

Marine Strategy Framework Directive consultation

UK Initial Assessment and Proposals for Good Environmental Status

March 2012



**Northern Ireland
Executive**

www.northernireland.gov.uk



**The Scottish
Government**



**Llywodraeth Cymru
Welsh Government**

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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.

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.

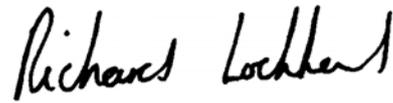
The Marine Strategy Framework Directive, which requires all EU Member States to take measures to achieve Good Environmental Status in their seas by 2020, puts in place a framework to allow co-ordinated action across Europe to improve the marine environment. It gives us the wider tools we need to achieve *clean, healthy, safe, productive and biologically diverse oceans and seas* for the UK.

This consultation is a major step in the implementation of the Directive. The targets and indicators proposed in the consultation reflect the ambitious agenda that the UK Government and Devolved Administrations are together already pursuing on the marine environment. The proposals have

been developed with help from stakeholders across the UK. We would like to thank everyone for their help so far and we welcome views from the wide range of people, businesses and other organisations with an interest in securing Good Environmental Status for our seas, both now and for the future.



Richard Benyon
Minister for Natural Environment
and Fisheries
HM Government



Richard Lochhead
Cabinet Secretary for Rural Affairs
and the Environment
Scotland



John Griffiths
Minister for Environment and
Sustainable Development
Wales



Alex Attwood
Minister of the Environment
Northern Ireland

Summary

Topic of this consultation:	This consultation sets out proposals for the UK's implementation of the EU Marine Strategy Framework Directive (MSFD). The MSFD requires Member States to put in place measures to achieve or maintain Good Environmental Status (GES) by 2020 through the development of national Marine Strategies.
Scope of this consultation:	<p>This consultation covers the following three elements of the UK's Marine Strategy:</p> <ul style="list-style-type: none"> • A cover paper for the initial assessment of the state of the UK's seas. • Proposals for characteristics of GES for the UK's seas. • Proposals for more detailed targets and indicators of GES, through which we will measure progress towards achieving GES. <p>This consultation does not cover the UK monitoring programmes for GES or the UK programmes of measures for achieving GES.</p>
Geographical scope:	The proposals apply to the marine waters over which the UK claims jurisdiction, including territorial waters in Scotland, Wales and Northern Ireland.
Impact Assessment:	An impact assessment which looks at the costs and benefits associated with the proposals had been prepared and accompanies this consultation.
To:	<p>This consultation has particular relevance to:</p> <ul style="list-style-type: none"> • Groups or individuals who use the sea for whatever purpose, or have an interest in it. • Business users of the sea. • National and local interest groups such as environmental and recreational non-governmental organisations and industry federations; and statutory advisers to government. • Governments in other EU Member States.
Body responsible for the consultation:	This consultation is being carried out by the Marine Strategy Framework Directive Implementation Team in Defra's Marine Programme.
Duration:	<p>Consultation starts: 27 March 2012</p> <p>Consultation ends: 18 June 2012</p>
Enquiries:	<p>During the consultation, if you have any enquiries or wish to receive hard copies of the documents, please contact:</p> <p>Jo Higgs 0208 650 1761 MSFDTeam@defra.gsi.gov.uk</p> <p>Further information on the MSFD can be found at: http://www.defra.gov.uk/environment/marine/msfd/</p>
How to respond:	Written responses can be submitted to:

