following:

(a) an analysis of the essential features and characteristics, and current environmental status of those waters, based on the indicative lists of elements set out in Table 1 of Annex III of the Directive and covering the physical and chemical features, the habitat types, the biological features and the hydro-morphology;
(b) an analysis of the predominant pressures and impacts, including human activity, on the environmental status of those waters which:
    (i) is based on the indicative lists of elements set out in Table 2 of Annex III of the Directive and covers the qualitative and quantitative mix of the various pressures, as well as discernible trends;
    (ii) covers the main cumulative and synergetic effects; and
    (iii) takes account of the relevant assessments which have been made pursuant to

[50] Based on ordnance survey digital measurements of 1:10000 maps using the high water line www.ordnancesurvey.co.uk/

existing Community legislation;

(c) an economic and social analysis of the use of those waters and of the cost of degradation of the marine environment.

The analyses referred to in paragraph 1 shall take into account elements regarding coastal, transitional and territorial waters covered by relevant provisions of existing Community legislation, in particular Directive 2000/60/EC. They shall also take into account, or use as their basis, other relevant assessments such as those carried out jointly in the context of Regional Sea Conventions, so as to produce a comprehensive assessment of the status of the marine environment.

The evidence base

144. The UK's Initial Assessment comprises this summary report ("Cover Paper") supported by a substantial evidence base (see Box 2).

145. This Cover Paper summarises and compiles the information from the underlying evidence base to provide an overall view on the use and value of UK marine waters, the resulting pressures and the resulting environmental quality status as a baseline for work under the MSFD towards the GES of UK waters. This "Cover Paper" should be used as the first point of reference as to the conclusions of the UK Initial Assessment.

Evidence base for environmental quality status

146. The assessment of the current environmental status of UK waters and the use of those waters by different economic and social sectors is based on the Charting Progress 2 assessment of the state of UK Seas, which was published in 2010. Charting Progress 2 was a milestone evaluation prepared by the UKMMAS community which has over 40 member organisations. It was based on a robust, peer-reviewed evidence base and provided key findings from UK marine research and monitoring for use by policy makers and others, as we move towards the UK vision of clean, healthy, safe, productive and biologically diverse oceans and seas. Where relevant, the Charting Progress 2 assessments have used and built on assessments and methodologies used in related EU Directives, including the Water Framework Directive (WFD), the Habitats Directive and the Birds Directive, and within the framework of the OSPAR Convention. Charting Progress 2 comprises the Charting Progress 2 summary report itself supported by four comprehensive and substantial feeder reports presenting and evaluating the evidence on clean and safe seas, healthy and biologically diverse seas, productive seas and ocean processes.

147. The Initial Assessment also includes reports presenting the evidence on the status of waters managed by different UK Devolved Administrations. Complementing and building on the results of Charting Progress 2, the UK Devolved Administrations for Scotland and Northern Ireland have prepared stand-alone assessments of the status of Scottish and Northern Irish waters respectively. In addition a strategic scoping study has been compiled to support the implementation of marine planning in English waters. The Initial Assessment has also been informed by the OSPAR Quality Status Report 2010 and its underlying thematic assessments.

148. Our conclusions on the state of UK seas depend critically on the extent and sufficiency of the available evidence. Marine research and monitoring varies hugely in its spatial and temporal coverage. In some cases there are robust data with full quality assurance and internationally recognised standards, while, in other cases data are less robust or provide only a partial picture and it is necessary to use expert judgement to reach an estimation of the likely status, if this is at all possible.

Evidence base for socio-economic analysis

149. Charting Progress 2 and its Productive Seas Feeder Report present an analysis of the economic use of UK waters. A more regionally-specific economic analysis for Scotland is provided in Scotland's Marine Atlas. This document includes an initial social analysis examining the value of the marine sector for coastal communities. An assessment of the predicted status of UK waters, given the continuation of the current regulatory framework has been developed through the Business-As-Usual project. An analysis of the costs of degradation assessing the difference in how the environment would look under Business As Usual (BAU) and GES is presented in Section 2.5 of this report.

150. Work to improve understanding of human interactions with the seas, and to characterise the balance between the services and benefits we draw from the seas and the ways that our activities affect the sea, is at an earlier stage of development and some of the methodologies are relatively novel. The assessments employ a mix of quantitative and qualitative data, employing expert opinion, where necessary.

Box 2.2: ►The Evidence Base for the UK's MSFD Initial Assessment

Charting Progress 2: UK Marine Monitoring and Assessment Strategy (UKMMAS) (2010). Charting Progress 2. The state of UK Seas. Published by Department for Environment Food and Rural Affairs on behalf of UKMMAS. 166pp.
http://chartingprogress.defra.gov.uk/

Charting Progress 2 Clean and Safe Seas Feeder report: UK Marine Monitoring and Assessment Strategy Community (UKMMAS) (2010). Charting Progress 2 Feeder report: Clean and Safe Seas. (Eds. Law, R. and Maes, T.). Published by Department for Environment Food and Rural Affairs on behalf of UKMMAS. 366pp.
http://chartingprogress.defra.gov.uk/clean-and-safe-seas-feeder-report

Charting Progress 2 Ocean Processes Feeder report: United Kingdom Marine Monitoring and Assessment Strategy (UKMMAS) (2010). Charting Progress 2 Feeder Report: Ocean Processes (Ed. Huthnance, J). Department for Environment Food and Rural Affairs on behalf of UKMMAS. 279pp.
http://chartingprogress.defra.gov.uk/ocean-processes-feeder-report

Charting Progress 2 Healthy and Biological Diverse Seas Feeder report: UK Marine Monitoring and Assessment Strategy (2010). Charting Progress 2 Healthy and Biological Diverse Seas Feeder report. (Eds. Frost, M. & Hawkridge, J). Published by Department for Environment Food and Rural Affairs on behalf of UKMMAS. 672pp.
http://chartingprogress.defra.gov.uk/healthy-and-biologically-diverse-seas-feeder-report

Charting Progress 2 Productive Seas Feeder report: United Kingdom Marine Monitoring and Assessment Strategy (UKMMAS) (2010). Charting Progress 2 Feeder Report Productive Seas. Department for Environment Food and Rural Affairs on behalf of UKMMAS (Eds. Saunders, J. and McKie, J.) 472pp.
http://chartingprogress.defra.gov.uk/productive-seas-feeder-report

Scotland's Marine Atlas: Baxter, J.M., Boyd, I.L., Cox, M., Donald, A.E., Malcolm, S.J., Miles, H., Miller, B., Moffat, C.F., (Editors), 2011. Scotland's Marine Atlas: Information for the national marine plan. Marine Scotland, Edinburgh. 191pp.
http://www.scotland.gov.uk/Publications/2011/03/16182005/0

Northern Ireland State of the Seas report: Agri-food and Biosciences Institute and Northern Ireland Environment Agency (2011). Northern Ireland State of the Sea report (Ed. Gibson, C). Agri-food and Biosciences Institute and Northern Ireland Environment Agency (2010). 112pp. http://www.doeni.gov.uk/niea/water-home/state_of_the_seas_ni_report.htm

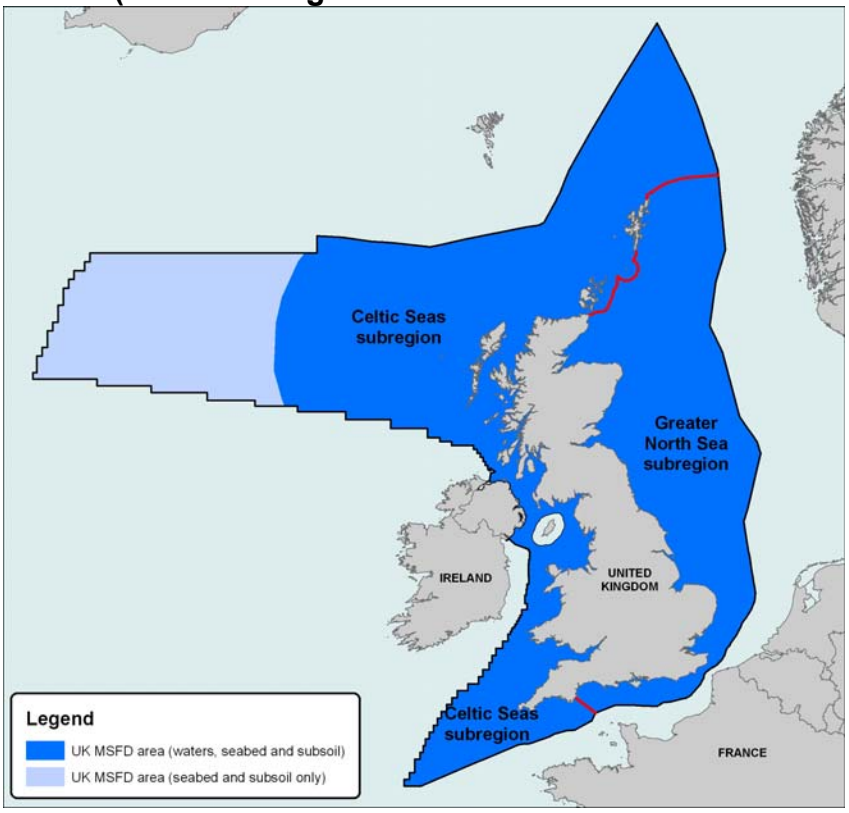
Business as Usual Report: ABP Marine Environmental Research Ltd and Economic for the Environment Consultancy (2011). Business as Usual Project Projections of the Marine Environment, to Inform the UK Implementation of the Marine Strategy Framework Directive. ABP Marine Environmental Research Ltd. 87pp + appendices. http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=17775&FromSearch=Y&Publisher=1&SearchText=ME5104&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description;

OSPAR Quality Status Report 2010: OSPAR, 2010. Quality Status Report 2010. OSPAR Commission. London. http://qsr2010.ospar.org/en/index.html

Approach to regional assessment of UK seas

151. Article 4 (1) of the MSFD requires Member States to take due account of the fact that marine waters covered by their sovereignty or jurisdictions form an integral part of four marine regions when implementing the directive. UK seas addressed by this Cover paper lie within the North-East Atlantic marine region. A separate initial assessment is being prepared for British Gibraltar Territorial Waters, which lie within the Mediterranean marine region. Within each marine region, Member States may take account of the specificities of particular areas by reference to subdivisions provided that such sub-divisions are delimited in a manner compatible with a series of defined marine subregions. UK seas addressed by this Cover paper occupy parts of two subregions identified in the Directive: the Greater North Sea and the Celtic Seas (see Figure 2.1).

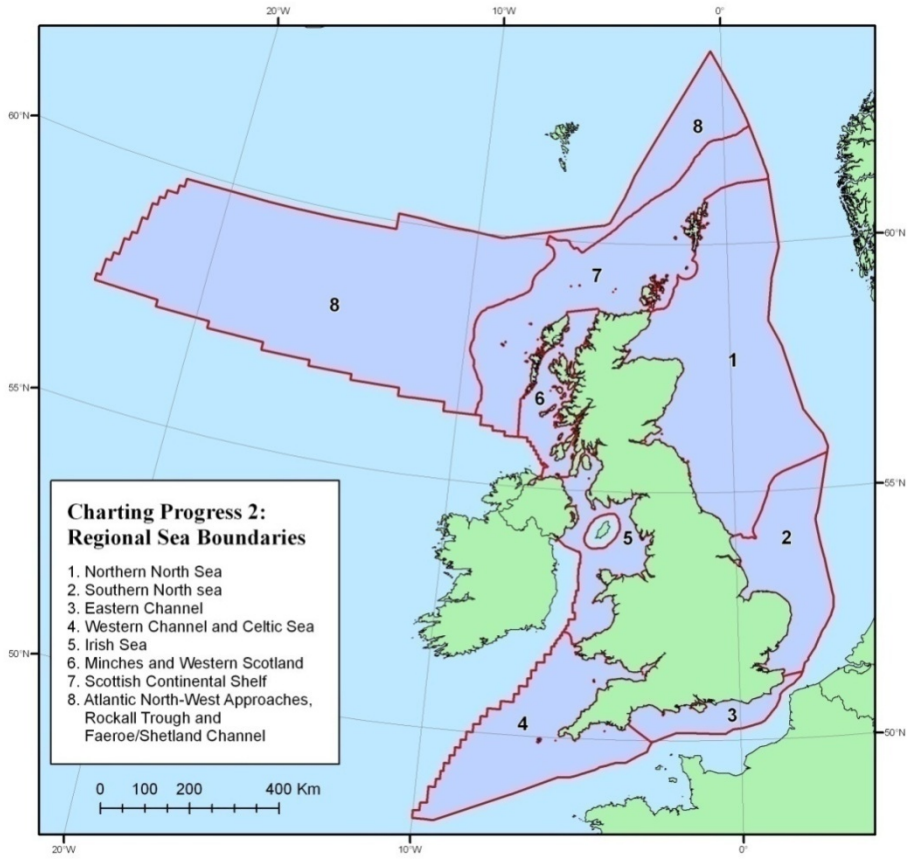
Figure 2.1. Definition of the Greater North Sea and Celtic Seas subregions in UK marine waters (not including British Gibraltar Territorial Waters).



152. For Charting Progress 2, UK seas were subdivided into eight biogeographically defined assessment regions (CP2 Regions), based upon the UK Review of Marine Nature Conservation (2004)[51] and principally using physical and biological features such as tidal fronts and seabed flora and fauna (see Figure 2.2).

153. In this Cover Paper, these CP2 Regions are referred to on an informal basis where this is relevant to describe the differences in status within the MSFD subregions. For other issues, where the main distinction is a north-south gradient in status in both subregions, conclusions are drawn at the scale of UK seas as a whole. For the purposes of this summary, the CP2 Regions have been allocated to the MSFD sub-regions as follows, taking into account hydrographic and biogeographical characteristics: the Greater North Sea subregion consists of CP2 Regions 1, 2 and 3; the Celtic Seas subregion consists of CP2 Regions 4, 5, 6, 7 and 8. Regional perspectives on the eight CP2 Regions are presented in Chapter 7 of Charting Progress 2[52].

Figure 2.2. Regional assessment areas in UK seas used for the Charting Progress 2 assessment.



Regional coordination with EU Member States

154. UK government officials and scientists have worked collaboratively with the other States with waters in the North-East Atlantic to prepare the OSPAR Convention's Quality Status Report (QSR) 2010[53]. The QSR 2010 presents an evaluation of the status of the North-East Atlantic as a whole. Its development has contributed to a coordinated viewpoint on the status of the North-East Atlantic as many of the methodologies and assessment tools used in the report are consistent with those used to prepare the Charting Progress 2 assessment and the assessments of other EU Member States in the North-East Atlantic Region. UK scientists are also heavily involved in the

[51] http://archive.defra.gov.uk/environment/biodiversity/marine/documents/rmnc-report-0704.pdf
[52] http://chartingprogress.defra.gov.uk/regional-perspectives
[53] http://qsr2010.ospar.org/en/index.html

work of International Council for the Exploration of the Seas (ICES) which develops coordinated scientific advice to assist the development of policies for the management and use of the seas. A key component of ICES' work is the development of fish stock assessments to inform the management of European Union fisheries. UK officials and scientists also work on the protection of populations of migratory and mobile populations of species in other international frameworks (e.g. Agreement on the Conservation of Small Cetaceans in the North Sea, African-Eurasian Waterbirds Agreement).

2.2 Analysis of the economic and social use of UK seas and the predominant pressures

Marine users and uses and their economic and social importance

155. Charting Progress 2 provides an assessment of the various marine activities in UK seas and the economic value of these activities. The principal human activities, for which Table 2.1 summarises the economic value (Gross Value Added or Investment), productivity trend and future outlook on growth rate, are those that use marine ecosystem goods and services directly to provide a marketable good or service. Of these, oil and gas makes the highest annual contribution to the economy of any activity in the marine environment, with a gross value added of £37 billion in 2008. Maritime transport and telecommunications provide vital links within the UK and to the rest of the world offering significant economic benefit. Gross value added by leisure and recreational activities is high and likely to be underestimated given current limitations in sourcing data for this sector. Expenditure on military defence activities provides additional benefits to the economies surrounding the main naval bases. Fisheries and aquaculture within the UK continue to supply food nationally and abroad and support local fishing communities. A range of ancillary activities, such as construction of wind farms or the manufacture of fishing nets support these main activities. There is also a wide range of secondary human activities that arise as a result of the outputs from the primary activity, for example, fish processing, and manufacturing of petrochemicals from oil and gas.

156. It should be noted that there is considerable regional variation in economic value and productivity across the UK. At this stage separate statistics for the two UK MSFD subregions have not been derived. Statistics for Scotland core marine sector have been provided in Scotland's Marine Atlas (see Scotland's Marine Atlas Chapter 5, page 142).

Table 2.1: Principal human activities in UK seas and their Gross Value Added and productivity trend as assessed in Charting Progress 2 (UKMMAS, 2010).

Activities	Year	Gross Value Added(unless otherwise stated), £m[a]	Productivity trend*** (2003-2009)[a]
Oil and Gas	2008	37,000	+
Maritime Transport	2007	4,700	0
Telecommunications	2005	2,700	+
Leisure and recreation	2003-08	1,289	+
Defence – Military	2007-08	468	0
Fisheries	2007	204	0
Aquaculture	2007	193	+
Water abstraction	2008	150	0
Mineral extraction	2008	54	0

Renewable energy	2008	50	++
Coastal defence	2009	358*	++
Waste disposal	2009	9.3*	0
Education	2009	95	0
R&D	2009	3,624*	0
Power Transmission[b]		No monetary value available	0
Storage of gases		No monetary value available	0

[a] Source: Charting Progress 2 Productive Seas Feeder Report UKMMAS (2010)
[b]Not possible to establish monetary value. No temporal data, deployment rates likely to have been stable
[c]Not possible to establish current monetary value. Significant increase in investments. No new development since 2003 but surveys (e.g. seismic) likely to have increased
*Denotes investment not GVA
*** 5 point scale: -- Significant decrease: - Decrease: 0 No change;
+ Increase; ++ Significant Increase

►Read More: Detailed analysis of economic and social use of UK Seas:

Charting Progress 2 Chapter 5 Productive Seas
http://chartingprogress.defra.gov.uk/chapter-5-productiveseas

Charting Progress 2 Productive Seas Feeder Report
http://chartingprogress.defra.gov.uk/productive-seas-feeder-report-download

Scotland's Marine Atlas Chapter 5 Productive
http://www.scotland.gov.uk/Publications/2011/03/16182005/60

157. In addition to their contribution to the national economy, uses of the marine environment play a key role for local coastal communities. The strong linkages between uses of the marine environment and the social-economic indicators in coastal communities have been demonstrated in a socio-economic study for England prepared for the Marine Management Organisation (MMO)[54]. This is summarised in Table 2.2, which gives an indication of the key coastal areas for each activity and three broad socio-economic indicators in England – a) labour utilisation (i.e. effects on skills, job growth and unemployment) b) labour productivity (i.e. impact on wages, new businesses and investment) and c) deprivation. For details on the linkages please refer to the study.

[54] 'Maximising the socio-economic impacts of marine planning for English coastal communities' by Roger Tim and Partners and OCSI. The research was funded by the Marine Management Organisation. http://marinemanagement.org.uk/marineplanning/se.htm

Table 2.2. Summary social analysis of principal human activities based on a study of English coastal communities (Tim et al. (2011) – see footnote 55) and Charting Progress 2. Column 2 has been augmented to include information on coastal communities in Scotland, although the relationships described in columns 3-5 do not necessarily hold for Scotland.

Activities	Where does the activity create employment	What are effects on local labour utilisation? (skills, job growth, unemployment)	What are effects on local labour productivity? (including wages, new businesses, investment	Is the activity likely to impact deprivation levels in local area?
Energy production and infrastructure (Oil and gas)	The oil and gas industry supports ca. 340,000 jobs (32,000 directly, 207,000 in supply chain and services, 100,000 exporting goods and services) distributed around the UK; Scotland 45%; South East England 21%; North West England 6%; West Midlands 5%; Eastern England 5% (Ref: Oil and Gas UK)	Variable dependent upon location and activities – medium to high local impacts. Jobs require highly skilled, skilled and semi skilled staff. Impacts on the rates of future labour utilisation may be modest. As the industry declines there will be growth in decommissioning activities offering alternative opportunities for employment. Direct employment benefits the broader local economy as incomes are re-spent in local businesses.	Variable dependent upon location and activities – medium to high local impacts. Operations and maintenance activities are likely to continue around the UK. Manufacturing will continue to take place locally or remotely. However, an increase in decommissioning activities will require a mix of highly skilled, skilled and semi-skilled employment to continue. Infrastructure will be brought to shore for disposal creating alternative opportunities. Some areas may have significant impacts while other areas will remain relatively unaffected.	Variable dependent upon location and activities – continued operations and maintenance plus decommissioning activities will ensure employment beyond 2020. Medium to high local impacts.
Offshore renewable energy	Wave and Tidal: West and North coasts of	Variable dependent upon location and	Variable dependent upon location and	Variable dependent upon location and activities – Medium to

	Scotland; Northern Ireland; North Wales; South West of England. Offshore Wind: North Sea, , Irish Sea, Eastern Channel, Western Channel and Celtic Sea, Minches and Western Scotland	activities – Medium to high local impacts – In some areas the jobs generated will require skilled staff. Significant new manufacturing facilities could have significant impact on labour utilisation rates, local GDP and increasing skills and employment rates, Impacts more likely in relatively deprived port areas with high levels of semi skilled unemployment Operations and maintenance provide a mix of skilled and semi-skilled employment, both as new employment and diversificatio n in existing, declining maritime sectors.	activities – Medium to high local impacts New manufacturing, fabrication, operation and maintenance activities are likely to be close to deployment sites, creating a mix of highly skilled, skilled and semi-skilled employment increasing local GDP and standards of living in traditionally economically under developed areas of the UK.	high local impacts There will be significant opportunity for new semi-skilled and skilled jobs to be created at a local level and for diversification from within declining local sectors, though less for low-skilled jobs. Most deployment and related activity will take place in traditional areas of deprivation and industrial decline. Direct employment will benefit broader local economies. Some rural peripheral communities may also experience trickledown effect.
Marine Transport	The extensive network of UK ports is important to a large proportion of coastal areas,. Key employment hotspots are located in Plymouth, Southampton, Portsmouth, Harwich and	High local – Labour catchments tend to be relatively local, and there is demand for lower skilled labour implying job creation for those skills.	High local – Wages are higher than average and in some of the largest port development projects (such as Bathside Bay port development scheme), there can be positive connectivity spin offs for local	High local – Ports employ relatively high proportions of lower skilled labour. Deprivation is concentrated in this demographic and those within it are at greatest risk of unemployment.

	Barrow-in-Furness. In 2007 97% of all port traffic was handled by 52 major ports. Scottish ports handle 17 per cent of UK trade by volume with 11 ports handling 96 per cent of this volume. Almost two thirds of passenger traffic in Scotland takes place in the Clyde and Solway Firth.	However, lower skill jobs make smaller contribution to productivity growth.	economies.	
Tele-communications and cabling	There are few areas in England where this activity is of particular importance. Approximately 40 per cent of the UK's international cables run through Scottish waters and roughly 50 per cent of Scotland's cables are in the Bailey, North Scotland Coast and Faroe Shetland areas.	Low local – Manufacture takes place at a small number of sites, and cable laying contractors are international. Jobs created are likely to be highly specialised.	Low local – Whilst telecommunications cabling marine activity has an important role in facilitating international communications, the prevalence of related activities will not in themselves provide improvement in labour productivity for coastal communities.	Low local- It is unlikely to have significant effects on local deprivation.
Tourism and recreation	A wide geographic spread across English coastal towns with particular importance in areas of North East, North-West and South West. Marine-related leisure activities	High local – Jobs created are low skill in nature. They are available to those in risk of unemployment but make smaller contribution to productivity growth. The jobs	Low local – Wages are low but speciality and refreshed tourism might raise productivity. In many areas investment can be low as a number of coastal towns are attempting to diversify from what	Medium local – Likely to have complex effects on deprivation. Likely to create jobs for the low skilled and deprived, but jobs tend to be low wage, seasonal and part time (reducing long term impact on deprivation).

	in Scotland are particularly prevalent on the West Coast, Hebrides and Northern Isles.	also tend to be seasonal and part time.	is perceived as over dependence on tourism.	
Defence – Military	Overall the Royal Navy employs 38,600 service personnel and 4,600 civilians. Defence employment is important to a number of coastal areas in England, including Plymouth and Portsmouth. In 2010, 11,920 Ministry of Defence personnel were stationed in Scotland and 5,830 civilians were employed, over a quarter in Argyll & Bute.	Medium local effects – Skill is higher than average as some bases employ significantly more of local labour than others, loss of these bases can lead to acute problems.	Medium local effects - Although defence industries are not associated with the production of goods and services for exchange, their work contributes to the total economic activity in the economy in a similar way to other public sector workers.	Different areas will be subject to different impacts (depending on the profile of the local economy and the relative importance of defence establishments within it).
Marine Aggregates	Important to a number of areas around the coast of England, and Wales . About 500 are employed directly in aggregate extraction activity.	Medium local – The specifically marine element of this industry is small in job terms but industry growth could have some impacts in more peripheral job markets.	Medium local – Broad sector data suggests that wages are slightly higher than average. Investment in aggregate extraction vessels is capital intensive, higher levels of investment will tend to increase per capita output.	Medium local – Study's assumption is that a high proportion of jobs are relatively unskilled and available to local labour.
Fisheries	Particularly important to coastal areas around south-west of England, the east coast of Scotland and the Northern Isles. The main	High local – Though local employment has declined over the years, changes in levels of fisheries will still have significant	Low local – Fisheries pay is below average, with intermittently high wages being eroded by seasonality and weather. As like other	High local – Jobs tend to be lower skilled in nature, creating opportunities for those at greatest risk of unemployment.

	concentrations of fishermen numbers in England are in the administration ports of Newlyn (1,167 fishermen), Poole (818), Plymouth (605), Grimsby (578), North Shields (545), Hastings (469), Brixham (465) and Scarborough (453).[55] In Scotland 5,218 were employed in this sector in 2010. The main ports of landing are Peterhead (168,400t), Shetland (90,600t) and Fraserburgh (28,200t), accounting for 75 per cent of landings volume.	impacts on local economies, particularly larger, more remote locations. Jobs tend to be lower skilled in nature and likely to make lower contribution to productivity growth	primary/extractive industries, fisheries are unlikely to drive forward local productivity. It is important to note, though, that the presence of fisheries may have an important role in creating distinctive local environments which assist tourism industry. There is difficulty in quantifying the extent of this influence and more evidence on the role of fishing in this regard will be welcomed.	
Aquaculture	Finfish – Scottish coastal areas although increasing in other areas of the UK. Shellfish - evenly spread throughout the UK and expanding. 3,150 employed in this sector indirectly with majority (2200) of jobs based in Scotland. The majority of Scottish	High local impacts - The majority of businesses predominantly offer employment to remote locations. Study has no direct evidence but anticipate that labour market catchments are likely to be local. Jobs tend to be lower skilled in nature which	Low local – The available statistics suggest that pay be below average. As with fishing, aquaculture industries are not likely to drive forward local productivity to any great degrees.	High local impacts - Jobs tend to be lower skilled in nature creating opportunities for those lower skilled individuals which are in greater risk of unemployment. Outlook is dependent on site availability and environmental carrying capacity.

[55] Employment data on fisheries industries may not pick up the high levels of self employment.

	aquaculture production occurs in the Minches and Malin Sea area. Scotland is one of the world's three largest producers of farmed Atlantic salmon.	creates opportunities for those at risk of unemployment but makes smaller contribution towards productivity growth.		
Surface water management and waste water treatment and disposal	Widespread locations. Most waste disposal in Scotland occurs along the east coast	Medium local impacts It can be assumed that a fair proportion of the workforce is made up from local employment markets. This would suggest employment in coastal areas would be positively affected by job expansion.	Medium local - Wage rates are slightly above average, this industry is a stable, utility function and is not going to drive local productivity to a great extent.	Medium local – Expansion in this activity may have mild positive impacts on local deprivation

158. The linkages between marine activities and coastal socio-economic processes in Table 2.2 (columns 3-5) were mainly developed based on English coastal communities, however, some of these linkages also hold for coastal communities in the Devolved Administrations. For example, Northern Ireland has a heavy dependence on its seaports, with a study in 2007 showing that 13% of Northern Ireland's workforce is employed by businesses that trade through the port of Belfast or are based in the Harbour Estate (undertaken by Centre for Economics and Business Research, reported in Northern Ireland: State of the Seas, 2011). These businesses generate £3.8 billion of GVA (£4.2 Billion GDP), equivalent to 15.7% of NI's GDP.

159. Similarly there are likely to be some differences on how these linkages (mentioned in Table 2.2) hold for other Devolved Administrations. For example, there is currently no marine aggregate extraction within Northern Ireland.

160. The Tim et al. socio- economic study also looked at how English coastal communities are currently performing against certain key socio-economic indicators. The results for English coastal and non coastal communities are presented in Table 2.3 below. With the help of experts from Marine Scotland information has been gathered for Scottish coastal and non coastal communities and incorporated into the table. More information on communities and indicators in Wales and Northern Ireland will be collected when the social impacts of specific measures under MSFD are assessed in 2014/15.

Table 2.3. Performance on indicators of English and Scottish coastal communities[56].

Typologies	English Coastal Average	English Non Coastal	England	Scotland Coastal Average	Scotland Non Coastal Average	Scotland
Labour utilisation						
People qualified to degree level (2009) (%)	19.1	25.5	23.5	21.9	20.3	21.4
Population growth 2001-2009 (% change)	4	5.1	4.8	2.7	2.4	2.6
Jobs growth 2001-2008* (% change)	4.8	5.3	5	4.1	6.5	5.2
Jobseekers Allowance claimants (2011) (%)	4	3.8	3.9	2.5	3.1	2.8
Seasonal unemployment (2010) - seasonal variation in JSA claim rates(%)	53. 0	48	50	N/A	N/A	N/A
Income Support claimants (2010) (%)	5.3	4.8	4.9	2.9	3.7	3.3
Incapacity Benefit claimants (2010) (%)	6.3	5.1	5.4	3.8	4.6	4.1
Summary: English coastal areas have a somewhat slower population growth and higher claimant rates (Income Support, Job Seekers Allowance and Incapacity Benefits) than in English non-coastal areas. In contrast Scottish coastal areas have experienced a slightly higher rate of population growth than non-coastal areas and have lower claimant rates. A lower proportion of people in English coastal areas are qualified to degree level than across non-coastal areas. This is in contrast to Scotland, where coastal areas have a larger proportion of people qualified to degree level but the rate of job growth is higher in non-coastal area. Job growth in English coastal areas is lower than growth levels in non-coastal areas, and self employment rates are lower in English coastal areas than non-coastal areas.						
Productivity drivers						
Employment in knowledge industry, 2009 (%) *	9	11.6	11	10.7	10.2	10.5
Business stock per 10,000 population, (2007 for England and 2009 for Scotland)**	488.6	565.9	545.7	386.3	308.5	354.4
VAT registrations (as a % of total stock), (2007 for England and 2009 for Scotland) **	10.1	10.8	10.4	7.2	9.0	7.9
VAT de-registrations (as a % of total stock)(2007 for England and 2009 for Scotland) **	7.3	7.6	7.4	7.3	9.6	8.3
Summary: A lower proportion of people in English coastal areas are employed in the knowledge industries than across non-coastal areas and there are lower levels of businesses per head in						

[56] Figures for England are based on 'Maximising the socio-economic impacts of marine planning for English coastal communities' by Roger Tim and Partners and OCSI. The research was funded by the Marine Management Organisation. http://marinemanagement.org.uk/marineplanning/se.htm. Figures for Scotland provided by Marine Scotland.

coastal areas than across England as a whole. In Scotland, coastal areas on average have more business sites per 10,000 people than non-coastal areas but a lower rate of business start ups and closures. Employment in the knowledge industry is relatively equal in coastal and non-coastal areas. Compared to English coastal areas, Scottish coastal areas have a larger proportion of people employed in the knowledge sector, but a lower level of business per head and rate of new business start ups.						
Outcomes / deprivation						
Index of Multiple Deprivation (IMD) 2010 - average score	22.78	21.2	21.67	N/A	N/A	N/A
IMD 2010 - average rank (where 1 is most deprived)	15,475	16,585	16,241	3449	3037	3253
% of LSOAs in the most deprived 20%	20.6	19.7	20	11.1	19.1	15[57]
Summary: On average, Scottish coastal areas rank ahead of non-coastal areas in the Scottish Index of Multiple Deprivation and have a lower proportion of areas within the most deprived 15%. In contrast, English coastal areas are slightly more deprived than non coastal areas and have a greater proportion of areas within the most deprived 20%.						
Risks						
Concentration of single industries, 2008 (%) *	3.5	4.7	4.4	N/A	N/A	N/A
Public sector employment, 2008 (%)*	22	18.7	20	28.5	25.4	27.2
Summary: English coastal areas in general have higher levels of people employed in public sector organisations than in non-coastal areas. As is the case for England, Scottish coastal areas have a higher proportion of people employed in the public sector than non-coastal areas and a higher rate of public sector employment than England overall.						

161. Data is based on Lower layer Super Output Area (LSOA) datasets, except for: * Data is based on Travel-To-Work-Area level datasets; ** Data is based on Local Authority level datasets *** Data is based on MSOA level datasets. See report entitled “Coastal Typologies: detailed method and outputs‟ provide for details of the indicators used here and elsewhere in the report.

Indirect users and non-users of the marine environment

162. Table 2.1 identifies direct uses of the UK’s marine waters. In addition to these direct users of the UK marine waters that make use of the resource in either a consumptive way (e.g. oil and gas, fisheries and mineral extraction) or a non-consumptive way (e.g. coastal defence or leisure activities), there are other beneficiaries, who derive value from the marine environment, that have not been included in Table 2.1, These beneficiaries are categorised as indirect users and non-users. Indirect users are users who benefit from the ecosystem services provided by a resource, rather than the direct use of the resource itself (e.g. the benefits to society provided by marine ecosystems through their role in carbon sequestration). Non-users derived benefit simply from the knowledge that the natural environment is maintained. Examples of non-use values are listed below:

- Local and non-coastal populations are likely to benefit from keeping open the option to make use of some aspects of the marine environment in the future, even though there is no current plan to make such use (option value);

[57] Scotland uses the Scottish Index of Multiple Deprivation (SIMD) which does not provide an overall rank and focuses on the most deprived 15% with the rank being out of 6505.

- Local and national population are likely to derive benefit from knowing that others can enjoy the services provided by the marine environment (altruistic value);
- Parts of the national population derive benefit simply from the satisfaction of knowing that ecosystems and the species they support (e.g. whales) continue to exist in good condition, regardless of whether they or others will use these resources, now or in future (existence values);
- Society also derives benefits from the knowledge that marine ecosystems will be passed on to future generations in good condition (bequest value).

163. The ecosystem services approach is a way to categorise and understand the linkages in an ecosystem that ultimately contribute to human welfare, both through the provision of goods and services (use values) and non-use values[58]. Section 2.5 of this "Cover paper" (analysis of cost of degradation) looks at key changes in ecosystem services as a result of pressures and attempts to assess the impact on human welfare due to these changes. These impacts on human welfare are then linked to user and non user.

Predominant pressures resulting from marine uses

164. The different marine uses of UK seas lead to a range of pressures on the marine environment, for example through pollution, or by disturbing and exploiting habitats and species. The main pressures arising as a result of each of the principal human activities in UK seas have been identified and analysed in Charting Progress 2 and the Business as Usual Report. Table 2.4. provides an overview of the priority pressures identified by Charting Progress 2 and the Business-as-Usual study and a brief summary of the temporal and spatial extent of these pressures. Priority pressures are either not currently well-managed, or there is lack of evidence about the activity or pressures or those where there are concerns that cumulative effects may lead to permanent impacts. Although there are a number of activities that result in physical damage of the sea bed through abrasion, the spatial extent of damage from bottom fisheries is considered to far outweigh contributions from other sources of this pressure. Litter was identified as a key pressure with potential impacts of unknown magnitude on habitats (smothering) and species (ingestion). The pressure stems from a number of different sources including both from land and sea, although there is very little information on its spatial extent. Underwater noise is increasingly recognised as a pressure on some marine animals, particularly marine mammals, fish and cephalopods. Its distribution is not well documented as it varies markedly in space and time.

Table 2.4. Overview of the priority environmental pressures arising from the principal marine uses in UK seas and summary information on their spatial extent and intensity and current outlook for development in the period to 2020/2030. Priority pressures are either not currently well-managed, or there is lack of evidence about the activity or pressures or those where there are concerns that cumulative effects may lead to permanent impacts.

Activity	Priority Pressures (MSFD pressure categories)	Spatial extent and intensity	Outlook 2020/2030
Oil & gas	Physical loss; Noise, Contamination by hazardous substances.	Many installations in parts of the Northern North Sea, Southern North Sea and the Irish Sea. A few installations and	In most areas a significant expansion in infrastructure is not expected as activity will be mostly

[58] The Economics and Social Working Group set up by Member States has put together a non-legally binding guidance on possible approaches (including ecosystem services approach) to assessing the use of marine waters, business as usual scenario and cost of degradation. The guidance document can be provided on request.

Activity	Priority Pressures (MSFD pressure categories)	Spatial extent and intensity	Outlook 2020/2030
		exploration in the North of Scotland region. Individual footprints are <500m but numerous. Infrastructure operational in 2009 (Oil & Gas, UK, 2010) included 107 oil platforms (18 floating rest fixed), 181 gas platforms and 14000km of pipelines.	focused on existing infrastructure. New installations are planned on the Scottish continental Shelf with further expansion a possibility. An increase in decommissioning activity is expected up to 2020 and beyond.
Maritime Transport	Litter, Noise; Non-indigenous species; Physical loss, Contamination by hazardous substances.	Activity is widespread. Main shipping lanes are in the Southern North Sea, Northern North Sea, Eastern Channel and Irish Sea. Main port facilities are on the coasts of these areas.	A sustained gradual long-term growth in activity is expected allied with a more sustainable operating framework.
Telecommunications	No significant unmanaged pressures.	Cables are widespread but spatial extent is negligible.	No major change in extent expected.
Leisure & recreation (including sea angling)	Litter; Physical loss; Non-indigenous species, removal of target species.	Activity occurs in coastal waters throughout Greater North Sea and Celtic Seas subregions.	Growth in tourism and recreation expected over the longer term, but subject to short-term fluctuation.
Defence – Military	Litter; Noise; Physical loss; Non-indigenous species.	Large areas of UK seas are designated for exercises particularly in the Western Channel, Eastern Channel, Northern North Sea and Southern North Sea, but actual spatial extent of activity is confidential. Intensity and frequency of activities is confidential.	Prediction is difficult. Activity likely to continue at the same level, but increased use of sustainable development strategies likely to lead to reduced pressure.
Fisheries	Physical damage (abrasion), Litter; Non-indigenous species; Removal of target species	Activity widespread in the shelf seas of Greater North Sea and Celtic Seas subregions. Activity most intense in Northern North Sea, Eastern Channel (parts)	No change in overall level of activity expected but revisions to CFP and possible national measures for capture shellfisheries are

Activity	Priority Pressures (MSFD pressure categories)	Spatial extent and intensity	Outlook 2020/2030
	(lethal); Removal of non-target species (lethal).	North of Scotland, West of Scotland, Irish Sea and Western Channel.	expected to increase management of fisheries within a broader ecosystem framework.
Aquaculture	Physical loss, Introduction of non-indigenous species; Contamination by hazardous substances, Microbial pathogens, Nutrient and organic matter enrichment.	Aquaculture installations primarily in coastal areas of West of Scotland, the Minches and North of Scotland and Irish Sea (Northern Ireland's sea loughs). Shellfish culture evenly spread throughout the UK.	Continued growth, particularly in England and Wales.
Water Abstraction	No significant unmanaged pressures	Activity occurs at specific coastal locations mainly in southern North Sea, Eastern Channel and Western Channel.	Some shifts in location may occur and there may be a considerable increase of coastal water abstraction in certain areas (e.g. Wales).
Mineral extraction	Physical loss.	Main activity is marine aggregate extraction which takes place in licensed areas off the coasts of the Southern North Sea and Eastern Channel. Smaller amounts of activity off South-West Wales and the West of England.	A significant increase in extraction is possible.
Renewable energy : wind	Physical loss; Noise;	Existing installations are in specific leased blocks off the coasts of the Southern North Sea and Irish Sea.	Much larger areas are leased for development in the Southern North Sea, Northern North Sea, Eastern Channel and Irish Sea. Areas are also leased in the Minches and west of Scotland.
Renewable energy: wave and tidal stream	Physical loss; Noise; Interference with	Small-scale installations on the Scottish Continental Shelf and in	Expansion expected in the Scottish Continental Shelf, the

Activity	Priority Pressures (MSFD pressure categories)	Spatial extent and intensity	Outlook 2020/2030
	hydrological processes.	the Minches and West of Scotland.	Minches and West of Scotland, the Irish Sea (off Wales), Western Channel and Celtic Sea and the Eastern Channel.
Navigational dredging	Physical loss;	Approaches to ports and harbours in all Regions. Maintenance dredging at least once every ten years.	Increased demand for capital dredging to accommodate larger vessels.
Coastal defence	Interference with hydrological processes; Physical loss.	44 % of the England and Wales coastline, 6% of the Scottish coastline and 15% of the Northern Ireland coastline. Most intense in the Southern North Sea.	Increased requirement for coastal defence but increased use of managed realignment and other forms of soft defence measures.
Waste disposal	Nutrient and organic enrichment, Contamination by hazardous substances, Litter.	Liquid discharges (including wastewater) at coastal locations and specific areas licensed for dredge spoil disposal at sea.	Increased demand for solid waste disposal at certain locations (e.g. port development in Southern North Sea.
Education	No significant unmanaged pressures	Activity takes place at coastal locations throughout UK. Low intensity at most sites.	Activity predicted to increase.
Research and development	Non-indigenous species;	No information. Activity is intermittent and intensity is generally low.	Predictions are uncertain.
Pipelines	No significant unmanaged pressures.	Most intense networks are in the Northern North Sea, Southern North Sea and Irish Sea. Actual spatial extent is small.	Further infrastructure is expected to support import of energy but spatial extent will be small.
Power transmission	No significant unmanaged pressures.	Cables are in place in all areas but spatial extent is low to negligible.	Increased deployment expected in connection with renewable energy developments, especially in Southern North Sea.