	<p>Marine Strategy Framework Directive Implementation Team Area 2D Nobel House 17 Smith Square London SW1P 3JR</p> <p>Email: MSFDTeam@defra.gsi.gov.uk</p>
<p>After the consultation:</p>	<p>At the end of the consultation period we will summarise the responses and place this summary on our website at www.defra.gov.uk/consult. This should be available by 10 September 2012. This summary will include a list of names of organisations that responded but not people's personal names, addresses or other contact details.</p> <p>We will also put a copy of the responses in the Defra library at Ergon House, London. This is so that the public can see them. Also, members of the public may ask for a copy of responses under freedom of information legislation.</p> <p>If you do not want your response - including your name, contact details and any other personal information – to be publicly available, please say so clearly in writing when you send your response to the consultation. Please note, if your computer automatically includes a confidentiality disclaimer, that won't count as a confidentiality request.</p> <p>Please explain why you need to keep details confidential. We will take your reasons into account if someone asks for this information under freedom of information legislation. But, because of the law, we cannot promise that we will always be able to keep those details confidential.</p>
<p>Compliance with the Code of Practice on Consultation:</p>	<p>This consultation is in line with the Code of practice on Consultations. This can be found at: http://www.bis.gov.uk/policies/bre/consultation-guidance</p>
<p>Getting to this stage:</p>	<p>The Directive is being implemented in a coordinated way across the UK Administrations.</p> <ul style="list-style-type: none"> • The cover paper for the initial assessment of the current state of the UK's seas is based primarily on evidence from Charting Progress 2 and its feeder reports, as well as evidence from Scotland's Marine Atlas and Northern Ireland's State of the Seas Report. • Proposals for UK characteristics of GES have been developed by policy makers in consultation with experts and key stakeholders. • Proposals for more detailed UK targets and indicators of GES have been developed on the basis of scientific advice provided the Centre for Environment, Fisheries and Aquaculture Science (Cefas), the Joint Nature Conservation Committee (JNCC) and a large range of other experts, including those involved in the UK Marine Monitoring and Assessment Strategy.
<p>Previous engagement:</p>	<p>Key stakeholders have already been involved in the development of these proposals and have had a chance to shape their development through a series of workshops and meetings held over the course of the</p>

last two years.

There was also a public consultation on the transposition of the MSFD starting in October 2009

(<http://webarchive.nationalarchives.gov.uk/20100505154859/http://www.defra.gov.uk/corporate/consult/msfd-legal-framework/index.htm>). A

summary of responses was published on 22 June 2010

(<http://archive.defra.gov.uk/environment/marine/documents/legislation/marine-strat-summary.pdf>).

Executive Summary

Part 1 – Explanation of the consultation

Part 1: Section 1 – Introduction

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

Part 1: Section 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. This is broken up into a number of specific stages between 2012 and 2020. This 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.

Part 1: Section 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 Convention¹ 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. 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.

Part 1: Section 4 – What the consultation proposals cover and how they were developed

This section explains the three key elements of this consultation package and explains how they have been developed.

The Initial Assessment of the State of the UK's seas Cover Paper - The evidence base for the UK Initial Assessment was developed by a wide range of UK experts working in the UK Marine Monitoring and Assessment Strategy (UKMMAS)² framework. The Initial Assessment cover paper is based primarily on peer reviewed evidence from Charting Progress 2 and its feeder reports, as well as evidence from Scotland's Marine Atlas and the Northern Ireland State of the Seas Report. This section describes how the UK Initial Assessment was developed and includes a summary of its conclusions.

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.

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.

Proposals for 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 proposals have been developed by policy makers in consultation with experts and key stakeholders. This section describes how the UK characteristics of GES were developed.

Proposals for more detailed 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 proposals for 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.

Part 1: Section 5 – Summary of the implications of the proposals

This section summarises the potential implications of the proposals. Although this consultation 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 consultation process of the potential implications of the proposed 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.

Part 2 – Consultation documents and questions

Part 2 is split into four sections and sets out the proposals which are the subject of this consultation.

Part 2: Section 1 – Consultation Proposals & Questions

This sets out the consultation questions for stakeholders.

Part 2: Section 2 – UK Initial Assessment Cover Paper

This sets out the 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.

Part 2: Section 3 – Proposals for GES characteristics, targets and indicators

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

Proposals 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 proposals for these Descriptors are the most complex to describe due to their wide coverage.

There are then separate sub-sections setting out proposals 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 proposals for 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.

Part 2: Section 4 – Impact Assessment (see separate document)

This section sets out the Impact Assessment which looks at the potential costs and benefits of achieving GES. The assessment of costs is based on analysis of a range of illustrative management measures which experts and policy makers consider to represent a reasonable example of the types of additional measures which may be needed to achieve GES. The assessment of benefits is based on an assessment of the change in value of ecosystem goods and services between the baseline scenario and the scenario if all the proposed GES targets are achieved.

Part 1: Explanation of the consultation

Part 1: Section 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 Directive³ and described in more detail by 11 high-level Descriptors (see p.15) 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 go through a number of stages before the eventual implementation of management measures to achieve GES (see Figure 1, below). The first stage, to be completed by July 2012, is for Member States to carry out an initial assessment of the current status of their seas and to determine specific characteristics of GES for their marine waters, setting out specific environmental targets and indicators to underpin this (based on the 11 Descriptors of GES given in the Directive). The second stage, to be completed by 2014, is for Member States to put in place monitoring programmes to measure progress towards GES. The final stage is the implementation of management measures to achieve GES by 2020. These have to be developed by 2015 and implemented by 2016. Each stage of the implementation process then has to be reviewed every 6 years and if necessary updated.
4. 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 2⁵, 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.
5. 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

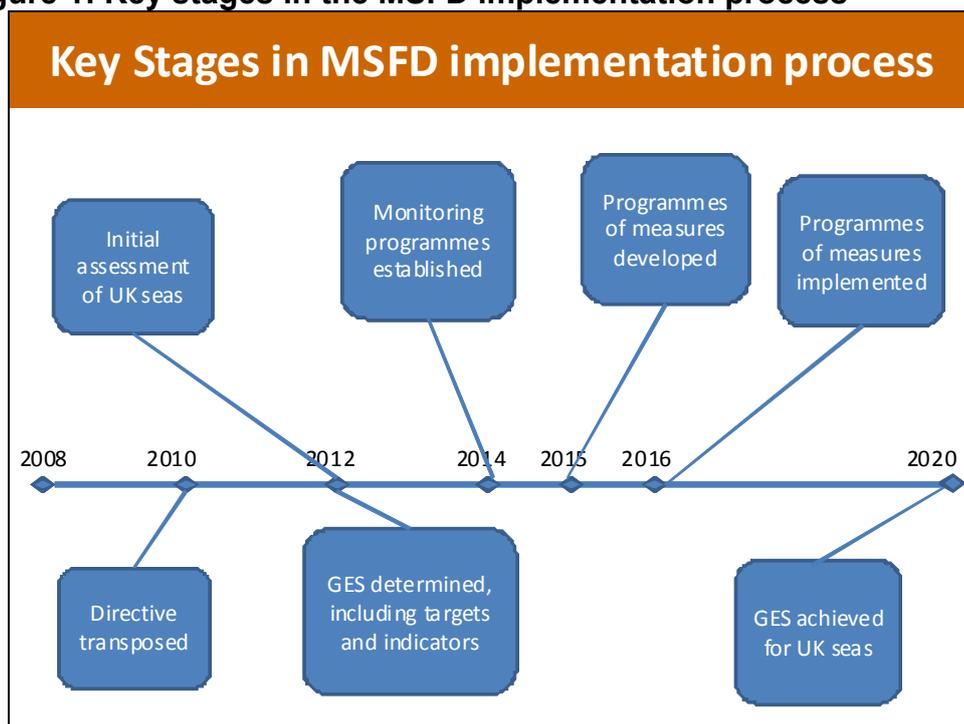
³ MSFD, 2008/56/EC Article 3(5) – Good Environmental Status means the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level 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).