Activity	Priority Pressures (MSFD pressure categories)	Spatial extent and intensity	Outlook 2020/2030
Storage of gases (e.g. CCS)	Noise.	One natural gas storage site in Southern North Sea. Others are planned. The viability of a number of CCS sites are under consideration spread throughout the North Sea.	A new Carbon Capture and Storage Commercialisation Programme has been launched in 2012 with the aim of enabling CCS to become cost competitive in the 2020s.
Biofuels	Physical loss.	Nil at present.	Cultivation is likely all around the UK (for methane) but with a concentration off the west of Scotland.

►Read More: Pressures:

Charting Progress 2 Chapter 5 Productive Seas (pages 90-113)
http://chartingprogress.defra.gov.uk/chapter-5-productiveseas

Charting Progress 2 Productive Seas Feeder Report
http://chartingprogress.defra.gov.uk/productive-seas-feeder-report-download

Scotland's Marine Atlas Chapter 5 Productive
http://www.scotland.gov.uk/Publications/2011/03/16182005/60

Cumulative and synergistic effects resulting from pressures

165. Methodologies for the assessment of the cumulative and synergistic effects of pressures from human activities are currently the subject of research development, including their use in different applications e.g. MPAs, marine planning or MSFD. There is limited existing information resulting from their application in assessments at regional (or subregional scale). For the purposes of the MSFD Initial Assessment, the assessments of the status of each of the ecosystem characteristics provide a means of understanding the integrated effects of the different human pressures acting on each characteristic. For many characteristics the cumulative effects of human pressures are dominated by one or a small number of pressures. Where relevant cumulative or synergistic impacts on ecosystem characteristics have been identified, or are suspected, these are commented on in the sections describing the status of each characteristics in Section 2.3 of this Cover Paper.

2.3 Current and predicted status of UK seas

166. This part of the Cover Paper provides a summary of the current environmental status of UK waters, taking into account the indicative lists of physical, chemical and biological features and

pressures and impacts at Annex III of the MSFD and the descriptors of GES at Annex I of the Directive. The relevant text from Annexes I and III to the Directive are provided in text boxes at the start of each section. The analysis draws heavily on the Charting Progress 2 assessment, supplemented where relevant by additional or updated information. The assessments drawn together here vary widely in the degree to which they are based on extensive data or mature assessment methodologies and for some there has been a need to supplement the data that are available with expert judgement.

167. Conclusions are provided on current environmental status in relation to issues covered by the UK determination of GES as an indication of the extent to which GES is currently met in UK seas. However, it needs to be recognised that further development of tools and methodologies is needed before a definitive assessment can be provided of whether the characteristics of GES established in 2012 are met in UK waters, building the targets and indicators that are being developed for that purpose.

168. Each section includes a section on the predicted status given business-as-usual. These sections are largely drawn from the BAU study which has developed scenarios of the future status given the continuation of the existing regulatory framework and in the absence of additional measures being taken as a result of the implementation of the MSFD.

169. A further section describes the current state of the evidence base used to develop the conclusion presented in this report and indications of the main issues that need to be addressed to improve the confidence of assessments.

Status of physical and chemical features

MSFD Annex III Table 1 Indicative Characteristics:

- Topography and bathymetry of the seabed
- Annual and seasonal temperature regime and ice cover, current velocity, upwelling, wave exposure, mixing characteristics, turbidity, residence time
- Spatial and temporal distribution of salinity
- Spatial and temporal distribution of nutrients (DIN, TN, DIP, TOC) and oxygen
- pH, $pC0_2$ profiles or equivalent information used to measure marine acidification

170. The UK seas extend to some 867 400 km^2, which is more than three and a half times the UK land area. Maximum depths range from less than 50 m near the coast and in the Southern North Sea to over 3000 m at the continental shelf edge in the approaches to the Western Channel and Celtic Sea and in the Iceland Basin west of Rockall. A detailed description of the geology and bathymetry of the seabed in UK waters is given in section 3.8 of the Charting Progress 2 Ocean Processes Feeder Report (page 211)[59].

171. Sea temperature varies widely, with winter minimum temperatures ranging from as low as 4 °C in the southern North Sea and Irish Sea to 9 °C along the northern tip of the UK. The temperature depends on water column depth and weather patterns although the deep sub-arctic waters of the Norwegian Sea and Faroe-Shetland Channel are usually below 0 °C. Maximum mean summer temperatures range from 12 °C in the north to 19 °C in the south-east (southern North Sea and eastern English Channel). These summer temperatures vary, however, between areas where water remains mixed throughout the year and areas where summer stratification occurs (so cooler water is found beneath an overlying layer of warmer water). Where these bodies of water meet, frontal boundaries occur. Fronts can exert an important influence on species distributions due to the hydrological, environmental and biological factors associated with their

[59] http://chartingprogress.defra.gov.uk/feeder/Section_3.8_Sedimentary_Processes_and_Morphology.pdf

occurrence. A detailed description of the sea temperature regimes in UK waters is given in section 3.2 of the Charting Progress 2 Ocean Processes Feeder Report (page 39)[60].

172. Salinity is influenced primarily by Atlantic water, slightly by rainfall and evaporation, and locally by the influx of fresh water from rivers via estuaries; values are usually between 34 and 35.6 in salinity units. Atlantic waters adjacent to the UK have experienced an increase in salinity of 0.05 to 0.1 units since the late 1970s and this in turn has caused a salinity rise in the nearby UK shelf waters. The picture is rendered more complex by spatial and inter-annual-to-decadal variability. Typically salinity is most variable, with potential impacts on biota, near the head of an estuary. Irish Sea salinities are especially variable. A detailed description of the salinity regimes in UK waters is given in section 3.2 of the Charting Progress 2 Ocean Processes Feeder Report (page 39)[61].

173. The Atlantic Meridional Overturning Circulation (AMOC) brings warm surface water past the west of the UK, strongly influencing our climate by warming the prevailing westerly airflow. Instantaneous currents in UK shelf seas comprise tidal flows, wind-driven flows and flows driven by differences in density that arise from summer stratification and riverine inflows. On the shelf, transport of water in a single storm can be significant; relative to a year's total. The residence time of seawater in UK seas is variable, but of the order of one year for the Greater North Sea, Irish Sea and Celtic Sea, but less for the seas to the north and west of Scotland. A detailed description of the ocean circulation and currents in UK waters is given in section 3.4 of the Charting Progress 2 Ocean Processes Feeder Report (page 123)[62].

174. Winter wave height increased through the 1970s and 1980s west of the UK and in the North Sea from the relatively calm conditions during the 1960s. However, recent trends are not clear and some measurements suggest a decrease in winter wave heights. A detailed description of wave regimes in UK waters is given in section 3.6 of the Charting Progress 2 Ocean Processes Feeder Report (page 159)[63].

175. The degree of turbidity in UK waters is very variable depending on current, biological influence on sediment properties and seabed characteristics. Many of the waters close to our shores and in the Southern North Sea often appear murky due to the high suspended load. There is no evidence of recent changes at the scale of the CP2 Regions, although changes have been documented at a local scale in the first Charting Progress report, for example, turbidity in the Menai Strait (Irish Sea) increased from the mid 1960s to the late 1980s. A detailed description of the suspended particulate matter and turbidity in UK waters is given in section 3.7 of the Charting Progress 2 Ocean Processes Feeder Report (page 181)[64].

176. Evidence suggests that the waters of the North West European shelf act as a net sink for atmospheric CO_2, but that this sink is highly variable. An apparent reduction in uptake of CO_2 exceeding 50% occurred in the North Atlantic from the mid-1990s to the period 2002–2005. This may be cyclical rather than a progressive change. Comprehensive baseline measurements of pH in UK waters are not yet available, and it will therefore be some time before the rate of acidification can be accurately assessed relative to natural annual and interannual cycles. A detailed description of the evidence for carbon dioxide and ocean acidification is given in section 3.3 of the Charting Progress 2 Ocean Processes Feeder Report (page 104)[65].

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[60] http://chartingprogress.defra.gov.uk/feeder/Section_3.2_Temperature_and_Salinity.pdf
[61] http://chartingprogress.defra.gov.uk/feeder/Section_3.2_Temperature_and_Salinity.pdf
[62] http://chartingprogress.defra.gov.uk/feeder/Section_3.2_Temperature_and_Salinity.pdf
[63] http://chartingprogress.defra.gov.uk/feeder/Section_3.6_Waves.pdf
[64] http://chartingprogress.defra.gov.uk/feeder/Section_3.7_Suspended_Particulate_Matter_and_Turbidity.pdf
[65] http://chartingprogress.defra.gov.uk/feeder/Section_3.3_Carbon_Dioxide_and_Acidification.pdf

177. Summaries of the state of ocean processes in each of the eight CP2 Regions are given in section 2.7 of the Charting Progress 2 Ocean Processes Feeder Report (page 15)[66]. Nutrients are considered in section 8 of this report.

►Read More: Physical and chemical features:

Charting Progress 2 Chapter 2 Ocean Processes (pages 13 - 25)
http://chartingprogress.defra.gov.uk/chapter-2-oceanprocesses

Charting Progress 2 Ocean Processes Feeder Report
http://chartingprogress.defra.gov.uk/ocean-processes-feeder-report

Scotland's Marine Atlas Chapter 2 Physical Characteristics (page 24 – 37)
http://www.scotland.gov.uk/Publications/2011/03/16182005/23

Status of biological features (Descriptors 1, 4 and 6)

MSFD GES Descriptor 1: Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.

MSFD GES Descriptor 4: All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.

MSFD GES Descriptor 6 : Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected

Fish communities

MSFD Annex III Table 1 Indicative Characteristics:
information on the structure of fish populations, including the abundance, distribution and age/size structure of the populations

178. More than 330 fish[67] species are thought to inhabit the shelf seas surrounding the British Isles, ranging in size from the 11 m basking shark (Cetorhinus maximus), to gobies and open-water species that rarely reach 1 cm in length. Fish diversity is considered to be greater in the south-west and along the western seaboard of the UK (Celtic Seas subregion) than in the southern and central North Sea (Greater North Sea subregion), which are the least diverse areas. The fish assemblages of the British Isles and the factors which affect them are summarised in Section 3.4.2.1 of the Healthy and Biologically Diverse Seas feeder report[68].

Key pressures

179. The main pressure on fish communities is the extraction of fish species by commercial fishing. Commercial fisheries in UK waters principally target 32 fish species and continue to exert

[66] http://chartingprogress.defra.gov.uk/feeder/Section_2_Overall_Assessment.pdf

[67] For the purposes of the MSFD assessments, the species group fish comprises the following functional groups: diadromous fish, coastal fish, pelagic fish, pelagic elasmobranchs, demersal fish, demersal elasmobranchs, deep-sea fish, deep-sea elasmobranchs and ice-associated fish

[68] http://chartingprogress.defra.gov.uk/feeder/HBDSEG-FeederReport-sec3_4.pdf

a significant pressure on fish populations, both directly through removal of target fish, and indirectly by removing non-target fish that are predators, prey or competitors and physically impacting essential habitats.

180. Other human pressures on fish communities are becoming increasingly recognised. As the use of the seas increases, physical pressures, including physical damage and loss of habitats and interference with hydrological pressures, are intensifying. There have also been concerns over the impact of hazardous substances, including endocrine disrupting substances[69]. The impacts of these additional pressures on fish communities have not been quantified at the regional assessment scale.

181. Climate change is beginning to have a detectable impact on fish populations, with marked changes in distribution, timing of migration and reproduction, recruitment and growth rates all being documented. The mix of species present in each CP2 Region has changed appreciably over the past 50 to 100 years and predictions suggest that a very different assemblage of fishes, including some introduced non-native species, might exist in UK waters in years to come. Warm-water fishes such as red-mullet, seabass, anchovy and John Dory are spreading rapidly around the UK, whereas cold-water species such as cod have retreated northwards in recent years. The UK Marine Climate Change Impacts Partnership reported in 2012 that some fish distributions have moved northwards over the past 30 years by between 50 to 400km, with coldwater species such as monkfish and snake blenny moving the furthest[70]. At the same time, some fish species have moved into deeper waters at an average rate of about 3.5 metres per decade. Such distribution shifts will have profound consequences for commercial fisheries and for the achievement of stated conservation objectives. Warmer temperatures around the UK are correlated with poor conditions for survival of cod larvae and cod growth, but enhanced growth rates in sole (a warm-water species). Diadromous species such as salmon and eel have been shown to be particularly vulnerable to climate change (water temperature and river flow) with impacts on both the freshwater and marine phases.

General status and trends

182. All parts of the marine fish community have been impacted on by human activities. Recent improvements in the status of some fish communities need, therefore, to be viewed within a longer historical context. Improvements in the status of demersal fish (i.e. fish that live on, or close to the sea bed) are predominantly a result of a reduction in fishing pressure. Further progress is needed in relation to these demersal fish communities to reach target levels as well as before the majority of commercial fish stocks are at safe levels, noting that a significant number of commercial fish stocks remain below safe levels. Fish communities in estuaries have also benefitted from improved water quality. However, there are particular concerns over the populations of several fish species that remain severely depleted with respect to the population sizes that are known to have existed 50 or 100 years ago. These include many deep-water fish species; sharks, rays and skates; as well as diadromous fish species, such as the European eel and salmon, that move between fresh and salt water during their life cycle. Many of these species have been recognised as threatened under International Conventions and listed in need of protection under appropriate legislation.

183. Charting Progress 2 provides the following regional conclusions on the overall status of fish communities in UK regional seas

- Greater North Sea sub-Region: Fish communities in the southern North Sea (CP2 Region 2) have been subjected to intensive trawling pressure for longer and have

[69] Substances from external sources that interfere with an organism's endocrine system, including hormone regulation and hormone equilibria, and produces adverse developmental, reproductive, neurological, or immune effects.

[70] http://www.mccip.org.uk/media/7562/mccip-report-2010-2011.pdf

been heavily impacted by fishing, as well as other human pressures. In the Northern North Sea (CP2 Region 1) and the Eastern Channel (CP2 Region 3) fish communities have clearly been impacted in relation to historic conditions, but not as extensively as elsewhere.

- Celtic Seas subregion: In the western Channel and Celtic Sea area (CP2 Region 4) several indices of the demersal fish community have improved since the early 1980,s but other indices suggest a longer-term deterioration. The Celtic Seas is an intensively fished ecosystem, where fisheries developed relatively late. There is some evidence of recent decreases in the proportion higher trophic species in the pelagic fish community. In the Irish Sea (CP2 Region 5), west of Scotland (CP2 Region 6 and 7), Rockall Bank and Trough (CP2 Region 8), fish communities appear to have been impacted in relation to historic conditions, but there is high uncertainty over the status of fish communities to west of Scotland, Rockall Bank and Trough.

184. Further summaries on the status of the different functional groups of fish species are given below:

- Demersal fish: Overall there are impacts on soft-bottom demersal fish communities in all CP2 Regions in relation to historical conditions, but analyses prepared for Charting Progress 2 showed that over the decade to 2008 the diversity and overall abundance of demersal fish communities have improved appreciably in most regions, although life history traits such as average size and age-at-maturity typically show little or no change, and seem to respond more slowly to reductions in human pressures. Demersal fish have been assessed as having some problems in all CP2 Regions apart from the Irish Sea, Minches and Western Scotland and the Atlantic North-West ApproachesThe improved diversity and overall abundance probably reflects reduced fishing pressure through a combination of EU controls on total allowable catches and the reduction of the UK whitefish (demersal trawl) fleet by around 15% through the two large-scale fishing vessel decommissioning schemes in 2001 and 2003. There continue to be concerns about the depletion of many demersal sharks, skates and rays, including common skate and angel shark which now appear to be absent from a number of areas in which they were commonly found, including the North Sea and the Irish Sea.
- Pelagic fish: Although there was no specific assessment of the status of the pelagic fish community in Charting Progress 2, some inference of the status of pelagic species can be drawn from assessments of relevant stocks provided by ICES. Stocks of herring in the North Sea sub-Region were assessed as not at full reproductive potential and not harvested sustainably in the period covered by Charting Progress 2. There has been an improvement in the assessed status of herring in the most recent ICES stock assessments (2008-2011), with fishing pressure having been brought to more sustainable levels according to the precautionary approach. In addition, the distribution of some pelagic fish species appears to be shifting in response to climate change. For example, the distribution of mackerel has expanded to the north and west in recent years, partly in relation to increased water temperature. A number of long-lived and slow growing pelagic shark species that occur in UK waters are of conservation interest, for example basking shark is listed as a prohibited species on EC fisheries regulations, and there is currently a zero Total Allowable Catch (TAC) for porbeagle shark.
- Transitional and estuarine fish: At the margins of the MSFD area, the condition of many estuaries has improved in recent years because of higher levels of urban waste water treatment and reductions in the input of hazardous substances. A gradual increase in fish diversity and overall numbers in estuaries has been linked to better conditions. As a result, the number of adult salmon and sea trout returning to rivers has increased on many rivers, although there have been declines in the River

Thames, where they were previously re-stocked, Rivers Awe and Morar in western Scotland and the Bush in Northern Ireland. Populations of several diadromous fish species are considered threatened and many have been listed for protection. The number of European eel juveniles has fallen in many of the regions where this species occurs as has the abundance of yellow or silver eels, and this reflects an Atlantic-wide downturn in the numbers of elvers returning to rivers. Causes of this decline are unclear but suggestions include changes in oceanic conditions, overexploitation, freshwater habitat destruction, contaminants and introduction of the parasite Anguillicola crassus from Asia.

- Deep-water fish: Data are generally scarce for the deep-water fish assemblages to the west of the British Isles. However, those indices that can be derived suggest that the diversity in the fish communities at those depths most subject to deep-water fisheries has been reduced since the start of these activities.
- Commercial fish and shellfish species (see subsequent section starting page 79).
- Species listed in community legislation of other international agreements: Prospects of certain vulnerable fishes continued to deteriorate during the period up to 2010. This includes many deep-water fish species; sharks, rays and skates; and transitional/ diadromous species that move between fresh and salt water, such as the European eel and salmon. Many of these fish have been recognised as threatened under international conventions (e.g. the CITES Convention, Bern Convention, Convention on Biological Diversity, EU Habitats Directive, OSPAR Convention) and listed for protection under the UK Wildlife and Countryside Act.

Predicted status in 2020/2030 given business as usual

185. The future status of all fish species groups is difficult to predict given the wide range of pressures on them and our lack of knowledge on species interactions. The proportion of large fish may improve if relevant measures are taken, for example under the reformed Common Fisheries Policy (CFP) and through effective implementation of area-based protection measures(e.g. marine protected areas including Marine Conservation Zones (MCZs)), but the rate of improvement will depend upon life-history characteristics particular to each species and there may be time lags in responses beyond 2030.

186. It is likely also that there will be continued shifts in the depth, distribution, migration and spawning behaviours of fish species in response to climate-driven warming of the sea which may have profound consequences for commercial and recreational fisheries and for the achievement of stated conservation objectives.

State of the evidence base and development needs

187. The summary above is based upon the analysis presented in Charting Progress 2, which considers trends in multiple datasets where possible, for each CP2 Region, in order to gain some idea of confidence and uncertainty in the trends detected. However, much of the analysis has focussed on soft-bottom demersal species, whereas trends with respect to estuarine, coastal, pelagic, deep-water, migratory and diadromous species are much more uncertain and should be interpreted with care. The UK will work to improve the basis for assessments, taking these components of the marine fish community into account. There is also a need for research to help characterise the impact on fish of climate change and ocean acidification and the pressures from other human activities than fishing building on the 2012 review by Marine Climate Change Impacts Partnership (MCCIP)[71], as well as to develop improved information on the causes of declines in diadromous fish species and highly migratory fish such as oceanic sharks.

[71] http://onlinelibrary.wiley.com/doi/10.1002/aqc.v22.3/issuetoc#group4

►Read More: Fish Communities:

Charting Progress 2 Healthy and Biologically Diverse Seas Feeder Report Page Section 3.4 Fish (pages 379-505)
http://chartingprogress.defra.gov.uk/feeder/HBDSEG-FeederReport-sec3_4.pdf

Scotland's Marine Atlas Chapter 04 Demersal Fish Community/Sharks and Rays (page 114-119)
http://www.scotland.gov.uk/Publications/2011/03/16182005/52

Northern Ireland State of the Seas Report Chapter 2 Marine Biodiversity (pages 19-22)
http://www.doeni.gov.uk/niea/2_marine_biodiversity.pdf

Cetaceans

MSFD Annex III Table 1 Indicative Characteristics:
- a description of the population dynamics, natural and actual range and status of species of marine mammals and reptiles occurring in the marine region or sub region

188. Twenty-eight species of cetacean have been recorded in UK waters. For almost all cetacean species, the animals found in UK waters are part of a much larger biological population or populations whose range extends beyond UK waters into the waters of other States and/or the High Seas. Equally, the number of individuals present at any one time may be only a small proportion of those that make use of UK waters at some point.

Key pressures

189. Cetaceans are affected by a variety of pressures. There are difficulties in making direct links between individual pressures and their impact, but the cumulative impact of the full range of pressures is of concern and may affect the long-term viability of some species. The main pressures identified in Charting Progress 2 as being of most concern for cetaceans are the extraction of species through by-catch, harbour porpoises and common dolphins, and the introduction of contaminants. The impacts of by-catch have only been quantified in some regions and were assessed as decreasing in most regions where quantified. There are concerns over the rate of entanglement of minke whales in lost fishing gear in the Minches and west of Scotland. A range of other human pressures on cetaceans have been recognised, including prey depletion and/ or competition, pollutants, disease, vessel or propeller strikes and noise in the marine environment. Populations of cetaceans entering UK seas are also affected by pressures beyond UK waters including whaling and drive fishing in Faroes, or bycatch in other European fisheries.

190. Climate change impacts on cetaceans remain poorly understood. It is extremely difficult to separate changes in abundance or distribution as a result of short-term regional variability in the prey resource from changes due to longer term environmental change that could be either natural or caused by human activities. The direct impact of climate change on cetaceans in UK waters is only likely to be observed in those species for which the UK represents the edge of their range, such as white-beaked dolphins. Cetaceans may, however, be impacted indirectly through changes in prey distribution and greater susceptibility to disease and contaminants.

Current status and trends

191. Cetacean populations in UK waters were affected historically by hunting before the international moratorium on commercial whaling under the International Whaling Convention (IWC), but have remained relatively stable in recent years. Charting Progress 2 concluded that the status of the five most abundant cetacean species in UK waters was favourable, taking into account the 2007 UK Favourable Conservation Status (FCS) assessments under the EU Habitats Directive. These are harbour porpoise, common bottlenose dolphin, white-beaked dolphin, fin whale and minke whale. A significant southerly shift in abundance of the harbour porpoise has been observed between the mid 1990's and mid 2000's in the SCANS surveys which has also been confirmed by sightings data. The status of a further six species was unknown due to a lack of suitable abundance estimates. The remaining 17 species are considered to be rare or vagrant and therefore it is not possible to assess their conservation status in UK waters.

192. Charting Progress 2 provides the following expert judgement assessments on the status of cetaceans as a group in the CP2 Regions. All Charting Progress 2 regional assessments of cetaceans are of low confidence because data collection is of insufficient resolution, with the exception of those in the Northern North Sea and Southern North Sea:

- Greater North Sea sub-region: few or no problems in the Northern North Sea (CP2 Region 1) and the Southern North Sea (CP2 Region 2), many problems in the Eastern Channel (CP2 Region 3), as a result of historical bycatch of harbour porpoise in fixed net fisheries, although there is some recent evidence of improvement[72].
- Celtic Seas sub-Region: some problems in the Western Channel and Celtic Sea (CP2 Region 4), the Irish Sea (CP2 Region 5) and the Minches and Western Scotland (CP2 Region 6). Some concerns were identified over the rates of entanglement of minke whales in fishing gear to the west of Scotland. The status of cetaceans is unknown in the Scottish Continental Shelf (CP2 Region 7) area and Atlantic North-West Approaches (CP2 Region 8).

Predicted status by 2020-2030 given business as usual

193. The future status of cetaceans is difficult to predict given the wide range of pressures on them and our lack of knowledge on interactions with prey species. Increases in anthropogenic underwater noise, particularly as a result of percussive piling during construction of offshore renewable developments have the potential to displace marine mammals, particularly in the Southern North Sea (CP2 Region 2), where a high proportion of future offshore wind farm development is planned. However, the significance and temporal nature of such displacement, for example at a population level, is currently unclear. The impact of fishing on the prey species of marine mammals is not well understood, but further improvements in the regulation of fisheries may benefit cetaceans.

194. The direct impact of any future climate change on cetaceans in UK waters is only likely to be observed in those species for which the UK represents the edge of their range, such as white-beaked dolphins. Cetaceans may, however, be impacted indirectly through changes in prey distribution and greater susceptibility to disease and contaminants.

State of the evidence base and development needs

[72] Macleod, C. D., Brereton, T. and Martin, C. (2009). Changes in the occurrence of common dolphins, striped dolphins and harbour porpoises in the English Channel and Bay of Biscay. Journal of the Marine Biological Association of the UK, 89, 1059-1065.

195. The assessments presented in Charting Progress 2 were based on expert judgement, using mainly the 2007 FCS assessment of all cetacean species occurring in UK waters. These FCS assessments used a baseline of dedicated surveys undertaken in 1994 that generated information on summer distribution and abundance estimates for a range of species and/or the Cetacean Atlas. This information was supplemented by data collected in 2005 during the SCANS II survey in the North Sea, survey work undertaken in 2007 off the continental shelf, and continued collection of strandings and bycatch data and assessments of bottlenose dolphins in nearshore Special Areas of Conservation (SACs). All regional assessments with the exception of those in the North Sea are of low confidence.

196. In addition to the current monitoring of designated sites, strategic censuses of population and abundance of cetaceans are being developed to meet the requirements of the EU Habitats Directive and the MSFD as well as monitoring of static-net fisheries where cetacean by-catch is greatest. This is being supported by research into the possibilities for detecting trends in distribution and abundance of the more common cetacean species. These developments need to be internationally coordinated.

197. There is a need for more information about the potential impacts on cetaceans of human activities that generate noise as well as the cumulative impacts of other anthropogenic pressures. In order to more adequately assess the potential impacts of underwater noise on marine mammal distribution and the overall significance of temporary/seasonal displacement, greater clarity is required on the locations of future offshore renewable energy developments (windfarms, tidal and wave installations), foundation type and the proximity of functionally important areas for significant populations of marine mammals. The zonal assessment processes and subsequent Environmental Impact Assessments that will be undertaken for future offshore renewable energy developments will generate useful information to inform such assessments. Further research at regional seas level will also be necessary to evaluate potential cumulative effects.

►Read More: Cetaceans

Charting Progress 2 Healthy and Biologically Diverse Seas Feeder Report Page Section 3.7 Cetaceans (Pages 551 – 591)
http://chartingprogress.defra.gov.uk/feeder/HBDSEG-FeederReport-sec3_5.pdf

Scotland's Marine Atlas Chapter 04 Cetaceans (Page 124 – 129)
http://www.scotland.gov.uk/Publications/2011/03/16182005/55

Northern Ireland State of the Seas Report Chapter 2 Marine Biodiversity (Pages 19-22)
http://www.doeni.gov.uk/niea/2_marine_biodiversity.pdf

Seals

MSFD Annex III Table 1 Indicative Characteristics
- a description of the population dynamics, natural and actual range and status of species of marine mammals and reptiles occurring in the marine region or sub region

198. UK seas host about 38% of the world's population of grey seals and about 4% of the world's population of harbour (or common) seals. Although both species can be seen all round the UK coast, they are considerably more abundant in some areas than others. Some 90% of grey seals and 80% of UK harbour seals live in Scotland, both in the Celtic seas sub-region and the Greater North Sea sub-region. Both grey and harbour seals are probably more numerous now than before the introduction of conservation measures (Conservation of Seals Act 1970), when

they were locally hunted. Harbour seals are often highly valued (e.g. to the local tourist industry), so even when populations are very small such as in southern England, pressure on these individuals is considered significant.

Key pressures

199. Seal populations are affected by both anthropogenic pressures and naturally occurring factors, although the main reasons for the decline in harbour seal populations have not been identified. The main anthropogenic pressures known to be affecting seal populations include illegal shooting (in some local areas) and by-catch by fisheries. The incidence and causes of corkscrew injuries to seals on the North Sea coast is being investigated. Natural factors such as competition between the two species, predation by killer whales (in the Northern Isles) and declines in important prey species (such as sandeels) are also relevant. The harbour seal population in eastern England has been seriously affected by two outbreaks of phocine distemper virus (PDV) in recent years. Climate change impacts on seals are difficult to determine and will depend on the nature of the change.

Current status and trends

200. Grey seals are generally experiencing few problems, but the reasons for declines in some harbour seal populations on the East Coast of the Scotland and in the Northern Isles, as well as the slow recovery of harbour seals from the most recent PDV outbreak in the Southern North Sea, need to be more fully understood.

201. The UK has around 36% of the global population of grey seals (around 180,000). After decades of increase, following the end of culling in the 1970s, total grey seal pup production appears to be levelling off in the UK and is now rising at only a small number of colonies. At least part of the previous increase in grey seal pup production was due to the increased availability of breeding sites following the abandonment of human settlements on remote islands, including through automation of lighthouses. The current reduction in the rate of increase is probably because of density dependent factors affecting the population as a whole. Charting Progress 2 assessed grey seals in the Eastern Channel, the Western Channel and Celtic Sea and the Irish Sea where grey seals as having some problems where populations because populations are no longer increasing. The reasons for this apparent plateau in populations in these areas are not clear at present.

202. UK Seas host about 4% of the global population of harbour seals (of the order of 30,000), but in contrast to grey seals, many local populations of harbour seals have experienced serious declines in recent years – particularly in the Northern North Sea and the Scottish Continental Shelf with Charting Progress assessing harbour seals as having many problems in these CP2 Regions. Harbour seal numbers have declined significantly in Shetland, Orkney and on the east coast of Scotland, in some places by more than 50% since 2001. In the Tay, the decline in numbers is around 90%. There has been a smaller decline in the Outer Hebrides. The causes of these localised declines are not yet known. Contributing factors could be either natural or human or both and could include: competition with grey seals, predation by killer whales (in the Northern Isles), and declines in important prey species (such as sandeels) and unregulated shooting (in some local areas). The outbreaks of PDV in eastern England led to the loss of 50% of harbour seals in 1988 and 22% in 2002. In Scotland, an estimated 5% died in 1988 and far fewer in 2002. In marked contrast to populations elsewhere in Europe which showed an immediate and rapid recovery, harbour seals in eastern England took three years to recover from the 1988 outbreak and only began to significantly increase in 2009 and 2010 following the 2002 outbreak. For this reason Charting Progress 2 assessed harbour seas as having many problems in Southern North Sea. Numbers of harbour seals on the west coast of Scotland and to the south and west of the UK

have remained relatively stable. Charting Progress 2 has assessed harbour seal populations in these areas (CP2 Regions 3, 4, 5 and 6) as having some problems.

Predicted status by 2020-2030 given business as usual

203. The future status of seals is difficult to predict given the wide range of pressures on them and our lack of knowledge on interactions with other species. The effects of increasing development at sea, for example for offshore renewable energy, are still being investigated. PDV outbreaks are likely to recur in the future but it is not possible to predict the proportion of the population that might be affected, which populations are most vulnerable (besides eastern England) or precisely when outbreaks will occur. It is even harder to predict the future susceptibility to PDV of harbour seal populations in northern and eastern Scotland, given recent declines and the lack of any obvious cause. The limited impact of PDV on harbour seals in Scotland and Northern Ireland in 2002 may result in reduced population immunity and increased susceptibility to a future outbreak.

204. Future impacts from climate change on seals are difficult to determine and will depend on the nature of the change. Rising sea levels are likely to remove certain breeding and haul out locations but are equally likely to make others sites available. There is no information on the speed at which seals will adapt to habitat loss as a result of sea level rise. Changing sea temperature is likely to affect the distribution of prey species and this, in turn, may have the greatest impact on seal populations and their distribution. Both species have a varied diet and are likely to switch from one available species (e.g. sandeels) to another.

State of the evidence base and development needs

205. Grey seal pup production has been monitored since the early 1960s; harbour seals have been monitored since the late 1980s, but less frequently. The extent and magnitude of most impacts have not been quantified, and the regional assessments in Charting Progress 2 are the result of using knowledge of pressures for each region to inform an expert judgement on the impacts on seals in that region. The Scottish Government and Scottish Natural Heritage have funded a number of projects investigating the declines in harbour seals in northern and eastern Scotland. Increasing renewable energy production, which may impact on marine mammal populations, may require more up-to-date and detailed information on seal distribution in relevant areas. Harbour seal monitoring frequency in Scotland is infrequent compared with grey seal monitoring.

►Read More: Seals

Charting Progress 2 Healthy and Biologically Diverse Seas Feeder Report Page Section 3.5 Seals (pages 507 – 539)
http://chartingprogress.defra.gov.uk/feeder/HBDSEG-FeederReport-sec3_5.pdf

Scotland's Marine Atlas Chapter 4 Seals (Page 120)
http://www.scotland.gov.uk/Publications/2011/03/16182005/54

Northern Ireland State of the Seas Report Chapter 2 Marine Biodiversity (Pages 19-22)
http://www.doeni.gov.uk/niea/2_marine_biodiversity.pdf

Reptiles (i.e. turtles)

206. Four species of turtle are occasionally reported from UK waters. Of these, the leatherback turtle is the most commonly sighted and the only turtle regarded as a true member of the British fauna, with some areas regarded as foraging grounds for the species, for example Carmathen Bay and Tremadog Bay, Wales . It is a wide-ranging species, migrating throughout the Atlantic. UK waters are temperate summer foraging habitat.

Key pressures

207. The most significant pressures on marine turtles in the Atlantic occur at the breeding sites which are outside UK waters. Within UK waters, the main pressures are from entanglement in fishing gear, especially inshore pot fisheries, and ingestion of plastic debris. The magnitude of the impacts of these pressures on conservation status of turtles cannot be assessed at present.

208. The impact of climate change impacts on turtles in UK waters is far from predictable. A rise in sea temperature might result in an expansion of the range at high latitudes, but the overall population size might also be negatively impacted, for example, by a reduction in nesting habitat.

Current status and trends

209. The status of marine turtles needs to be assessed at a broader geographical scale than that of UK waters. Although the leatherback turtle is critically endangered globally, data are too sparse to be able to assign a conservation status within UK waters or to interpret any trends. All other turtle species recorded in UK waters are believed to reach UK waters only when displaced by adverse currents and so UK waters are not considered part of their functional range.

Predicted status by 2020-2030 given business as usual

210. The current understanding of the impacts of human pressures and climate change provides a too limited basis for predicting future status.

State of the evidence base and development needs

211. To be able to assess status at the level of the entire North-East Atlantic, data collection must have a strong international component, as this is the geographical scale most appropriate to this species. An international effort around the entire western approaches to the European shelf (with a focus around the Bay of Biscay) is needed to estimate numbers and trends in population size. Three lines of research are considered high priority for marine turtles: genetics and tagging studies to establish migration patterns, analyses of by-catch data and monitoring.

►Read More: Turtles

Charting Progress 2 Healthy and Biologically Diverse Seas Feeder Report Page Section 3.6 Turtles (pages 540 – 549)
http://chartingprogress.defra.gov.uk/feeder/HBDSEG-FeederReport-sec3_6.pdf

Northern Ireland State of the Seas Report Chapter 2 Marine Biodiversity (Pages 19-22)
http://www.doeni.gov.uk/niea/2_marine_biodiversity.pdf

Seabirds

MSFD Annex III Table 1 Indicative Characteristics - a description of the population dynamics, natural and actual range and status of species of seabirds occurring in the marine region or sub region

212. Thirty-eight species of seabird regularly occur in the seas around the UK. Some species occur in large numbers, but other species are only present during the breeding season, over winter or during migration. Species present all year in low numbers, or seasonally present in low numbers may still be important. Seabirds feed mainly on plankton, fish, squid, or pick detritus from the sea surface. Gulls also feed on benthos, foraging on exposed intertidal areas. Most seabirds spend the majority of their lives at sea: some stay in inshore waters (e.g. terns, gulls, great cormorant and European shag) and others venture much further offshore and beyond the shelf-break, even during the breeding season.

Key pressures

213. The main pressures on seabirds arise from climate change and fishing, but pressures from non-indigenous species, hazardous substances, habitat loss, litter and visual disturbance are also recognised. The introduction of non-indigenous mammals, such as rats and North American Mink, on islands where there are breeding colonies of ground-nesting seabirds has been a significant pressure in some locations

214. There is strong evidence that climate-driven changes in the food chain have had acute negative impacts on seabirds, reducing the productivity of key prey species such as sandeels. Changes in the North Sea plankton community in the late 1980s caused by rising sea temperatures led to large reductions in abundance and species composition of zooplankton on which larval fish feed and poor sandeel productivity. There is also a cumulative pressure from fisheries, where fishing has contributed to a reduction in sandeel availability and quality. The best evidence for this being from the seas off south-eastern Scotland, where a sandeel fishery during the 1990's significantly depressed the adult survival and breeding success of black-legged kittiwakes compared with years prior to the fishery opening and after it was closed in 2000. Some seabird species have benefited from fisheries through food provided at sea by discharging offal and discarding undersize fish. As a result, the abundance of scavenging species, such as great skua and northern fulmar, may have been elevated above levels that naturally occurring food sources could sustain.

Current status and trends

215. Although numbers of seabirds breeding in the UK as a whole increased from around 4.5 million in the late 1960s to 7 million by the end of the 1990s, mainly as a result of increased protection from hunting and persecution in the UK and overseas, recent downward trends in breeding success of seabirds in the Greater North Sea and the northern Celtic Seas are of concern.

216. Of the seabirds breeding in the UK, only northern gannet and great skua have sustained a positive trend in population size since 1969 when comprehensive monitoring of breeding numbers began. The biggest declines have been seen in numbers of herring gulls and roseate terns – by more than 50% and 90% respectively since 1969. In 2004, 2005 and 2007, the mean breeding success of a sample of 21 seabird species was at its lowest since monitoring began in the mid-1980s levels. Falls in breeding success have been acute in black-legged kittiwakes that feed offshore on sandeels, especially on the coast of the North Sea and recently have been seen in

other offshore species such as common guillemot. Declines have also been seen in inshore species such as arctic skua.

217. Charting Progress 2 provides the following expert judgement assessments on the status of seabirds as a group in the CP2 regions. All CP2 regional assessments of seabirds are of low confidence, with the exception of those in the Northern North Sea and Southern North Sea:

- Greater North Sea sub-Region: some problems in the Northern North Sea (CP2 Region 1) and many problems in the Eastern Channel (CP2 Region 3) – in both CP2 regions there have been significant declines in seabird abundance – and few or no problems in the Southern North Sea (CP2 Region 2), where status has been stable,
- Celtic Seas sub-Region: many problems in the Minches and Western Scotland (CP2 Region 6 - low confidence) and the Scottish Continental Shelf (CP2 Region 7) and status deteriorating. Few or no problems in the Western Channel and the Celtic Sea (CP2 region 4) and Irish Sea (CP2 Region 5), with seabird colonies on the coast of Wales not having experienced the declines seen elsewhere[73]. No assessment possible in the Atlantic North-West Approaches (CP2 Region 8), due to lack of data.

218. The status of the different functional feeding groups in UK waters can be summarised as follows:

- Offshore surface-feeding birds: While northern gannet and great skua sustained a positive trend in population size from 1970 to 2008, all other offshore surface-feeders have started to decline in numbers at various points since the mid-1990s. There were 40% fewer black-legged kittiwake and 16% fewer great black-backed gulls in 2008 compared to 1970.
- Offshore pelagic-feeding birds: The populations of the three offshore diving species increased in size throughout the 1970s, 1980s and 1990s but started to level off in 2000 and are now starting to decline.
- Inshore surface-feeding birds: Few inshore surface feeders have shown positive trends since 1970. Herring gull and roseate tern numbers have declined by more than 50% and 90% respectively since 1969. Arctic skua numbers have declined sharply by more than two-thirds since the early 1990s.
- Inshore diving birds: European shag numbers declined sharply following severe storms in the North Sea during the winter of 1992/93. The subsequent recovery of shag numbers was reversed by the effects of storms in early 2005. There are now 28% fewer shags breeding in the UK than in 1970.

Predicted Status in 2020 given business as usual

219. The future status of all seabirds is difficult to predict given the wide range of pressures on them and our lack of knowledge on species interactions, but declines will continue in the short-term after any measures have been taken as seabirds do not breed until three to nine years old. Improved understanding of the interactions between climate, plankton, prey fish, fishing and seabirds is needed in order to predict the future status of seabirds.

220. Rising sea temperatures around the UK have contributed to a reduction in the number and quality of prey fish, such as lesser sandeel and lower breeding success and survival of some seabirds. As sea temperatures continue to rise, it is likely that kittiwakes and other seabirds that feed on sandeels will continue to experience poor breeding seasons with increasing frequency. The combination of reduced recruitment and lower adult survival will lead to further large scale declines in population size.

[73] Seabird Population Trends and Causes of Change: 2011 Report.

221. The possible elevation of populations of scavenging species, such as great skua and northern Fulmar above naturally sustainable levels, through the supply of discarded non-target fish and offal may mean that reduction in fishing pressures and controls on discarding lead to declines in some species back to more natural levels.