⁴ Natural Environment White Paper, p.3 <http://www.official-documents.gov.uk/document/cm80/8082/8082.pdf>

⁵ <http://chartingprogress.defra.gov.uk/>

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: Key stages in the MSFD implementation process



6. This consultation sets out Government and Devolved Administrations proposals for the *first* stage of the MSFD implementation process. The proposals cover the following:

- **The initial assessment of the current state of the UK's seas cover paper** (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 Atlas⁶ and Northern Ireland's State of the Seas Report⁷. The Initial Assessment also draws on an analysis of predicted environmental status in 2020/2030 given business-as-usual⁸ and uses this to provide an assessment of the costs of degradation. Part 1: Section 4 (p.20) of this consultation paper describes how the UK initial assessment was developed. The UK Initial Assessment Cover Paper can be found in Part 2: Section 2 (p.44) with specific questions for stakeholders.
- **Proposals for 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. Part 1: Section 4 (p.20) of this consultation paper describes how the UK characteristics of GES were developed. The proposals themselves can be found in Part 2: Section 3 (p.113) with specific questions for stakeholders.

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

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>

- **Proposals for more detailed 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 Strategy⁹. 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. Part 1 of this consultation paper describes how the GES targets and indicators were developed (see Part 1: Section 4, p.24) and the key implications of the proposals in terms of management measures and monitoring programmes (see Part 1: Section 5, p.28). The proposals themselves can be found in Part 2: Section 3 (p.111) with specific questions for stakeholders.
7. Stakeholders have already been involved in the development of these proposals and have had a chance to shape their development through a series of workshops and meetings held over the course of the last two years. This consultation is an opportunity for stakeholders to provide formal views on the proposals and the UK Government and Devolved Administrations welcome further input to make the UK's marine strategy as robust as possible.
8. This consultation does not cover:
- **The UK monitoring programmes for GES** – although this consultation 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 separate consultation process in due course.
 - **The UK programmes of measures for achieving GES** – although this consultation gives a broad indication of the kinds of management measures which might be needed to achieve GES, this is not the purpose of the consultation. All decisions on which measures are taken to achieve GES will be subject to a separate consultation process in 2014/15 which will assess the effectiveness of those measures in achieving GES as well as their socioeconomic implications.

Part 1: Section 2 - Background to the MSFD

9. 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:
10. 'Protect and preserve the marine environment, prevent its deterioration or, where practicable, restore marine ecosystems in areas where they have been adversely affected;'
11. '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

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>.

¹⁰ MSFD 2008/56/EC Article 1(2).

12. 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 future¹¹.
13. The aims of the Directive are to be delivered through the development of marine strategies 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).
14. Each stage of the marine strategy must be reviewed every six years and revised if necessary¹². As explained in the introduction, this consultation covers UK proposals for the first three elements of the marine strategy – a, b and c above.
15. 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 generations¹³’.
16. 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 indicators¹⁴. 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”).

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.

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

17. Member States are required to further develop these 11 GES Descriptors by determining a more detailed set of characteristics for GES¹⁵. In turn, these characteristics must be underpinned by the more specific GES targets and indicators¹⁶ which will be used to assess progress towards the achievement of GES.

18. The Directive covers the extent of the marine waters over which the UK claims jurisdiction. This area extends from the landward boundary of coastal waters¹⁷ 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 area of the continental shelf beyond the renewable energy zone over which the UK has a claim¹⁸. The area of UK waters over which the MSFD applies is shown below in Figure 2.

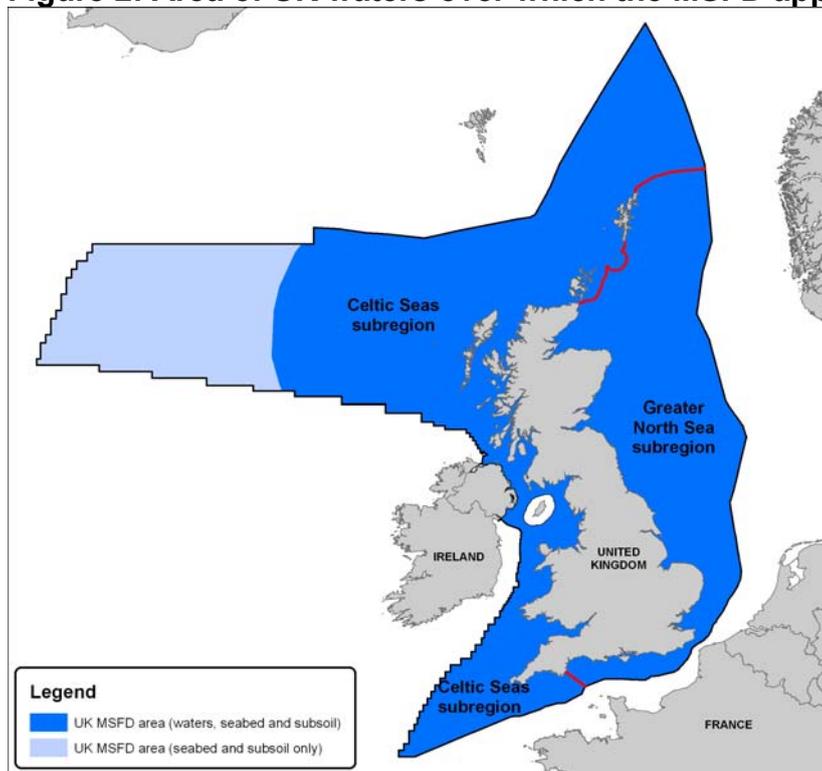
¹⁵ As required by Article 9 of the MSFD.

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 2: Area of UK waters over which the MSFD applies



19. 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. The Directive is being implemented in a coordinated way across the UK Administrations. The UK Initial Assessment and proposals for GES characteristics and associated target and indicators in this consultation have 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.

Part 1: Section 3 - The European and Regional context

Regional coordination requirements of the Directive

20. 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.

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

Table 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

22. 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 Sea 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 members of the OSPAR Regional Sea Convention¹⁹ for the 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).

23. The UK will have *one* marine strategy covering 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 regions developed for Charting Progress 2.

European level coordination

24. 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.

25. **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:

- *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.

¹⁹ <http://www.ospar.org/>

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.

26. This Working Group also has two technical sub-groups, one on litter (Descriptor 10) and one on noise²² (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.
27. **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.
28. **The Working Group on Data, Information and Knowledge Exchange** – this Working Group has been set up to develop a coordinated MSFD information and data reporting process. It is in the process of developing proposals for 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.
29. 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 finalising the proposals set out in this consultation.

Regional level coordination

30. 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 Regional Sea 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 2010²⁴ as an overarching regional-scale assessment of the environmental quality status of the North-East Atlantic. The work to prepare this report and its underlying thematic assessment reports, which has been carried out jointly by OSPAR member countries, 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.

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

- 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.
31. 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. However, at the time the UK proposals were being developed, there was still relatively limited information from other countries about their plans for implementing the Directive, which has made the process of coordination particularly challenging. Regional coordination will continue into mid 2012 and beyond and it may be necessary to review the proposals set out in this consultation as more information becomes available about the implementation proposals being put forward by other Member States.

Part 1: Section 4 - What the consultation proposals cover and how they were developed

32. This consultation covers the following three elements of the UK's marine strategy:
- 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.
33. This section explains how the different elements of the Marine Strategy were developed and guides the reader to the appropriate sections in Part 2 of the consultation where the proposals themselves are set out.

The UK Initial Assessment

Requirements of the Directive

34. 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 environment²⁵.
35. 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

36. The development of the UK 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

²⁵ Directive 2008/56/EC Article 8(1)

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.

37. 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 published 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. The report has been commended across Europe as setting a benchmark for marine assessment. Charting Progress 2 has been supplemented by Scotland's Marine Atlas²⁶ and the Northern Ireland State of the Seas report²⁷.
38. An additional assessment of the costs of degradation of the UK marine environment has also been carried out. 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 the MSFD (i.e. under a Business as Usual (BAU) scenario). This is the same as valuing the forgone benefits from not achieving GES.
39. A key input to this assessment was a Business As Usual Report²⁸ (BAU Report) produced by ABPmer with guidance from Government officials in Defra and the Devolved Administrations. 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.