State of the evidence base and development needs

222. The state of seabird populations has been assessed in Charting Progress 2 using data on numbers and breeding success collected by the Seabird Monitoring Programme and there is good confidence in the conclusions. Expert judgement was employed to consider the magnitude of impact of the different pressures in each CP2 Region, and very few assessments have a high degree of confidence, due to limited knowledge of the impacts of many pressures. New monitoring of internationally important inshore and offshore aggregations of marine birds is currently under development and there is a need to expand monitoring of the rate of by-catch of seabirds on commercial fishing vessels. The main development needs centre on developing a better understanding of the different factors that affect seabird breeding performance, their interaction and the extent of their impact. These include the links between climate, fishing and availability of prey species, and also the extent of the impacts from non-indigenous mammalian predators on island seabird colonies, entanglement of seabirds in fishing gear and marine renewable energy installation.

►Read More: Seabirds

Charting Progress 2 Healthy and Biologically Diverse Seas Feeder Report Page Section 3.8 Marine Birds (Pages 593 – 665)
http://chartingprogress.defra.gov.uk/feeder/HBDSEG-FeederReport-sec3_8.pdf

Scotland's Marine Atlas Chapter 04 Seabirds (Pages 130 – 133)
http://www.scotland.gov.uk/Publications/2011/03/16182005/56

Northern Ireland State of the Seas Report Chapter 2 Marine Biodiversity (Page 15 – 26)
http://www.doeni.gov.uk/niea/2_marine_biodiversity.pdf

Waterbirds

223. Fifty-seven species of waterbird regularly use UK seas for at least part of their lifecycle, occurring in large aggregations where food is abundant, for example in and around estuaries. Most internationally important aggregations occur during spring and autumn migrations or during winter. Of those waterbird species that breed in internationally important numbers in the UK, only five predominantly forage in the marine environment during the breeding season (red-throated diver, common shelduck, common eider, ringed plover and pied avocet).

Key pressures

224. The main pressures on waterbirds arise from climate change with contamination by hazardous substances, removal of species, habitat damage and habitat loss also being significant. In the past severe winter weather increased the mortality of some species, but recent milder winters have increased survival rates. Such benefits may be countered in the future by the negative impacts of 'coastal squeeze' as rising sea levels lead to the loss of intertidal feeding areas. As a result, more birds are now wintering on the east coast of Britain and fewer birds are wintering in the south-west. It is not clear whether birds will continue to move north-eastwards and

relocate elsewhere in Europe, or if total numbers migrating through and wintering in Europe will decline as a consequence of these climate-related changes.

Current Status and trends

225. Average numbers of waterbirds wintering in, or migrating through, marine areas in the UK doubled on average between the mid-1970s and the mid-1990s. Since then, average numbers have declined being 85% higher in the winter of 2006/07 than in the mid-1970s, when co-ordinated monitoring began. Charting Progress 2 assessed waterbirds as a group as having few or no problems in most CP2 Regions, apart from the Irish Sea where there were some problems. There was insufficient evidence to make and assessment for the Minches and West of Scotland (CP2 Region 6) and the Scottish Continental Shelf (CP2 Region 2).

226. In contrast to this overall assessment of waterbirds, populations of several diving species and estuarine waders have declined throughout the period since the mid-1970's, for example, goldeneye, dunlin, pochard and bar-tailed godwit. As mentioned above, there is also evidence of a shift in aggregation areas in response to climate change, with the trend towards milder winters allowing more birds to take advantage of the richer feeding in the muddier east coast estuaries with a much reduced risk of cold weather mortality. Total numbers of waders wintering in the UK may be starting to decline as more birds move eastward and overwinter along the coasts of mainland Europe.

Predicted Status in 2020 given business as usual

227. The future status of waterbirds is difficult to predict given the wide range of pressures on them and our lack of knowledge on species interactions. The trend in shifts in the centre of abundance of waterbird populations from south-west to north-east is likely to continue as warming of the seas progresses, but little is known about the long-term implications of this range change in terms of survival and population status. There is a possibility that the international importance of the UK coast for waterbirds may diminish as a consequence. There is uncertainty over the exact impact of other pressures.

Development needs

228. The state of waterbird populations in the UK has been assessed in Charting Progress 2 based on trends in numbers of non-breeding waterbirds at a sample of coastal sites derived from data collected by the Wetland Bird Survey. The assessments of pressure impacts were based on expert opinion. Future assessments of waterbird populations would be strengthened by the inclusion of information on trends in numbering wintering waterbirds, such as divers, grebe and seaduck. There is also a need to address knowledge gaps in the understanding of the impact of pressures on waterbirds, including litter, underwater noise and introduction of microbial pathogens, although it is recognised that while some of these pressures may affect prey species, their direct impacts on waterbirds may be small compared to the pressures that have been identified as important.

►Read More: Waterbirds

Charting Progress 2 Healthy and Biologically Diverse Seas Feeder Report Page Section 3.8 Marine Birds (pages 540 – 549)
http://chartingprogress.defra.gov.uk/feeder/HBDSEG-feeder.pdf

Scotland's Marine Atlas Chapter 04 Waterbirds (Pages 134 – 135)
http://www.scotland.gov.uk/Publications/2011/03/16182005/57

Northern Ireland State of the Seas Report Chapter 2 Marine Biodiversity (Pages 15 – 26)
http://www.doeni.gov.uk/niea/2_marine_biodiversity.pdf

Status of Habitats (Descriptors 1, 4 and 6)

MSFD GES Descriptor 1: Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.

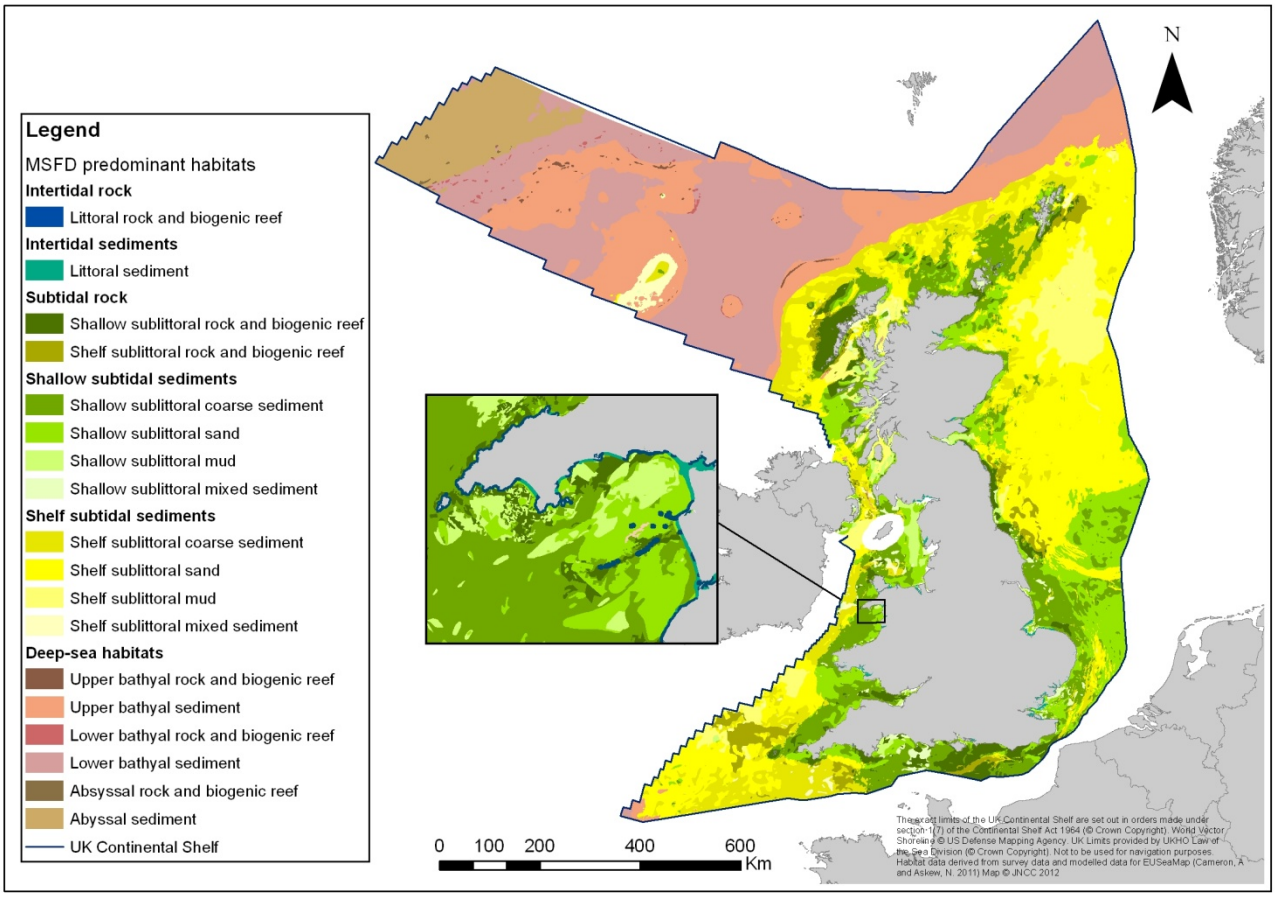
MSFD GES Descriptor 4: All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.

MSFD GES Descriptor 6 : Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected

MSFD Annex III Table 1 Indicative Characteristics
The predominant seabed and water column habitat type(s) with a description of the characteristic physical and chemical features, such as depth, water temperature regime, currents and other water movements, salinity, structure and substrata composition of the seabed,
— identification and mapping of special habitat types, especially those recognised or identified under Community legislation (the Habitats Directive and the Birds Directive) or international conventions as being of special scientific or biodiversity interest.

229. The wide range of physical conditions in the UK regional seas, stretching from the intertidal zone and estuaries down to the deep sea, and the extensive coastlines of mainland Britain and the many islands mean that UK seas host an exceptional variety of marine habitats: the widest range of any European country with an Atlantic border. UK waters encompass the transition zone between north-eastern, cold-water communities and south-western, temperate-water communities found along Western Europe. For this reason they are particularly important at a European scale for their exceptional variety of benthic habitats and high overall biodiversity.

Figure 2.3. Predominant seabed habitats in UK seas based on survey and modelled data from EUSeaMap (Cameron, A and Askew, N., 2011). Modelled data derived using seabed substrate, depth zones, energy and salinity data layers. The relationship between the habitat categories assessed in Charting Progress 2 and reported on through the initial assessment is shown in the legend. The inset details the mapping of littoral habitats.



230. Charting Progress 2 considered the status of six of the broad habitat categories, based on Level 2 of the EUNIS classification and defined by a combination of bathymetry, seabed substrate information, and relative influence of wave action. This categorisation was developed due to the need to take into account the imbalance in the available information between well-studied habitats in nearshore waters and habitats in offshore and deep waters where understanding is still limited. The assessments of these broad habitat categories took into account the methodologies for assessments of listed habitat types under the EU Habitats Directive. The relationship between the habitat categories assessed in Charting Progress 2 and the MSFD predominant habitat types defined according to EUNIS level 2 is shown in the legend of Figure 2.3.

Key pressures

231. Human activities particularly lead to physical and biological pressures on marine habitats. The main sources of pressure on benthic habitats arise from benthic fishing activity. Intertidal and shallow habitats are most likely to be affected by pressure from climate change. Changes in the planktonic pelagic habitat are particularly driven by climate change, but also impacted by human pressures, most substantially nutrient inputs and fishing.

General status and trends of predominant seabed habitats

232. Impacts on seabed habitats are widespread and the composition of seabed habitats has been altered over large areas. In general, sediment habitats are more extensively degraded than

rocky habitats. Subtidal habitats close to shore are generally impacted by a greater variety of pressures than habitats further offshore. The areas impacted by the greatest number of human activities, and associated pressures, are the Southern North Sea, the Western Channel/Celtic Sea and the Irish Sea. For most activities the intensity of pressures has been relatively stable over the past ten years; however, the distribution of some pressures may have changed. The current status of the six-broad seabed habitat types is summarised in the following paragraphs.

233. Intertidal rocky habitats, which include rocky and boulder shores and sea cliffs and occur in all UK seas, are generally in good condition. The harvesting of edible shellfish, particularly molluscs such as winkles and blue mussels, is affecting some local rocky shore biological communities in the Greater North Sea sub-region and the south-west parts and the Irish Sea in the Celtic Seas sub-region. Non-native species are also causing adverse effects to rocky shore communities on a local scale. In addition, species composition of intertidal rocky communities in the Western Channel and Celtic Sea region is already impacted by warmer waters due to climate change.

234. Intertidal sediments have been adversely affected over moderate to large areas, notably mudflats and saltmarshes, in most of the UK seas apart from those around northern and western Scotland. Historical land claim, the construction of coastal defences and other structures and resultant coastal squeeze have caused widespread habitat loss, particularly in England and also affect intertidal sediments by changing current patterns and sediment distribution. In the Southern North Sea and Eastern Channel, the presence of invasive non-native species such as common cordgrass (Spartina anglica) has led to widespread changes to saltmarshes and mudflats. Water quality can affect these habitats and although water quality has improved overall, there are still some small inshore areas where hazardous substances and nutrient enrichment are a problem.

235. Subtidal rocky habitats have been impacted by human activity in localised areas, with some permanently damaged or removed by mobile fishing gears such as bottom trawl. When judged at a subregional scale, the overall area impacted is limited, but at a local scale damage can be more significant. Rocky habitats occur in large areas in Scottish waters, particularly to the west of the Hebrides and around Shetland. Some extensive areas also occur off Devon and Cornwall. Elsewhere this habitat occurs mainly as a narrow band adjacent to rocky shores. There are also offshore biogenic reefs built by marine species including horse mussels (Modiolus modiolus, found mainly to the north), and ross worms (Sabellaria spinulosa), which are more common in the south and east. Overall, bottom trawling has had a particular impact on biogenic reefs, including Modiolus modiolus beds in the Celtic Seas sub-region and Sabellari spinulosa reefs in the southern North Sea. Locally (such as near some large ports around England and Wales), subtidal rocky habitat has also been lost because of construction and coastal infrastructure.

236. Shallow subtidal sediments, consisting of sand, gravel, mud’s and mixed sediments, have been adversely affected over large areas in most CP2 Regions by mobile fishing gears such as bottom trawls. These habitats are especially widespread in the Irish Sea, the Eastern Channel and the Southern North Sea, where they occur out to considerable distances offshore. They also occur in coastal lagoons, particularly in southern England and western Scotland. Impacts on the Scottish Continental Shelf and in the Eastern Channel. The sediments can be regularly disturbed by surface waves and are impacted by several human pressures with considerable variability in the distribution and/or severity of the impacts. Aggregate extraction in the Eastern channel and the Southern North Sea has had local effects, altering the nature of the seabed, although recent research is indicating that the some sedimentary seabed habitats can recover rapidly. Some estuaries and subtidal coastal habitats along the south coast of England and in the Irish Sea continue to experience nutrient enrichment and pollution. Non-native species are spreading in the subtidal coastal areas in most regions.

237. Shelf subtidal sediments are thought to have been affected over significant areas in all regions except the Eastern Channel, where they have very limited extent. These habitats are only rarely disturbed by surface waves because of their greater water depth, and can therefore support more stable communities. The most widespread, frequent and severe source of human disturbance on shelf subtidal sediments occurs through disturbance by demersal fishing. The habitats occur throughout offshore areas of most regions, but also much closer to coasts where the water deepens rapidly, such as around most of Scotland, Northern Ireland and Cornwall. They are also found on Rockall Bank, west of Scotland. The most strongly impacted areas of this habitat are in the Western Channel and Celtic Sea and the Rockall Bank and Trough are also strongly impacted. There are major differences between the predominant gear types used in demersal fisheries in each CP2 Region and these have different levels of impact on different substrates. However, because shelf subtidal sediment habitats are only rarely affected by surface wave action the impacts of demersal fishing are potentially much higher than for comparable fishing on shallower, less disturbed sediments.

238. Deep-sea habitats are impacted to varying extent in the different CP2 Regions, but in areas of the Scottish Continental Shelf the impacts occur over large areas. This category of habitats comprise a range of rock, biogenic[74] reef and sediment habitat types occurring below 200 m, beyond the edge of the continental shelf. Within UK waters they mainly occur to the north and west of Scotland and west of Rockall, although there are also small areas in the extreme south-west of the Celtic Seas sub-Region. Most are sediment habitats, with rocky habitats and reefs largely confined to seamounts and similar structures. Current understanding of deep-sea habitats is limited, but similar to other subtidal habitats; deep-sea habitats are vulnerable to the impacts of some types of mobile fishing gears. Due to the low productivity and biomass of deep-sea ecosystems, coupled with the low physical energy of the environment, deep-sea habitats may mean that their sensitivity to such pressures is much higher than that of shallower water habitat types. Although fishing represents the main pressure on these habitats, their current status varies by region, with large areas of habitat impacted in the Scottish Continental Shelf Region, and limited areas known to be impacted in the Atlantic North-West Approaches.

General status and trends of pelagic habitats

239. Pelagic habitats were assessed in Charting Progress 2 through an assessment of the plankton community, which plays a crucial role in the pelagic food-web and in determining the carrying capacity of the whole marine ecosystem. Charting Progress 2 also reviewed the existing evidence base on microbes as the base of the food web, although there was insufficient evidence to contribute to an assessment. There is clear evidence of large and extensive changes in the composition, abundance and spatial and temporal abundance of both phytoplankton and zooplankton in waters adjacent to the UK and the North-East Atlantic. However, based on the large amount of data gathered on plankton from long-term observations, including the Continuous Plankton Recorder (CPR) Survey, plankton as a whole are considered healthy and are subject to few direct human pressures.

240. The overall assessment of the plankton community is that there are“some problems” in both subregions (all CP2 assessment areas). This takes account of the consequences for ecosystems and fisheries from observed changes to plankton communities due to rising sea temperatures, including:

- a large increase in phytoplankton biomass over the past two decades in offshore waters around and to the west of the British Isles and in the past decade in the subpolar oceanic circulation, known as the subpolar gyre;

[74] Produced by biological processes.

- many groups of phytoplankton species have begun to bloom sooner in the year, putting them out of synchrony with the zooplankton and fish larvae that rely on them for food;
- a progressive shift northward in warmer water zooplankton and a retreat to the north of colder water species over the past 50 years.

241. The assessment also takes into account that it is still unclear to what extent natural variability, climate change, ocean acidification and cascading effects from fishing may be contributing to change. There is a limited understanding of the impacts of human pressures on some other components of the pelagic ecosystem, e.g. microbial communities and cephalopods (e.g. octopus, squid and cuttlefish), and the status of pelagic fish species that are not directly targeted by commercial fisheries. The impacts of fishing on key commercial pelagic fish stocks is taken into account in the assessments of commercial fish stocks in Section 5.6.

Habitats in particular areas (e.g. intense specific pressures, specific protection)

MSFD Annex III Table 1 Indicative Characteristics - Habitats in areas which by virtue of their characteristics, location or strategic importance merit a particular reference. This may include areas subject to intense or specific pressures or areas which merit a specific protection regime.

242. Marine protected areas are established in UK waters under a range of different instruments. They include Natura 2000 sites, Sites of Special Scientific interest, Ramsar sites, Marine Conservation Zones and Scottish Marine Protected Areas. Plans to include Marine Conservation Zones in the waters around Northern Ireland are included in the Northern Ireland Marine Bill. In October 2012 there were 96 Special Areas of Conservation (SACs) with marine components, 107 Special Protection Areas (SPAs) with marine components, one MCZ and two Marine Nature Reserves. Together these protect 5.6% of UK seas.

Predicted status in 2020 given business as usual

243. Under a business as usual scenario the status of seabed habitats would be expected to remain stable, or improve slightly, between now and 2020 depending on the area concerned. Demersal fishing activity, the main source of pressure, is predicted to decrease in spatial extent between 2010 and 2020 (and beyond to 2030). Therefore, an overall improvement in benthic habitats might be expected, depending on the spatial extent of new conservation measures that exclude demersal fishing activity and depending on the recovery rates of benthic habitats. However, the area of benthic habitats likely to be impacted by fishing remains significant, particularly for certain habitat types. The development of tidal range devices may result in locally significant impacts on intertidal habitats and coastal squeeze may be exacerbated by projected sea-level rise. There are also potential effects on biogenic habitats from ocean acidification.

244. Many changes are likely in the composition and distribution of plankton in response to pressures from climate change. The nature of these changes and their impacts on food webs is unclear.

State of the evidence base and development needs

245. The assessment of seabed habitats in Charting Progress 2 was largely based on a combination of data and expert judgement, considering the relationship between habitats and pressures and drawing upon limited evidence from monitoring studies and research. The many

uncertainties will be greatly reduced and the approach enhanced through more robust evidence on the distribution and intensity of pressures, and the distribution and condition of a wider range of habitats in certain areas. The threshold values, against which benthic habitats were judged in the above assessment, were derived from the EU Habitats Directive and work by OSPAR. These have been reviewed to contribute to targets for GES.

246. There is also a need for development of capacities to assess pelagic habitats, including better knowledge of the impacts of human pressures on microbial communities and their interactions with plankton and other trophic levels in the food web. Monitoring of plankton needs to take into account the need for data on zooplankton in coastal waters and for all plankton data in some parts of UK offshore waters.

►Read More: Seabed and water column habitats

Charting Progress 2 Healthy and Biological Diverse Seas Feeder Report Section 3.1 Seabed Habitats
http://chartingprogress.defra.gov.uk/feeder/HBDSEG-FeederReport-sec3_1.pdf

Charting Progress 2 Healthy and Biological Diverse Seas Feeder Report Section 3.3 Plankton
http://chartingprogress.defra.gov.uk/feeder/HBDSEG-FeederReport-sec3_3.pdf

Scotland's Marine Atlas Chapter 04 Healthy and Biologically Diverse (Page 72-103)
http://www.scotland.gov.uk/Publications/2011/03/16182005/43

Northern Ireland State of the Seas Report (Pages 17-19)
http://www.doeni.gov.uk/niea/7_seabed_integrity.pdf

2.4 Analysis of pressure descriptors and Impacts

Non-indigenous species (Descriptor 2)

MSFD Descriptor 2: Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem

MSFD Annex III Table 2 Indicative pressures and impacts
an inventory of the temporal occurrence, abundance and spatial distribution of non-indigenous, exotic species or, where relevant, genetically distinct forms of native species, which are present in the marine region or subregion.

247. Over 60 non-indigenous species (NIS) are known to have become established in UK waters[75], but there is no consensus on numbers that have adverse impacts.

Key driving forces

248. The main activities linked to the introduction of NIS are maritime transport (both commercial and recreational) and aquaculture. Boats and ships may transport NIS either in ballast water or as biofouling (i.e. attaching to hulls, anchor chains and other parts of the vessel). Aquaculture activities can also cause unintended introduction of NIS when cultivated species are transported. Globalisation and a growth in trade and tourism have greatly increased the potential for human-assisted movement of species and climate change is likely to favour the establishment of some

[75] ALIENS Conserving native biodiversity by raising awareness of invasive species: http://www.marlin.ac.uk/marine_aliens/

introduced NIS in UK waters. There is no information on the rate of new introductions to UK waters.

Current status of the pressure and its impacts

249. There is insufficient information currently available to properly assess the current status in relation to NIS. The impacts of most concern are those on intertidal and shallow subtidal habitats particularly around the south and south-western coasts of the UK (CP2 regions 3 and 4), where studies suggest there are far more NIS. It is also recognised that there are particularly high numbers of NIS in areas subject to high shipping intensity, for example a survey of the southern part of Poole Harbour reported in 2007 revealed that NIS represented 60% of the wet weight of all species' present[76]. There are localised impacts in other CP2 Regions, however, not all areas have been surveyed.

250. There is no up to date national overview of all marine introductions to UK waters, the last was completed over a decade ago[77]. At a North-East Atlantic regional scale the OSPAR Quality Status Report 2010 included an overview of 30 NIS that have been identified as problematic, based on an assessment prepared by ICES. All species identified affect or occur in UK waters (OSPAR Regions II and III) and almost all the species concerned were introduced before current measures, some as much as several hundred years ago. The main vector for the initial introduction of these species has been mariculture, followed by ballast water from ships, hull fouling and fishing.

251. The most important and widespread impacts are changes to habitats and competition for food and space with indigenous organisms with intertidal and subtidal habitats being most affected, for example:

- Saltmarshes and the upper reaches of mudflats have been impacted by the spread of the invasive common cordgrass (Spartina anglica), which can rapidly colonise new areas of sediment and can form extensive 'monocultures', displacing indigenous species in the process. Some populations of S. anglica have ceased expanding and appear to be experiencing dieback, particularly along the south coast of the UK; however, along the northeast or northwest coasts the species still seems to be expanding. Estuarine channels and creeks may experience bank erosion through the burrowing activities of the non-indigenous Chinese mitten crab (Eriocheir sinensis).
- In shallow subtidal sediments, the slipper limpet (Crepidula fornicata) and American oyster drill (Urosalpinx cinerea), have been reported causing damage to habitats, including maerl beds and both native and cultivate oyster beds. The slipper limpet can alter sediment characteristics by removing a huge volume of suspended organic material from the water column, and depositing smothering large areas of habitat with resulting pseudofaeces. The oyster drill preferentially preys upon indigenous and introduced oysters
- There are localised impacts on rocky shore communities from the occurrence of non-indigenous species, such as the Australasian barnacle (Elminius modestus), which has become widespread and but does not generally displace indigenous species. Establishment of wireweed (Sargassum muticum) has occurred at sufficient density to impact on indigenous communities in some locations (e.g. Strangford Lough,).
- On shallow subtidal hard substrata (especially artificial structures) colonial seasquirts, such as the invasive non native carpet seasquirt (Didemnum vexillum) can have impacts on native species by rapidly over growing them and smothering them. The rapid growth and size of the colonies and their propensity for growing on artificial substrata means

[76] Underhill, J., & Dyrynda, P. (2007) Non native species in and around Poole harbour

[77] http://www.jncc.gov.uk/pdf/pub02_nonnativereviewdirectory.pdf

that this species also has the potential to impact on economic activities, such as shellfish farming and boating. Records of this species have so far been found in north-west Wales, south-west Scotland and south and east England.

- As sea temperatures rise, it is anticipated that there will be an increase in the introduction and range expansion of NIS with unknown consequences for biodiversity, ecosystem functioning and living marine resources. The summer melting of Arctic sea ice and the opening up of links between the Pacific and North Atlantic by summer melting of Arctic sea ice is likely to exacerbate this problem. It is important that an adequate monitoring programme is funded to assess rates of introductions and their impacts.

Predicted status by 2020-2030 given business as usual

252. Although there are increased controls on the main vectors for introductions, it is expected that by 2020 there will still be significant issues presented by invasive NIS and these are unlikely to be resolved by 2030. There are increased risks of new introductions if best practice guidance vessels do not comply with regulations or best-practice guidance is not followed. There are no cases of successful eradication of any NIS in the UK marine environment. In addition, it is expected that changes in sea temperature may create conditions conducive for new species to establish that previously were limited by sub-optimal temperature ranges.

State of the evidence base and development needs

253. The assessment of NIS is based upon partial information. There is a need for further research and survey effort to understand the patterns and mechanisms of establishment, the rate of spread of NIS, and the degree to which they displace indigenous species and indigenous communities. Monitoring is needed of the abundance and distribution of NIS in locations where there is high risk of new introductions, such as close to ports.

►Read More: Non-indigenous species

OSPAR Quality Status Report 2010 Chapter 9 Other Human Uses and Impacts: Non-indigenous species (Page 118)
http://qsr2010.ospar.org/en/ch09_13.html

Scotland's Marine Atlas Chapter 4 Non-Native Species in Scottish Waters (Page 138)
http://qsr2010.ospar.org/en/ch09_13.html

Northern Ireland State of the Seas Report Chapter 3 Invasive Alien Species (Pages 27-33)
http://www.doeni.gov.uk/niea/3_invasive_alien_species.pdf

Commercial fisheries (Descriptor 3)

MSFD Descriptor 3: Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.

MSFD Annex III Table 2 Indicative pressures and impacts
— Selective extraction of species, including incidental non-target catches (e.g. by commercial and recreational fishing).

Key driving forces

254. Commercial fisheries in UK waters principally target 32 fin-fish species, as well as a variety of shellfish species, including crabs, lobsters, scallops and Nephrops.

Current status of commercial fish stocks

255. There has been a substantial increase in the number of fish stocks that are harvested sustainably over the period 2000 -2011. However, a significant proportion of indicator stocks continue to be harvested at rates that are unsustainable and/or have reduced reproductive capacity and further reductions in fishing pressure on around half of stocks in UK waters would be needed to ensure levels expected to provide the highest long term yield (maximum sustainable yield). There is a lack of consistent and quality data for shellfish species from throughout the UK, which means that, except for Nephrops, which are well assessed by ICES, robust stock assessment has not so far been possible at a regional level.

256. Charting Progress 2 reported that during the period 1997 to 2007 fishing mortality declined in 67% of assessed fin-fish stocks. This has been achieved through the combination of EU controls on catches and the decommissioning of fishing vessels in the UK and some other countries. The UK demersal trawl fleet was decommissioned by 15% over this period and the total fishing effort in the international demersal fisheries has fallen by around 30% or more in the North Sea, west of Scotland and in the Irish Sea.

257. Charting Progress 2 reviewed the status of the 20 indicator fin-fish stocks in 2007, for which the ICES is able to provide quantitative advice in relation to safe biological limits for both fishing mortality (F) and spawning stock biomass (B). These represent 40% of all fin-fish species landed by UK vessels into the UK and abroad. By 2007 the proportion of these 20 indicator stocks with acceptable reproductive capacity (i.e. with spawning stock biomass above precautionary limits) and acceptable level of fishing mortality (i.e. fishing mortality below precautionary limits) had risen to 25%, having been around 10% in the early 1990s. The proportion of these 20 indicator fin-fish stocks with acceptable reproductive capacity had changed little since 1990, while the proportion being fished at an acceptable level had risen from 10% to around 40% over the same time period. The lack of a concomitant increase in reproductive capacity following reductions in fishing mortality was linked to time lags in the recovery of stock biomass, or environmental factors affecting recruitment. For the remaining stocks where ICES is not able to provide quantitative advice, available information suggests that the proportion of stocks with each status is probably comparable with these 20 indicator stocks.

258. The following subregional patterns were identified.

- Greater North Sea subregion. In the North Sea (CP2 Regions 1, 2) during 1998–2007, for a predominance of stocks there were significant reductions in fishing mortality whereas in the previous decade for most stocks there was no trend and for some, fishing mortality increased. This may reflect the large reductions in fishing capacity of the Scottish offshore fleet following decommissioning. The benefits in terms for spawning stock biomass were less clear, only a single additional stock showed a significant increase in 1998–2007 compared with the preceding decade. The latest available information (based on 2012 ICES advice reporting on the status of stocks in 2011) suggests that of those stocks in the Greater North Sea of commercial interest to the UK for which a robust scientific assessment is possible 64% are being fished at, or below, the level required to achieve a maximum sustainable yield in the longer term and around 91% had an acceptable level of spawning stock biomass.
- Celtic Seas subregion: To the west of the UK (CP2 Regions 4, 5, 6, 7, 8 east), reductions in fishing mortality were achieved for an increased number of stocks over the

period 1998-2007. Two additional stocks showed improvements in spawning stock biomass over the period 1998–2007 compared with the previous decade and one less showed a downwards trend. The latest available information (based on 2012 ICES advice reporting on the status of stocks in 2011) suggests that of those stocks in the Celtic Seas of commercial interest to the UK for which a robust scientific assessment is possible, 61% are being fished at, or below, the right level needed to achieve a maximum sustainable yield in the longer term or better and around 72% had an acceptable level of spawning stock biomass.

259. The above implies that around half of stocks in UK waters will need to improve their position to ensure GES. However, the status of almost a third of all UK commercial finfish stocks is not quantitatively assessed. As of 2012 ICES is providing quantitative catch advice for a far greater range of stocks using newly developed "data limited" approaches that will be taken into account in the future management of EU fisheries under the EU CFP. Whilst the new "data limited" methods are being extended and refined the assumption is that the focus on representative species for each sea area will ensure the health of the wider ecosystem is also improved.

Current status of commercial shellfish species

260. The life histories and behaviours of crustaceans are relatively complicated and assessments use a variety of indices, including length composition, landings and surveys, to provide an indication of the state of exploitation of a stock and whether increased yields could be expected through a reduced fishing rate. With the exception of Nephrops, which are well assessed by ICES there is an absence of consistent data from throughout UK seas. Based on ICES stock assessments around 75% of Nephrops stocks in the Greater North Sea and 100% in the Celtic Seas have an acceptable level of spawning stock biomass.

261. Shellfish assessments in Scottish and English[78] waters indicate that most edible crab stocks are fully exploited or over-exploited, lobster stocks are either fully exploited or over-exploited and scallop stocks to the west of Scotland exhibit a declining biomass while those to the east fluctuate without an obvious trend. Overall shellfish to the south and west of Scotland appear heavily exploited, while those to the north and east appear less heavily exploited. In the Western Irish Sea the Nephrops stock has maintained it status over the past four decades suggesting it is fished sustainably while data suggest that scallop stocks around the Northern Irish Coast are withstanding current levels of exploitation.

Predicted status in 2020/2030 given business as usual

262. Under a business-as-usual scenario it is concluded that effective implementation of the CFP would prevent further collapse of most fisheries stocks in UK waters but may not deliver significant progress in achieving objectives such as the recovery of stocks to support MSY across fisheries, or a fully-integrated ecosystem-based management approach to fisheries. This may be due to time lags in stock recovery and impacts from other pressures such as climate change, which will continue to affect depth, distribution, migration and spawning behaviours of fish. Recovery plans assume that recruitment will follow a historic relationship between recruits and Spawning Stock Biomass (SSB). However, in most cases the properties of collapsed stocks are different from healthy stocks, in terms of distributional extent and size truncation and these factors are likely to be at least as important as climate change in causing the time lag.

[78] Bannister, 2009. On the Management of Brown Crab Fisheries. 55 pages and 42 figures. Mimeo document distributed by SAGB, London.

State of the evidence base and development needs

263. The assessments of indicator fin-fish presented in Charting Progress 2 were based upon the stock assessment advice to the European Commission prepared by ICES. There is confidence in the assessments of these indicator stocks in most regions and ICES has begun work to extend the range of stocks for which quantitative stock assessments can be developed. Comparable and good quality assessments for shellfish species are more scarce and a monitoring and assessment system needs to be developed. This needs to be informed by improvement in the methodology for status assessment, knowledge and biological parameter estimation and through improvements in the quality of commercial data.

►Read More: Selective extraction of species

Charting Progress 2 Productive Seas Feeder Report Section 3.5 Fisheries (Page 111)
http://chartingprogress.defra.gov.uk/feeder/Section_3.5_Fisheries.pdf

Scotland's Marine Atlas Chapter 04 Commercial fish and shellfish stocks (Page 108 - 113)
http://www.scotland.gov.uk/Publications/2011/03/16182005/51

Northern Ireland State of the Seas Report Chapter 4 Fisheries and Aquaculture (Pages 35 - 44)
http://www.doeni.gov.uk/niea/4_fisheries_and_aquaculture.pdf

Eutrophication (Descriptor 5)

MSFD Descriptor 5: Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters

MSFD Annex III Table 2 Indicative pressures and impacts
Inputs of fertilisers and other nitrogen — and phosphorus-rich substances (e.g. from point and diffuse sources, including agriculture, aquaculture, atmospheric deposition),
Inputs of organic matter (e.g. sewers, mariculture, riverine inputs).

264. Eutrophication occurs when waters are enriched by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned.

Key driving forces

265. The main pressures which can lead to eutrophication in the marine environment are inputs of fertilisers and other nitrogen and phosphorus-rich substances. These arise mainly from agriculture, aquaculture, sewage treatment works, mariculture and industrial installations and enter the sea mainly through rivers, direct discharges to the sea and atmospheric deposition. Significant Inputs of naturally occurring nitrogen also enter the UK waters from the Atlantic Ocean.

Current Status and Trends

266. There are relatively few eutrophication problem areas in UK waters at present. These are of limited size and measures have been put in place to address the main sources for nutrient inputs to UK waters.

267. Charting Progress 2 presented a trend analysis of nitrogen and phosphorus inputs from UK rivers and atmospheric deposition which showed that over time, inputs of nutrients to the marine environment are generally decreasing. Charting Progress 2 also used the eutrophication assessment methodology developed by OSPAR (the Comprehensive Procedure) to assess the eutrophication status of waters in the eight UK marine regions. This showed that there were few or no problems with respect to eutrophication. The assessment identified 17 small estuaries and harbours were identified as problem areas and five as potential problem areas. The locations are shown in figure 3.82 of the Charting Progress 2 Clean and Safe Seas Feeder Report (page 21). The reasons for this are clear, with the key pressures being inputs from sewage treatment works and/or inputs from agriculture. These small water bodies have been designated as either Nitrate Vulnerable Zones under the EU Nitrates Directive or Sensitive Areas under the Urban Waste Water Treatment Directive, and appropriate measures to reduce nutrient inputs to the associated waters have been put in place. These small areas are largely in "transitional waters" and are generally considered to be outside of the scope of the MSFD. The Charting Progress 2 assessment found that UK coastal and offshore waters in each of the 8 regions are currently non-problem areas. The coastal waters include 5 areas that had caused concern in an earlier assessment undertaken in 2002 and reported in Charting Progress. These were East England, East Anglia, Liverpool Bay, the Solent and the Firth of Clyde. Although these areas are still nutrient enriched, and some showed evidence of accelerated growth of algae, there was no evidence for undesirable disturbance, and the risk is not increasing.

268. More recently, a first assessment of coastal and transitional waters in England and Wales under the WFD was undertaken and the results were published in associated river basin management plans by the Environment Agency. These show that the predicted status of some coastal waters in the Humber, North West, South East, South West, Thames and Western-Wales river basins is estimated to be of moderate status by 2015. The moderate status in these assessments was generally based on exceeding nutrient standards due to the one-out-all-out principle used for the WFD, but assigned reduced confidence for determining eutrophication on the basis that understanding of the biological quality of these waters was very limited. The assessments of marine waters in adjacent areas carried out using the OSPAR Comprehensive Procedure also showed that nitrogen concentrations were elevated in some cases, but better evidence on the absence of undesirable effects resulted in them being classified as having non-problem status. Further examination of the WFD nitrogen standards for coastal and transitional waters is envisaged in 2011 - 2012 in the light of a better understanding of biological status and whether eutrophication is actually occurring, which may lead to a revision of the potential status of these waters.

Transboundary impacts and transboundary features

269. A recent OSPAR modelling exercise[79] gives estimates of transboundary nutrients from riverine sources reaching the waters of other countries in the Greater North Sea. The exercise used different models, which gave different estimates, so the results need to be treated with caution. This showed that nutrients from human activities coming from other countries into UK waters were extremely small and unlikely to contribute significantly to nutrient enrichment or eutrophication problems. This modelling study also infers that although some nutrients from UK rivers are likely to reach the waters of other countries, the levels are extremely low compared with the land-based inputs from these countries, and the impacts of transboundary transport are probably minor.

[79] OSPAR Commission (OSPAR 2008). Nutrient Reductions and Model Scenarios for the North Sea. OSPAR Commission, London. OSPAR Publication 374/2008.

Predicted status in 2020/2030 given business-as-usual

270. There are few problem areas in relation to eutrophication at present and it can be expected that the continued application of current management measures will be sufficient to ensure improvements in remaining areas of concern by 2020. It is expected that nutrient inputs from the main sources (sewage treatment works and agriculture) will continue to fall due to the measures put in place under the EU Urban Waste Water treatment Directive and EU Nitrates Directives and the extent of eutrophication problem areas will continue to be minimised in UK in the period up to 2020. However, it needs to be acknowledged that recovery from eutrophication, for example in small estuaries and embayments, can take many years, due to the large reservoirs of nutrients in sediments.

State of the evidence base and development needs

271. There is a high confidence in the assessment of eutrophication in UK coastal and offshore areas due to the availability of extensive datasets and the enhanced monitoring employed in regions previously reported as being of concern. The results presented in Charting Progress 2 are consistent with, and have contributed to the assessment of eutrophication in the North East Atlantic presented in the OSPAR Quality Status Report 2010. The same assessment methodology was used and the overall assessment of eutrophication status was agreed by the OSPAR Commission. However, OSPAR is investigating whether the existing WFD phytoplankton tool and phytoplankton indices could be further developed to give greater confidence to addressing indicators on floristic composition.

►Read More: Nutrient and organic matter enrichment

Charting Progress 2 Clean and Safe Seas Feeder Report Section 3 Eutrophication
http://chartingprogress.defra.gov.uk/feeder/CSSEG-section-3-3-eutrophication.pdf

Scotland's Marine Atlas Chapter 03 Eutrophication (Page 60 - 65)
http://www.scotland.gov.uk/Publications/2011/03/16182005/38

Northern Ireland State of the Seas Report Chapter 6 Eutrophication (Pages 50 - 54)
http://www.doeni.gov.uk/niea/6_eutrophication.pdf

OSPAR Quality Status Report 2010. Chapter 4 (Pages 27 - 36)
http://qsr2010.ospar.org/en/ch04.html

Permanent alteration of hydrographic conditions (Descriptor 7)

MSFD Descriptor 7. Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.

MSFD Annex III Table 2 Indicative pressures and impacts: Interference with hydrological processes
Significant changes in thermal regime (e.g. by outfalls from power stations),
Significant changes in salinity regime (e.g. by constructions impeding water movements, water abstraction).

Key driving forces

272. The UK has over 19000km of coastline, 30% of which has seen some form of development i.e. 'the carrying out of any building, engineering, mining or other operation in, on, over or under land, or the making of any material change in the use of buildings or other land[80]. Many of these developments can affect waves, tides and currents, including activities such as navigation, flood protection, land reclamation, recreation and development. Although most effects are short term and localised, some permanent alterations in hydrographic conditions do occur. These alterations can include:

- Dredging altering sedimentation, water circulation and tidal flows;
- Constructions such as groynes, harbours, training walls, barrages and weirs altering patterns of water movement and as a consequence patterns of erosion and deposition;
- Constructions for marine renewable energy development (e.g. with the potential to alter flow and wave regimes);
- Power stations discharging cooling water into coastal areas;
- Seawalls and rock armour that prevent waves dissipating energy through erosion and breaking, and reflect energy back to sea. This can cause greater turbulence in adjacent sand and mud and/or reduce sediment supply to adjacent habitats;

Current status and trends of the pressure and its impacts

273. There are no significant broad-scale effects on ecosystems in UK waters beyond those currently covered by provisions of the WFD, where assessments of hydromorphological conditions (shape and flow) recognise that altering the physical regime in the coastal zone has the potential to adversely impact the ecology. A large proportion of the coastal water bodies in England and Wales have been provisionally designated as heavily modified water bodies under WFD, recognising that the body of water has had its original appearance significantly changed to suit a specific purpose (see Table 2.5).

274. Beyond these coastal water bodies, significant broad-scale alterations of hydrographical conditions resulting from human developments, with consequent effects on marine ecosystems, have not been recognised in UK seas and there is relatively scarce knowledge of the cumulative effects of human developments.

Table 2.5. Coverage of WFD Heavily Modified Water Bodies (HMWBS) in coastal and transitional waters in the UK national administrations and the Greater North Sea and Celtic Seas subregions (number, area and % coverage). NB. Designations of HMWBs are currently under review in England and Wales.

	Greater North Sea		Celtic Seas	
	Coastal HMWBs	Transitional HMWB	Coastal HMWBs	Transitional HMWB
England	31 (4946km^2) 85%	63 (1079km^2) 95%	15 (1931km^2) 46%	16 (421km^2) 51%
Wales	-	-	6 (390km^2) 9%	13 (514km^2) 72%
Scotland	3 (99km^2) 1%	4 (49km^2) 11%	10 (0.21km^2) <0.1%	4 (6km^2) 1%

[80] Town and Country Planning Act, 1990.

Northern Ireland	-	-	2 (5km^2) 0.4%	6 (40km^2) 98%
Overall %age	40%	71%	5%	46%

Predicted status in 2020/2030 given business-as-usual

275. It is expected that the existing marine licensing and consents process, marine planning, and the requirements of the WFD in relation to hydromorphological conditions will continue to ensure that all significant developments are assessed, and potential impacts are appropriately managed and monitored, in line with the requirements of the EU Environmental Impact Assessment Directive and the EU Habitats and Birds Directives. Marine Plans, when in place, will provide the regulatory framework for the licensing and consents process.

276. Understanding of changes in hydrographical conditions as a result of human developments at a local or sub-Regional scale in UK seas needs to be set against the increasing evidence of wider regional scale shifts in hydrographic conditions as a result of changing climate and increased levels of atmospheric CO_2. For example, temperatures in the North Atlantic have risen by around 1°C since 1910 and there is a clear trend of rising surface temperatures in both summer and winter months around the UK coastline, which is especially pronounced in the southern North Sea, Irish Sea and the Tiree Passage. The extent of the effects on marine ecosystems from this warming are still being characterised, but there is evidence of adverse effects for seagrasses and shellfish, shifts in plankton populations and changes in the timing of spawning.

State of the evidence base and development needs

277. Hydrographical conditions in UK waters are relatively well monitored. Considerable advances have been made in our ability to assess ocean processes and our evidence base and modelling capabilities are now fairly well developed, particularly for tides, currents, salinity, temperature and pH profiling. There is a need for clear reference points against which we can assess the prevailing conditions in the physical environment and seek to determine the broader impacts of large scale developments on ecosystems. These can include the development of monitoring and assessment tools, including models.

► Read More: Hydrographical processes

Northern Ireland State of the Seas Report Chapter 8 Hydrographical Conditions (Page 64 - 69)
http://www.doeni.gov.uk/niea/8_hydrography.pdf

Contaminant levels and effects (Descriptors 8 and 9)

MSFD Descriptor 8: Concentrations of contaminants are at levels not giving rise to pollution effects

MSFD Descriptor 9 (Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards)

MSFD Annex III Table 1 Indicative Characteristics: Other features
- A description of the situation with regard to chemicals, including chemicals giving rise to concern, sediment contamination, hotspots, health issues and contaminants of biota (especially biota meant for human consumption),
MSFD Annex III Table 2 Indicative pressures and impacts: Contamination by hazardous substances
- Introduction of synthetic compounds (e.g. priority substances under Directive 2000/60/EC which are relevant for the marine environment such as pesticides, antifoulants, pharmaceuticals, resulting, for example, from losses from diffuse sources, pollution by ships, atmospheric deposition and biologically active substances),
- Introduction of non-synthetic substances and compounds (e.g. heavy metals, hydrocarbons, resulting, for example, from pollution by ships and oil, gas and mineral exploration and exploitation, atmospheric deposition, riverine inputs),

278. Contaminants, including hazardous substances, oil, radionuclides and microbial pathogens, can enter the marine environment from natural sources and as a result of human activities, either as direct inputs or via rivers, estuaries and the atmosphere. Pollution itself is considered to be the introduction substances which have, or are likely to have, deleterious effects on the marine environment and its uses. These include harm to biodiversity, hazards to human health, impaired water quality, and reduced uses of the sea.

Contamination by Hazardous Substances

Key driving forces

279. Hazardous substances enter the sea from rivers, sewage works and industrial discharges and through deposition from the atmosphere. They include synthetic compounds, such as pesticides, antifoulants and pharmaceuticals, and non-synthetic compounds, such as metals, which are dispersed as a result of a variety of industrial processes, and polycyclic aromatic hydrocarbons, which are dispersed mainly as a result of combustion.

Current status and trends

280. Environmental concentrations of monitored hazardous substances in the sea have generally fallen, but are still above levels where there is a risk of pollution effect in many coastal areas, especially where there have been historical discharges, emissions and losses from high population densities or heavy industry. Levels of persistent organic pollutants found in marine species have declined following the regulation of the substances concerned, but additional man-made chemicals are still being found in marine samples, and there is a need to keep gathering data to assess their potential impacts and the need for further controls. Historic pollution in aquatic sediments acts as a continued source for releases of some well-regulated persistent contaminants as a result of past industrial activity.

281. Charting Progress and Charting Progress 2 assessments have reported on downward trends in the waterborne inputs of mercury, cadmium and lindane to both the Greater North Sea and the Celtic Seas subregions. Inputs of polychlorinated biphenyls (PCBs) concentrations have stabilised. Between 1990 and 2007, emissions of cadmium to the atmosphere decreased by 84%, of copper by 57%, of lead by 96%, of zinc by 55% and of mercury by 80%. Emissions of PAHs to the atmosphere have decreased by 84% since 1990. In 2007, the largest source of PAHs was road transport combustion, followed by domestic combustion. Twelve years earlier, the major source was the aluminium smelting industry, which contributed around 50%. Since then, thanks to improved practices, this industry is now responsible for only 1% of total PAH emissions.

282. Most of the areas in UK seas where there are problems from contamination with hazardous substances are local in nature. These are particularly in industrialised estuaries and coasts and generally associated with historic discharges and emissions from industry and agriculture. Concentrations of the most commonly monitored hazardous substances[81] in seawater have fallen during the past ten years as a result of controls placed on their use and are now generally below UK environmental quality standards (EQS)[82]. WFD chemical status assessments (2009) reported that all transitional and coastal waterbodies in Scotland and Northern Ireland achieved good status for contaminants, while in England and Wales, 69% of transitional waters and 91% of coastal waters assessed were at good chemical status. Less than good chemical status was, in the majority of cases, related to tributyl tin contamination. There were few breaches of the contaminant standards at sites in Northern Ireland. The WFD chemical status assessments were informed by data collection within monitoring implemented for the EU Dangerous Substances and Shellfish Waters Directives.

283. Monitoring of concentrations of hazardous substances in sediments and biota (fish and shellfish) has been used to reveal more clearly where there are problems as concentrations in seawater are very low and variable. For the most commonly monitored contaminants (metals (cadmium, mercury and lead) and PAHs), the levels in sediments and biota are a particular issue in estuaries at the margins of the MSFD area that have been the subject of heavy pressure from industrial activities over time e.g. the Thames, Tees, Tyne, Mersey, Severn Estuary and Belfast Lough.. There is, however, much more widespread contamination in estuarine and coastal biota and sediments from the use of PCBs, which was brought under regulation in the 1980s. Concentrations of the most toxic congener included in the analyses (CB118) are at levels that pose a risk of toxicological effects in sediment and biota in most areas. Over the past twenty years there has been a downward trend in the concentrations of PCBs but few recent (last five years) downward trends over the last five years can be detected, suggesting that there is a significant historical burden in the environment.

284. UK waters outside the coastal area appear less affected by pollution, however, man-made chemicals, especially those that are most persistent, are still being found in deep-sea fish and marine mammals off UK coasts. Levels of some flame retardant compounds in the blubber of harbour porpoises, which inhabit waters to a depth of 200m, have declined over the period 1998 to 2008, following EU regulatory action and as a result of improvements in industry practice. However, PCBs are present at levels that affect harbour porpoises around the UK, probably by suppressing their immune systems and making them more prone to death from infectious diseases. Levels are only declining slowly. Tissues of deep-sea fish collected from the Rockall Trough to the west of the UK contained both CBs and brominated diphenyl ethers, but not the brominated flame retardants hexabromocyclododecane (HBCD) or tetrabromobisphenol-A (TBBP-A). In harbour porpoises from UK waters, a rapidly rising trend in blubber concentrations after 2001 has been reversed since 2003. This is probably because of the closure of two UK plants, one manufacturing HBCD and the other using HBCD in the manufacture of expanded polystyrene.

►Read More: Contamination by hazardous substances

Charting Progress 2 Clean and Safe Seas Feeder Report Section 3.1 hazardous substances
http://chartingprogress.defra.gov.uk/feeder/CSSEG-section-3-1-hazardous-substances.pdf

Scotland's Marine Atlas Chapter 3 Hazardous Substances (Page 42 - 47)
http://www.scotland.gov.uk/Publications/2011/03/16182005/32

[81] Metals (cadmium, lead and mercury), PAHs, PCBs

[82] www.environment-agency.gov.uk/research/planning/40295.aspx

Northern Ireland State of the Seas Chapter 9 – Contaminants (Pages 70-76)
http://www.doeni.gov.uk/niea/9_contaminants.pdf

Contaminant levels in fish and other seafood

285. With respect to GES Descriptor 9, Monitoring of fish and other seafood for human consumption in connection with Commission Regulation 1881/2006 as amended, has generally not been directly related to specific geographical areas in UK waters, but based on 'shelf' surveys of fish and seafood from retail outlets. It is therefore not possible to make an assessment of the status of particular waters on the basis of existing data. These surveys do indicate that contaminant levels in fish and seafood for retail rarely exceed maximum levels specified in the legislation. However some consumers e.g. children and pregnant women are advised to avoid eating certain species such as shark, marlin and swordfish due to their elevated mercury content. Recent work[83] in Scottish Waters has found mercury and lead in fish landed from representative sea areas in both the Greater North Sea and Celtic Seas subregions to be at levels below the Maximum Permissible Limits in EU legislation. Cadmium levels were below maximum permissible limits in all areas apart from the Rockall Bank, where a link to natural processes was postulated as the cause.

Biological impacts of hazardous substances

286. The UK has a well developed monitoring programme of biological effect measurements, which indicate the exposure of marine organisms to hazardous substances. The impacts of hazardous substances on populations or functional groups of species are less well quantified. The main conclusions on this monitoring from Charting Progress 2 are summarised below:

- Elevated levels of detoxification enzyme activity in fish liver at coastal and offshore sites (off the north-east English coast, on the western edge of the Dogger Bank, close to the Liverpool Bay coastline and at two historical sewage disposal sites close to the Scottish east coast) indicate exposure to planar organic contaminants such as dioxins and furans, planar CBs or PAHs, however adverse effects have not been observed. (►Read More: Charting Progress 2 Clean Safe and Healthy Seas Feeder Report 3.1.4.4 (page 139))
- Levels of DNA adducts of PAHs detected in fish in industrialized estuaries at the margins of the UK Marine Strategy area were similar to those previously reported in Charting Progress in 2005, indicating that while concentrations of contaminants are not increasing, there is an ongoing risk of carcinogenic exposure at these locations. (►Read More: Charting Progress 2 Clean Safe and Healthy Seas Feeder Report S 3.1.4.5 (page 149))
- Fish liver pathologies, including cancers, have a higher, and potentially increasing, incidence at certain Irish Sea sites, higher but static at some North Sea sites, and low and static (approaching or at background levels) at Inner North Sea and English Channel sites. The causes of the higher levels are unknown, but cancers do not result solely from exposure to hazardous substances. It is not possible attribute to the cause of such impacts to specific contaminants. (►Read More: Charting Progress 2 Clean Safe and Healthy Seas Feeder Report 3.1.4.1 (page 114))
- In a number of UK estuaries at the margins of the UK Marine Strategy area levels of the blood protein vitellogenin (VTG) in male fish suggests that affected fish are gradually accumulating persistent oestrogenic compounds, which disrupt endocrine function,

83 Devalla, S., Robinson, C.D., Webster, L., Darding, M., and Fernandes, A. 2011. Trace Elements in Food and the EU Marine Strategy Framework Directive: The Scottish Experience. Poster presentation at the Fourth International IUPAC Symposium for Trace Elements in Food (TEF-4), 19-22nd June 2011, Aberdeen, UK.

through their diet. Recent estuarine monitoring data from the Tyne and the Mersey has suggested that the effects in fish may be decreasing. Concentrations of VTG in offshore species of fish have been found to be at, or close to, background levels. (►Read More: Charting Progress 2 Clean Safe and Healthy Seas Feeder Report 3.1.4.2 (page 124))

- There has been a fall in the development of male characteristics in female dogwhelks in some areas due to further regulation preventing the use of tributyltin-based antifouling paints on large seagoing vessels. This decline is expected to continue. (►Read More: Charting Progress 2 Clean Safe and Healthy Seas Feeder Report 3.1.4.3 (page 128))

►Read More: Biological effects of hazardous substances

Charting Progress 2 Clean and Safe Seas Feeder Report Section 3.1.4 Contaminant-specific biological effects (Page 114)
http://chartingprogress.defra.gov.uk/feeder/CSSEG-section-3-1-hazardous-substances.pdf

Charting Progress 2 Healthy and Biologically Diverse Seas Feeder Report

Scotland's Marine Atlas Chapter 03 Biological Effect of Contaminants (Page 048 – 051)
http://www.scotland.gov.uk/Publications/2011/03/16182005/33

Predicted Status in 2020/2030 given business as usual

287. The effective implementation of the Urban Waste Water Treatment Directive, the WFD, the Integrated Pollution Prevention and Control Directive, the Existing Substances Regulation and European Community Regulation on chemicals and their safe use (REACH) (EC 1907/2006) is likely to ensure progress towards Good Chemical Status (for priority and priority hazardous substances) and contribute to Good Ecological Status (for other pollutants) for some problem areas up to 2020, with further improvements likely up to 2030. However, there are likely to be some areas where the measures taken to control inputs of contaminants may not be sufficient to minimise impacts due to the presence of very persistent legacy contaminants in sediments where it will not practicable to take remedial measures.

288. Under the WFD future monitoring in coastal waters will potentially encompass a wider range of substances. WFD environmental quality standards adopted in Directive 2008/105/EC and transposed into UK law, aim to provide an enhanced level of environmental protection. For this reason, they are in many cases lower than the earlier UK environmental quality standards and their use may result in standards being exceeded more often than previously.

State of the evidence base and development needs

289. The UK's monitoring of hazardous substances, oil (some components), and radioactive substances takes place under the Clean and Safe Seas Monitoring Programme. Monitoring of Hazardous Substances already meets requirements of the WFD and OSPAR. Additional monitoring could be required in the future if new substances are added to priority substances lists. There is a need to consolidate criteria for the assessment of measurements of the biological effects of contaminant.

290. For contaminants in fish and other seafood, it is likely that some additional monitoring in commercial fishing grounds in the relevant MSFD subregions (Greater North Sea and Celtic Seas) will be necessary because current Food Standards Agency monitoring schemes are generally not able to identify the source of the samples being tested.

Oil Pollution

MSFD Annex III Table 2 Indicative pressures and impacts: Contamination by hazardous substances
- Introduction of non-synthetic substances and compounds (e.g. heavy metals, hydrocarbons, resulting, for example, from pollution by ships and oil, gas and mineral exploration and exploitation, atmospheric deposition, riverine inputs),

291. Over the period 2002 to 2008, the volume of oil discharged in produced water from the offshore oil and gas installations in UK waters has reduced by about 50%, in response to regulatory controls. Confidence in these estimates is high as the UK Government has a mandatory reporting requirement.

292. The volume of oil accidentally spilled varies widely from year to year and the total oil spilled in one year can be dominated by a single large spill. In 2010, the most recent year for which data are available, there were 582 accidental discharges of oil from ships and offshore platforms into UK waters. There has been an underlying downward trend in both statistics since 2000. Most spills occur in major shipping lanes or where the offshore oil and gas industry operates and are small in volume. In 2010 only 6% of oil spills involved losses in excess of 2 tonnes. It has not been possible to assess the regional impact of accidental spillages of oil, because in general they are logged as the number of incidents reported.

293. There have been no major marine oil spills in UK waters since 2005. There were, however, two incidents of note in this period. The container ship MSC Napoli was beached in Lyme Bay (Eastern Channel CP2 Region) in January 2007, spilling a total of 302 tonnes of oil, of which 150 tonnes affected the Devon and Dorset coast. The incident was effectively dealt with by the Secretary of State's Representative for Maritime Salvage and Intervention and the Maritime and Coastguard Agency, and only had a small local impact on seabirds. A leak from the pipeline to the Gannet oil platform in the Northern North Sea in 2011 led to the release of 218 tonnes of oil and led to significant mitigation action and impact surveillance.

►Read More: Oil Pollution

Charting Progress 2 Clean and Safe Seas Feeder Report Section 3.5 Oil and Chemical Spills. Page 245
http://chartingprogress.defra.gov.uk/feeder/CSSEG-section-3-5-oil-and-chemical-spills.pdf

Scotland's Marine Atlas Chapter 03 Oil and Chemical Spills (Page 52 - 53)
http://www.scotland.gov.uk/Publications/2011/03/16182005/34

Radioactive Substances

MSFD Annex III Table 2 Indicative pressures and Impacts: Contamination by hazardous substances
- Introduction of radio-nuclides.

294. Doses of radioactivity received by people and wildlife continue to be well within regulatory limits. Since 2005, technetium-99 (99Tc) discharges from processes at Sellafield have fallen below 10 TBq per annum, and have met the end of 2006 target set in the UK Strategy for radioactive discharges (2002). Environmental concentrations of this radionuclide have also decreased

significantly overall since 1995. Polonium-210 (210Po) was historically discharged by a phosphate processing plant near Whitehaven, Cumbria. The levels of 210Po in seafood around Whitehaven have fallen to within the range of natural variability. 210Po is responsible for ~50% of the radiation dose to seafood consumers around Sellafield, which remains well within the UK and EU annual dose limit of 1 mSv set to protect human health. Most of this dose is due to the legacy of earlier discharges. Current discharges from Sellafield are very low relative to their 1970s peak and continue to fall. Concentrations of tritium (3H) and carbon-14 (14C) in fish and molluscs near the radiopharmaceutical plant in Cardiff are decreasing, although tritium levels remain higher than elsewhere in coastal waters. The offshore oil and gas industry is responsible for a large proportion of the total alpha-emitting radioactivity entering UK waters, as a result of discharges of the 'produced water', which contains elevated levels of the naturally occurring radionuclides radium-226 (226Ra), radium-228 (228Ra) and lead-210 (210Pb). However, discharges fell by about 25% between 2000 and 2006, and will continue to reduce in line with declining production of oil and gas.

►Read More: Radioactive Substances

Charting Progress 2 Clean and Safe Seas Feeder Report Section 3.2 Radioactivity. Page 175
http://chartingprogress.defra.gov.uk/feeder/CSSEG-section-3-2-radioactivity.pdf

Scotland's Marine Atlas Chapter 03 Radioactive Substances (Page 54 - 55)
http://www.scotland.gov.uk/Publications/2011/03/16182005/35

Microbiological contamination

MSFD Annex III Table 2 Indicative pressures and Impacts: Biological disturbance
- Introduction of microbial pathogens.

295. Microbial contamination of coastal waters from sewage treatment plants has fallen significantly as a result of improvements in infrastructure. For Bathing Water Quality, Table 2.6 shows the compliance rates over the past five years with the 'mandatory' standard, and the 'guideline' standard ("EC guideline) under the EU Bathing Waters Directive, as well as with the UK guideline, which takes into account the faecal streptococci parameter of the current Bathing Water Directive (76/160/EEC) that is used as the water quality criterion for the Blue Flag award. In 2007, 40% of sampled shellfish waters met the guideline value under the EU Shellfish Waters Directive. This value is significantly more stringent than the guideline standard in the Bathing Waters Directive. Shellfish taken from more contaminated waters are cleansed prior to sale for human consumption, to reduce bacterial contamination to a safe level. In 2007, shellfish from 21% of areas could be consumed without treatment, while 78% required some treatment. Less than 1% was prohibited from harvest on the grounds of microbiological contamination. The comparable figures in the 2005 Charting Progress assessment were 17%, 82% and 1%, respectively.

Table 2.6. UK Compliance rates for the period 2007 to 2008 with the EU Bathing Waters Directive Mandatory and Guideline standards and the UK Guideline standard.

	2007	2008	2009	2010	2011
Mandatory	96.5	95.9	97.6	97.3	97.7
EC Guideline	76.2	69.2	80.2	82.6	84.4
UK Guideline	71.3	64.7	70.4	71.7	76.9

296. The levels of compliance reflect a significant investment in sewage treatment and infrastructure driven by the Bathing Waters and Shellfish Waters Directives. Those CP2 assessment areas and with poor hygiene quality within Shellfish waters at several sites were: Northern North Sea; Eastern Channel; Western Channel and Celtic Sea; and Irish Sea. UK water companies plan to spend over £300 million on additional improvements under these Directives over the next five years. Further improvements in microbiological quality will also require measures to reduce the impact of land run-off. This includes reducing misconnections in piping, sustainable drainage systems, and in changes to land management, such as establishing buffer zones excluding grazing animals from the vicinity of water courses. Viruses are also of concern and further work is needed to measure them and establish suitable standards.

►Read More: Microbiological contamination
Charting Progress 2 Clean and Safe Seas Feeder Report Section 3.4 Microbiological Contamination. (Pages 232 - 244)
http://chartingprogress.defra.gov.uk/feeder/CSSEG-section-3-4-microbiological-contamination.pdf

Scotland's Marine Atlas Chapter 03 Microbiological Contamination (Page 56 - 57)
http://www.scotland.gov.uk/Publications/2011/03/16182005/36

Northern Ireland State of the Seas Chapter 14 – Bathing water quality (Pages 97-100)
http://www.doeni.gov.uk/niea/14_bathing_water_quality.pdf

Marine Litter (Descriptor 10)

MSFD Descriptor 10: Properties and quantities of marine litter do not cause harm to the coastal and marine environment.

MSFD Annex III Table 2 Indicative pressures and Impacts: Other physical disturbance
- Marine litter.

297. Any persistent, manufactured or processed solid material discarded, disposed of, abandoned or lost in the marine and coastal environment can be defined as marine litter[84]. Most marine litter consists of material that degrades slowly, if at all, so a continuous input of large quantities of these items results in a build-up in the marine and coastal environment.

Key driving forces

298. Whilst sources of litter are difficult to trace, the Marine Conservation Society's Beachwatch programme reported that, based upon beaches included in the programme, 35% of litter on beaches came from beach users, 14% from fishing activities and up to 40% of litter items remain unassigned each year, either because they are too small or too weathered to identify a source, or because they could have come from a number of sources. Around 70% of beached marine litter is plastic.

Current status and trends for marine litter

299. Charting Progress 2 identifies some problems from marine litter in all CP2 Regions within the Greater North Sea and the Celtic Seas subregions where there are systematic surveys of beached litter density. This suggests that further measures, at national and international level, will

[84] Marine Litter – An analytical overview, Regional Seas Programme, UNEP.

be needed to achieve GES with respect to litter in both the Greater North Sea and the Celtic Seas subregions. There is not enough information on quantities in the northern part of the Celtic Seas subregion (CP2 Regions 6, 7 and 8) on which to base an assessment.

Beached Litter

300. Densities of beached litter recorded in the UK have increased since monitoring commenced in 1994, with an average of around 1000 items per kilometre in 1994 having almost doubled by 2007. The majority of this increase occurred between 1994 and 2003. Between 2003 and 2007 densities of beached litter have been generally stable, although some reductions in the density of beached litter have been achieved on the south coast of England, driven primarily by reductions in public litter.

301. The highest densities of beached litter are found in the south-west of England, which has been attributed to pressure from tourism and fishing as well as litter entering UK waters through prevailing currents. Average densities in Scotland are slightly higher than the UK average, while the average density in Northern Ireland is slightly lower than the UK average. There are insufficient data to draw any firm conclusions for the northern part of the Celtic Seas subregion.

302. The main identified sources of litter on UK beaches include the general public, fishing, sewage discharges and shipping.

Offshore litter

303. Seabed litter has been surveyed at only a few sites and data are sparse, which limits the possibilities for an assessment of changes in quantities of litter over time or between regions. The available data indicate that there is a generally low, but variable, abundance of litter on the seabed ranging from 0 to 17 items per hectare. Higher densities of litter have been found at specific locations, such as Carmarthen Bay, North Cardigan Bay, in the Celtic Deep and in Rye Bay. This suggests that these could be areas of accumulation, where litter gathers because of the effects of winds and currents. The most common forms of offshore litter are rope, polypropylene twine and hard plastics, with a dominance of items from fishing vessels and shipping.

304. The results presented in Charting Progress 2 are consistent with, and have contributed to, the assessment of litter in the North-East Atlantic presented in the OSPAR QSR 2010. The QSR 2010 also presents an indication of the abundance of floating litter at sea through an assessment of data from the period 2002 to 2006 for the content of plastic particles in the stomachs of seabirds (fulmars – fulmaris glacialis) in relation to an Ecological Quality Objective. The EcoQO was not met in any subregions of the North-East Atlantic. This is further confirmed by a study on fulmars collected from UK waters in the period 2005 – 2010[85].

Impacts of marine litter

305. The main risks to marine life include entanglement of, and ingestion by, marine species and transport of non-indigenous species, but there are currently no agreed assessment tools to quantify the impacts on marine life at the population level from the presence of marine litter. Impacts have been particularly recognised on marine mammals, seabirds and turtles. There are also localised impacts from smothering of the biological communities associated with intertidal rocky and sediment habitats.

[85] http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=17438

306. Economic risks from the presence of marine litter have been identified in Charting Progress 2. These include harm to wildlife, costs to local communities in terms of clean-up costs and lost tourism, and costs to fishermen through lost catch and snagged nets. KIMO International has estimated the costs to UK local authorities of clean-up of beached litter to be in the region of 18 million euros (KIMO, 2010[86]).

Predicted Status by 2020/2030 given business as usual

307. Under the current regulatory regime it can be expected that litter is likely to remain a problem, accumulating in coastal areas and in the water column. However, there is very low certainty in this assessment due to the lack of quantitative information regarding litter, especially on water column and floating litter.

State of the evidence base and development needs

308. Beached litter has been assessed in Charting Progress 2 using the methodology of the Marine Conservation Society, which is comparable to that used by OSPAR and the recently published UNEP/IOC guidelines on survey and monitoring of marine litter. Offshore litter data have been collected during cruises associated with the UK Clean Seas Environmental Monitoring Programme and other research cruises. There is a need for improved data on the extent and spread of offshore litter, both floating and on the seabed, to support the efforts to address litter in these parts of the marine environment. More research is required on the environmental and economic impacts of marine litter, including on microplastics and the role of litter in the accumulation of pollutants and as a vector for the transport of on-indigenous species .

►Read More: Marine litter
Charting Progress 2 Clean and Safe Seas Feeder Report Section 3.6 (Pages 252 -279)
http://chartingprogress.defra.gov.uk/feeder/CSSEG-section-3-6-litter.pdf

Scotland's Marine Atlas Chapter 03 Marine Litter (Page 66 - 67)
http://www.scotland.gov.uk/Publications/2011/03/16182005/40
Northern Ireland State of the Seas Report Section 11 Litter (Pages 82 – 85)
http://www.doeni.gov.uk/niea/11_litter.pdf

Underwater noise (Descriptor 11)

MSFD Descriptor 11 - Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.

MSFD Annex III Table 2 Indicative pressures and impacts: Other physical disturbance -Underwater noise (e.g. from shipping, underwater acoustic equipment)

Key driving forces

309. Underwater noise from man-made sources arises primarily from explosions, shipping, seismic surveys, offshore construction, offshore industrial operations and sonars of various types.

[86] KIMO International (2010). Economic Impacts of marine litter (eds. Mouat, J., Lopez Lozarno, R. and Bateson, H. Kimo International. 117pp. http://www.kimointernational.org/Portals/0/Files/Marine%20Litter/Economic%20Impacts%20of%20Marine%20Litter%20Low%20Res.pdf

Current status and trends

310. There is currently not enough evidence to provide a quantitative assessment of the current status and trends of underwater noise in UK seas, due to a lack of information from monitoring studies, but increasing activity is likely to have led to increased ambient noise levels. Localised and temporally limited increases in impulsive noise levels also occur as a result of seismic surveys (e.g. for oil and gas) and around marine construction activity, particularly, pile driving for offshore renewable energy developments. Increased construction activity has taken place in parts of the Southern North Sea for offshore wind farms and further large-scale developments of offshore renewables are likely in the future at various licensed areas in UK Seas. It remains unclear whether changes in shipping activity have resulted in an increase in ambient noise levels.

311. Increases in ambient noise levels are thought to be occurring globally primarily as a result of increases in maritime transportation. This is currently the subject of debate within the International Maritime Organization.

312. Overall, further monitoring and investigation is necessary to fully understand the effects of noise at an individual and population level, the risks and significance of noise inputs to the environment, and appropriate options for mitigation. Underwater noise is known to be an issue for most marine mammals, many marine and diadromous fish, and perhaps some shellfish as sound is important for communication, detecting predators and long-range navigation. Continuous noise may degrade the sound habitat, masking biologically relevant signals such as echolocation clicks, making it harder or impossible to find a mate, locate food or detect predators. Impulsive sounds can lead to a variety of behavioural reactions such as avoidance of feeding or breeding areas or may result in physiological effects such as temporary or permanent damage to hearing organs, and at very high levels, even death. There is a scarcity of quantitative data on the actual impacts of marine noise on species and populations, and the thresholds at which noise is considered to be having a ‘significant’ impact on organisms. From a conservation perspective, estimating the effects of noise disturbances on populations is critical, and there are first attempts to develop population consequences of acoustic disturbance models, at least for marine mammals.

Predicted status by 2020/2030 given business as usual

313. The major current source of impulsive underwater noise is from seismic surveys, and will continue to be so up to 2020. The relative proportion of noise from offshore renewable energy construction (wind farm, wave and tidal stream energy installations) is likely to increase significantly by 2020, and possibly beyond. Although the number of impulsive noise events is likely to increase, it is not expected that there will be a substantial increase in noise impacts at the temporal and spatial scales relevant to this Descriptor. Therefore, at current levels of knowledge, it is considered unlikely that there would be a significant adverse effect on marine animal populations, provided measures continue to be taken to manage the impacts of individual noisy activities through the licensing process. Marine planning would also need to take into account some wider aspects of activities.

314. Ambient noise levels are likely to increase if the volume of shipping in UK waters increases, and no measures are taken to reduce noise levels from ships. However, there are limited data to support any assessment.

State of the evidence base and development needs

315. There are significant gaps in our understanding of the current levels of noise in the marine environment, the actual impacts of marine noise on species and populations, and the thresholds at

which noise is considered to be having a 'significant' impact on organisms. Underwater noise is not currently monitored or recorded systematically in the UK.

316. There is a need to develop improved information on the location of noise-generating activities and the duration and intensity of their relevant activities as well as mapping and modelling of ambient noise. This would allow a better understanding of potential cumulative impacts and management of activities through improved scheduling.

►Read More: Under water noise
Clean and Safe Seas Feeder Report section 3.8 Underwater noise (Page 304)
http://chartingprogress.defra.gov.uk/feeder/CSSEG-section-3-8-underwater-noise.pdf

Scotland's Marine Atlas Chapter 03 Underwater Noise (Page 69)
http://www.scotland.gov.uk/Publications/2011/03/16182005/42

Northern Ireland State of the Seas Report Chapter 12 Energy and Underwater Noise (Page 86 - 88)
http://www.doeni.gov.uk/niea/12_energy_and_underwater_noise.pdf

2.5 Analysis of the costs of degradation

Analysis of the costs of degradation and benefits of achieving the GES

317. The marine environment provides ecosystem goods and services which benefit society. The Millennium Ecosystem Assessment[87] sets out a typology of ecosystem services under four broad headings: provisioning, regulating, cultural and supporting services. The diagram below provides examples of some ecosystem services provided by the marine environment.

Categories		Relevant Categories		Example of Product or Service
Provisioning services	→	Food	→	Fish for human consumption
		Fibre		Fish used in animal feeds
				Aggregates
		Biochemicals, pharmaceuticals & natural medicines		Fish oil
Regulating services	→	Gas & climate	→	Carbon sequestration
		Bioremediation of waste		Waste remediation, water purification
		Natural hazard		Protection from natural hazard
Cultural services	→	Knowledge & education	→	Scientific knowledge of ecosystem functions, genetic information, and potential for chemical/therapeutics discovery
		Recreation		Recreational sea angling Nature-based recreation Scuba Diving
		Spiritual &		Artistic work based on the marine

[87] http://www.maweb.org/en/Global.aspx

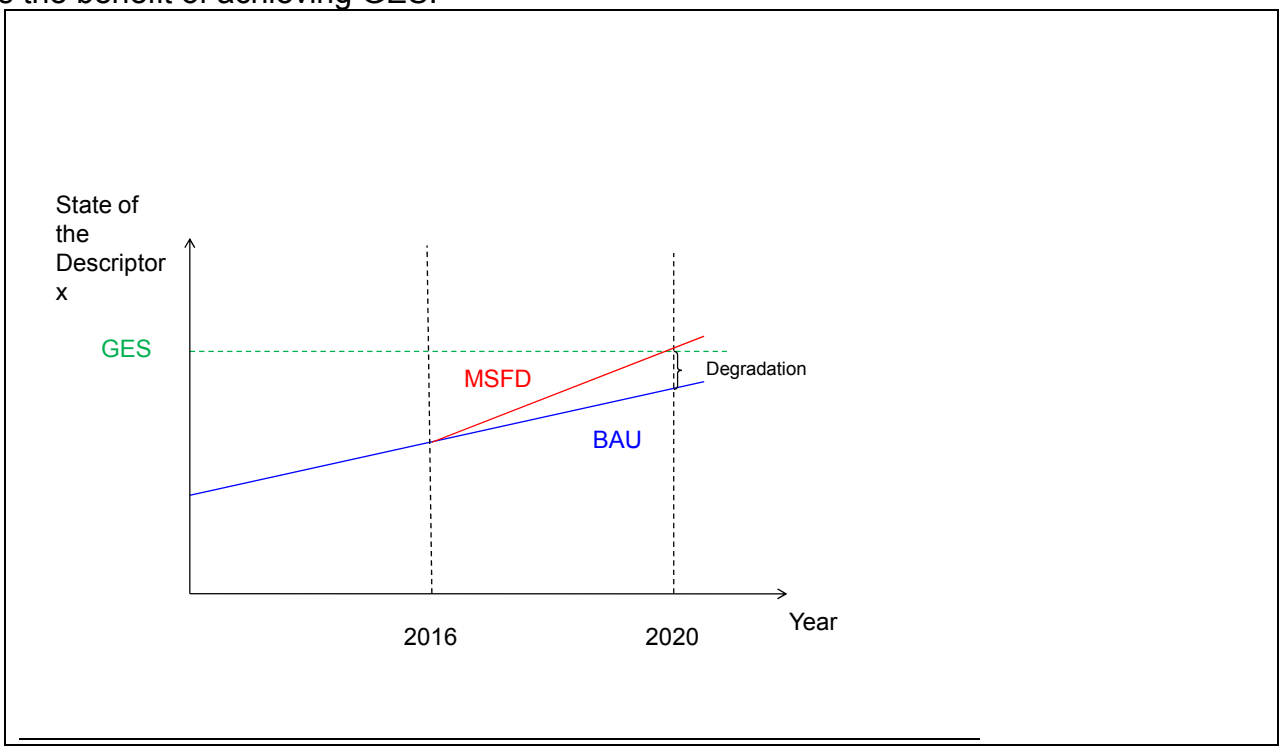
		religious		environment
		Cultural & social		Protection of iconic sites or archaeological features
		Aesthetic & inspiration		Protection of iconic sites or archaeological features
		Non-use and option values		Altruistic/Bequest/Existence/Option/Quasi-option values
Supporting services	→	Primary production Photosynthesis Nutrient cycling Biologically-mediated habitat Resilience & resistance	→	(Not directly analysed to avoid double counting[88])

318. The cost of degradation in 2020 is estimated by valuing the difference in societal welfare when we compare the expected state of the environment if GES is achieved by then and the expected state of the marine environment without the MSFD, where GES is not achieved. The counterfactual is represented by a Business as Usual (BAU) scenario. The cost of degradation in 2020, therefore, is the same as the benefits that accrue in that year due to the implementation of the MSFD as it values the avoided costs arising from degradation in the marine environment if GES not achieved. However, in addition, there will also be earlier benefits that arise from the transition to GES before 2020 where this diverges from the BAU scenario.

319. The underlying theoretical model is illustrated in Figure 2.4 however, due to lack of trend data it has not been possible to fully apply this model and only certain elements have been assessed. Also it is important to note that for some of the GES Descriptors (e.g. D3 – fisheries) there is likely to be a converging trend between GES and BAU as shown in the diagram, reflecting an optimistic BAU scenario where the existing legislative drivers are assumed to deliver improvement in the state of the marine environment. However, for other GES Descriptors (e.g. D10 - litter) there could be a diverging trend, reflecting a BAU scenario where the state of the marine environment worsens and hence there is an increasing cost of inaction.

[88] Supporting services are those that are necessary for the production of all other ecosystem services. The important point to emphasise is that they differ from provisioning, regulating, and cultural services in that their impacts on people are indirect and will therefore not be valued directly but by taking account of the impact on these other ecosystem services that are directly 'consumed'.

Figure 2.4. Cost of Degradation: theoretical model. The blue line shows projected improvements in the state of the marine environment under the BAU scenario before or by 2020. The green line shows the expected environmental state when GES is achieved. The red line shows the trajectory towards achieving GES under MSFD measures. The gap between GES and BAU in 2020 describes the degradation in the marine environment that will occur in the absence of efforts to achieve GES through MSFD and the value of this gap, in terms of change in welfare, describes the benefit of achieving GES.



320. In order to value the change in societal welfare (the gap in the Figure 2.4) the ecosystem services framework was used. This framework enables an assessment of the changes in services to society caused by changes in the state of ecosystem components and pressures in the marine environment. There are a wide range of pressures and components covered by the 11 GES Descriptors, and measuring the change in state across all these elements would be a challenging task. However, for the purposes of valuation the ecosystem services framework requires assessments to be based only on final ecosystem services[89] – those that directly contribute to human welfare - in order to remove the risk of double counting the benefits. This does not mean that intermediate ecosystem services are less important but that their value in supporting the final services should be captured through the changes in value of the latter. For example, the intermediate ecosystem service of primary production by phytoplankton and macro-algae (ecosystem component) supports the final ecosystem service of food provision in the form of fish and shellfish (ecosystem component) higher up the food chain. This means that the value of food provision also reflects the value of primary production, because without primary production, food will not be available.

321. Similarly, increased levels of litter (pressure) could cause negative impacts on marine mammals (ecosystem component) and could therefore indirectly affect the provision of the aesthetic and cultural services provided by them. At the same time increased levels of litter directly reduce the value of the aesthetic and cultural services received from going to the beach. For the purposes of valuation, only the direct effects of litter have been considered. The indirect

[89] Final ecosystem services include provisioning services, cultural and recreational services, regulating services.

effects should be reflected when measuring the value of aesthetic and cultural services from sightings of marine mammals.[90]

322. To identify the changes in the provision of the ecosystem services between the BAU scenario and the achievement of GES, the following steps were taken:

a) Identification of the ecosystem components that provide these final ecosystem services and the key pressures that impact on them;

b) Assessment of whether there is any degradation in the ecosystem components, or significant changes in the impact of the pressures, when comparing the BAU scenario with the achievement of GES.

323. These assessments were made based on discussions with UK economists and policy experts in Defra (step i) and with experts from JNCC and Cefas (step ii) who worked on developing the UK targets and indicators for GES[91]. Table 2.7 shows the components and pressures which are considered to relate to final ecosystem services.

Table 2.7: Final ecosystem services and related ecosystem components and pressures

Final ecosystem service	Relevant ecosystem components or pressures	Further explanation
Provisioning services	Fish and Cephalopods (D1 and D4) Intertidal rocky habitats (D1 and D6) Intertidal sediment habitats (D1 and D6)	Fish and Cephalopods provide food for consumption. Intertidal rocky habitats provide provisioning services such as food, medicine and fertilizer from seaweed. Intertidal sediment habitats also provide food e.g. different types of fish, mussels and cockles.
Cultural and Recreational Services	Marine Mammals (D1 and D4) Fish (D1 and D4) Seabirds (D1 and D4) Intertidal sediment habitat (D1 and D6) Intertidal rocky habitat (D1 and D6) Subtidal benthic habitats (D1 and D6) Litter (D10) Organic enrichment (D8) Contamination (D8)	Marine mammals, fish and seabirds provide aesthetic pleasure to divers, tourists, nature lovers and sea anglers. Intertidal Rock, intertidal sediment and subtidal benthic habitats also provide aesthetic pleasure to divers and nature lovers. Litter in the sea and on beaches is likely to have negative impact on the cultural services that visitors benefit from when they visit these places. Similarly, increases in organic enrichment and contaminants could reduce the aesthetic value of marine waters.
Regulating services	Intertidal sediment habitats (D1 and D6) Intertidal rocky habitats (D1 and D6) Subtidal benthic habitats (D1 and D6)	These habitats provide key regulating services such as natural hazard protection, climate regulation and detoxification and purification (regulation of water quality and air quality). They also provide key

[90] Similarly invasive species are likely to indirectly impact health of final ecosystem components such as fish stocks and cause loss of native biodiversity. Such indirect impacts are captured through degradation of these components and hence are not valued to avoid double counting. However, this does not include the risk of new species of NIS having severe detrimental impacts on biodiversity, which are hard to quantify.