Key findings of the UK Initial Assessment

40. The UK Initial Assessment is summarised in a cover paper which can be found at **Part 2: Section 2** (p.44). The evidence base supporting the assessment has already been extensively peer reviewed and consulted on during the development of Charting Progress 2, the Scottish Marine Atlas and the State of Northern Ireland's Seas Report and it is not the intention of this consultation to substantially review that evidence base. However, the UK Government and Devolved Administrations would like to seek views from stakeholders on whether the overall conclusions of the Initial Assessment are an accurate summary of the evidence base, and whether there is any substantive new evidence which should be taken into account which may affect these conclusions. Specific questions for stakeholders are set out in **Part 2: Section 1** (p.42). The key findings of the UK Initial Assessment are set out below.

Biological characteristics (Descriptors 1, 4 and 6)

41. **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

²⁶ <http://scotland.gov.uk/Topics/marine/science/atlas>

²⁷ http://www.doeni.gov.uk/niea/water-home/state_of_the_seas_ni_report.htm

²⁸ 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, 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>

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.

42. **Cetaceans.** Populations of whales and dolphins were severely affected by whaling before the international moratorium, 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, indicating good status only in the northern North Sea and Southern North Sea where the assessments are of higher confidence.
43. **Seals.** The current overall status of grey seals is generally good, 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 virus²⁹ outbreak in the Southern North Sea, need to be more fully understood.
44. **Seabirds.** The number 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. However, there is concern over recent trends in breeding success of seabirds in the Greater North Sea and the northern Celtic Seas, with declines 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.
45. **Waterbirds.** Average numbers of waterbirds wintering in, or migrating through, UK marine areas in the UK doubled on average between the mid-1970s and the mid-1990s, as a result of protection from hunting and persecution. Since the late 1990's average numbers have declined only slightly, with average numbers in the winter of 2006/07 still 85% higher than in the mid-1970s, when co-ordinated monitoring began. However, there have been some significant declines in numbers of some diving species and estuarine waders over the same period. 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.
46. **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.
47. **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. However, the changes in plankton community composition as a result of rising temperatures may have consequences for other species

²⁹ A virus causing laboured breathing, fever and nervous symptoms in seals.

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)

48. Around 60 Non Indigenous Species (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.

Commercial fish stocks (Descriptor 3)

49. 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.

Eutrophication (Descriptor 5)

50. 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.

Hydrographic Conditions (Descriptor 7)

51. 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)

52. 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)

53. 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)

54. 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)

55. 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

56. 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 Directive³⁰.

57. 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 Directive³¹.

58. 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

59. 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.