[91] These assessments were made by policy experts within Defra in conjunction with experts from JNCC and CEFAS.

	Pelagic habitats (D1 and D4)	supporting services such as nutrient cycling, ecological interactions and the maintenance of hydrographic conditions. A large part of nutrient cycling is carried out by pelagic habitats and plankton is the foundation of the marine food web. These habitats also play an important role in gas exchange, including regulating the amount of carbon in the atmosphere, and releasing oxygen as a product of photosynthesis.

324. On comparing the state of these ecosystem components under the BAU scenario and the achievement of GES it was found that not all the components were likely to face degradation in the absence of MSFD. Similarly, on comparing the impacts of the pressures under BAU and GES it was found that some pressures are already likely to be managed at levels equivalent to GES under the BAU scenario. For example, for contaminants and organic enrichment GES targets are predicted to be achieved under the BAU scenario, therefore it is concluded that there is no degradation as a result of these pressures. Further details of the assessment of degradation across different components and pressures are provided in the UK Impact Assessment on MSFD Good Environmental Status and related targets and indicators (to be published in December 2012) and presented in Annex B of the supplement to this cover paper[92]. Based on this assessment the final list of components and pressures relevant for valuation of the cost of degradation was reduced to the following:

- Fish
- Litter
- Seabed habitats
- Birds

325. The following section provides an assessment of the cost of degradation associated with degradation in the state of these components in the absence of GES targets, as well as costs associated with increase in litter levels in the absence of GES targets. The benefits have been assessed both quantitatively and qualitatively (where there was a lack of substantial evidence).

Cost of degradation – loss in net benefits from fish stocks not at MSY

326. Reductions in the abundance of fish stocks would lead to a decrease in provisioning services and recreational services (e.g. from activities such as sea angling and diving).

327. Some stocks are currently in good condition i.e. around MSY, however others, for example North Sea cod are in a depleted state. The BAU scenario projects that without the impetus provided by MSFD, the CFP will prevent any further significant deterioration in fish stocks, but will not deliver significant progress in achieving objectives such as the recovery of stocks to support MSY across all fisheries, or a fully-integrated ecosystem-based management approach to fisheries. Therefore GES targets have been defined to ensure that key fish stocks reach MSY. In terms of benefits this would imply higher levels of provisioning services (i.e. higher numbers of fish, shellfish and crustaceans for consumption). The costs of degradation for fisheries will be the loss of these benefits in the absence of GES targets.

[92] It should be noted that there is a significant level of uncertainty in this assessment. It is based on expert judgement, but for some ecosystem components e.g. marine mammals, there is insufficient evidence to make an assessment of degradation.

328. The net benefits to the fishing industry of achieving the GES targets are estimated at between £761.2K to £39.9m over the appraisal period[93]. The benefits are referred to as 'net benefits' as they take into account cost implications to the fishing industry for reducing fishing effort in the initial years to obtain benefits from healthier stocks in the future[94]. The benefits under this target were arrived at by looking at increases in catch levels of 9 key fish stocks from reaching Maximum Sustainable Yield levels. It has not been possible to quantify the recreational benefits from improvement in fish stocks.

329. The assessment of the loss in net benefits from 9 fish stocks not reaching MSY levels is equivalent to estimating the magnitude of net benefits arising from improvements in the abundance of fish stocks. The key scenarios, assumptions and economic approach taken to arrive at these net benefits are summarised below:

Fisheries Model Scenarios

I. A baseline scenario, which reflects a continuation of the most recent trend in the realised fishing mortality rates (Fsq) as derived from the 2011 ICES assessment (under current management plans, where these are in place) and a number of other plausible target MSY scenarios have been considered in this analysis. These MSY scenarios are linked with different levels of fishing mortality capable of producing MSY(Fmsy). For each stock, a particular fishing mortality scenario (Fmsy) has been modelled to reflect the existing view in the scientific community on the appropriate fishing mortality threshold which corresponds to fishing at Maximum Sustainable Yield (MSY)[95].

II. Targeting lower level of fishing mortality (corresponding to Fmsy) implies decreasing fishing effort in the initial years. This results in costs to the fishing industry from lower levels of landings realised. However, as the stocks improve these losses convert into benefits in the longer term. There are also other factors that also impact on the trajectory of future stock such as recruitment into the stock (i.e. the number of young fish surviving to enter the fishery), interactions between different fish stocks and effectiveness of policy on discards.

III. For Sole and Cod stocks for the North Sea and Irish Sea, the linkage between recruitment and the adult spawning stock biomass (the proportion or size of the stock which is at sexual maturity) is a major factor in determining the trajectory of future stock biomass and yield. An optimistic, high recruitment model assumes that recruitment will recover to historic levels (for example in the case of North Sea Cod, to the historic levels recorded in the 1970's and 80's[96]). A pessimistic, low recruitment model assumes that recruitment will remain at the lower levels seen in more recent years. For these stocks, both high and low recruitment scenarios have been considered in this analysis in order to reflect the current uncertainty as to the future dynamics of the stock.

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[93] Due to overlaps between MSFD and CFP an apportionment scenario of 25% benefits to MSFD has been applied to come up with these figures. Also, the benefits are presented in terms of a range of monetised values, where the value of operating profit is the lower end of the range and the value of GVA the higher end.

[94] However these 'net benefits' don't included costs of enforcement. These are assessed as a part of the UK Impact Assessment on MSFD Good Environmental Status and related targets and indicators (published in December 2012).

[95] For North Sea Cod on the other hand, the thresholds that correspond to fishing at MSY lie within a range. ICES advice states that Fmsy for the North Sea Cod is expected to lie in the range 0.16 to 0.42. ICES has suggested a target of 0.19 at the lower end of the scale, but the current agreed EU-Norway plan uses 0.4 as its target for long term exploitation. Note that both of these lie within the Fmsy range for North Sea Cod, which mean that both targets will achieve Fmsy in the long term. For further information please refer to Annex D of the UK Impact Assessment on MSFD Good Environmental Status and related targets and indicators (published December 2012).

[96] Some observers have commented that the high abundance of cod during the 1970s and 1980s was due to conditions prevalent at that time that resulted in a gadoid (cod, whiting and haddock) outburst which supported uncharacteristically high populations.

IV. North Sea Cod, Haddock and Whiting are a part of mixed fisheries, and are caught together. This is also the case for Western Channel Plaice and Sole. Due to the different biological characteristics (e.g. growth rates, natural mortality) of each of these stocks, it is not possible for each stock to achieve Fmsy individually under current exploitation patterns. So in the case of North Sea Cod, Haddock and Whiting, yield of Haddock and Whiting would have to be reduced below MSY in order to exploit Cod at MSY[97].

V. For species where discarding is included in the model, it is assumed in the baseline that discarding policies are not put in place and that fish considered as discards are thrown overboard and not sold. In the target MSY scenario, it is assumed that a discard ban becomes operational in 2018 and is 100% effective. This means that fish which would have been discarded are landed and sold from 2018 onwards.

Economic Modelling Assumptions

I. Price per tonnage for small (discards) and large fish is assumed to be constant over the time period[98]. In reality an increase in supply could result in a fall in price. Sensitivity analysis considering a 20% and 50% fall in price is provided.

II. At present, the market for undersized or discarded fish is in its infancy. Consequently, limited evidence is available as to what the market price is for undersized fish, or fish that would otherwise be discarded. For the purposes of this analysis, it has been assumed that undersized fish that would previously have been discarded are sold in the market at 1/3 of the price of larger, more valuable fish.

III. The net benefits have been assessed over 13 and 18 years (presented in table 10). CFP reform is likely to be implemented from 2013 onwards implying that the costs and benefits related to this descriptor will accrue earlier compared to other measures where the start date is 2016. As the appraisal period is 2013-2025 the 13 year benefit estimates were used to inform the overall impacts of the policy. For some stocks higher landings are realized over a much longer timeframe (over 18 years) but we have not been able to model these due to scientific uncertainty.

IV. Following the advice of the UK HM Treasury Green Book, a discount rate of 3.5% is applied to these values to calculate the present value of landings over a 13 (2013 -2025) and an 18 year period (2013 -2030)[99].

V. For most stocks, the transition to reach MSY will be delivered through the reformed CFP. However, MSFD will be a key influence on the shape and content of the reformed CFP, and provides part of the impetus behind the policy to deliver to deliver Fmsy. This implies that some of the benefits and costs of achieving lower Fmsy would be attributable to MSFD. However, as CFP is considered to be the major driver for changes in fisheries management a 75% share of the benefits and costs achieved by reaching MSY are attributed to the CFP reform. The remaining 25% of the benefits and costs of achieving Fmsy are attributed to MSFD.

[97] Further details on mixed fishery considerations for cod, haddock and whiting in the North Sea are provided in the UK Impact Assessment on MSFD Good Environmental Status and related targets and indicators (published December 2012) and are presented in Annex F of the supplement to this Cover Paper. .

[98] The values of these landings of the UK fleet are found by multiplying the amount of annual landings to the selling price of the species, using data from the MMO Monthly Statistics (MMO, March 2012) http://www.marinemanagement.org.uk/fisheries/statistics/monthly.htm

[99] HM Treasury, The Green Book: http://www.hm-treasury.gov.uk/data_greenbook_index.htm

Economic Modelling approach used

I. The annual change in landings between the baseline (status quo) and the target MSY scenario is estimated. The annual change in landings are then multiplied by the price[100] and then by UK relative stability[101] to determine the proportion of value of landings attributable to the UK fishing fleet. As per the assumptions mentioned above, the value of discards (quantity of discards multiplied by price) is added to the value of revenues from landings.

II. Revenues from landings are not an accurate measure of net economic benefits from additional fish landings. This is because the UK fleet would incur costs to catch and land these additional fish, which would not be incurred otherwise[102]. To calculate the net benefits it is necessary to deduct the value of the additional costs incurred from the revenues generated by additional landings to obtain values for the net benefits associated with increases in landings.

III. Identifying the appropriate value of costs to deduct is not straightforward. In particular, the potential presence of unemployment or underemployment in fishing communities may mean that the opportunity cost of labour may be less than the value of the wages or crew share received by fishermen, as their next best employment opportunity may be a lower-paying one. If this is the case, viewing additional crew share/ wages as a cost may exclude an element of the benefits of catching and landing additional fish. However, it is empirically difficult to estimate the extent to which crew share should be included as a benefit at this point in time. In light of this uncertainty, this analysis of cost of degradation of loss in net benefits from fish stocks not at MSY presents benefits from additional fish landings as a range of values. The lower end of the range is taken to be the value of operating profits, which is defined as total income minus operating costs. The upper end of the range is taken to be the value of Gross Value Added (GVA), which is defined as operating profits plus wages / crew share[103]. If a particular fish stock has recruitment scenarios available, the lower end of the range is taken to be the value of operating profits at low recruitment, while the upper end of the range is taken to be the value of GVA at high recruitment. This was done to reflect the uncertainty of the size of the fish stock and its impacts on the net benefits that are actually realised. For purposes of determining a 'best estimate', the midpoint in this range is used[104].

IV. The operating profit and GVA estimates are then scaled down to 25% to arrive at net benefits attributable to MSFD alone. Table 2.8 applies the low and high recruitment scenarios (if recruitment scenarios are available), assumptions and methodology described above to arrive at the expected range of benefits of harvesting at Fmsy.

[100] The values of these landings of the UK fleet are found by multiplying the amount of annual landings to the selling price of the species, using data from the MMO Monthly Statistics (MMO, March 2012) http://www.marinemanagement.org.uk/fisheries/statistics/monthly.htm.

[101] Scientists estimate how much of a stock may be caught and landed and the relative stability indicates the percentage of that catch attributable to each Member State.

[102] Fishing vessels incur a range of operating costs which are often split into two groups: fishing costs and vessel costs. Fishing costs include fuel and oil, boxes, ice, food and stores, sales commission, harbour dues, subscriptions and levies, shore labour, travel costs, quota leasing, days at sea purchase and crew share (wages). Fishing costs vary depending on the amount of vessel activity and the value and volume of landings. **Vessel costs** comprise gear and vessel repairs, insurance, administration, and the purchase, hire and maintenance of electronic equipment. Many vessel costs are fixed, costs are fixed, regardless of level of vessel activity during the year.

[103] Information on crew share, operating profits and total income of the UK fishing fleet was taken from Seafish's Economic Survey of the UK Fishing Fleet 2006 to 2009 surveys. This information was then categorised according to broad gear types since different species are caught by different gear types. The GVA and operating profits estimates account for 40-59% and 11-43% of landings value estimates respectively across the gear types.

[104] Further details on the methodology employed to calculate operating profit and GVA are provided in the UK Impact Assessment on MSFD Good Environmental Status and related targets and indicators (published December 2012) and made available in Annex C of the supplement to this Cover Paper.

Table 2.8. Net Benefits and range of potential landing that would be foregone if fish stocks fail to reach MSY[a]

Fish Stock	Fishing Mortality[b]	UK Relative Stability [c]	Price per tonne [d]	Range of present value of net benefits (and range of potential landings tonnage, including discards) [e]	
				13 Years	18 years
North Sea Cod (ICES area IV) North Sea Haddock (ICES area IV) North Sea Whiting (ICES area IV)	Baseline: Fsq = 0.68 Target: Fmsy= 0.4 Baseline: Fsq = 0.23 Target: 10% annual reduction in fishing mortality until Fmsy for Cod is reached Baseline: Fsq= 0.27 Target: 10% annual reduction in fishing mortality until Fmsy for Cod is reached	0.32 [a] 0.565 0.34	Landings £1,800; Discards£600 Landings: £1063; Discards: £354 Landings: £1042; Discards: £347	£817.4K to £37.1m 251.1K to 1.5m tonnes)	£1.7m to £49.3m (426.4K to 2.1m tonnes)
Irish Sea Cod (ICES area VIIa)	Baseline: Fsq= 0.61 Target: 25% reduction in fishing mortality until Fmsy=0.4 is achieved	0.43	Landings: £1800	£27.5K to £3m 1.8K to 56.1K tonnes)	£47.8K to £4.8m (3.2K to 95.3K tonnes)
Irish Sea Sole (ICES area VIIa	Baseline: Fsq= 0.31 Target: 10% annual reduction in fishing mortality until Fmsy (0.16) is achieved	0.22	Landings: £8980	-£11K to -£27.6K (-33.8 to -152 tonnes)	-£3K to £84K (49 to 930 tonnes)
Western Channel Plaice (ICES area VIIe) Western Channel Sole (ICES area VIIe)	Baseline: Fsq= 0.45 Target: 10% annual reduction in fishing mortality until Fmsy (0.19) is achieved Baseline: Fsq= 0.247 Target: 10% annual reduction in fishing mortality until Fmsy for Plaice is achieved	0.29 0.59	Landings: £1007 Landings: £8980	-£163.4Kto -£470K[f] (-3.7K tonnes)	-£169K to -£486K[f] (-3.5K tonnes)
North Sea Sole (ICES area IV)	Baseline: Fsq= 0.34 Target: 10% annual reduction in fishing mortality until Fmsy (0.22) is achieved	0.04 [a]	Landings: £8980	-£57K to -£290K[f] (-3.3K to -7K tonnes)	-£23K to -£78K[f] (3.1K to 9.8K tonnes)
West of	According to	0.78 [a]	Discards:	£148K to	£208K to

Fish Stock	Fishing Mortality[b]	UK Relative Stability [c]	Price per tonne [d]	Range of present value of net benefits (and range of potential landings tonnage, including discards) [e]	
				13 Years	18 years
Scotland Haddock (ICES area VIa)	experts this stock is effective at its target in the baseline. However discards are landed under the policy scenario due to the ban		£354	£493K (25.5K tonnes)	£696K (38.5K tonnes)
TOTAL[g]				£761.2K to £39.9m 271.3K to 1.5m tonnes)	£1.7m to £54.4m (474.3K to 2.3m tonnes)

Notes:
[a] The estimated wide range of net benefits for each stock is explained by the wide recruitment scenarios for certain stocks. In addition the low estimate represents economic benefits in terms of operating profit while the higher estimate expresses them in terms of GVA.
[b] Fishing mortality is the level of stock mortality generated by fishing activity.
[c]These are based on 2011 shares. The relative stability relating to North Sea cod, haddock and whiting are not the overall UK share of all of the Cod TACs, but UK share of IV as a proportion of the overall stock yields.
[d] Fixed price is assumed over the whole time period for analysis. For landings, price is taken from MMO, 2012, Monthly Return of Sea Fisheries Statistics for England, Wales, Scotland and Northern Ireland, March; Table 1a. For discards, it is assumed that price is 1/3 of the value of the price for full-sized fish landings since discards are smaller, less valuable fish. This information is taken as anecdotal evidence from a Cefas fisheries liaison officer (based on experience of working at fish auction markets).
[e] The figures presented as a range are only applicable to species that have recruitment scenarios.
[f] The negative values reflect that while there is a long term benefits from increase in landings in the future, these are outweighed by the losses in the initial period (due to restriction in fishing efforts). This is mainly because the benefits in the future are discounted (i.e. the value of £1 a few years from now is less than the value of £1 today).
[g] Total values may not match due to rounding errors

Sensitivity analysis

Change in prices

330. A sensitivity analysis was carried out for North Sea Cod based on the assumptions outlined under economic modelling (see Table 2.9). This considered a scenario of a 20% and a 50% fall in price of landings (following a rise in fish stocks) and assessed the impact this would have on net benefits. This analysis was applied to North Sea Cod only, because achieving the target fishing mortality under the central scenario (Fmsy= 0.4) results in a significant increase of landings, and this increase may be large enough to drive down the price of North Sea Cod[105]. It is assumed that the decrease in the price of landings starts in 2017 since this is the year where the most significant increase in landings starts. To simplify the analysis, it is also assumed that this new price stays constant afterwards.

Table 2.9: Sensitivity analysis under different apportionment scenarios

Fishing mortality scenario for North Sea Cod	Price (per tonne) scenario	Range of net present value benefits for Cod	
		13 years	18 years

[105] For North Sea Cod, the increase in landings is in the magnitude of tens of thousands of tonnes, while for the other stocks, the magnitude of increase is only tens or hundreds of tonnes

Baseline: Fsq= 0.68 Target: Fmsy= 0.4	Original price: Landings: £1800 Discards: £600	£1.9m to £41m	£2.9m to £53.5 m
	20% decrease from original price: Landings: £1440 Discards: £480	£1.5m to £32.8m	£2.3m to £43m
	50% decrease from original price: Landings: £900 Discards: £300	£989.1K to £20.5m	£1.5m to £26.8m
Total net present value benefit of all landings			
		13 years	18 years
20% decrease in price of North Sea Cod		£365.5K to £31.7m	£1.15m to £43.6m
50% decrease in price of North Sea Cod		-£228K to £19.3m	£268.5K to £27.6m

331. A 20% reduction in price would imply overall net benefits of £365.5K to £31.7m over 13 years, while a 50% reduction in price would imply benefits of -£288K to £19.3m over 13 years. Both these figures show that a decline in prices (due to increased supply of fish) can possibly result in negative net benefits. However, the best estimate of net benefits is still positive even if we account for a fall in price[106].

Cost of degradation – Increase in litter levels under the BAU scenario

332. Marine litter directly and indirectly affects ecosystem services and the benefits we enjoy from the marine environment. Marine litter can cause impacts to marine animals through entanglement or ingestion, smothering of seabed, damage propellers of boats, and can be an eye sore for tourists visiting beaches or taking boat trips. This in turn could result in economic costs and losses to coastal communities (tax payers), individuals, fishermen, farmers, ports and marinas and others.

333. Evaluation of the BAU scenario and GES show clear evidence that in the absence of GES targets and the measures needed to achieve them there is likely to be degradation in marine environment quality status as a result of marine litter. These aspects of degradation have been listed below

334. Both the direct and indirect costs of litter are discussed further below. However, as mentioned at the start of this chapter, for valuation purposes (and to prevent double counting) only the direct costs of litter have been assessed. Direct and indirect impacts of litter include:

335. Degradation caused by increasing levels of litter in coastal areas – The BAU study predicts that there is likely to be an increased accumulation of litter in coastal areas. Accumulation of litter on beaches will lead to a reduction in aesthetic, recreational and cultural services provided by these beaches to tourists and the local community (and consequently negatively impacting their welfare).

336. Degradation caused by litter items floating in the marine waters - The BAU study predicts that there is likely to be a continuing problem with litter in the water column. This could result in negative impacts on boats and other vessels through damage to propellers. There are also likely to be impacts of litter on other marine activities such as aquaculture.

[106] Further sensitivity using alternative Fmsy scenarios (considered less plausible compared to the central scenario) are presented in the UK Impact Assessment on MSFD Good Environmental Status and related targets and indicators (published December 2012) and are made available in Annex E of the supplement to this Cover Paper.

337. Degradation caused by the indirect effects of litter on sediment habitats and marine mammals - The BAU study predicts that litter will continue to affect subtidal and intertidal benthic habitats and floating litter items are also likely to affect marine mammals, turtles and fish populations through entanglement and ingestion. These indirect impacts are not valued here as they should be captured in the assessment of degradation for marine mammals, fish and benthic habitats.

Cost of degradation from increase in litter items on beaches

338. Litter on beaches can negatively affect people's experiences through reduced recreational opportunities, loss of aesthetic value and loss of non-use values. There are two types of benefit arising from cleaner beaches – use benefits and non-use benefits. Use benefits are benefits that are directly enjoyed by beach users e.g. relaxation, walking. Non use benefits are benefits enjoyed by people who do not directly use beaches but are keen on maintaining their value so that they can be used by others (altruistic), future generations (bequest), or simply the benefit derived from knowing clean beaches exist (existence value). As many of the benefits associated with cleaner beaches are not traded in the market, alternative valuation techniques have to be used which take into account both use and non-use values, for example, willingness to pay techniques[107].

339. A willingness to pay study by Susana Mourato et al[108] estimated £2.3bn in benefits to Wales and England from avoidance of dog mess and litter on beaches over 25 years. The study used choice experiment methods to evaluate how much individuals are willing to pay for absence of litter (compared to current levels). Using the average 2002 WTP estimate of £6 (per year per household) these benefits are estimated to be £1.72 billion over 10 years[109] for the whole of UK.

340. Given that the estimates above relate to what people were willing to pay for complete removal of litter from the beaches this is an over-estimate of the benefits of achieving GES in relation to litter, which only requires a reduction in litter levels. However, this does provide evidence that individuals prefer to have lower litter levels and hence there will be degradation costs to society in the absence of measures to achieve the proposed GES targets.

Damaging Impacts of litter on fishing vessels

341. Commercial fisheries could be also affected by marine litter and the damage caused could be significant enough to affect overall profitability of a vessel. For instance, fishing gear damaged or lost as a result of marine litter will need to be replaced or repaired, which can also result in costs due to loss of time at sea. The increased levels of marine litter predicted under the BAU study would increase the cost of these impacts, resulting in financial losses to the industry.

342. This analysis of cost of degradation investigates direct costs associated with marine litter across all UK sea fisheries. KIMO International has developed a questionnaire to investigate how marine litter affects fishing vessels in Scotland. Fishermen were asked to provide values based on the direct economic impacts of marine litter on their vessels including the value of dumped catch, the costs of repairs to fishing gear, the cost of fouling incidents and lost earnings as a result of

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[107] Willingness to pay (WTP) is the maximum amount a person would be willing to pay, sacrifice or exchange in order to receive a good or to avoid something undesired, such as pollution.

[108] CSERGE Working Paper ECM 03-12, Bathing water directive revisions, what are the benefits to England and Wales (a stated preference study), Susana Mourato, Stavros Georgiou, Ece Ozdemiroglu, Jodi Newcombe and Alexandra Howarth

[109] The WTP has been converted to 2010 prices using the GDP deflator. The number of households were based on: http://www.communities.gov.uk/housing/housingresearch/housingstatistics/housingstatisticsby/householdestimates/livetables-households/

reduced fishing time[110]. For the purposes of this analysis it has been assumed that the average costs of marine litter identified in this report apply to the whole UK fishing fleet, rather than just Scottish vessels[111].

343. The total costs of marine litter related incidents for UK fisheries are estimated using the average costs of marine litter per vessel in the Scottish fleet[112]. Costs to the UK fishing fleet associated with litter incidents that involve dumping catch, repairing fishing gear and lost earnings as a result of reduced fishing time due to clearing litter from the nets are estimated at between £29.75m to £33.14m per annum. Costs to the UK fishing fleet associated with litter incidents that involve fouling (e.g. of propellers) are estimated at between £763,111 and £770,282 per annum. These estimates should be treated with caution[113].

344. The estimated total costs to the UK fishing industry of the impacts of marine litter in the water column and on the seabed is between £30.5 million to £33.9 million per annum. This is equivalent to 5% reduction (approximately) in the total revenues that are generated by the UK fleet in comparison to 2009 UK vessels landed value. If the damage costs are assumed to remain the same over the future years[114] and GES targets are assumed to reduce the severity of damage caused by reducing damage costs by 2-5% (from the baseline), then this would result in benefits (in terms of damage costs avoided) to the fishing industry of £4.3m to £10.7m over the appraisal period[115].

345. The analysis above indicates that measures to reduce marine sources of litter will bring benefits to the fishing industry and other marine users in terms of reducing the severity of damage to vessels caused by litter. The benefits to the fishing industry of reducing marine litter related incidents have been estimated at £4.3m to £10.7m over 10 years.

Benefits - improvements to seabed habitats under GES

Subtidal benthic habitats, intertidal rocky habitats and intertidal sediment habitats

346. Subtidal benthic habitats, intertidal rocky habitats and intertidal sediment habitats provide key regulating services (such as climate regulation, regulation of water and air quality, hazard

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[110] Fishermen were asked to provide the costs of marine litter per year. 22 vessels have responded and out of which only 4 vessels reported that they had not experienced incidents with marine debris in the last year. The 18 vessels have experienced incidents with marine litter and, therefore they were able to provide their cost associated with marine litter. The KIMO report also states that on average each vessel participating in the project experienced just less than one incident per year involving marine litter.

[111] This is because there are no other studies that can be used to elicit information about the costs of marine litter incurred by other parts of the UK fleet.

[112] KIMO estimates are converted using the following exchange rate Euro1 = 0.8685 GBD.

[113] Average costs of litter related incidents have been disaggregated into two categories is due to the different economic costs of marine litter impacts associated with different fishing methods:

- Incidents due to dumped catch, repairs to fishing gears and reduced fishing time due to clearing nets are mainly applicable to those fisheries that have contact with the seabed. The total cost of these kind of incidents has been estimated based on the average costs per vessel for this category of incident and the number of active UK vessels that use seafloor fishing gear. It is assumed that each vessel in the affected category has one litter 'incident' of this sort each year. This simplifying assumption is made as a result of a lack of robust data as to the frequency and prevalence of incidents of this sort.

- Incidents due to fouling are more likely to be due to litter in the water column and can therefore affect any type of vessel. The total costs to the UK fleet of these kind of incidents has been estimated based on the average cost per vessel for this category of incident and the number of active UK fishing vessels. It is assumed that each vessel in the affected category has one litter 'incident' of this sort each year. This simplifying assumption is made as a result of a lack of robust data as to the frequency and prevalence of incidents of this sort.

[114] We assume increase in litter causes a proportional increase in damage costs to vessels (i.e. a 5% increase in litter results in a 5% increase in damage costs). There is not information on litter trends of marine litter floating in the sea so we used a proxy of litter trends on beaches. The 5% increase was arrived at looking at the average beach litter trends over the last 5 years (Marine Conservation Society Beachwatch report 2010).

[115] These estimates need to be interpreted cautiously due to lack of representation of original sample data and the probability of incidence with marine litter across the UK fleet. At this stage, these estimates are based on best available evidence and some broad assumptions (that have been highlighted above).

protection (e.g. protection from floods) and regulation of disease and pests), provisioning services (such as food and medicine from seaweed) and recreational services (e.g. to divers).

347. On comparing the BAU scenario and the achievement of GES targets, it is clear that there is likely to be degradation of seabed habitats in the absence of MSFD. However, it is difficult, given the existing evidence base, to determine the impact of this degradation in terms of changes to regulating, provisioning and recreational services, other than to conclude that it would reduce the capacity of seabed habitats to provide those services. Further analysis will need to be carried out in future to understand the cost of degradation associated with this ecosystem component.

348. The Department for Environment, Food and Rural Affairs is in the process of commissioning an 18 month project that will look at changes in ecosystem services from marginal changes in the state of seafloor habitats. The work will help inform any future cost benefit analysis of measures for seafloor habitats.

349. Table 2.10[116] below lists the specific ecosystem processes and services provided by seafloor habitats which are likely to improve in status as a direct result of the GES (note that other habitats are also likely to improve, but these improvements are attributed to other drivers such as the Habitats Directive, the Water Framework Directive etc):

Table 2.10: Ecosystem processes and services provided by seafloor habitats that can be expected to be improved under GES targets

Type of sediment habitat	Ecosystem Process	Ecosystem Service
Shallow/ Shelf sublittoral coarse sediment	The beneficial ecosystem processes identified were primary and secondary production, larval/gamete supply, food web dynamics, formation of species habitat, species diversification, erosion control and biogeochemical cycling.	The beneficial ecosystem services identified were fisheries, environmental resilience, and regulation of pollution
Shallow/ Shelf sublittoral sand		
Shallow/ Shelf sublittoral mud		
Shallow/ Shelf sublittoral mixed sediments		

Benefits - Increase in aesthetic services from abundance of birds

350. Seabirds provide direct cultural and aesthetic services to tourists, as well as providing key supporting services to help maintain vital marine ecosystems. A comparison of BAU scenario with the achievement of GES targets suggests that some degradation of seabird populations will occur in the absence of measures to achieve GES. In particular, it is considered that the GES targets for birds would allow for an increased resilience of seabird populations to climate change impacts than would be the case under the BAU scenario.

351. An RSPB study[117] estimates that in 2009, there were more than 142,000 visitors to the four RSPB sites that have the most significant population of seabirds[118]. The total expenditure for such visits was estimated to be £5m- £10m. This would imply cultural and aesthetic benefits from

[116] UK Impact Assessment on MSFD Good Environmental Status and related targets and indicators (published December 2012) .

[117] RSPB, (2010), The Local Value of Seabirds: Estimating spending by visitors to RSPB coastal reserves and associated local economic impact attributable to seabirds, The RSPB, Sandy, UK, accessed online http://www.rspb.org.uk/Images/seabirds_tcm9-262584.pdf on 23 June 2011

[118] Estimate was made using the information on the number of visitors in the RSPB Reserves of - Bempton Cliffs, South Stack Cliffs, Mull of Galloway and Rathlin Island.

seabirds in the range of £51m - £102m over 10 years[119]. This valuation is an under-estimate as it only looks at expenditure in four bird reserves and it fails to take into account the value people place on conserving bird colonies for future generations, or the value people derive from knowing that healthy bird populations exist.

352. It has not been possible to assess the degradation in cultural and aesthetic services that would result from not taking measures to achieve the proposed GES targets for birds, but the estimates above show the significant benefits that are associated with healthy bird colonies. Further analysis will need to be carried out in future to understand the cost of degradation associated with this ecosystem component[120].

Conclusions on costs of degradation

353. This section provides an assessment of the costs associated with the degradation in the state of components of the marine environment that can be expected in the absence of GES targets. The assessment uses an ecosystem service approach to understand impacts on human welfare arising from the changes in the levels of ecosystem services that can be expected in the absence of GES targets. Cost of degradation was identified in terms of reductions in provisioning services (from fish stocks not reaching MSY), in cultural and recreational services (from lower fish stocks, increasing litter levels and degradation of bird populations) and in regulating services (from degradation of seabed habitats).

354. The total quantified cost of degradation is estimated to be £5m to £50.6m[121]. These however represent a small portion of benefits forgone as it has not been possible to quantify:

355. Cultural and recreational benefits forgone from key fish stocks not reaching MSY (implying loss of potential benefits to sea anglers and divers), increase in litter levels (implying negative impact to beach walkers), continued deterioration of seafloor habitats (implying negative impact on experience derived by divers) and no improvement in abundance of sea birds (implying loss of potential benefit to bird watchers).

356. Benefits forgone from no improvement in education and knowledge of the public, industry and government administration (regarding various marine species and habitats) in the absence of MSFD from various awareness raising campaigns, monitoring programmes and research projects.

357. Non-use benefits from knowing that rare, threatened and representative marine species, habitats and features of geological or geomorphological interest are being protected. These benefits include the benefit to themselves (existence value), as well as the benefit that they gain from knowing that species and habitats are being conserved for others in the current generation (altruistic value) or future generations (bequest value)

358. Reductions in these services and benefits (both quantified and unquantified) are likely to have impacts on the welfare of both users and non-users of the marine environment. For example, a reduction in provisioning services will affect the fishing industry (direct consumptive users), while reductions in cultural and recreational services are likely to impact tourists such as beach visitors (direct non consumptive users). Likewise, reductions in recreational and cultural services resulting from the degradation of seabird populations are likely to reduce the welfare of non-users who

[119] The average expenditures are inflated to 2010 prices using GDP deflator figures.

[120] It could be assumed that for areas where the bird population is quite depleted measures to increase abundance would result in higher marginal increase in benefits compared to areas where there is significant abundance of birds.

[121] These estimates do not include the costs of measures required to be taken under MSFD to achieve these benefits. The costs of measures are presented in the UK Impact Assessment on MSFD Good Environmental Status (published in December 2012).

derive benefits from the knowledge that the bird populations are maintained and kept in good condition. It is important to understand the impacts across all groups of users and non-users of the marine environment. The cost of degradation assessment has used a qualitative description of the impacts of degradation when it has not been possible to assess impacts quantitatively due to the lack of data. We are working towards improving our capacity to provide quantitative assessments of costs of degradation for future MSFD assessments.

Section 3 – GES characteristics and targets and indicators

3.1 Introduction

359. This section sets out the UK characteristics of Good Environmental Status (GES) and associated targets and indicators for each of the GES Descriptor. It should be noted however that many targets will contribute to several descriptors; an effort to draw out these links can be found at the end of this Section.

360. Characteristics and targets for Descriptors 1 (biodiversity), 4 (food webs) and 6 (sea-floor integrity) are set out first and are dealt with together in one sub-section due to the significant degree of overlap between them. The targets for these Descriptors are the most complex to describe due to their wide coverage. The overall approach to setting GES targets and indicators for these Descriptors is set out first, followed by separate sections setting out the targets for species (mammals, fish and birds), and the targets for habitats (pelagic habitats, sediment habitats and rock & biogenic reef habitats).

361. There are then separate sub-sections setting out the characteristics and targets for Descriptors 2 (non-indigenous species), 3 (commercial fish), 5 (eutrophication), 7 (hydrographical conditions), 8 (contaminants), 9 (contaminants in seafood), 10 (litter) and 11 (noise). For each Descriptor the information is arranged in the following format:

- Background
- Summary of current status from Initial Assessment
- GES characteristics and associated targets and indicators – in tabular format.
- Approach to setting GES targets
- Implications of the targets
- Key gaps and development needs

362. Further details on the approach to setting targets for each of the Descriptors can be found in the **Cefas CBA Report 2011, Part 3**[122]. Further details and cost implications can be found in the **MSFD Impact Assessment, Part 2, Section 4**[123].

3.2 Biodiversity - Descriptor 1 (biodiversity), Descriptor 4 (food webs), Descriptor 6 (sea-floor integrity)

363. MSFD Descriptor 1: Biological Diversity is maintained – the quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.

364. MSFD Descriptor 4: All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of those species and the retention of their full reproductive capacity.

365. MSFD Descriptor 6: Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems in particular are not adversely affected.

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122 http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16817&FromSearch=Y&Publisher=1&SearchText=ME5405&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

123 www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

Background

366. Descriptor 1: This Descriptor has a very broad biological and geographical scope. To achieve GES a multi species and multi habitat approach will be needed, together with a robust assessment of human pressures (and impacts) on these components. Most activities in the marine environment affects biodiversity in some way, and achieving GES in the other Descriptors will ultimately help achieve GES for this Descriptor.

367. Descriptor 4: A properly functioning marine food web is crucial to the overall health of the marine ecosystem. This Descriptor is intended to cover the functional aspects of marine food webs (particularly energy transfer) and levels of productivity. There is not currently enough known about energy transfer between trophic levels[124] and species interaction to meaningfully cover these within the targets for this Descriptor. In the medium term a pragmatic approach is proposed, which focuses on the abundance, distribution and productivity of key species and trophic groups[125] within the food web. This means there is significant overlap with Descriptor 1.

368. Descriptor 6: This Descriptor is intended to ensure that human pressures on the seabed do not hinder the ecosystem components from retaining their natural diversity, productivity and dynamic ecological processes. The seabed and associated benthic habitats[126] underpin key elements of the marine ecosystem, supporting both primary and secondary production. Human pressures are known to reduce the diversity of benthic communities. One of the most significant single activities contributing to the pressure on sea-floor habitats is bottom towed fishing gear. There is significant overlap between this and Descriptor 1.

369. The characteristics of GES for these Descriptors are very high-level and we have aimed to ensure consistency with existing legislative commitments and the level of ambition set out in the Natural Environment White Paper, the England Biodiversity Strategy and relevant commitments in the Devolved Administrations.

Summary of current status from Initial Assessment

370. Current status of the UK's marine biodiversity is described in the initial assessment.

UK Characteristics of GES for Descriptors 1, 4 and 6

Table 3.1 – Characteristics for descriptors 1, 4 and 6	
Characteristics of GES for Descriptor 1 (biodiversity)	The UK characteristics of GES for this Descriptor are as follows: At the scale of the MSFD sub-regions, and in line with prevailing conditions[127], the loss of biodiversity[128] has been halted[129] and. where practicable, restoration is underway: The abundance, distribution, extent and condition of species and habitats in UK waters are in line with prevailing environmental

[124] The **trophic level** is the position that an organism occupies in a food chain - what it eats, and what eats it.
[125] Trophic group refers to a category of organisms within a trophic structure, defined according to their mode of feeding (e.g. primary producers).
[126] Benthic habitats are those on the seafloor. It is a generic term that refers to both rocky and sedimentary seafloor habitats.
[127] Prevailing conditions are defined as "in accordance with the intrinsic physiographic and climatic conditions of the different geographic regions". Prevailing conditions are understood to include climatic changes caused by human induced climate change. Prevailing conditions (including climatic changes) will need to be monitored in order for a full assessment of progress towards GES to be carried out and targets will need to be revised if prevailing conditions change in such a way as to make them no longer relevant or achievable.
[128] According to the Convention on Biological Diversity (CBD), biodiversity is defined as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems".
[129] This is in line with the updated CBD Target 12 "By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained."

	conditions as defined by specific targets for species and habitats. Marine ecosystems and their constituent species and habitats are not significantly impacted by human activities such that the specific structures and functions for their long-term maintenance exist for the foreseeable future. Habitats and species identified as requiring protection under existing national or international agreements are conserved effectively through appropriate national or regional[130] mechanisms.
Characteristics of GES for Descriptor 4 (food webs)	The UK characteristics of GES for this Descriptor are as follows: At the level of the MSFD sub-regions, populations of key species groups within the food web have an age and size structure indicative of sustainable populations and occur at levels that ensure the long-term sustainability of the marine ecosystem of which they are part, in line with prevailing conditions, as defined by specific targets for species and pelagic habitats. There should be no significant adverse change in the function of different trophic levels in marine food webs as a result of human activities, including as a result of by-catch and discards.
Characteristics of GES for Descriptor 6 (sea-floor integrity)	The UK characteristics of GES for this Descriptor are as follows: Sea-floor habitats (physically and structurally) are both productive and sufficiently extensive at the level of the MSFD sub-regions, to carry out natural functionality, including the necessary ecological processes[131] which underpin ecosystem goods and services[132], and are capable of supporting a healthy and sustainable ecosystem for the long term.

Approach to setting GES targets for Descriptors 1, 4 and 6

371. The GES targets and indicators for these Descriptors have been developed on the basis of advice from experts in the UK Marine Monitoring and Assessment Strategy (UKMMAS) Healthy and Biologically Diverse Seas Evidence Group, facilitated by the Joint Nature and Conservation Committee (JNCC)[133]. The targets and indicators have been organised according to six ecosystem components: three species groups (fish, birds, marine mammals), and three habitats groups (pelagic habitats, sediment habitats, rock and biogenic reef habitats), rather than Descriptor by Descriptor. This reflects the fact that there is significant overlap between the three Descriptors, and tacking the targets in this way has allowed experts to use many of the same targets and indicators across the Descriptors, minimising duplication.

372. Experts have also developed a range of more detailed indicators, following the indicators in the Commission Decision document, which underpin the targets and explain how they would be assessed – these are set out in Annex A. Some of these indicators are already being used as part of existing monitoring programmes and are already operational, others require further development in order to make them operational for 2014, and some will not be operational until 2018. The UKMMAS Healthy and Biologically Diverse Seas Evidence Group has an on-going programme of work to develop and operationalise these indicators.

[130] The term 'regional' refers to the scale of the regions and subregions in the Directive e.g. the Greater North Sea, The Celtic Seas.

[131] For example, cycling of carbon and nutrients.

[132] For example, food security and climate regulation.

[133] This advice is included in the Cefas CBA Report 2012, Section 3.

373. The approach to setting targets for these Descriptors has been coordinated with other Member States across OSPAR. We have high confidence that other OSPAR countries will follow the same broad approach as the UK, although further work will be needed between now and 2018 to improve coordination, with the aim of developing a common set of biodiversity indicators across OSPAR.

Approach to setting GES targets – Species

374. The Initial Assessment gives a mixed picture of the current status of marine birds, fish and mammals – for more information see Section 2.

375. GES targets and indicators have been developed for mammals, fish and birds covering Descriptor 1 (biodiversity) and Descriptor 4 (food webs). These include targets and indicators for species distribution, population size and condition, as well as the productivity of key species/trophic groups and the abundance/distribution of key trophic groups. No species targets have been proposed for Descriptor 6 (sea-floor integrity) as the approach to setting targets for this Descriptor focuses on sea-floor habitats and their associated species (see the section on habitats targets below). The approach to setting targets for these different species groups is set out in more detail in the Cefas CBA Report 2012[134]. Existing targets have been used wherever suitable (e.g. from the Habitats Directive and OSPAR) and the proposals have been based as far as possible around existing indicators and monitoring programmes.

Marine Mammals:

376. For marine mammals the targets are all based on existing commitments under the Habitats Directive, which covers all marine mammal species. They aim to ensure that marine mammal distribution is not significantly affected by human activities and that their abundance is not decreasing as a result of human activities, using baselines consistent with those used for the Habitats Directive. Specific targets have also been developed for the condition of marine mammals, looking at species productivity and the impacts from key pressures, such as by-catch.

377. Separate targets have been developed for seals and cetaceans reflecting the fact that the life histories of these two groups are very different. Most of the targets and indicators for cetaceans will not be operational in 2014 because further work needs to be completed to enable the definition of baselines and trends. These targets and indicators will be developed as soon as possible after 2014, covering all those cetacean species for which there is sufficient data to enable estimates of abundance and trends over time.

378. The baselines for the marine mammal targets will be consistent with those used for the Habitats Directive (i.e. 1992 or the closest best estimate). Experts from across the North East Atlantic have acknowledged that 'although the most robust way to set baselines for marine mammals is based on historical data, these are not available at the appropriate spatial and temporal scale. Moreover, the historical abundance of many cetacean species (i.e. pre-commercial hunting) is unknown and cannot realistically be restored (where it is known to have declined) as today's marine environment is very different.[135]'

Birds:

379. For birds, targets have been developed for bird population distribution and abundance, and for the condition of bird species. The targets for condition look at species productivity and impacts

[134] Cefas CBA Report 2012, Section 3.

[135] ICG-COBAM advice manual – need to find exact reference.

from key pressures. The targets for distribution and abundance are based on work carried out in OSPAR to develop an ecological quality objective for birds and aim to ensure that bird distribution and abundance are not significantly impacted by human activities. These targets are based on indicators covering bird species whose sub-regional populations rely on the marine environment and are therefore likely to be affected by the impacts of human activities in the marine environment. In order for GES to be achieved 70% of species are required to meet their individual indicator thresholds. Bird abundance and distribution can be affected by a range of factors, both natural (e.g. climate change and changes in prey distribution) and human related, so it is considered consistent with GES that some species may decline within UK waters. However, it is acknowledged that continual declines that are caused by human activity are not consistent with GES and follow-up action will be taken for any species which is consistently missing its individual thresholds to try to establish the cause, leading to management measures where appropriate.

380. For birds, good data is available and the baselines for the targets will be set individually for each species indicator, based on historic data (usually the highest known population size during the available time series of the last 40 years), and species thresholds will be set as a deviation from this, promoting recovery where this is required.

381. At this stage it has not been possible to develop indicators for seabirds at sea and inshore waterbirds due to lack of robust, reliable and representative data from monitoring of these species. Work is underway to develop monitoring schemes for these species with the aim of including MSFD indicators in 2018. For the target related to breeding success, which currently only covers kittiwakes, work is already being carried out by the British Trust for Ornithology to look at whether indicators could be developed for other species, such as guillemot, that depend on the availability of small shoaling fish.

Fish:

382. For fish, there are few targets in existing legislation which are suitable as indicators of fish biodiversity. For this reason most of the GES targets developed for fish are new. Targets have been developed in relation to fish abundance and distribution, and also in relation to the overall health of the fish community.

383. Targets for fish abundance and distribution: These targets aim to ensure that the distribution and abundance of sensitive fish species is not significantly impacted by human activities and require a statistically significant proportion of sensitive fish species to be meeting targets for recovery. Fish species may decline for a number of reasons, both natural and due to pressures from human activities and these targets explicitly acknowledge that long-term declines in some fish species may be consistent with the achievement of GES. However, it is acknowledged that continual declines that are caused by human activity are not consistent with GES and follow-up action will be taken for any species which are consistently missing their individual indicator thresholds to try to establish the cause, leading to management measures where appropriate. The Government and DAs are already taking a proactive approach to the management of key sensitive species, such as elasmobranches, and will continue to do so.

384. These targets apply to suites of sensitive fish species, including both commercially targeted and non-targeted species. Sensitive species are those which are least able to withstand additional mortality, and tend to be slow growing, large bodied species with low rates of reproduction. The species to be included in the assessment for these targets are chosen by identifying the 33% most sensitive species caught in existing research surveys and then excluding any for which data is too poor to allow robust statistical analysis (e.g. because they are so rare that they are not routinely

caught in research surveys)[136]. As the available data do not go back to periods when human activity was minimal, baselines will be set as the average value for each species throughout the entire time period.

385. Whilst it is acknowledged that setting the targets in this way means that the rarest species (e.g. angel shark) will be excluded from the assessment of GES, it is not considered possible to set appropriate, technically defined indicators and targets for these species due to the lack of survey data to support assessments. The way in which the targets have been set ensures that a representative suite of sensitive species are assessed and they give an indication of the overall status of sensitive species. Dealing with these particularly rare and vulnerable species will continue to happen on a case by case basis in line with the Government and Devolved Administrations existing commitments to protecting vulnerable species.

386. It is also acknowledged that these targets will not cover coastal, deep-sea or pelagic fish species. Although the methodology can be applied to these groups of species, there is currently limited data availability. Data sets have been identified that cover deep water and coastal fish species, but they still do not provide comprehensive coverage of all areas and further work is needed to consider how these could be used for the purposes of MSFD assessment.

Targets for fish community length:

387. These targets and associated indicators aim to assess the overall health of the fish community and are based on indicators developed within OSPAR for the North Sea.

388. The targets look at the size structure of the fish community as a whole and measure the relative proportion (by weight) of large fish to small fish observed in a survey. The assessment covers most fish species caught by bottom trawl research surveys, including both commercial and non-commercial species[137]. Nonetheless, these targets do require interpretation in order to draw reliable conclusions and inform management decisions (e.g. to determine whether change is happening due to increases in small fish or decreases in large fish).

389. The baselines for these targets vary depending on the area being assessed and represent a time when the exploitation of the fish communities in that region was generally deemed to be at sustainable levels (for example the baseline for the North Sea is the early 1980s and the baseline for the Celtic Seas are the late 1980s). No data are available to allow the development of baselines equivalent to periods when human activity was minimal.

Implications of the targets – Species

390. There are numerous measures already in place, or planned under existing commitments, which are expected to reduce the pressures on species and support the achievement of the targets for species. These include: measures required under the Birds and Habitats Directives; management measures for the UK MPA network; measures to achieved more sustainable fisheries under the CFP; work on monitoring and mitigating marine mammal by-catch in UK waters, and; measures to reduce levels of contaminants. Although these existing measures are likely to play a significant role in achieving the proposed GES targets for species the MSFD Impact Assessment identifies potential additional measures which may be needed to further reduce the key human pressures on these species. Fisheries impacts remain a potential pressure, both

[136] To support robust statistical analysis species are only carried forward into the assessment if they are recorded in 50% of the surveys undertaken.

[137] Exceptions to this include species which are rarely caught in demersal surveys, and young individuals of each species due to the highly variable levels of young fish recruitment that can occur.

through by-catch (of birds, fish and mammals) and potentially through competition for prey species. For birds, predation by non-indigenous mammals on key island seabird colonies is also considered to be a significant pressure, and for fish additional measures may be needed to protect sensitive species not covered by existing legislation. Further work to assess the need for additional measures will be carried out between now and 2015, with involvement from stakeholders, as part of the development of the MSFD programme of measures.

391. Monitoring of species for MSFD will be closely linked to monitoring for the Birds and Habitats Directives and add the costs of monitoring will be highly dependent on the design of monitoring and work is on-going to determine how MSFD monitoring programmes can be designed to focus on key risks and how the use of resources can be optimised through sharing of facilities (e.g. ships). In some cases the need to develop a properly informed basis for these approaches will mean that monitoring will be established in a staged approach with it not being possible to establish effective monitoring of some aspects until after 2014.

GES Targets for Species

Table 3.2 – GES targets for marine mammals (Descriptors 1 and 4)	
Marine mammal targets – Species distribution	At the scale of the MSFD sub-regions the distribution of cetaceans is not contracting as result of human activities: in all of the indicators monitored there is no statistically significant[138] contraction in the distribution of marine mammals caused by human activities[139]. At the scale of the MSFD sub-regions the distribution of seals is not contracting as result of human activities: in all of the indicators monitored there is no statistically significant contraction in the distribution of marine mammals caused by human activities[140]
Marine mammal targets – Population size	At the scale of the MSFD sub-regions abundance of cetaceans is not decreasing as a result of human activity: in all of the indicators monitored, there should be no statistically significant decrease in abundance of marine mammals caused by human activities[141]. At the scale of the MSFD sub-regions abundance of seals is not decreasing as a result of human activity: in all of the indicators monitored, there should be no statistically significant decrease in abundance of marine mammals caused by human activities[142]
Marine mammal targets – Population condition	At the scale of the MSFD sub-regions cetacean populations are in good condition: mortality of cetaceans due to fishing by-

[138] The way in which statistical significance of an event is determined will vary because indicators for different species are based on very different types of data e.g. trends, or proportions etc. Because of the mobile nature of marine mammal populations and the inherent variability in monitoring abundance and distribution, it is essential that a pragmatic approach is taken. The level of significance at which decisions will be made will be decided once the monitoring option has been agreed and we have a good idea of our ability to detect change (i.e. the statistical power of the monitoring programme), It is likely that our ability to detect change will be greater for some species than others and highest for grey seals. Such an approach allows the utilisation of different p values for different species if that is considered to be appropriate depending on the power to detect change. This is something that the ICES WGMME has proposed.

[139] This target will not be operational until 2018.

[140] This target will be based on indicators for grey seal and harbour seal distributional range.

[141] This target will not be operational until 2018.

[142] This target will be based on indicators for grey seals and harbour seal abundance.

	catch is sufficiently low so as not to inhibit population targets being met[143]. At the scale of the MSFD sub-regions seal populations are in good condition: there is no statistically significant decline in seal pup production caused by human activities; and mortality of seals due to fishing by-catch is sufficiently low so as not to inhibit population targets being met[144]
Marine mammal targets – Productivity of key species	At the scale of the MSFD sub-regions] marine mammal productivity is not significantly affected by human activities: There should be no statistically significant decline in seal pup production caused by human activities[145]
Marine mammal targets - Abundance/ distribution of key species/ trophic groups	At the scale of the MSFD sub-regions abundance of cetaceans is not decreasing as a result of human activity: in all of the indicators monitored, there should be no statistically significant decrease in abundance of marine mammals caused by human activities[146] At the scale of the MSFD sub-regions abundance of seals is not decreasing as a result of human activity: in all of the indicators monitored, there should be no statistically significant decrease in abundance of marine mammals caused by human activities[147]

Table 3.3 –GES targets for birds (Descriptors 1 and 4)	
Bird targets – Species distribution	At the scale of the MSFD sub-regions distribution of marine birds is not significantly affected by human activities: No major shifts or shrinkage in the population distribution of marine birds in 75% of species monitored[148].
Bird targets –Population size	At the scale of the MSFD sub-regions abundance of marine birds is not significantly affected by human activities: Changes in abundance of marine birds should be within individual target levels in 75% of species monitored[149].
Bird targets –Population condition	At the scale of the MSFD sub-regions marine bird productivity is not significantly affected by human activities: Annual breeding success of black-legged kittiwakes should not be significantly different, statistically, from levels expected under prevailing climatic conditions (i.e. sea surface temperature,and

[143] This target will be based on by-catch indicator thresholds for harbour porpoise and common dolphin.

[144] In 2012 this target will be based on indicators for grey seal and harbour seal pup production, and by-catch threshold indicators for harbour seal and grey seal. Indicators for contaminants and algal toxins in seals will be added in 2018.

[145] In 2012 this target will be based on indicators for grey seal and harbour seal pup production only.

[146] In 2012 this target will be based on indicators for grey seals and harbour seals abundance only. Cetacean species indicators are likely to be added in 2018.

[147] This target will be based on indicators for grey seals and harbour seal abundance.

[148] In 2012 this would be based on indicators for breeding seabirds, non-breeding shorebirds and coastal breeding waterbirds. Indicators for seabirds at sea and non-breeding waterbirds are likely to be added in 2018.

[149] In 2012 this would be based on indicators for breeding seabirds, non-breeding shorebirds and coastal breeding waterbirds. Indicators for seabirds at sea and non-breeding waterbirds are likely to be added in 2018.

	widespread seabird colony breeding failures should occur rarely[150] in other species that are sensitive to changes in food availability. At the scale of the MSFD sub-regions, the risks to island seabird colonies from non-native mammals are reduced.
Bird targets –Productivity of key species	At the scale of the MSFD sub-regions marine bird productivity is not significantly affected by human activities: Annual breeding success of black-legged kittiwakes should not be significantly different, statistically, from levels expected under prevailing climatic conditions (i.e. sea surface temperature).
Bird targets Abundance/distribution of key species/trophic groups	At the scale of the MSFD sub-regions abundance of marine birds is not significantly affected by human activities: Changes in abundance of marine birds should be within individual target levels in 75% of species monitored[151].

Table 3.4 – GES targets for fish (Descriptors 1 and 4)	
Fish targets – Species distribution	At the scale of the MSFD sub-regions distribution of sensitive fish species is not significantly impacted by human activities: the geographic and depth distribution of sensitive fish should meet individual indicator targets in a statistically significant proportion of species monitored.
Fish targets –Population size	At the scale of the MSFD sub-regions populations of sensitive fish species are not significantly impacted by human activity: the population abundance density and population biomass density of sensitive fish species should meet individual indicator targets for recovery in a statistically significant proportion of species monitored.
Fish targets –Ecosystem structure	The size-composition of fish communities should reflect a healthy status and not be significantly impacted by human activity[152]: More than 30% (by weight) of demersal fish in the Greater North Sea and 40% (by weight) of demersal fish in the Celtic Seas exceed a length of 40cm and 50cm respectively.
Fish targets –Proportion of selected species at the top of the top of food webs	The size composition of fish communities should not be impacted by human activity such as to indicate any adverse change in trophic function within the community[153]: A specified proportion (by weight) of fish in any defined marine region should exceed a stipulated length threshold.

[150] The percentage of colonies [per species] experiencing breeding failure does not exceed the mean percentage of colonies failing over the preceding 15 years, or 5%, whichever value is greater.

[151] In 2012 this would be based on indicators for breeding seabirds, non-breeding shorebirds and coastal breeding waterbirds. Indicators for seabirds at sea and non-breeding waterbirds are likely to be added in 2018.

[152] Variation in the size composition of fish communities is indicative of change in their status, such that communities with relatively high proportions of large fish are considered "healthy".

[153] Food web structure in fish communities is linked to size composition such that the proportion of fish exceeding an appropriate length threshold is indicative of the fraction of top-predators in the community.

Approach to setting GES targets – habitats

392. The Initial Assessment identifies significant problems for a number of seafloor habitats, particularly shallow and shelf subtidal sediments. For pelagic habitats, although regional-scale changes in the composition of plankton communities have been linked to rising sea temperatures, plankton as a whole are considered healthy and subject to few direct anthropogenic pressures. For more information see Section 2.

393. GES targets and indicators have been developed for pelagic, sediment and rock & biogenic reef habitats covering Descriptor 1 (biodiversity), Descriptor 4 (food webs) and Descriptor 6 (seafloor integrity). These include targets and indicators for habitat distribution, habitat extent and habitat condition, as well as physical damage (to the seabed), and condition of the benthic community. The targets and indicators for pelagic habitats also cover the abundance/distribution of key trophic groups. More detail on the approach to target setting for these different habitats is set out in more detail in the Cefas CBA Report 2012[154].

Seafloor habitats:

394. For rock and biogenic reef habitats the targets are all based on existing targets for these habitats under the Habitats Directive. The aim here has been to ensure consistency with the requirements of the Habitats Directive, which already provides protection for these the vast majority of rock and biogenic reef habitats. The targets require the distribution and extent of rock and biogenic reef habitats to be stable or increasing, using Favourable Reference Area and Favourable Reference Area under the Habitats Directive as a baseline. They also require these habitats to be in good condition – not significantly impacted by human activities.

395. For listed sediment habitats (i.e. those habitats covered by existing legislation) the targets are also based on existing requirements under the Habitats Directive and the Water Framework Directive. However, a large proportion of sediment habitats are not protected by existing legislation. These are known as predominant sediment habitats[155] and new targets have been developed to cover these habitats. The targets for these habitats have been particularly hard to develop because there is a significant lack of evidence and understanding on both current and desired state, meaning that it is not possible to set ecologically meaningful GES target thresholds. For this reason the targets for the condition of predominant sediment habitats are trend-based, pressure targets, requiring a reduction in damaging human impacts on these habitats. It is not currently possible to define the necessary level of reduction in impacts in quantitative terms, but further research will be carried out with the aim of setting specific, quantified targets for predominant sediment habitats as soon as possible in the future.

Pelagic habitats:

396. For pelagic habitats[156], there are no suitable targets in existing legislation and all the targets are new. The targets and indicators all focus on plankton, which plays a crucial role in the pelagic food-web and the whole marine ecosystem. Changes in plankton are driven by climate but are also affected by human pressures, particularly eutrophication and fishing. The targets and indicators are designed to identify changes in plankton caused by human pressures, and require that the distribution, structure, condition and abundance of the plankton community 'are not significantly adversely influenced by anthropogenic drivers'. Detailed quantitative indicators to

[154] Cefas CBA Report 2012, Section 3, pages 61-117

[155] These are broadscale, sediment habitats which cover a large % of the UK's seafloor. They are not currently protected by any existing legislation.

[156] Pelagic habitats refer to the water column. The focus of pelagic habitats is plankton. Plankton is the collective name for the small and microscopic organisms that drift with the waters of the sea; it includes bacteria, microscopic algae (phytoplankton), single-celled protozoans, microscopic animals (zooplankton) such as copepods (which are crustaceans), young fish, and larger animals such as jellyfish.

Implications of the targets – habitats

Seafloor habitats:

397. There are numerous measures already in place, or planned under existing commitments, which are expected to reduce the pressures on benthic habitats and support the achievement of the targets for seafloor habitats. These include measures required under the Habitats Directive, management measures for the MPA network, the marine licensing regime, and existing measures to achieve more sustainable fisheries under the CFP.

398. For those rock & biogenic reef and sediment habitats that are covered by the Habitats Directive it has been assumed that measures taken under that Directive will be sufficient to achieve GES, particularly through the implementation of the UK's network of Marine Protected Areas (MPAs). For those seafloor habitats not covered by the Habitats Directive (primarily sediment habitats, but also some rock habitats), the UK's network of MPAs will play a key role in achieving the proposed targets, however additional measures may be needed to further reduce the key human pressures on these habitats. Fisheries impacts remain the most significant pressure on sediment habitats and where unacceptable impacts are identified it is likely that more significant fisheries management measures will be needed under the reformed CFP or national inshore measures in order to reduce these (e.g. additional controls on the use of mobile demersal gear, modification of gear which is most damaging to the seabed).

399. Monitoring costs for seabed habitats will be highly dependent on the design of monitoring and how well the use of resources for monitoring can be optimised through sharing of facilities (e.g. ships). Work is on-going to determine how MSFD monitoring can be designed to focus on areas at risk and how an optimal use of monitoring facilities can be achieved. MSFD monitoring for seafloor habitats will be closely linked to information requirements under the Habitats Directive and evidence associated with commitments on Marine Protected Areas. For these the need to develop a properly informed basis for these approaches will mean that monitoring programmes will be established in a staged approach with it not being possible to establish effective monitoring of some aspects until after 2014.

Pelagic habitats:

400. For pelagic habitats, the targets proposed under Descriptor 3 and Descriptor 5 are likely to support the achievement of GES for pelagic habitats. Provided the targets for Descriptors 3 and 5 are achieved it is unlikely that additional measures would be necessary in relation to pelagic habitats. Additional monitoring of pelagic habitats is likely to be needed and work is on-going to consider the most effective way of implementing this.

GES Targets for Habitats

Table 3.5 – GES targets for pelagic habitats (Descriptors 1, 4 and 6)	
Pelagic habitat targets - Habitat distribution	At the scale of the MSFD sub-regions, distribution of plankton community is not significantly adversely influenced by anthropogenic drivers, as assessed by indicators of changes in plankton functional types (life form) indices.
Pelagic habitat targets - Habitat	At the scale of the MSFD sub-regions, condition of plankton community is not significantly adversely influenced by anthropogenic

condition	drivers.
Pelagic habitat targets - Ecosystem structure	At the scale of the MSFD sub-regions, structure of plankton community is not significantly adversely influenced by anthropogenic drivers, as assessed by indicators of changes in plankton functional types (life form) indices.
Pelagic habitat targets - Abundance/distribution of key species/trophic groups	At the scale of the MSFD sub-regions, abundance/distribution of plankton community is not significantly adversely influenced by anthropogenic drivers, as assessed by indicators of changes in plankton functional types (life form) indices.
Pelagic habitat targets - Condition of the benthic community	At the scale of the MSFD sub-regions, condition of the meroplanktonic (plankton with benthic life phase) community is not significantly adversely influenced by anthropogenic drivers, as assessed by indicators of changes in plankton functional types (life form) indices.

Table 3.6 – GES targets for rock and biogenic reef habitats (Descriptors 1 and 6)	
Rock & Reef targets - Habitat distribution	At the scale of the MSFD sub-regionsrock and biogenic[157] reef habitats are stable or increasing: For all listed (special) and predominant habitat types range and distribution are stable or increasing and not smaller than the baseline value (Favourable Reference Range[158] for Habitats Directive habitats).
Rock & Reef targets - Habitat extent	At the scale of the MSFD sub-regions rock and biogenic[159] reef habitats are stable or increasing: For all listed (special) and predominant habitat types area is stable or increasing and not smaller than the baseline value (Favourable Reference Area[160] for Habitats Directive habitats).
Rock & Reef targets - Habitat condition; Physical damage; Condition of the benthic community	At the scale of the MSFD sub-regions of rock and biogenic[161] reef habitats is not significantly affected by human activities: For all listed (special) and predominant habitat types the area of habitat in poor condition (as defined by condition indicators) must not exceed 5% of the baseline value (Favourable Reference Area for Habitats Directive habitats).

Table 3.7 – GES targets for sediment habitats (Descriptors 1 and 6)	
Sediment habitat targets - Habitat distribution	Predominant habitat types: No target proposed – see target below for Criterion 1.6 Listed (special) habitat types: At the scale of the MSFD sub-regions the range and distribution of listed (special) sediment habitat types is stable or increasing and not smaller than the baseline value (Favourable Reference Range for

[157] Built-up by dense growths of a species that changes the habitat (eg certain shellfish or deepwater corals).
[158] Favourable Reference Range is part of the assessment of Favourable Conservation Status under the Habitats Directive.
[159] Built-up by dense growths of a species that changes the habitat (eg certain shellfish or deepwater corals).
[160] Favourable Reference Area is part of the assessment of Favourable Conservation Status under the Habitats Directive.
[161] Built-up by dense growths of a species that changes the habitat (eg certain shellfish or deepwater corals).

	Habitats Directive habitats)
Sediment habitat targets - Habitat extent	Predominant habitat types: No target proposed – see target below for Criterion 1.6 Listed (special) habitat types: At the scale of the MSFD sub-regions the area of listed (special) sediment habitat types is stable or increasing and not smaller than the baseline value (Favourable Reference Area for Habitats Directive habitats). WFD extent targets for saltmarsh and seagrass should be used within WFD boundaries as appropriate.
Sediment habitat targets - Habitat condition; Physical damage; Condition of the benthic community	Predominant habitat types: At the scale of the MSFD sub-regions damaging human impacts on predominant sediment habitats are reduced: The area of habitat which is unsustainably impacted by human activities (as defined by vulnerability criteria) is reduced and the precautionary principle is applied to the most sensitive habitat types and/or those which are most important for ecosystem functioning. Listed (special) habitat types: At the scale of the MSFD sub-regions the area of special (listed) sediment habitat types below GES (i.e. unacceptable impact / unsustainable use) as defined by condition indicators must not exceed 5% of baseline value (favourable reference area for Habitats Directive habitats). WFD targets (km2 thresholds) for area of unacceptable impact for benthic invertebrates, macroalgae, saltmarsh and seagrass should be used within WFD boundaries as appropriate.

Gaps and development needs

401. No targets have been proposed regarding cephalopods, due to the lack of information and data on these species. Further development work may be required as targets for these species would be an important part of assessing GES under Descriptors 1 and 4.

402. For short term development the fish component group have identified spatial gaps in monitoring for pelagic, deep-sea and coastal fish species. The proposed targets for fish are therefore based on offshore assessments of demersal fish species. The pelagic habitat group has also identified the need for more information regarding zooplankton in inshore areas.

403. Additional monitoring or changes to existing monitoring activities will be needed for a number of the targets, although these could be combined with other legislative commitments and developments at the OSPAR level.

404. Over the longer term there will be a need to understand the energy flows within food web and the structure of food webs (size and abundance), development of detailed baseline information for assessing the quality/condition of benthic habitats as well as habitats resilience towards pressures exerted upon them (thresholds for loss and damage).

3.3 Descriptor 2 – Non-indigenous species

Background

405. It is widely accepted that one of the greatest threats to biodiversity across the globe is posed by non-indigenous species (NIS) which become invasive, known under the Convention on Biological Diversity as invasive alien species (IAS). Globalisation and a growth in trade and tourism have greatly increased the human-assisted movement of species over vast distances to new habitats where they may become invasive. It has been estimated that damage caused by terrestrial and marine invasive species worldwide amounts to almost five percent of the world economy. The cost to the British economy alone is estimated to be £1.7 billion per annum[162].

406. Invasive NIS may alter ecosystem processes, decrease native species abundance and richness via competition, predation, hybridization and indirect effects[163], change community structure[164] and alter genetic diversity.

407. The main anthropogenic activities that contribute to the introduction of NIS are maritime transport (both commercial and recreational) and aquaculture. Boats and ships may transport NIS either in ballast water or as biofouling (i.e. attaching to hulls, anchor chains and other parts of the vessel). Aquaculture activities can also cause unintended introduction of NIS when transporting species intended for cultivation.

408. Climate change, although outside of the MSFD considerations, may create conditions which are more suitable for NIS to survive and establish themselves in UK waters.

Summary of current status from Initial Assessment

409. Around 60 NIS have become established in UK seas, but there is no consensus on the proportion that have an adverse impact. The impacts of most concern are those on intertidal and shallow subtidal habitats, particularly around the south and south-western coasts of the UK, where studies suggest there are far more NIS compared to the rest of the UK.

Table 3.8 - GES characteristics and associated targets for Descriptor 2

GES characteristics for non-indigenous species (Descriptor 2)	
Characteristics of GES for Descriptor 2 (non-indigenous species)	The UK characteristics of GES for this Descriptor are as follows: The risk from pathways and vectors which facilitate the introduction and spread of NIS as a result of human activities is significantly reduced, leading to a reduction in the risk of introducing new species some of which may have adverse impacts.
GES targets for non-indigenous species (Descriptor 2)	
Targets for Descriptor 2 - Abundance and state characterisation of non-	Reduction in the risk of introduction and spread of non native species through improved management of high risk pathways and vectors. Surveillance indicator looking at the abundance, distribution and number of new introductions of NIS in areas which are at a high risk of new introductions (with a view to being able to develop a baseline

[162] Williams, F. et al (2010) The Economic Cost of Invasive Non-Native Species on Great Britain. This includes terrestrial, freshwater and marine IAS.

[163] Gaertner et al., (2008) Understanding biodiversity consequences of habitat change, Journal of Applied Ecology **45** pp883-893

[164] Hejda et al (2009) Impact of invasive plants on the species richness, diversity and composition of invaded communities, Journal of Ecology, **97** pp 393-403

indigenous species	for the rate of establishment of new NIS).
Targets for Descriptor 2 – Environmental impact of invasive non-indigenous species	Action plans are developed for key high risk marine non indigenous species by 2020.

Approach to setting GES targets for NIS

410. Due to the lack of information on current abundance, distribution and impacts of IAS, and the very high costs and lack of feasibility associated with widespread management or eradication programmes, the targets for this Descriptor are operational targets, focused on:

a. Taking measures to reduce the risk of introduction and spread of NIS (by managing key pathways and vectors more effectively), and;
b. Putting in place management plans for dealing with key high risk species should they arrive in UK waters.

411. The targets are based on the advice in the Cefas CBA Report 2011, but the full range of targets proposed in that report has not been put forward in this Strategy because several of them were felt to need significant further development work before they could be implemented. An additional operational target has also been developed by policy makers: 'Action plans are developed for key high risk marine non indigenous species by 2020'. This is based on Cefas advice that efforts should focus on reducing the impact of NIS through the implementation of effective management measures, but the target proposed by Cefas has been changed to make it more specific.

412. The abundance, distribution and number of new introductions of NIS in high risk areas and hotspots of introduction (e.g. ports) should be monitored as a surveillance indicator. This will allow assessment of whether measures to reduce the risk of new introductions are succeeding and would give useful information about which pathways and vectors of introduction may need additional management. It would also help to develop a baseline for NIS in high risk areas which could be used to develop a more specific, quantitative target for the next cycle of the Directive in 2018.

413. The targets and surveillance indicator are in line with the Invasive Non Native Species Framework Strategy for GB[165] approach of prevention, early detection and eradication where feasible. This approach is also likely to be compatible with the approach of the EU Invasive Alien Species Strategy which is currently being developed by the Commission and is expected to take the form of a new Directive.

414. For further detail on the approach to setting targets for this Descriptor see **Section 2.1 of the Cefas CBA Report 2012[166]**.

[165] https://secure.fera.defra.gov.uk/nonnativespecies/downloadDocument.cfm?id=99

[166] http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16817&FromSearch=Y&Publisher=1&SearchText=ME5405&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

Implications of the proposed targets

415. Some voluntary and statutory measures are already in place to manage the key pathways and vectors of introduction of NIS, including controls on aquaculture and shipping, as well legislation to prevent the movement of NIS through aquaculture operations and ban the deliberate release of NIS into the wild[167]. Many of the measures needed to reduce the risk of introductions of NIS need to be implemented at an international scale in order to be effective. The International Maritime Organization is leading action to reduce the spread of NIS through international shipping. However, additional national measures are likely to be necessary to achieve the targets for this Descriptor, particularly in relation to reducing the risk of spread of NIS around the coast once they have entered UK waters. At this stage it is difficult to assess what additional measures might be needed, however the Impact Assessment which accompanies this Strategy look at a range of illustrative management measures, primarily to reduce the risks associated with movement of small vessels, and movements of fish and shellfish within the aquaculture industry.

416. Action will also need to be taken by Government and its agencies. Development of action plans for key species is something which has already been committed to in the Invasive Non Native Species Framework Strategy for GB and action plans for certain species have already been developed. However, very few marine species have been covered so far and this activity would need to be expanded to cover key marine species between now and 2020. The plans themselves are developed on a case by case basis and the detailed actions they put forward will vary from for different species and locations.

417. Further work to implement a risk based approach to preventing NIS introduction and spread will be taken forward as part of the development of the MSFD Programme of Measures with the involvement of stakeholders. More information on the potential costs and benefits associated with these targets can be found in the MSFD Impact Assessment[168].

418. The targets and surveillance indicator for this Descriptor would also imply additional monitoring costs to Government and regulators - primarily related to monitoring the abundance and distribution on NIS in high risk locations (e.g. ports). Existing monitoring programmes could be adapted to include sampling for NIS species, but additional monitoring at high risk/hot spot areas of introduction will be needed. This type of assessment may form part of the larger ports exemptions from the IMO requirements as part of an ecological assessment, although these requirements are not yet finalised. Additional monitoring may also be required for the species specific action plans, but these will be reviewed and developed on a case by case basis. It has not been possible to provide estimates for any additional monitoring required at this stage.

Gaps and development needs

419. It has not been possible to explicitly cover all elements of Descriptor 2 from the Commission Decision on GES, due mainly to the lack of data and full understanding of NIS in respect to abundance, distribution, introduction (vectors and timing) and ability to survive in new environments.

420. Some additional monitoring, or changes to existing monitoring may be required, particularly with the risk based pathways management approach and the surveillance indicator which have been proposed.

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[167] Section 14 of the Wildlife and Countryside Act (1981), The Conservation of Habitats and Species Regulations (2010), and the Offshore Marine Conservation Regulations (2009)

[168] www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

421. Over the longer term there is a need to develop detailed baseline information regarding the abundance of NIS. Continual engagement within OSPAR intersessional Correspondence group on the Coordination of Biodiversity Assessment and Monitoring will be necessary to ensure a regional approach is taken in regards to monitoring and preventing movement of NIS.

3.4 Descriptor 3 – Commercially exploited fish and shellfish

Background

422. The MSFD requires commercially exploited fish and shellfish to be within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock. This generally means that commercial species will be exploited sustainably (consistent with the highest sustainable long term yield), species will have adequate reproductive capacity for replacement (able on average to reproduce at least once before being caught) and that stocks will have an age and size distribution that avoids impaired recruitment.

423. The CFP is the principle legal mechanism for managing fish stocks in EU waters, ensuring consistency across Member States. For some nationally important species national or local management measures exist, although the achievement of Maximum Sustainable Yield (MSY)[169] is largely dependent on the success of the fisheries management measures that will be determined and agreed under the reformed CFP[170] which will be co-decided by the Council Fisheries Ministers and the European Parliament. The UK approach to Descriptor 3 is based on the agreement reached by Fisheries Ministers in June 2012 however the targets may need to be revisited to reflect the outcome of the final agreement between Council and Parliament.

Summary of current status from Initial Assessment

424. Although, there has been a substantial increase in the number of fish stocks that are harvested sustainably over the period 2000 -2010, a significant proportion of indicator stocks (>60%) continue to be harvested at rates that are unsustainable and/or have reduced reproductive capacity. Further reductions in fishing pressure on approximately half of stocks in UK waters would be needed to ensure levels expected to provide the highest long term yield.

Table 3.9 - GES characteristics and associated targets for Descriptor 3

GES characteristics for commercial fish (Descriptor 3)	
Characteristics of GES for Descriptor 3 (commercial fish)	The UK characteristics of GES for this Descriptor are as follows: The level of stock mortality generated by fishing activity (F) is equal to or lower than Fmsy - the level capable of producing Maximum Sustainable Yield (MSY). The spawning stock biomass is within safe biological limits and all stocks are sustainably exploited.
GES targets for commercial fish (Descriptor 3)	
Targets for Descriptor 3 – Fishing Mortality	The exploitation of living marine biological resources restores and maintains populations of harvested species at least at levels which can produce MSY. This exploitation rate shall be achieved by 2015, where possible, and by 2020 for all stocks at the latest.

[169] Maximum Sustainable Yield, or MSY, is the largest average catch that can be taken from a particular fish stock for an indefinite period i.e. without threatening its long-term viability.

[170] The Common Fisheries Policy (2002, and due for revision in 2012) is the EU's instrument for the management of fisheries and aquaculture. It is highly centralised with EU Ministers making decisions each year on catch limits on 'quota' stocks and related measures such as the time fishermen can spend at sea. The CFP also provides financial support through the European Fisheries Fund as well as providing the regulatory framework for monitoring, control and enforcement.

	The exploitation rate of each stock is either at or below F_{MSY}, or within the range of plausible fishing mortalities consistent with F_{MSY}. Where data does not allow FMSY, or FMSY proxies, to be calculated exploitation of each stock will be based on the precautionary approach with limits defined by agreed proxies for sustainable exploitation.
Targets for Descriptor 3 – Reproductive Capacity of Stock	The reproductive capacity of the stock shall be maintained at, or above levels that will support the long term exploitation of stocks at F_{MSY}, as indicated by spawning stock biomass of all stocks being above Bpa.

Approach to setting GES targets setting for commercial fish

425. Fish stock management within the CFP currently utilises "safe biological limits" within the Precautionary Approach (PA). These limits are defined in terms of thresholds for the upper level of fishing mortality and lower level of (adult) spawning stock biomass. This prevents high levels of fishing mortality reducing stock size and impeding reproductive potential. Where possible scientific evaluation of each stock's status relative to its safe biological limits is published annually by the International Council for the Exploration of the Sea (ICES) – based on information provided by Member States' scientific authorities. ICES also provide an assessment against more ambitious stock specific targets for fishing mortality rates to achieve high levels of average yield (MSY).

426. For this Descriptor the targets are based on the achievement of stock specific targets for fishing at levels consistent with the MSY. Achieving a fishing mortality rate of MSY for all stocks is considered to be equivalent to safe biological limits, while also reducing fishing pressure on the wider ecosystem.

427. The UK government has accepted the principle of MSY under a number of different commitments including the World Summit on Sustainable Development (WWSD). For this Descriptor the UK will consider all stocks for which the UK has an obligation to provide information under European Data Collection Programmes. Currently ICES provides assessments in relation to MSY or alternative sustainability criteria for a subset of these stocks, based on available data. For those stocks considered to be data poor, ICES has developed a series of data limited approaches which have been implemented in the 2012 catch advice.

428. The UK position is closely aligned with what is put forward by other Member States, ensuring consistency both with the MSFD (which is particularly prescriptive for this Descriptor) and with our position on reform of the CFP. The ICES advice on methodologies for GES targets for commercial (shell)fish has provided further consistency in approaches.

429. For further detail on the approach to setting targets for this Descriptor see **Section 2.2 of the Cefas CBA Report 2012**[171].

Implications of the proposed targets

430. Delivering the targets for GES under this descriptor will, with the exception of measures for most shellfish species (with the exception of nephrops) and other stocks where there is some scope for national measures, be dependent on the success of the fisheries management

171 http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16817&FromSearch=Y&Publisher=1&SearchText=ME5405&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

measures that will be determined and agreed under the reformed CFP[172]. The targets reflect the UK's approach to CFP reform and the achievement of sustainable stock levels. Additional management measures necessary to achieve MSY could include things such as limits on landings and various other technical measures.

431. For shellfish, as most commercial species (all except nephrops) are not managed directly through the CFP, we have considered the potential costs of other measures which could be taken on a national or more local basis; e.g. technical conservation[173], national limits on landings, use of less destructive gear and the protection of key shellfish life stages.

432. More information on the potential costs and benefits associated with these target proposals can be found in the MSFD Impact Assessment[174].

433. No new monitoring programmes will be required in relation to those stocks already covered by EU Data Collection Programmes. There could however be some additional monitoring and assessment costs in relation to shellfish stocks (e.g. for scallops, crab and lobsters) to ensure accurate assessments can be made.

Gaps and development needs

434. No targets have been proposed for Criterion 3.3 Population age and size distribution in the Commission Decision on GES. This is on the basis that there is no scientific agreement on whether the population age and size distribution can be defined for single species/stocks in isolation. It is considered that achieving "safe biological limits" will invariably result in a "healthy" age and size distribution.

435. For many fish stocks and the majority of shellfish stocks there are currently no agreed indices of exploitation rate and biomass status due to limited data availability. In the short term, studies will need to be conducted for shellfish stocks in particular, to derive the required proxy indicators and the level of their targets/thresholds.

3.5 Descriptor 5 – Eutrophication

Background

436. Eutrophication is one of the major threats to the health of estuarine, coastal and shelf sea ecosystems around the world. It occurs when waters are enriched by nutrients, especially compounds of nitrogen and/or phosphorus, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned.

437. Anthropogenic eutrophication can occur in certain conditions when inputs of nitrogen and phosphorus (nutrients) from point sources (e.g. sewage effluents and industrial processes) and diffuse sources (e.g. agricultural run-off and transport emissions) enter the coastal and marine environment.

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[172] The Common Fisheries Policy (2002, and due for revision in 2012) is the EU's instrument for the management of fisheries and aquaculture. It is highly centralised with EU Ministers making decisions each year on catch limits on 'quota' stocks and related measures such as the time fishermen can spend at sea. The CFP also provides financial support through the European Fisheries Fund as well as providing the regulatory framework for monitoring, control and enforcement.

[173] For instance changes to fishing gear and minimum and maximum landing sizes.

[174] www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

Summary of current status from Initial Assessment

438. There is high confidence in the assessment of eutrophication in UK coastal and offshore areas[175] due to the availability of extensive datasets and the enhanced monitoring employed in regions previously reported as being of concern.

439. There are relatively few eutrophication problem areas in UK waters at present. These are of limited size and measures have been put in place to address the main sources of nutrient inputs to UK waters in these areas.

Table 3.10 - GES characteristics and associated targets and indicators for Descriptor 5

GES characteristics for eutrophication (Descriptor 5)		
Characteristics of GES for Descriptor 5 (Eutrophication)	The UK characteristics of GES for this Descriptor are as follows: Human-induced eutrophication in UK seas is minimised and all UK marine waters are non-problem areas: Nutrient concentrations do not lead to an undesirable disturbance[176] to the balance of organisms present in the water or to the quality of the water concerned resulting from accelerated growth of algae; and The direct effects of nutrient enrichment associated with algal growth do not constitute or contribute to an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned ; and Indirect effects of nutrient enrichment associated with growth of macroalgae, sea grasses, and reductions of oxygen concentrations do not constitute an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned.	
GES targets for eutrophication (Descriptor 5)[177]		
	Non Problem Areas 2007/2010	**Problem Areas 2007/2010**
Targets for Descriptor 5 – Nutrient levels	No increase in the assessed dissolved inorganic nitrogen and phosphorous concentration, resulting from anthropogenic nutrient input using data from periodic surveys.	A downward trend in dissolved inorganic nitrogen and phosphorous concentration, resulting from decreasing anthropogenic nutrient input, over a 10 year period.
Targets for Descriptor 5 – Direct effects of nutrient enrichment	No increase in the chlorophyll 90 percentile in the growing season (linked to increasing anthropogenic input) based on periodic surveys.	A downward trend in the chlorophyll 90 percentile in the growing season, over a 10 year period (linked to decreasing anthropogenic input).

[175] OSPAR Comprehensive Procedure for the identification of eutrophication status in 2007 and assessments prepared under relevant EU Directives (including Urban Waste Water Treatment Directive, Nitrates Directive, and Water Framework Directive).

[176] Undesirable disturbance is demonstrated when adverse effects resulting from nutrient enrichment and accelerated growth of algae occur, such as losses in biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters.

[177] These targets are assessed holistically to determine whether eutrophication is occurring. Failure with respect to any individual target does not, on its own, necessarily lead to identification of eutrophication problems.

	AND If there is evidence of nutrient enrichment and accelerated growth, then: No trend in a eutrophication relevant plankton index that is attributable to increases in nutrient loading, winter nutrient concentrations or trends in nutrient ratios.	AND Changes in a eutrophication relevant plankton index that is attributable to decreases in nutrient loading, winter nutrient concentrations or trends in nutrient ratios[178].
Targets for Descriptor 5 – Indirect effects of nutrient enrichment		WFD macroalgae and seagrass tools at good status. Oxygen (concentrations/5 percentile) in bottom waters should remain above area-specific oxygen assessment levels (e.g. 4-6 mg/l). There should be no kills in benthic animal species as a result of oxygen deficiency that are directly related to anthropogenic input of nutrients.

Approach to setting GES targets for euthrophication

440. The targets are all based on existing OSPAR or WFD targets and how these are used to assess eutrophication. Whilst no common targets for this Descriptor have yet been agreed by OSPAR countries, the level of ambition across these countries is similar and it is clear that the established assessment criteria developed in the WFD and OSPAR will be used to determine eutrophication status.

441. The targets have been developed using a risk-based approach. Where eutrophication problems have been shown not to exist then the target is simply to maintain non-problem area status, but for areas which have been identified as eutrophication problem areas, a more comprehensive set of targets has been developed in order to bring them to non-problem area status.

442. It should be noted that the targets must be considered holistically with the overall eutrophication goal of ensuring no undesirable disturbance (adverse effects) resulting from human-induced nutrient inputs in mind. This reflects the methodology used to determine eutrophication status under the OSPAR Common Procedure i.e. failure to meet an individual target does not, on its own, necessarily signify eutrophication problems[179]**.**

443. For further detail on the approach to setting targets for this Descriptor see **Section 2.3 of the Cefas CBA Report 2012**[180].

[178] Further work required as indicator has not been tested in operation

[179] For example, it might be acceptable to have nutrient levels in the sea which exceed the target in a particular area provided that this does not lead to eutrophication effects such as elevated levels of chlorophyll or other undesirable disturbances.

[180] http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16817&FromSearch=Y&Publisher=1&SearchText=ME5405&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

Implications of the targets

444. As the main sources of nutrients in UK waters arise from discharges from sewage treatment, industry and agriculture, any measures which are required to meet the GES targets for eutrophication would already need to be taken under the WFD, the Nitrates Directive and the Urban Waste Water Treatment Directive; therefore it has been assumed that no additional cost implications from these targets beyond the additional monitoring costs mentioned above.

445. The UK will utilise existing monitoring programmes under the WFD and OSPAR to meet monitoring requirements for MSFD, although there are likely to be some additional monitoring requirements for plankton related eutrophication monitoring.

446. More information on the potential costs and benefits associated with these targets can be found in the MSFD Impact Assessment[181].

Gaps and development needs

447. Targets have not been developed for two of the Commission Indicators outlined in the Commission Decision on GES. For the Commission Indicator on nutrient ratios, no specific target has been put forward given the area specific variability of nutrient ratios in UK waters. This information will, however, still be collected and interpreted under the Commission Indicator for nutrient concentrations and used in diagnosing eutrophication. For the Commission Indicator relating to water transparency, no target has been proposed due to the difficulty of interpreting water transparency data in UK waters (resulting from turbidity etc).

448. Some additional monitoring or changes to existing monitoring activities may be needed, especially in light of the need to adopt a risk based approach. Continued engagement is also needed within OSPAR to ensure the OSPAR Comprehensive Procedure continues to develop in a manner which supports the UK approach to assessing GES, including consideration of how to further develop the existing WFD phytoplankton tool and phytoplankton indices to give greater confidence in addressing indicators on floristic composition.

3.6 Descriptor 7 – Permanent alteration of hydrographical conditions

Background

449. The MSFD requires that any permanent alteration of prevailing hydrographical conditions resulting from human activities does not have an adverse affect on coastal and marine ecosystems. This Descriptor is, therefore, intended to manage the potential hydrographical impacts (including cumulative and in-combination environmental effects) arising from large scale projects such as offshore windfarms, tidal barrages, tidal farms, offshore airports, and other significant marine infrastructures.

450. Development in the coastal and marine zone can be broadly categorised into urban (e.g. housing), infrastructure (e.g. ports, harbours, navigation channels, windfarms), tourism & leisure (e.g. marinas), and resources (e.g. oil, gas, and aggregate extraction). Developments in these areas can, if poorly managed, alter hydrographical conditions, resulting in significant local scale impacts on both the coastal and marine environments. Some projects, such as large scale tidal barrages, have the potential to have broader scale impacts on hydrographical conditions.

[181] www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

451. Although there is the potential for developments to cause impacts due to changes in hydrographical conditions, impacts arising from marine and coastal development are currently managed through the marine licensing and consents process. All significant developments are assessed, and their potential impacts monitored, in line with the requirements of the Environmental Impact Assessment Directive, the WFD, and the Habitats Directive. In addition, Marine Plans, when in place, will provide the framework for the licensing and consents process and will be subject to the Strategic Environmental Assessment Directive.

Summary of current status from Initial Assessment

452. There are no significant broad scale alterations of hydrographic conditions affecting ecosystems in UK waters beyond those currently covered by provisions of the WFD, through classification as heavily modified water bodies. However, the impacts of human developments at local or Subregional scales need to be set against increasing evidence of wider regional scale shifts in hydrographic conditions as a result of changing climate and increased levels of atmospheric CO2.

Table 3.11 - GES characteristics and associated targets for Descriptor 7

GES characteristics for hydrographical conditions (Descriptor 7)	
Characteristics of GES for Descriptor 7 (Hydrographical conditions)	The UK characteristics of GES for this Descriptor are as follows: The nature and scale of any permanent changes to the prevailing hydrographical conditions (including but not limited to salinity, temperature, pH and hydrodynamics) resulting from anthropogenic activities (individual and cumulative), having taken into account climatic or long-term cyclical processes in the marine environment, do not lead to significant long term impacts on those biological components considered under Descriptors 1,4, and 6.
GES targets for hydrographical conditions (Descriptor 7)	
Targets for Descriptor 7 – Spatial Characteristics of Permanent Alterations / Impact of Permanent Hydrographical Changes	All developments must comply with the existing regulatory regime and guidance should be followed to ensure that regulatory assessments are undertaken in a way that ensures the full consideration of any potential impacts, including cumulative effects at the most appropriate spatial scales to ensure that GES is not compromised.

Approach to setting GES targets for hydrographical conditions

453. The Cefas CBA report proposed two options for GES targets under this Descriptor; one of which has been discounted. The discounted option would have required developments above certain thresholds to carry out additional assessment and monitoring of their potential impacts. This option was discounted because there is currently high confidence in the robustness of the existing licensing regime in ensuring significant negative impacts on hydrographical conditions are appropriately considered.

454. The target which is has been put forward reflects the fact that we expect to achieve GES under current licensing regimes. It requires all new developments to continue to comply with the existing regulatory regime, and guidance to be followed to ensure that regulatory assessments are undertaken in a way that ensures the appropriate consideration of any potential cumulative and in-

combination environmental effects at the most appropriate spatial scales so that GES is not compromised.

455. Discussions with other Member States lead us to believe that there is a mixed approach to this Descriptor across OSPAR countries. The UK approach is in line with advice generated within OSPAR and a number of other countries, such as the Netherlands, are proposing similar approaches. However, other countries, such as Belgium, are proposing targets which would involve extensive monitoring of hydrographical conditions on a scale which would not be feasible in the UK.

456. For further detail on the approach to setting targets for this Descriptor see **Section 2.4 of the Cefas CBA Report 2012**[182].

Implications of the target

457. There will be a need to review the operation of the existing marine licensing regime to ensure it adequately reflects the most up to date understanding of the potential for developments to cause changes to hydrographical conditions, and guidance for developers and licensing authorities may need to be updated to reflect this.

458. As the target is based on the application of the existing regulatory regime there will be no additional measures or costs to industry, assuming there is currently compliance with the Environmental Impact Assessment Directive and other relevant legislation.

459. More information on the potential costs and benefits associated with these target proposals can be found in the MSFD Impact Assessment [183].

Gaps and development needs

460. There is a short term need to review, and if necessary revise, existing guidance for developers on addressing impacts on hydrographical conditions and cumulative impacts as part of the Environmental Impact Assessment and Strategic Environmental Assessment processes. To assist with this a number of case studies of existing or potential future planning applications are being developed in order to support the assertion that the current regulatory regime is sufficiently robust to ensure GES can be achieved. They will also help confirm whether there will be any additional licensing, monitoring, or assessment burdens for Government, the MMO, or developers.

461. In the longer term there will be a need to develop more detailed baseline information on prevailing environmental conditions.

3.7 Descriptor 8 – Concentrations of contaminants

Background

462. This Descriptor is intended to ensure the presence of contaminants in the marine environment and their biological effects are kept within acceptable agreed limits, so as to ensure that there are no significant impacts on, or risk to, the marine environment. These contaminants include synthetic compounds (e.g. pesticides, antifoulants, pharmaceuticals etc), non-synthetic

182 http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16817&FromSearch=Y&Publisher=1&SearchText=ME5405&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

183 www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

compounds (e.g. heavy metals, hydrocarbons etc), and other substances considered pollutants, whether solid, liquid or gas.

463. Hazardous substances can enter the marine environment through natural sources and as a result of anthropogenic activities, either as direct inputs or via rivers, estuaries and the atmosphere. Pollution itself is considered to be the introduction of substances which have, or are likely to have, deleterious effects on the marine environment and its uses. This includes effects that result in loss of biodiversity, are hazardous to human health, impair water quality, and reduce our ability to use the sea.

464. There is already a robust UK legislative framework in place for controlling pollution from contaminants, including appropriate consenting and monitoring programmes. There is good knowledge of contaminant levels in the marine environment, particularly in coastal and inshore areas, as a result of OSPAR and the WFD which require the monitoring of specific contaminants and compliance with specific concentration limits to prevent pollution. However, it should be noted that the Environmental Quality Standards Directive are currently under revision, and it will be necessary to take account of the new requirements that are adopted

Current Status from the Initial Assessment

465. Environmental concentrations of monitored hazardous substances in the sea have generally fallen, but are still above levels where there is a risk of pollution effects in many coastal areas, especially where there have been historical discharges, emissions and losses from high population densities or heavy industry. Levels of persistent organic pollutants found in marine species have declined following the regulation of the substances concerned, but additional man-made chemicals are still being found in marine samples, and there is a need to keep gathering data to assess their potential impacts and the need for further controls.

Table 3.12 - GES characteristics and associated targets for Descriptor 8

GES characteristics for contaminants (Descriptor 8)	
Characteristics of GES for Descriptor 8 (Contaminants)	The UK characteristics of GES for this Descriptor are as follows: Concentrations of contaminants in water, sediment, or biota are kept within agreed[184] levels and these concentrations are not increasing; and The effects of contaminants on selected biological processes and taxonomic groups, where a cause/effect relationship has been established, are kept within agreed[185] levels.
GES targets for contaminants (Descriptor 8)	
Targets for Descriptor 8 – Concentration of Contaminants	Concentrations of substances identified within relevant legislation and international obligations are below the concentrations at which adverse effects are likely to occur (e.g. are less than Environmental Quality Standards applied within the Water Framework Directive[186] and Environmental Assessment Criteria applied within OSPAR[187]).
Targets for	For biological effects: The intensity of those biological or ecological

[184] Agreed at a national/EU/International level e.g. within domestic legislation, Regional Seas Conventions etc.

[185] Agreed at a national/EU/International level e.g. within domestic legislation, Regional Seas Conventions etc.

[186] An Ecological Quality Standards (EQSs) is defined as 'the concentration of a particular pollutant or group of pollutants in water, sediment or biota which should not be exceeded in order to protect human health and the environment.' WFD Article 2 (35)

[187] Environmental Assessment Criteria (EAC) represent to contaminant concentration in the environment below which no chronic effects are expected to occur in marine species, including the most sensitive species. Concentrations below the EACs are considered to present no significant risk to the environment and are unlikely to give rise to unacceptable biological effects.

Descriptor 8 – Effects of Contaminants	effects due to contaminants agreed by OSPAR as appropriate for MSFD purposes are below the toxicologically-based standards. For oil/chemical spills: Occurrence and extent of significant acute pollution effects (e.g. slicks resulting from spills of oil and oil products or spills of chemical) and their impact on biota affected by this pollution should be minimised through appropriate risk based approaches.

Approach to setting GES targets for contaminants

466. The targets for contaminants are based on existing OSPAR or WFD targets. There is a high-level of regional coordination on the approach to assessment of contaminants and the coordination work undertaken within OSPAR has shown that EU Member States in the North East Atlantic will follow a similar approach to setting targets. As a result of this coordination work a new target for indicator 8.2.2 (significant pollution events) has been developed which is likely to adopted by a number of OSPAR countries.

467. For further detail on the approach to setting targets for this Descriptor see Section 2.5 of the Cefas CBA Report 2012[188].

Implications of the targets

468. It is likely that any measures necessary to meet the GES targets for this Descriptor will be taken under existing legislation (e.g. the Urban Waste Water Treatment Directive (UWWTD), the WFD, the Integrated Pollution Prevention and Control (IPPC) Directive, the Existing Substances Regulation and REACH. The only exception to this is in relation to the presence in a few areas of persistent legacy contaminants in sediments which will not be dealt with under existing legislation. Measures to remove these contaminated sediments would not be practical and would be highly costly. The UK does not propose implementing these measures on the grounds that they would be disproportionately costly. Therefore, our assessment is that there will be no additional cost implications from measures associated with these targets.

469. The UK will utilise existing monitoring programmes under the WFD and OSPAR to meet monitoring requirements for MSFD. Therefore we are confident there will be negligible additional costs in terms of monitoring, although additional monitoring could be required in the future if new substances are added to priority substances lists.

470. More information on the potential costs and benefits associated with these targets can be found in the MSFD Impact Assessment[189].

Gaps and development needs

471. There are no major gaps or development needs, but it will be necessary to keep in step with on-going work on the development of environmental quality standards for new chemicals and to participate in inter-calibration exercises carried out in OSPAR and the EC.

188 http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16817&FromSearch=Y&Publisher=1&SearchText=ME5405&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

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3.8 Descriptor 9 – Contaminants in fish and other seafood

Background

472. This Descriptor is intended to ensure contaminants, specifically organic chemicals and trace metals found in fish and shellfish destined for human consumption do not exceed thresholds laid out in Community legislation or other agreements. Biotoxins[190] and microbiological contamination are not expressly included under this Descriptor, nor elsewhere in the assessment of GES[191].

473. Contaminants present in fish and other seafood destined for human consumption may arise for a number of reasons, from both anthropogenic sources (e.g. industry, sewage discharges, agriculture, aquaculture, etc) and natural sources (e.g. natural geological factors including geothermal activity).

Summary of current status from the Initial Assessment

474. With the exception of some shellfish, testing of fish and fisheries products in the UK has generally been carried out just prior to it reaching the consumer i.e. as it reaches the shelf, making it almost impossible to determine exactly where the sample was taken from. However, very few non-compliant samples have been reported suggesting that contaminant levels are generally acceptable and maximum levels specified in the legislation are not being exceeded.

Table 3.13 - GES characteristics and associated targets for Descriptor 9

GES characteristics for contaminants in seafood (Descriptor 9)	
Characteristics of GES for Descriptor 9 (Contaminants in seafood)	The UK characteristics of GES for this Descriptor are as follows: Concentrations of contaminants in fish and other seafood caught or harvested for human consumption in UK seas do not exceed the relevant maximum levels listed in EU Regulation 1881/2006 (as amended)or other relevant standards and are not increasing[192].
GES targets for contaminants in seafood (Descriptor 9)	
Targets and indicators for Descriptor 9 - Levels, numbers and frequency of contaminants	For contaminants where regulatory levels have been set, there should be a high rate of compliance based on relevant surveys and including samples originating from commercial fishing grounds in the greater North Sea and the Celtic Seas.

[190] Paralytic, Diarrhetic and Amnesic Shellfish Poisoning toxins

[191] The ICES Task Group 9 report says “the term "**contaminants**" is interpreted as "hazardous substances present in fish as a result of environmental contamination for which regulatory levels have been set for human consumption or for which the presence in fish is relevant". In this interpretation, hazardous substances are substances (i.e. chemical elements and compounds) or groups of substances that are toxic, persistent and liable to bio-accumulate, and other substances or groups of substances which give rise to an equivalent level of concern. It also says: Although regulatory levels have been set for marine biotoxins, they are not considered as contaminants. Their presence in fish and seafood is not always linked to human activities. Harmful algal bloom events are often due to climatic and hydrographical circumstances although human induced eutrophication from domestic, industrial and agricultural wastes can stimulate harmful algae blooms. Therefore, there is not always a consistent link between the levels of marine biotoxins in fish and seafood and the environmental status of the marine environment. In addition, the threat from marine biotoxins is managed in a different manner to other regulatory levels in seafood, prompting controls on harvesting.

[192] With the exception of fish liver, for which a high rate of non-compliance is expected.

Approach to setting GES targets for contaminants in seafood

475. The targets and indicators are based on existing thresholds for contaminants set out in existing EU legislation or other internationally and nationally agreed standards. Since the targets reflect existing agreed standards, we have high confidence that other Member States will take a similar approach.

476. For further detail on the approach to setting targets for this Descriptor see **Section 2.6 of the Cefas CBA Report 2012[193].**

Implications of the proposed targets

477. It is unlikely that additional measures will be needed to achieve GES for this Descriptor beyond those already being put in place to meet existing legislative requirements on contaminants (including the WFD, the UWWTD, the Shellfish Waters Directive, the revised Bathing Waters Directive, the IPPC Directive and REACH).

478. Some additional monitoring in commercial fishing grounds in the relevant MSFD sub-regions (Greater North Sea and Celtic Seas) is likely to be necessary because current Food Standards Agency monitoring schemes are generally not able to identify the source of the samples being tested in their current monitoring programmes.

479. More information on the potential costs and benefits associated with these target proposals can be found in the MSFD Impact Assessment[194].

Gaps and development needs

480. No target has been specifically proposed for the Commission Indicator relating to the frequency of regulatory level exceedences as outlined in the Commission Decision on GES. This is because this element is considered to be adequately covered under the target established for the Commission Indicator relating to actual levels of contaminants detected.

481. In the short term consideration will be given to the monitoring data currently available with respect to developing a robust baseline. Current monitoring activities will also be adapted to ensure samples of tissue are taken from commercially exploited species in fishing grounds for laboratory analysis. In the longer term, the feasibility of adapting current food safety monitoring programmes to provide spatially referenced data will be considered.

3.9 Descriptor 10 – Marine litter

Background

482. Significant amounts of litter[195] appear in our seas and on our beaches. It is unsightly and can cause harm to marine wildlife through entanglement and ingestion, and through smothering of the seabed. However there are currently no agreed assessment tools to quantify how such impacts on

193 http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16817&FromSearch=Y&Publisher=1&SearchText=ME5405&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

194 www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

195 "Marine litter (marine debris) is any persistent, manufactured or processed solid material discarded, disposed of, abandoned or lost in the marine and coastal environment" Marine Litter – An analytical overview, Regional Seas Programme, UNEP.

individuals might translate to population level effects. Litter also has economic effects through clean up costs to local communities and lost tourism, and costs to fishermen through lost catch and snagged nets. It can also pose a hazard to seafarers through fouling of ship propellers. Plastics are the main type of litter found both on beaches and offshore, including increasing quantities of microscopic pieces of plastics resulting from degradation of larger plastic products in the sea. These may act as a vector for transferring toxic chemicals to the food chain. There is, therefore, widespread recognition that current and future measures to reduce marine and coastal litter will bring ecological, economic and social benefits.

483. Any persistent, manufactured or processed solid material discarded, disposed of, abandoned or lost in the marine and coastal environment can be defined as marine litter.[196] Most marine litter consists of material that degrades slowly, if at all, so a continuous input of large quantities of these items results in a gradual build-up in the marine and coastal environment. Whilst sources of litter are difficult to trace, most found in UK waters comes from land based sources rather than through shipping or other maritime activities.

Summary of current status from the Initial Assessment

484. Levels of marine litter are considered problematic in all areas where there are systematic surveys of beached litter density. There has only been limited surveying of litter on the seabed and in the water column, which has demonstrated that litter tends to accumulate in certain areas as a result of wind and currents. There is limited information from the northern part of the Celtic Seas Subregion.

Table 3.14 - GES characteristics and associated targets for Descriptor 10

GES characteristics for marine litter (Descriptor 10)	
Characteristics of GES for Descriptor 10 (Marine Litter)	The draft UK characteristics of GES for the Descriptor are as follows: The amount of litter, and its degradation products[197], on coastlines and in the marine environment is reducing over time and levels do not pose a significant risk to the coastal and marine environment, either as a result of direct mortality such as through entanglement, or by way of indirect impacts such as reduced fecundity or bioaccumulation of contaminants within food chains.
GES targets for marine litter (Descriptor 10)	
Targets and indicators for Descriptor 10 – Characteristics of Litter in the Marine Environment	Overall reduction in the number of visible litter items within specific categories/types on coastlines
	Surveillance indicator to monitor the quantities of litter on the seafloor
	Surveillance indicator to monitor the amounts of plastic found in the contents of fulmars stomachs (in line with the OSPAR Ecological Quality Objective)

[196] Marine Litter – An analytical overview, Regional Seas Programme, UNEP.

[197] Degradation products of litter include small plastic particles and micro plastic particles

Approach to setting GES targets for marine litter

485. Due to our limited understanding of the current levels, properties, and impacts of marine litter experts have been unable to propose quantitative targets indicating the point at which GES would be achieved i.e. a litter threshold. Instead, a trend based target for litter on coastlines has been developed which requires an absolute reduction in visible litter items on coastlines within specific categories (e.g. plastics, fishing litter). This target, which is in line with the conclusions of the initial assessment and consistent with Government policies on terrestrial litter, will lead to a reduction in the levels of litter on our beaches and coastlines. It is likely that other countries in the North East Atlantic will implement very similar target for litter on coastlines.

486. In addition to litter on coastlines, the Commission Decision on GES covers a number of other aspects of litter, including litter on the seafloor and in the water column, microparticles, and the impacts of litter on marine life (through indicators of the amounts of litter ingested by key marine species). For these aspects of litter it is not considered possible to set specific targets at this time both due to uncertainties surrounding impacts and a current lack of data to set suitable baselines, however, a number of surveillance indicators will be put in place to improve our understanding of trends and allow us to set targets in the future as appropriate.

487. For levels of litter items on the seafloor a surveillance indicator will be adopted in this initial MSFD management cycle. A surveillance indicator will also be adopted for assessing the levels of litter in the water column, based on an assessment of the amount of plastic particles found in the stomachs of northern fulmars (a seabird which accumulates plastic particles in their stomachs). Both of these indicators will allow us to collect more data and will give an indication of the amounts of litter present in the wider marine environment and how this is varying over time. However, due to the persistent nature of most types of litter, these indicators are only likely to change very slowly in response to management measures. Both indicators will be monitored in order to develop robust baselines and targets may be developed in the future if this is considered necessary.

488. With regard to microparticles, expert opinion has indicated that our understanding of the nature of microparticles in the marine environment and their propensity to cause harm is too underdeveloped to establish a meaningful target or indicator at this point in time. Further work will be carried out to improve our understanding of the issue.

489. With regard to the impacts of litter on marine life, UK experts believe that there are currently no robust indicators which could be used to assess this. Several Member States are likely to use the indicator for the level of plastic particles in the stomachs of fulmars for this purposes, but UK experts currently consider that the links to harm are unclear and therefore the UK is only putting this forward as an indicator of litter levels in the water column. Further work will be undertaken to develop a robust indicator of the impact of litter on marine life as soon as possible.

490. For further detail on the approach to setting targets for this Descriptor see **Section 2.7 of the Cefas CBA Report 2012**[198].

Implications of the targets

491. Land-based sources are estimated to make up around 80% of the litter reaching the marine environment[199]. Measures to reduce land-based sources of litter are already being taken forward

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http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16817&FromSearch=Y&Publisher=1&SearchText=ME5405&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

199 Faris and Hart, 1994

as part of the UK Government's Waste Review[200] and Devolved Administrations waste policy. These include measures to increase recycling and improve product design. Existing policies on terrestrial litter, such as the Love Where You Live campaign in England, will also lead to the implementation of measures which will play a large part in meeting the GES target for litter on coastlines. Current litter policies involve a strong focus on action being taken across society (e.g. by communities and businesses) rather than centralised action by Government, and could include measures such as public campaigns to raise awareness and promote changed behaviour on littering and encouraging and facilitating community clean-up activity.

492. Action will also be needed to reduce litter from marine sources. A range of measures are already in place, particularly relating to litter from shipping. MARPOL Annex V (Garbage) has just been reviewed by the IMO resulting in a general prohibition being applied with a limited amount of exceptions for discharge of litter into the sea. These changes will take effect internationally from 1st January 2013 and will be enforced by the MCA. Further action may be required to address other marine sources of litter, for example, through the extension of voluntary codes of practice with the fishing industry. The target and indicators will require some additional monitoring and work is on-going to consider the options.

493. More information on the potential costs and benefits associated with these target proposals can be found in the MSFD Impact Assessment[201].

Gaps and Development Needs

494. Targets have not been specifically proposed for the Commission Indicators relating to litter in the water column and on the seafloor (10.1.2) as outlined in the Commission Decision on GES. For these indicators it was felt that insufficient baseline data exist at this time, making it difficult to establish robust targets. Instead surveillance indicators will be put in place in order to collect relevant monitoring data with a view to developing targets for 2018 if necessary. With respect to micro-particle trends (10.1.3), and impacts of litter on marine life (10.2) no target s have been put forward due to current levels of scientific uncertainty, however this will be addressed by way of appropriate research.

3.10 Descriptor 11 – Introduction of energy, including underwater noise

Background

495. According to the Commission Decision on GES 2010[202], at this stage this Descriptor is intended to address the impacts of noise on the marine environment and does not currently cover the impacts of any other forms of energy. The Descriptor is divided into two Commission indicators, impulsive sound[203], caused primarily by activities such as oil and gas seismic activity and pile driving for wind farms, and ambient sound[204] caused primarily by shipping.

496. Anthropogenic inputs of sound can potentially affect marine organisms in a variety of ways. Continuous noise may degrade the sound habitat, masking biologically relevant signals such as echolocation clicks, making it harder or impossible to find a mate, locate food or detect predators. Impulsive sounds can lead to a variety of behavioural reactions such as avoidance of feeding or

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200 Government Review of Waste Policy in England 2011 - http://www.defra.gov.uk/publications/files/pb13540-waste-policy-review110614.pdf

201 www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

202 Commission Decision of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters (2010/477/EU)

203 Impulsive sounds are loud, low and mid frequency impulsive sounds which tend to be caused by activities such as pile driving.

204 Ambient sounds are continuous low frequency sounds.

breeding areas, or may result in physiological effects such as temporary or permanent damage to hearing organs, and at very high levels, even death.

Summary of current status from Initial Assessment

497. There is currently insufficient data to provide a quantitative assessment of the current status and trends of underwater noise in UK seas due to a lack of available information from monitoring studies. However, increases in construction levels are likely to have contributed to localised increases in impulsive noise levels, whilst it remains unclear whether changes in shipping activity have resulted in an increase in ambient noise levels.

498. Further research, monitoring and investigation is necessary to fully understand the effects of noise at an individual and population level, the risks and significance of sound inputs to the environment, and appropriate options for mitigation. However, at this time there is no evidence to suggest that current levels of noise in UK waters are having an impact at the population level on cetaceans or other noise sensitive marine animals.

Table 3.15 - GES characteristics and associated targets for Descriptor 11

GES characteristics for noise (Descriptor 11)	
Characteristics of GES for Descriptor 11 (underwater noise)	The UK characteristics of GES for this Descriptor are as follows: Loud, low and mid frequency impulsive sounds and continuous low frequency sounds introduced into the marine environment through human activities do not have adverse effects on marine ecosystems: Human activities potentially introducing loud, low and mid frequency impulsive sounds into the marine environment are managed to the extent that no significant long term adverse effects are incurred at the population level or specifically to vulnerable/threatened species and key functional groups. Continuous low frequency sound inputs do not pose a significant risk to marine life at the population level, or specifically to vulnerable/threatened species and key functional groups e.g. through the masking of biologically significant sounds and behavioural reactions
GES targets for noise (Descriptor 11)	
Targets for Descriptor 11 - Distribution in time and place of loud, low and mid frequency sounds	To establish a 'noise registry' to record, assess, and manage the distribution and timing of anthropogenic sound sources measured over the frequency band 10 Hz to 10 kHz, exceeding the energy source level 183 dB re 1 $\mu Pa^2 m^2 s$; or the zero to peak source level of 224 dB re 1 $\mu Pa^2 m^2$ over the entire UK hydrocarbon licence block area.
Targets for Descriptor 11 - Continuous low frequency sound	Surveillance indicator to monitor trends in the ambient noise level within the 1/3 octave bands 63 and 125 Hz (centre frequency) (re 1µPa RMS; average noise level in these octave bands over a year) measured by observation stations.

Approach to setting GES targets for underwater noise

499. Due to the high level of uncertainty about the effects of noise, it has not been possible for experts to recommend a specific target for either impulsive sounds or ambient sounds which they believe to be equivalent to GES. Instead, an operational target has been developed for impulsive

sounds and a surveillance indicator developed for ambient sounds – these are summarised below. This approach is designed to enable us to better monitor, understand and manage the impacts of noise.

500. There is still considerable uncertainty over the approach that other Member States will be taking to setting targets for both impulsive and ambient sounds. However, the UK co-chairs the EU Technical Sub-Group on Noise[205], established by the Commission to assist in developing a coordinated approach to this Descriptor, so is well-placed to promote the approaches to target setting proposed in this impact assessment.

Approach to setting targets - Impulsive sounds:

501. The majority of impulsive sounds will come from seismic surveys (e.g. for oil and gas) and pile driving (e.g. for renewable energy installations). The potential physical effects of such sounds on marine life i.e. hearing loss, death etc occur close to these sources and are recognised and managed in the existing licensing regime; for example, through the use of mammal observers, temporal restrictions on when activities can take place, and "soft starts[206]". For this reason this Descriptor and the associated Commission indicator aim to address the cumulative impacts of noise generating activities on the behaviour of noise sensitive populations i.e. marine mammals, fish etc, through consideration of noise levels, and their distribution in space and time.

502. Whilst a good scientific understanding exists with regard to the level of noise which can cause physical harm to certain species, there is far less certainty about the levels of noise which are likely to cause negative behavioural impacts and can have an effect at a population level. The difficulty in setting thresholds for behavioural impacts is further compounded by the fact that behavioural change is very context specific. A sound that might have an effect in one context may not have an effect in another context.

503. In order to overcome these uncertainties experts in Cefas and JNCC have made an assessment of current and planned noise levels in UK waters. The major current source of impulsive underwater sound arises from seismic surveys, and this will likely continue to be the case up to 2020 and most likely beyond. The relative proportion of noise from offshore renewable energy construction is likely to increase by 2020, and possibly beyond. Experts have predicted the future distribution of impulsive sound events and although the number of noise generating events is likely to increase (largely as a result of renewable energy expansion), it is not expected that this will be significant at the temporal and spatial scales relevant to this Descriptor. Therefore our current understanding indicates that it is unlikely that there would be any significant adverse effects on marine animal populations up to 2020 and beyond, provided appropriate measures continue to be taken through the current licensing regime to manage the potential physical impacts near to individual noise generating activities[207].

504. However, there is currently no means of recording, assessing or managing the distribution or timing of impulsive noise, increasing the risk that the pattern of activity might pose a threat to the achievement of GES in the future. Not setting any target could also imply that cumulative effects of projects do not need to be considered.

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[205] This is a group of experts established by, and reporting to, the EU Commission. They have been tasked with discussing and providing advice on marine noise, including approaches to target setting and monitoring methodologies.

[206] A soft start involves slowly building up the strength/intensity of a noise generating activity thus allowing noise sensitive species the opportunity to leave the area prior to physical harm occurring.

[207] This assessment is based on work which was done after the BAU Report 2011 was completed. For this reason the BAU Report conclusions on Descriptor 11 are not considered to be the most up-to-date analysis.

505. Setting a specific target representing GES is difficult, given current uncertainties. Based on the conclusions above, the aim of the GES target for impulsive sounds is to take a proportionate, precautionary approach, allowing continued management, collection and evaluation of better evidence relating to behavioural impacts of noise at a population level. The target establishes a requirement to develop and maintain a 'noise registry' which would record in space and time activities generating noise in order that they can be analysed to determine whether they may potentially compromise the achievement of GES. Such a registry is likely to be managed by JNCC and will require a degree of coordination from regulating authorities around the UK. It would enable a better understanding of potential cumulative and in-combination effects, and allow for some adjustment in the scheduling of activities if it appeared significant adverse impacts may arise. However, any adjustments to the scheduling of activities would need to be very carefully managed and made well in advance given the high potential for significant costs to be incurred by developers e.g. as a result of increased project timescales, missed grid connections etc.

506. For further detail on the approach to setting targets for this Descriptor see **Section 2.8 of the Cefas CBA Report 2012[208].**

Implications of the targets – impulsive sounds

507. It is anticipated that the administrative and financial burden of establishing and maintaining a noise registry would be relatively small for both the regulator and industry (a small additional cost may be incurred by industry where applications are required to provide more detailed information in advance with respect to when and where an activity will take place). No additional monitoring costs are envisaged.

Approach to setting targets - Ambient sounds

508. The main source of anthropogenic ambient noise in the marine environment is from shipping activity and ambient noise levels are likely to increase if the volume of shipping in UK waters increases, and no measures are taken to reduce noise levels from ships. However, there is insufficient monitoring data at this time to support any assessment of current ambient noise levels or their impact on marine animal populations.

509. Action already being taken through the IMO to improve efficiency standards in newly built ships will also make them less noisy (more hydrodynamic ships are more efficient and also tend to create less noise). In July 2011 the IMO adopted, by means of an amendment to the MARPOL Convention, an Energy Efficiency Design Index (EEDI) which will establish a mandatory efficiency standard for the design of new ships, with a tightening stringency over time. The EEDI provisions come into force on 1 January 2013, and the first efficiency improvements must be made from 1 January 2015. It is currently unclear how far these measures will reduce noise levels from shipping.

510. As with impulsive sound, what constitutes GES is uncertain given current levels of knowledge but in contrast to impulsive sounds, a management regime for preventing physical harm does not exist and far less is known about current noise levels. The effects of ambient noise on marine life are also largely unknown so, in contrast to impulsive sounds, where it has been possible to use thresholds for physical harm, there are no specific exposure thresholds that can be proposed which can be used as part of a framework to define GES[209].

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208 http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16817&FromSearch=Y&Publisher=1&SearchText=ME5405&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

209 Tasker et al. 2010

511. Given uncertainties with respect to current levels and impacts of ambient noise, a specific target has not been developed and instead a surveillance indicator has been put forward with the UK determination of GES for noise being used as a generic, qualitative target. This approach will ensure appropriate monitoring is put in place in order that a more specific target can be established at a later date when sufficient evidence has been collected.

512. For further detail on the approach to setting targets for this Descriptor see **Section 2.8 of the Cefas CBA Report 2012[210].**

Implications of the targets – Ambient sounds

513. Additional monitoring will be necessary in order to establish the surveillance indicator and improve our understanding of ambient noise levels. Cefas are currently developing a proposal for a cost effective monitoring programme for ambient sounds based on in situ observations (utilising existing platforms) and modelling. Marine Scotland are also developing a programme of placement for noise monitoring devices in Scottish waters to monitor noise levels from anthropogenic activity, primarily offshore renewables, but once in place could be used for other activities.

Gaps and development needs

514. Targets have not been put forward in relation to the Commission Indicator relating to trends in ambient noise levels. Instead a surveillance indicator has been proposed to ensure further monitoring data is collected with a view to developing an appropriate target for 2018.

515. There is a need to develop and implement the proposed noise registry and a continuing need to develop the quantitative elements of the targets in order to better understand the relationship between the distribution in time and space of impulsive sounds and the implications for achieving GES and promote this approach at an EU level.

516. Over the longer term there will be a need to develop an ambient noise monitoring programme which is coordinated with neighbouring Member States. Further research is also needed to understand the levels of noise, both ambient and impulsive, which result in harm at a population level and significant behavioural effects.

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http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=16817&FromSearch=Y&Publisher=1&SearchText=ME5405&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

ANNEX A: Detailed Indicators for Descriptors 1, 4 and 6

Descriptor	Commission Decision GES criteria	Commission Decision indicator or indicator-class	Component	Proposed Indicator Name	Indicator Metric	Proposed Target	Target relevance	Development stage of indicator and target
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Birds	Distributional pattern of winter gull roosts	percentage occupancy of tetrads (2km x 2km survey squares)	The distributional range (as measured by percentage occupancy) in each admin area should not decrease, with statistical significance by x% or more;	Applicable to all species of gull at inshore winter gull roosts	Further development needed (expected to be operational by 2014)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Birds	Distributional pattern of non-breeding shorebirds	percentage occupancy of tetrads (2km x 2km survey squares).	The distributional range (as measured by percentage occupancy) in each admin area should not decrease, with statistical significance by 10% or more;	Applicable to non-breeding shorebird species (intertidal benthic feeders in non-estuarine areas outside the breeding season).	Further development needed (expected to be operational by 2014)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Birds	Distributional pattern of inshore non-breeding waterbirds	% of modelled 1km squares with loss of habitat (displacement)	Within each UK regional sea < X% modelled 1km square with loss of habitat (displacement)	Applicable to all non-breeding waterbird species in inshore waters i.e. Ducks, grebes & divers	Further development needed (expected to be operational by 2018 if adopted)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Birds	Distributional pattern of coastal-breeding waterbirds	percentage occupancy of tetrads (2km x 2km survey squares)	The distributional range (as measured by percentage occupancy) in each admin area should not decrease, with statistical significance by x% or more;	Applicable to coastal-breeding waterbirds (i.e. all species of shorebird, duck and other waterbirds that breed close to the shoreline and are dependent on intertidal and inshore areas for feeding).	Further development needed (expected to be operational by 2014)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Birds	Distributional pattern of breeding seabirds	Number /location of breeding seabirds colonies	The distributional range in each admin area should not decrease, with statistical significance by x% or more;	Applicable to all breeding seabird species in all relevant functional groups	Further development needed (expected to be operational by 2014)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Birds	Distributional pattern of seabirds at sea	% of modelled 1km squares with loss of habitat (displacement)	Within each UK regional sea < X% modelled 1km square with loss of habitat (displacement)	Applicable to all seabird species in all functional groups	Further development needed (expected to be operational by 2018 if adopted)
1	1.2 Population size	1.2.1 Population abundance	Birds	Species-specific trends in relative non-breeding abundance of marine birds at sea (inshore and offshore)	Annual abundance of non-breeding marine birds at sea expressed as a percentage of baseline	Species specific annual abundance is within +/-x% of the baseline. (Target levels to be set once a monitoring programme is in Place)	Potentially applicable to all non-breeding seabird and waterbird species in all functional groups when at sea - both inshore and offshore.	Further development needed (expected to be operational by 2018 if adopted)
1	1.2 Population size	1.2.1 Population abundance	Birds	Species-specific trends in relative breeding abundance of seabirds	Annual abundance of breeding seabirds expressed as a percentage of baseline	Species-specific annual breeding abundance should be more than 80% of the baseline for species that lay one egg, or more than 70% of the baseline for species that lay more than one egg.	applicable to all breeding seabird species in all relevant functional groups	Further development needed (expected to be operational by 2014)
1	1.2 Population size	1.2.1 Population abundance	Birds	Species-specific trends in relative abundance of non-breeding shorebirds	Annual abundance of non-breeding shorebirds expressed as a percentage of baseline	Species-specific annual non-breeding abundance should be more than 75% of the baseline.	Applicable to non-breeding shorebird species (intertidal benthic feeders in non-estuarine areas outside the breeding season).	Further development needed (expected to be operational by 2014)

2	1.2 Population size	1.2.1 Population abundance	Birds	Species-specific trends in relative abundance of breeding waterbirds	Annual abundance of breeding waterbirds expressed as a percentage of baseline	Species-specific annual breeding abundance should be more than 75% of the baseline.	Applicable to coastal-breeding waterbirds (i.e. all species of shorebird, duck and other waterbirds that breed close to the shoreline and are dependant on intertidal and inshore areas for feeding).	Further development needed (expected to be operational by 2018 if adopted)
1	1.3 Population condition	1.3.1 Population demographic characteristics	Birds	Non-native mammal presence on island seabird colonies	Number-of island seabird colonies where non-native mammal species are present	Minimise the risk of invasion by non-native mammals on all island seabird colonies, where this has not already occurred (including islands from where mammals have been eradicated); and eliminate detrimental impacts caused by mammals at a prioritised list of island seabird colonies.	All island seabird colonies.	Further development needed (expected to be operational by 2014)
1	1.3 Population condition	1.3.1 Population demographic characteristics	Birds	Mortality of seabirds from fishing (bycatch) and aquaculture	Number of seabirds killed by commercial fishing and by aquaculture	Estimated mortality as a result of fishing bycatch and aquaculture entanglement does not exceed levels that would prevent targets for 1.2 population size from being achieved.	All marine birds susceptible to being caught and killed by commercial fishing and by being entangled and killed aquaculture.	Further development needed (expected to be operational by 2018 if adopted)
1	1.3 Population condition	1.3.1 Population demographic characteristics	Birds	Breeding failure of seabird species sensitive to food availability	Percentage of colonies failing per year, per species (the proportion of colonies at which breeding success was 0.1 chicks per nest or less)	The annual percentage of colonies experiencing breeding failure does not exceed the mean percentage of colonies failing over the preceding 15 years, or 5%, whichever value is greater, in more than three years out of six.	Applicable to breeding seabird species that are notably sensitive to food availability	Further development needed (expected to be operational by 2014)
1	1.3 Population condition	1.3.1 Population demographic characteristics	Birds	Annual breeding success of kittiwakes	Annual mean breeding success (no. offspring per pair) of kittiwake at sampled colonies. (Missing annual observations can be predicted by models - separate models recommended for the Celtic Seas, the Northern Isles and the Greater North Sea (except the Northern Isles)	Annual breeding success is not significantly different, statistically, from the level expected in the prevailing climatic conditions (defined by local SST in winter 2 years previous winter) in five years out of six.	Kittiwakes are considered amongst most sensitive of UK breeding seabirds to changes in food availability. Indicator will be applicable to other species that rely on small shoaling fish (e.g. sandeels).	Further development needed (expected to be operational by 2014)
4	4.1 Productivity (production per unit biomass) of key species or trophic groups	4.1.1 Performance of key predator species using their production per unit biomass (productivity)	Birds	Annual breeding success of kittiwakes	Annual mean breeding success (no. offspring per pair) of kittiwake at sampled colonies. (Missing annual observations can be predicted by models - separate models recommended for the Celtic Seas, the Northern Isles and the Greater North Sea (except the Northern Isles)	Annual breeding success is not significantly different, statistically, from the level expected in the prevailing climatic conditions (defined by local SST in winter 2 years previous winter) in five years out of six.	Kittiwakes are considered amongst most sensitive of UK breeding seabirds to changes in food availability. Indicator will be applicable to other species that rely on small shoaling fish (e.g. sandeels).	Further development needed (expected to be operational by 2014)
4	4.3 Abundance/distribution of key trophic groups/species	4.3.1 Abundance trends of functionally important selected groups/species	Birds	Species-specific trends in relative non-breeding abundance of marine birds at sea (inshore and offshore)	Annual abundance of non-breeding marine birds at sea expressed as a percentage of baseline	Species specific annual abundance is within +/-x% of the baseline. (Target levels to be set once a monitoring programme is in Place)	Potentially applicable to all non-breeding seabird and waterbird species in all functional groups when at sea - both inshore and offshore.	Further development needed (expected to be operational by 2018 if adopted)
4	4.3 Abundance/distribution of key trophic groups/species	4.3.1 Abundance trends of functionally important selected groups/species	Birds	Species-specific trends in relative breeding abundance of seabirds	Annual abundance of breeding seabirds expressed as a percentage of baseline	Species-specific annual breeding abundance should be more than 80% of the baseline for species that lay one egg, or more than 70% of the baseline for species that lay more than one egg.	applicable to all breeding seabird species in all relevant functional groups	Further development needed (expected to be operational by 2014)

4	4.3 Abundance/distribution of key trophic groups/species	4.3.1 Abundance trends of functionally important selected groups/species	Birds	Species-specific trends in relative abundance of non-breeding shorebirds	Annual abundance of non-breeding shorebirds expressed as a percentage of baseline	Species-specific annual non-breeding abundance should be more than 75% of the baseline.	Applicable to non-breeding shorebird species (intertidal benthic feeders in non-estuarine areas outside the breeding season).	Further development needed (expected to be operational by 2014)
4	4.3 Abundance/distribution of key trophic groups/species	4.3.1 Abundance trends of functionally important selected groups/species	Birds	Species-specific trends in relative abundance of breeding waterbirds	Annual abundance of breeding waterbirds expressed as a percentage of baseline	Species-specific annual breeding abundance should be more than 75% of the baseline.	Applicable to coastal-breeding waterbirds (i.e. all species of shorebird, duck and other waterbirds that breed close to the shoreline and are dependant on intertidal and inshore areas for feeding).	Further development needed (expected to be operational by 2018 if adopted)
1	1.1 Species distribution	1.1.1 Distributional range	Marine Mammals	Distributional range of Harbour seal	Change in presence at extremities of range in UK waters	No decrease in current (baseline) range as a result of anthropogenic activities	harbour seal	Operational (in 2012)
1	1.1 Species distribution	1.1.1 Distributional range	Marine Mammals	Distributional range of Grey seal breeding	Change in presence at extremities of breeding range	No decrease in current (baseline) range as a result of anthropogenic activities	grey seal	Operational (in 2012)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Marine Mammals	Distributional pattern within range of harbour porpoises	Presence/absence in quarter ICES rectangles per year in five year periods	No statistically significant decrease in current (baseline) distributional pattern as a result of anthropogenic activities	harbour porpoises	Further development needed (expected to be operational by 2018 if adopted)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Marine Mammals	Distributional pattern within range of bottlenose dolphins	Presence/absence in quarter ICES rectangles per year in five year periods	No statistically significant decrease in current (baseline) distributional pattern as a result of anthropogenic causes	bottlenose dolphin	Further development needed (expected to be operational by 2018 if adopted)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Marine Mammals	Distributional pattern within range of short-beaked common dolphins	Presence/absence in quarter ICES rectangles per year in five year periods	No statistically significant decrease in current (baseline) distributional pattern as a result of anthropogenic causes	short beaked common dolphins	Further development needed (expected to be operational by 2018 if adopted)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Marine Mammals	Distribution pattern within range of white beaked dolphins	Presence/absence in quarter ICES rectangles per year in five year periods	No statistically significant decrease in current (baseline) distributional pattern as a result of anthropogenic causes	white beaked dolphins	Further development needed (expected to be operational by 2018 if adopted)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Marine Mammals	Distributional pattern within range of minke whales in summer	Presence/absence in quarter ICES rectangles per year in five year periods	No statistically significant decrease in current (baseline) distributional pattern as a result of anthropogenic causes	minke whale	Further development needed (expected to be operational by 2018 if adopted)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Marine Mammals	Distributional pattern within range of harbour seal	Proportion of occupancy of sampling sub-units	No statistically significant decrease in current (baseline) distributional pattern as a result of anthropogenic causes	harbour seal	Operational (in 2012)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Marine Mammals	Distributional pattern within range of grey seal breeding	An assessment of changes in distribution within core areas including an assessment of similarity between years	No statistically significant decrease in current (baseline) distributional pattern as a result of anthropogenic causes	grey seal	Operational (in 2012)
1	1.2 Population size	1.2.1 Population abundance	Marine Mammals	Abundance of two inshore bottlenose dolphin populations	Total number of bottlenose dolphins in the Scottish East Coast and Welsh, Cardigan Bay, populations	No statistically significant decrease in abundance of either of the two populations as a result of anthropogenic causes	inshore bottlenose dolphin	Further development needed (expected to be operational by 2014)
1	1.2 Population size	1.2.1 Population abundance	Marine Mammals	Abundance of harbour porpoise	Abundance	No statistically significant decrease in abundance as a result of anthropogenic causes	harbour porpoise	Further development needed (expected to be operational by 2018 if adopted)

1	1.2 Population size	1.2.1 Population abundance	Marine Mammals	Abundance of white-beaked dolphin	Abundance	No statistically significant decrease in abundance as a result of anthropogenic causes	white beaked dolphin	Further development needed (expected to be operational by 2018 if adopted)
1	1.2 Population size	1.2.1 Population abundance	Marine Mammals	Abundance of short-beaked common dolphin	Abundance	No statistically significant decrease in abundance as a result of anthropogenic causes	short-beaked common dolphin	Further development needed (expected to be operational by 2018 if adopted)
1	1.2 Population size	1.2.1 Population abundance	Marine Mammals	Abundance of minke whale	Abundance	No statistically significant decrease in abundance as a result of anthropogenic causes	minke whale	Further development needed (expected to be operational by 2018 if adopted)
1	1.2 Population size	1.2.1 Population abundance	Marine Mammals	Abundance of bottlenose dolphin	Abundance	No statistically significant decrease in abundance as a result of anthropogenic causes	bottlenose dolphin	Further development needed (expected to be operational by 2018 if adopted)
1	1.2 Population size	1.2.1 Population abundance	Marine Mammals	Harbour seal abundance	Annual abundance expressed as estimates (counts during moult) at approximately 5 year intervals or as a five year rolling mean	No statistically significant deviation from long-term variation in abundance as a result of anthropogenic causes	harbour seal	Operational (in 2012)
1	1.2 Population size	1.2.1 Population abundance	Marine Mammals	Grey seal abundance	Annual abundance expressed as estimates (from counts during pupping) at approximately 5 year intervals or as a five year rolling mean	No statistically significant deviation from long-term variation in abundance as a result of anthropogenic causes	grey seal	Operational (in 2012)
1	1.3 Population condition	1.3.1 Population demographic characteristics	Marine Mammals	Harbour seal pup production	Numbers of pups and adults through the breeding season in The Wash and in the Moray Firth	No statistically significant deviation from long-term variation in pup production in The Wash and in the Moray Firth as a result of anthropogenic causes.	harbour seal	Further development needed (expected to be operational by 2014)
1	1.3 Population condition	1.3.1 Population demographic characteristics	Marine Mammals	Grey seal pup production	Estimated total number of pups born at individual breeding colonies	No statistically significant deviation from long-term variation in pup production as a result of anthropogenic causes	grey seal	Operational (in 2012)
4	4.1 Productivity (production per unit biomass) of key species or trophic groups	4.1.1 Performance of key predator species using their production per unit biomass (productivity)	Marine Mammals	Harbour seal pup production	Numbers of pups and adults through the breeding season in The Wash and in the Moray Firth	No statistically significant deviation from long-term variation in pup production as a result of anthropogenic causes	harbour seal	Further development needed (expected to be operational by 2014)
4	4.1 Productivity (production per unit biomass) of key species or trophic groups	4.1.1 Performance of key predator species using their production per unit biomass (productivity)	Marine Mammals	Grey seal pup production	Estimated total number of pups born at individual breeding colonies	No statistically significant deviation from long-term variation in pup production as a result of anthropogenic causes	grey seal	Operational (in 2012)
4	4.3 Abundance/distribution of key trophic groups/species	4.3.1 Abundance trends of functionally important selected groups/species	Marine Mammals	Harbour seal abundance	Annual abundance expressed as estimates (counts during moult) at approximately 5 year intervals or as a five year rolling mean	No statistically significant deviation from long-term variation in abundance as a result of anthropogenic causes	harbour seal	Operational (in 2012)
4	4.3 Abundance/distribution of key trophic groups/species	4.3.1 Abundance trends of functionally important selected groups/species	Marine Mammals	Abundance of two inshore bottlenose dolphin populations	Total number of bottlenose dolphins in Scottish East coast, and Welsh, Cardigan Bay populations	No statistically significant decrease in abundance of either of the two populations as a result of anthropogenic causes	inshore bottlenose dolphin	Further development needed (expected to be operational by 2014)

4	4.3 Abundance/distribution of key trophic groups/species	4.3.1 Abundance trends of functionally important selected groups/species	Marine Mammals	Abundance of harbour porpoise	Abundance	No statistically significant decrease in abundance as a result of anthropogenic causes	harbour porpoises	Further development needed (expected to be operational by 2018 if adopted)
4	4.3 Abundance/distribution of key trophic groups/species	4.3.1 Abundance trends of functionally important selected groups/species	Marine Mammals	Abundance of white-beaked dolphin	Abundance	No statistically significant decrease in abundance as a result of anthropogenic causes	white beaked dolphin	Further development needed (expected to be operational by 2018 if adopted)
4	4.3 Abundance/distribution of key trophic groups/species	4.3.1 Abundance trends of functionally important selected groups/species	Marine Mammals	Abundance of short-beaked common dolphin	Abundance	No statistically significant decrease in abundance as a result of anthropogenic causes	short beaked common dolphins	Further development needed (expected to be operational by 2018 if adopted)
4	4.3 Abundance/distribution of key trophic groups/species	4.3.1 Abundance trends of functionally important selected groups/species	Marine Mammals	Abundance of minke whale	Abundance	No statistically significant decrease in abundance as a result of anthropogenic causes	minke whale	Further development needed (expected to be operational by 2018 if adopted)
4	4.3 Abundance/distribution of key trophic groups/species	4.3.1 Abundance trends of functionally important selected groups/species	Marine Mammals	Abundance of bottlenose dolphin	Abundance	No statistically significant decrease in abundance as a result of anthropogenic causes	bottlenose dolphin	Further development needed (expected to be operational by 2018 if adopted)
1	1.3 Population condition	Pressure indicator	Marine Mammals	Harbour porpoise bycatch	Estimate of bycatch	Annual bycatch rate is reduced to less than 1.7% of best population estimate (until CLA approach is operational)	harbour porpoise	Operational (in 2012)
1	1.3 Population condition	Pressure indicator	Marine Mammals	Common dolphin bycatch	Estimate of bycatch	Annual bycatch rate is reduced to less than 1.7% of best population estimate (until CLA approach is operational)	short beaked common dolphins	Further development needed (expected to be operational by 2014)
1	1.3 Population condition	Pressure indicator	Marine Mammals	Harbour seal bycatch	Estimate of bycatch	Annual bycatch rate is reduced to less than 1.7% of best population estimate (until CLA approach is operational)	harbour seals	Further development needed (expected to be operational by 2014)
1	1.3 Population condition	Pressure indicator	Marine Mammals	Grey seal bycatch	Estimate of bycatch	Annual bycatch rate is reduced to less than 1.7% of best population estimate (until CLA approach is operational)	grey seals	Further development needed (expected to be operational by 2014)
1	1.3 Population condition	Pressure indicator	Marine Mammals	PCB and other organohalogenated contamination in porpoises	Estimate of PCB and other organohalogenated contaminants in tissues	PCB and other organohalogenated contamination in porpoises are below estimated threshold levels for adverse health effects.	harbour porpoise	Further development needed (expected to be operational by 2018 if adopted)

1	1.1 Species distribution	1.1.1 Distributional range	Fish	Distributional range of Fish (Continental Shelf Seas)	Proportion of sampled ICES rectangles in which the species occurs. The metric to be derived for a suite of "sensitive" species specified for each region/survey.	For each *species-specific metric*, a recovery trend-based *metric-level target* of 'the "current assessment year" metric value should be in the upper 25 percentile (or other specified percentile range) of all metric values in the full time-series "reference period" ' should be set. The indicator-level target would then be ' The number of *species-specific metrics* meeting their individual *metric-level targets* should represent a statistically significant departure from the binomial distribution'.	Applicable to all species sampled adequately in international and national bottom-trawl groundfish surveys	Further development needed (expected to be operational by 2014)
1	1.1 Species distribution	1.1.1 Distributional range	Fish	Distributional range of Fish (Shelf-edge Seas)	Proportion of sampled depth bands in which the species occurs. The metric to be derived for a suite of "sensitive" species specified for each region/survey.	For each *species-specific metric*, a recovery trend-based *metric-level target* of 'the "current assessment year" metric value should be in the upper 25 percentile (or other specified percentile range) of all metric values in the full time-series "reference period" ' should be set. The indicator-level target would then be ' The number of *species-specific metrics* meeting their individual *metric-level targets* should represent a statistically significant departure from the binomial distribution'.	Applicable to all species sampled adequately in international and national bottom-trawl groundfish surveys	Further development needed (expected to be operational by 2014)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Fish	Distributional pattern within range of Fish (Shelf-edge Seas)	Measure of depth distribution within occupied depth range – e.g. Dispersion/Contagion metric such as mean:variance ratio. The metric to be derived for a suite of "sensitive" species specified for each region/survey.	Target currently under development	Applicable to all species sampled adequately in international and national bottom-trawl groundfish surveys	Further development needed (expected to be operational by 2014)
1	1.1 Species distribution	1.1.2 Distributional pattern within range	Fish	Distributional pattern within range of Fish (Continental Shelf Seas)	Measure of species patchiness within the distribution – e.g. Dispersion/Contagion metric such as mean:variance ratio. The metric to be derived for a suite of "sensitive" species specified for each region/survey.	Target currently under development	Applicable to all species sampled adequately in international and national bottom-trawl groundfish surveys	Further development needed (expected to be operational by 2014)
1	1.2 Population size	1.2.1 Population abundance	Fish	Population abundance of Fish	Log abundance estimates standardised to a defined area appropriate to the survey in question – e.g. 30km^2 for North Sea Q1 IBTS, or minimum swept area. The metric to be derived for a suite of "sensitive" species specified for each region/survey.	For each *species-specific metric*, a recovery trend-based *metric-level target* of 'the "current assessment year" metric value should be in the upper 25 percentile (or other specified percentile range) of all metric values in the full time-series "reference period" ' should be set. The indicator-level target would then be ' The number of *species-specific metrics* meeting their individual *metric-level targets* should represent a statistically significant departure from the binomial distribution'.	Applicable to all species sampled adequately in international and national bottom-trawl groundfish surveys	Further development needed (expected to be operational by 2014)

1	1.2 Population size	1.2.1 Population biomass	Fish	Fish population biomass	Log biomass, either directly obtained from the measured weight of species in the survey or derived from application of weight at length relationships applied to the abundances at length data, standardised to a defined area appropriate to the survey in question – e.g. 30km^2 for current N. Sea coast study, or minimum swept area. The metric to be derived for a suite of "sensitive" species specified for each region/survey.	For each *species-specific metric*, a recovery trend-based *metric-level target* of 'the "current assessment year" metric value should be in the upper 25 percentile (or other specified percentile range) of all metric values in the full time-series "reference period" ' should be set. The indicator-level target would then be ' The number of *species-specific metrics* meeting their individual *metric-level targets* should represent a statistically significant departure from the binomial distribution'.	Applicable to all species sampled adequately in international and national bottom-trawl groundfish surveys	Further development needed (expected to be operational by 2014)
1	1.3 Population condition	1.3.1 Population demographic characteristics	Fish	Proportion of mature fish in population	Proportion of individual fish greater than their species-specific length at first sexual maturity. The metric to be derived for a suite of "sensitive" species specified for each region/survey.	For each *species-specific metric*, a recovery trend-based *metric-level target* of 'the "current assessment year" metric value should be in the upper 25 percentile (or other specified percentile range) of all metric values in the full time-series "reference period" ' should be set. The indicator-level target would then be ' The number of *species-specific metrics* meeting their individual *metric-level targets* should represent a statistically significant departure from the binomial distribution'.	Applicable to all species sampled adequately in international and national bottom-trawl groundfish surveys	Further development needed (expected to be operational by 2014)
1	1.7 Ecosystem structure	1.7.1 Composition and relative proportions of ecosystem components	Fish	Fish relative abundance	Proportion of Large Fish Indicator (LFI): proportion (by weight) of demersal fish exceeding a specified length threshold (current thresholds 40cm in North Sea, 50cm in Celtic Sea).	Current targets are 0.3 in the North Sea and 0.4 in the Celtic Sea	Applicable to all species sampled adequately in international and national bottom-trawl groundfish surveys	Operational (in 2012)
1	1.7 Ecosystem structure	1.7.1 Composition and relative proportions of ecosystem components	Fish	Fish relative abundance	Hills N1 indicator of species diversity	Target currently under development	Applicable to all species sampled adequately in international and national bottom-trawl groundfish surveys	Further development needed (expected to be operational by 2018 if adopted)
4	4.2 Proportion of selected species at the top of food webs	4.2.1 Large fish by weight	Fish	Large fish indicator (LFI)	Proportion (by weight) of fish exceeding a specified length threshold where the length threshold is pertinent to the community and species composition in question	Targets to be established for each marine region relative to a region specific reference period, and dependent on the species composition included in the indicator calculation. Being a food web metric, pelagic species may be included - thus new targets will need to be established.	Applicable to all species sampled adequately in international and national bottom-trawl groundfish surveys	Further development needed (expected to be operational by 2014)
4	4.3 Abundance/distribution of key trophic groups/species	4.3.1 Abundance trends of functionally important selected groups/species	Fish	Dietary functional group biomass	Biomass of pelagic planktivores, pelagic piscivores, demersal benthivores, demersal piscivores and omnivores	Target currently under development	Applicable to all species sampled adequately in international and national bottom-trawl groundfish surveys	Further development needed (expected to be operational by 2014)

1	1.4 Habitat distribution	1.4.1 Distributional range	Pelagic habitats	Change of plankton functional types (life form) index	Lifeforms:Ratio between: Diatoms & Dinoflagellates; Large copepods & Small copepods; Copepod grazers & Non-copepod grazers	Plankton community not significantly influenced by anthropogenic drivers	As plankton are primarily influenced by climate and natural variability, difficulty lies in separating out the anthropogenic changes. The comparison between the changes in lifeform seasonal variability (see Annex III) occurring in coastal waters to those in the open ocean can help us distinguish between changes due to manageable anthropogenic pressures and those due to climate and natural variability. If a shift in lifeforms occurs in coastal waters concomitantly with a pressure event (nutrient loading, etc) and there is no corresponding shift in other coastal time-series or in the open ocean, the coastal shift could be a response to an anthropogenic pressure, especially if there is a correlation between the trend in lifeforms and anthropogenic pressure.	Further development needed (expected to be operational by 2014)
1	1.4 Habitat distribution	1.4.2 Distributional pattern within range	Pelagic habitats	Change of plankton functional types (life form) index	Lifeforms: Ratio between: Diatoms & Dinoflagellates; Large copepods & Small copepods; Copepod grazers & Non-copepod grazers	Plankton community not significantly influenced by anthropogenic drivers	As plankton are primarily influenced by climate and natural variability, difficulty lies in separating out the anthropogenic changes. The comparison between the changes in lifeform seasonal variability (see Annex III) occurring in coastal waters to those in the open ocean can help us distinguish between changes due to manageable anthropogenic pressures and those due to climate and natural variability. If a shift in lifeforms occurs in coastal waters concomitantly with a pressure event (nutrient loading, etc) and there is no corresponding shift in other coastal time-series or in the open ocean, the coastal shift could be a response to an anthropogenic pressure, especially if there is a correlation between the trend in lifeforms and anthropogenic pressure.	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Pelagic habitats	Change of plankton functional types (life form) index	Ratio between: Diatoms & Dinoflagellates; Ciliates & Microflagellates; Pseudo-nitzchia spp. & Other toxin producing dinoflagellates	Plankton community not significantly influenced by anthropogenic drivers	As plankton are primarily influenced by climate and natural variability, difficulty lies in separating out the anthropogenic changes. The comparison between the changes in lifeform seasonal variability (see Annex III) occurring in coastal waters to those in the open ocean can help us distinguish between changes due to manageable anthropogenic pressures and those due to climate and natural variability. If a shift in lifeforms occurs in coastal waters concomitantly with a pressure event (nutrient loading, etc) and there is no corresponding shift in other coastal time-series or in the open ocean, the coastal shift could be a response to an anthropogenic pressure, especially if there is a correlation between the trend in lifeforms and anthropogenic pressure.	Further development needed (expected to be operational by 2014)

1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Pelagic habitats	Change of plankton functional types (life form) index	Lifeforms: Ratio between: Diatoms & Dinoflagellates; Large copepods & Small copepods; Copepod grazers & Non-copepod grazers	Plankton community not significantly influenced by anthropogenic drivers	As plankton are primarily influenced by climate and natural variability, difficulty lies in separating out the anthropogenic changes. The comparison between the changes in lifeform seasonal variability (see Annex III) occurring in coastal waters to those in the open ocean can help us distinguish between changes due to manageable anthropogenic pressures and those due to climate and natural variability. If a shift in lifeforms occurs in coastal waters concomitantly with a pressure event (nutrient loading, etc) and there is no corresponding shift in other coastal time-series or in the open ocean, the coastal shift could be a response to an anthropogenic pressure, especially if there is a correlation between the trend in lifeforms and anthropogenic pressure.	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.2 Relative abundance and biomass	Pelagic habitats	Zooplankton biomass	Zooplankton biomass	Plankton community not significantly influenced by anthropogenic drivers	As plankton are primarily influenced by climate and natural variability, difficulty lies in separating out the anthropogenic changes. The comparison between the changes in lifeform seasonal variability (see Annex III) occurring in coastal waters to those in the open ocean can help us distinguish between changes due to manageable anthropogenic pressures and those due to climate and natural variability. If a shift in lifeforms occurs in coastal waters concomitantly with a pressure event (nutrient loading, etc) and there is no corresponding shift in other coastal time-series or in the open ocean, the coastal shift could be a response to an anthropogenic pressure, especially if there is a correlation between the trend in lifeforms and anthropogenic pressure.	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.2 Relative abundance and biomass	Pelagic habitats	Phytoplankton biomass	Phytoplankton biomass	Plankton community not significantly influenced by anthropogenic drivers	As plankton are primarily influenced by climate and natural variability, difficulty lies in separating out the anthropogenic changes. The comparison between the changes in lifeform seasonal variability (see Annex III) occurring in coastal waters to those in the open ocean can help us distinguish between changes due to manageable anthropogenic pressures and those due to climate and natural variability. If a shift in lifeforms occurs in coastal waters concomitantly with a pressure event (nutrient loading, etc) and there is no corresponding shift in other coastal time-series or in the open ocean, the coastal shift could be a response to an anthropogenic pressure, especially if there is a correlation between the trend in lifeforms and anthropogenic pressure.	Further development needed (expected to be operational by 2014)

1	1.7: Ecosystem structure	1.7.1: Composition and relative proportion of ecosystem components	Pelagic habitats	change in all pelagic indicators for D1, D4, D5.2.4, D6	Change in all pelagic indicators for D1, D4, D5.2.4, D6	Plankton community not significantly influenced by anthropogenic drivers	As plankton are primarily influenced by climate and natural variability, difficulty lies in separating out the anthropogenic changes. The comparison between the changes in lifeform seasonal variability (see Annex III) occurring in coastal waters to those in the open ocean can help us distinguish between changes due to manageable anthropogenic pressures and those due to climate and natural variability. If a shift in lifeforms occurs in coastal waters concomitantly with a pressure event (nutrient loading, etc) and there is no corresponding shift in other coastal time-series or in the open ocean, the coastal shift could be a response to an anthropogenic pressure, especially if there is a correlation between the trend in lifeforms and anthropogenic pressure.	Further development needed (expected to be operational by 2014)
4	4.3 Abundance/distribution of key trophic groups/species	4.3.1 Abundance trends of functionally important selected groups/species	Pelagic habitats	Change of plankton functional types (life form) index	Life forms: Ratio between: Ratio between: Gelatinous zooplankton & Fish larvae, Copepods & Phytoplankton; Holoplankton & Meroplankton	Plankton community not significantly influenced by anthropogenic drivers	As plankton are primarily influenced by climate and natural variability, difficulty lies in separating out the anthropogenic changes. The comparison between the changes in lifeform seasonal variability (see Annex III) occurring in coastal waters to those in the open ocean can help us distinguish between changes due to manageable anthropogenic pressures and those due to climate and natural variability. If a shift in lifeforms occurs in coastal waters concomitantly with a pressure event (nutrient loading, etc) and there is no corresponding shift in other coastal time-series or in the open ocean, the coastal shift could be a response to an anthropogenic pressure, especially if there is a correlation between the trend in lifeforms and anthropogenic pressure.	Further development needed (expected to be operational by 2014)
6	6.2 Condition of benthic community	6.2.2: Multi-metric indexes assessing benthic community condition and functionality	Pelagic habitats	Change of plankton functional types (life form) index	Life forms: Holoplankotn, meroplankotn	Plankton community not significantly influenced by anthropogenic drivers	As plankton are primarily influenced by climate and natural variability, difficulty lies in separating out the anthropogenic changes. The comparison between the changes in lifeform seasonal variability (see Annex III) occurring in coastal waters to those in the open ocean can help us distinguish between changes due to manageable anthropogenic pressures and those due to climate and natural variability. If a shift in lifeforms occurs in coastal waters concomitantly with a pressure event (nutrient loading, etc) and there is no corresponding shift in other coastal time-series or in the open ocean, the coastal shift could be a response to an anthropogenic pressure, especially if there is a correlation between the trend in lifeforms and anthropogenic pressure.	Further development needed (expected to be operational by 2014)
1	1.4 Habitat distribution	1.4.1 Distributional range	Rock and biogenic reef habitats	Distributional range of habitat	Location of habitat (NGR / lat/long)	Range is stable or increasing and not smaller than the baseline value (Favourable Reference Range for HD habitats)	Target applies to all listed (special) & predominant habitat types. A favourable reference range will be established for each habitat.	Further development needed (expected to be operational by 2014)
1	1.4 Habitat distribution	1.4.2 Distributional pattern	Rock and biogenic reef habitats	Distributional pattern of habitat	Spatial extent of habitat (ha) Location of habitat (NGR / lat/long) Spatial distribution of habitat (NGR / Lat/long) Boundary of habitat (NGR /lat/long)	Spatial distribution is stable	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)

1	1.5 Habitat extent	1.5.1 Habitat Area	Rock and biogenic reef habitats	Area of subtidal biogenic structures	Area measured in ha OR number of units of occurrence (5km2?).	Area is stable or increasing and not smaller than the baseline value (Favourable Reference Area for HD habitats)	Target applies to all listed (special) & predominant habitat types. A favourable reference area will be established for each habitat.	Further development needed (expected to be operational by 2014)
1	1.5 Habitat extent	1.5.1 Habitat Area	Rock and biogenic reef habitats	Area of intertidal rock	Area measured in km2 or linear extent	Area is stable or increasing and not smaller than the baseline value (Favourable Reference Area for HD habitats)	Target applies to all listed (special) & predominant habitat types. Energy / exposure sub-types should be considered in application of the target. A favourable reference area will be established for each habitat.	Further development needed (expected to be operational by 2014)
1	1.5 Habitat extent	1.5.1 Habitat Area	Rock and biogenic reef habitats	Area of subtidal rock	Area measured as km2 / m2	Area is stable or increasing and not smaller than the baseline value (Favourable Reference Area for HD habitats)	Target applies to all listed (special) & predominant habitat types. Energy / exposure sub-types should be considered in application of the target.	Further development needed (expected to be operational by 2014)
1	1.5 Habitat extent	1.5.1 Habitat Area	Rock and biogenic reef habitats	Area of littoral chalk habitat	Area measured as km2 or linear extent	Area is stable or increasing and not smaller than the baseline value (Favourable Reference Area for HD habitats)	Target applies to all listed (special) & predominant habitat types. A favourable reference area will be established for each habitat.	Further development needed (expected to be operational by 2014)
1	1.5 Habitat extent	1.5.1 Habitat Area	Rock and biogenic reef habitats	Area of intertidal sea caves	Number of intertidal sea caves	Area is stable or increasing and not smaller than the baseline value (Favourable Reference Area for HD habitats)	Target applies to all listed (special) & predominant habitat types. A favourable reference area will be established for each habitat.	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Abundance of typical species on biogenic reef	Species composition/ richness	Maintain current species richness / diversity of biogenic structures	Target applies to all biogenic reefs. This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Density of biogenic reef forming species	Numbers per unit area	Maintain current density of biogenic species at known locations with biogenic structures	Target applies to all biogenic reefs. This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Subtidal species composition & abundance (sponge anthozoan community)	Abundance of taxa and/or % cover of taxon groups or diversity indices	Subtidal species composition is maintained	Target applies to subtidal reef. This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Further development needed (expected to be operational by 2018 if adopted)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Sponge diversity	Morphological richness and diversity measures	Sponge morphological diversity / richness is maintained within regional seas	Target applies to subtidal reef. This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Further development needed (expected to be operational by 2018 if adopted)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Intertidal species composition & abundance	Abundance and presence of species from full land reduced lists	Macroalgal species composition is maintained within regional seas	Target applies to intertidal reef. This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Operational (in 2012)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Epifaunal indicator species	Abundance per unit of area for e.g. erect indicator taxa	Proportion of erect fauna are maintained in circalittoral habitats	This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Boulder turning index	Percentage cover of key species	Proportion of boulders with reference proportions of indicator biota	This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Further development needed (expected to be operational by 2014)

1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Intertidal community indicator (MarClim)	SACFORN scale abundance. Semi-logarithmic abundance scale: Superabundant/Abundant/Common/Frequent/Occasional/Rare/Not seen. Rocky intertidal invertebrates Rocky intertidal macroalgae	Maintain native intertidal biodiversity	Target applies to intertidal reef. This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Kelp depth and kelp park depth	Max depth bcd at which kelp occurs and at which a specific density of kelp occurs.	Maintain the depth of kelp communities within a regional context	Target applies to subtidal reef. This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Further development needed (expected to be operational by 2018 if adopted)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Impact/Vulnerability of habitat to 'Penetration and/or disturbance of the substrate below the surface of the seabed' (Physical pressure)	Level of exposure of habitat to pressure 'Penetration and/or disturbance of the substrate below the surface of the seabed'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures).	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Impact/Vulnerability of habitat to 'Shallow abrasion/penetration: damage to seabed surface and penetration' (Physical pressure)	Level of exposure of habitat to pressure 'Shallow abrasion/penetration: damage to seabed surface and penetration'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Impact/Vulnerability of habitat to 'Surface abrasion: damage to seabed surface features' (Physical pressure)	Level of exposure of habitat to pressure 'Surface abrasion: damage to seabed surface features'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Impact/Vulnerability of habitat to 'Removal of target species' (Biological pressure)	Level of exposure of habitat to pressure 'Removal of target species'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Rock and biogenic reef habitats	Impact/Vulnerability of habitat to 'Removal of non-target species' (Biological pressure)	Level of exposure of habitat to pressure 'Removal of non-target species'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
6	6.1 Physical damage having regard to substrate characteristics	6.1.2 Extent of the seabed significantly affected by human activities for the different substrate types	Rock and biogenic reef habitats	Impact/Vulnerability of habitat to 'Penetration and/or disturbance of the substrate below the surface of the seabed' (Physical pressure)	Level of exposure of habitat to pressure 'Penetration and/or disturbance of the substrate below the surface of the seabed'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures).	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
6	6.1 Physical damage having regard to substrate characteristics	6.1.2 Extent of the seabed significantly affected by human activities for the different substrate types	Rock and biogenic reef habitats	Impact/Vulnerability of habitat to 'Shallow abrasion/penetration: damage to seabed surface and penetration' (Physical pressure)	Level of exposure of habitat to pressure 'Shallow abrasion/penetration: damage to seabed surface and penetration'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)

6	6.1 Physical damage having regard to substrate characteristics	6.1.2 Extent of the seabed significantly affected by human activities for the different substrate types	Rock and biogenic reef habitats	Impact/Vulnerability of habitat to 'Surface abrasion: damage to seabed surface features' (Physical pressure)	Level of exposure of habitat to pressure 'Surface abrasion: damage to seabed surface features'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
6	6.1 Physical damage having regard to substrate characteristics	6.1.1 Type, abundance, biomass and areal extent of relevant biogenic substrate	Rock and biogenic reef habitats	Area of subtidal biogenic structures	Area measured in ha OR number of units of occurrence (5km2?).	Area is stable or increasing and not smaller than the baseline value (Favourable Reference Area for HD habitats)	Target applies to all listed (special) & predominant habitat types. A favourable reference area will be established for each habitat.	Further development needed (expected to be operational by 2014)
6	6.1 Physical damage having regard to substrate characteristics	6.1.1 Type, abundance, biomass and areal extent of relevant biogenic substrate	Rock and biogenic reef habitats	Density of biogenic reef forming species	Numbers per unit area	Maintain current density of biogenic species at known locations with biogenic structures	Target applies to all biogenic reefs. This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Further development needed (expected to be operational by 2014)
1	1.4 Habitat distribution	1.4.1 Distributional range	Sediment habitats	Distributional range of habitat	Location of habitat (NGR / lat/long)	Range is stable or increasing and not smaller than the baseline value (Favourable Reference Range for HD habitats)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
1	1.4 Habitat distribution	1.4.2 Distributional pattern	Sediment habitats	Distributional pattern of habitat	Spatial extent of habitat (ha) Location of habitat (NGR / lat/long) Spatial distribution of habitat (NGR / Lat/long) Boundary of habitat (NGR /lat/long)	Spatial distribution is stable	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
1	1.5 Habitat extent	1.5.1 Habitat Area	Sediment habitats	Area of sediment habitat	Spatial extent of habitat (ha)	**Option 1:** area of habitat lost + area of habitat below GES ≤ 10% **Option 2:** area of habitat lost + area of habitat below GES ≤ 15%	Predominant habitat types	Further development needed (expected to be operational by 2014)
1	1.5 Habitat extent	1.5.1 Habitat Area	Sediment habitats	Area of sediment habitat	Spatial extent of habitat (ha)	Area is stable or increasing and not smaller that the baseline value (Favourable Reference Area for HD habitats) WFD extent targets for saltmarsh and seagrass should be used within WFD boundaries as appropriate. These ensure Good Ecological Status of benthic invertebrates, macroalgae and angiosperms. No deterioration between classes for High/Good/Moderate/Poor/Bad classifications of water bodies permitted under WFD. For seagrass good/moderate boundary is >30% loss **at the waterbody level**.	All listed (special) habitat types	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Sediment habitats	WFD seagrass tool	Ecological Quality Ratio based on the species composition, density and extent of cover of seagrass communities	Targets should be aligned with those set under WFD. These ensure Good ecological status of angiosperms. No deterioration between classes for High/Good/Moderate/Poor/Bad classifications of water bodies permitted under WFD.	Applies to special habitat 'Zostera'. This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Operational (in 2012)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Sediment habitats	Infaunal Quality Index	Ecological Quality Ratio based on the sensitivity, richness and diversity (evenness) of benthic communities	Targets should be aligned with those set under WFD. These ensure Good ecological status of benthic invertebrates. No deterioration between classes for High/Good/Moderate/Poor/Bad classifications of water bodies permitted under WFD.	Proposed for all predominant habitats as well as the special habitat, intertidal mudflats. However - it is currently not applicable to coarse habitats and for assessing response to physical pressures. This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Operational (in 2012)

1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Sediment habitats	Opportunistic macroalgae	Identification and collection for measurement of macroalgal bloom algae (opportunistic nuisance weed) at a shore site, for the purpose of estimating the Ecological Quality Ratio	Targets should be aligned with those set under WFD. These ensure Good ecological status of macroalgae. No deterioration between classes for High/Good/Moderate/Poor/Bad classifications of water bodies permitted under WFD.	Applicable to intertidal mudflats (and possibly sandflats) in coastal and transitional waters. This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Operational (in 2012)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Sediment habitats	Saltmarsh WFD classification tool	Ecological Quality ratio based on the diversity, extent and zonation of intertidal saltmarsh habitats	Targets should be aligned with those set under WFD. These ensure Good ecological status of angiosperms. No deterioration between classes for High/Good/Moderate/Poor/Bad classifications of water bodies permitted under WFD.	Applies to special habitat 'Atlantic salt meadows (Glauco-Puccinellietalia maritimae)' and other special habitats as appropriate (this indicator is still under development). This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.3 Physical, hydrological & chemical conditions	Sediment habitats	Sediment profile imaging	Benthic Habitat Quality (BHQ) derived from Sediment profile imaging	BHQ in appropriate range according to Rosenburg et al 2009.	Applicable to soft sediments but methodology not fully developed and could be issues with mobile coarse sediment and the deep sea - applicable to all habitats as this indicator repeated across habitats. This indicator and target can also be used to assess criterion 6.2 (condition of benthic community).	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Sediment habitats	Impact/Vulnerability of habitat to 'Penetration and/or disturbance of the substrate below the surface of the seabed' (Physical damage)	Level of exposure of habitat to pressure 'Penetration and/or disturbance of the substrate below the surface of the seabed'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Sediment habitats	Impact/Vulnerability of habitat to 'Shallow abrasion/penetration: damage to seabed surface and penetration' (Physical damage)	Level of exposure of habitat to pressure 'Shallow abrasion/penetration: damage to seabed surface and penetration'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Sediment habitats	Impact/Vulnerability of habitat to 'Surface abrasion: damage to seabed surface features' (Physical damage)	Level of exposure of habitat to pressure 'Surface abrasion: damage to seabed surface features'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Sediment habitats	Impact/Vulnerability of habitat to 'Removal of target species' (Biological pressure)	Level of exposure of habitat to pressure 'Removal of target species'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
1	1.6 Habitat condition	1.6.1 Condition of the typical species and communities	Sediment habitats	Impact/Vulnerability of habitat to 'Removal of non-target species' (Biological pressure)	Level of exposure of habitat to pressure 'Removal of non-target species'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)

6	6.1 Physical damage having regard to substrate characteristics	6.1.2 Extent of the seabed significantly affected by human activities for the different substrate types	Sediment habitats	Impact/Vulnerability of habitat to 'Penetration and/or disturbance of the substrate below the surface of the seabed' (Physical damage)	Level of exposure of habitat to pressure 'Penetration and/or disturbance of the substrate below the surface of the seabed'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
6	6.1 Physical damage having regard to substrate characteristics	6.1.2 Extent of the seabed significantly affected by human activities for the different substrate types	Sediment habitats	Impact/Vulnerability of habitat to 'Shallow abrasion/penetration: damage to seabed surface and penetration' (Physical damage)	Level of exposure of habitat to pressure 'Shallow abrasion/penetration: damage to seabed surface and penetration'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)
6	6.1 Physical damage having regard to substrate characteristics	6.1.2 Extent of the seabed significantly affected by human activities for the different substrate types	Sediment habitats	Impact/Vulnerability of habitat to 'Surface abrasion: damage to seabed surface features' (Physical damage)	Level of exposure of habitat to pressure 'Surface abrasion: damage to seabed surface features'	Level of exposure to pressure should not result in more than 'Moderate Impact/Vulnerability' of the habitat (dependent on the sensitivity of the habitat to this pressures)	Target applies to all listed (special) & predominant habitat types.	Further development needed (expected to be operational by 2014)