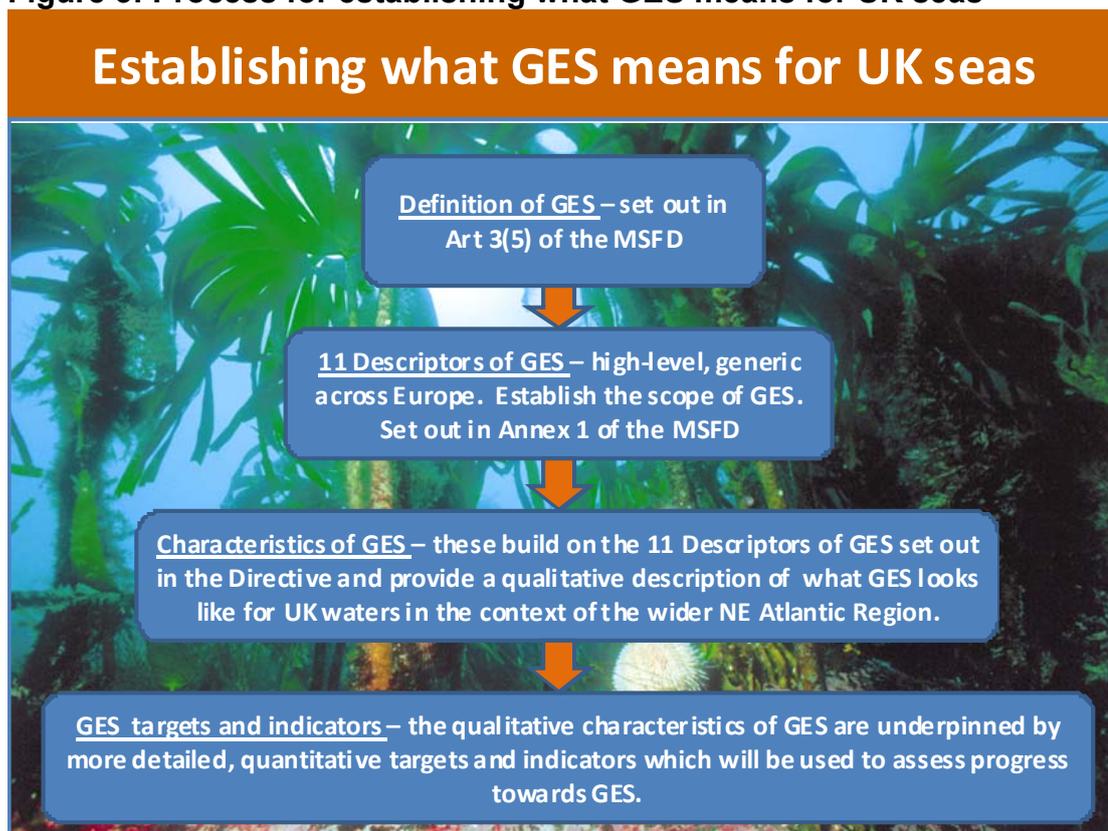
60. The determination of characteristics of GES is the next stage in the process of establishing what achieving GES means in practice, building on the 11 Descriptors of GES and the conclusions of Member States' Initial Assessments. The UK has interpreted this stage of the implementation process as a 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.

³⁰ Directive 2008/56/EC Article 9.

³¹ Directive 2008/56/EC Article 10(1).

61. 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.
62. 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*³². 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.

Figure 3: Process for establishing what GES means for UK seas



Proposals for UK Characteristics of GES

63. The proposals for UK characteristics of GES have been developed by policy makers in consultation with experts and stakeholders³³. 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 GES³⁴, which must be followed by Member States when developing their national proposals for GES characteristics.

³² Available on request from Defra.

³³ 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.

³⁴ 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>

64. The proposed 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;
 - be coordinated with other countries in the NE Atlantic.
65. The proposals for UK characteristics of GES are set out Descriptor by Descriptor in **Part 2: Section 3** (p.113), alongside the proposals for GES targets and indicators. The UK Government and Devolved Administrations would like to seek views from stakeholders on whether the proposals are consistent with the definition of GES and the overarching aims of the Directive, whilst at the same time acknowledging gaps in our knowledge base. Specific questions for stakeholders are included in **Part 2: Section 1**(p.42).

Proposals for UK targets and indicators of GES

66. The proposals for UK characteristics of GES are underpinned by proposals for more specific, and where possible quantitative, targets and indicators which will be used to assess UK progress towards achieving GES. The proposed 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.
67. The proposals 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.
68. The main evidence base for the development of proposals for 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 Eftec³⁵, 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 2010³⁶. 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.

69. 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.
70. JNCC, working closely with experts in the Healthy and Biologically Diverse Seas Evidence Group³⁷, 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. Due to the complexity of these Descriptors a wide range of potential indicators have been put forward in the Cefas CBA Report to underpin the targets and explain how they would be assessed and monitored. These indicators are still being refined and developed and may not all be put forward to the European Commission in 2012. The full list of indicators under consideration can be found in the **Cefas CBA Report 2012, Appendices p.230**³⁸.
71. 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 consultation paper. In most cases, the options for targets and indicators set out in the scientific advice have been put forward with no changes. However, in a few cases options recommended in the report have been excluded from the consultation proposals, because they were not felt to be relevant, or were modified slightly to improve their consistency with existing policy commitments. Where the proposals in this consultation differ from the scientific advice provided in the Cefas CBA Report 2012 this has been made clear and the reasons explained.
72. The proposals for UK GES targets and indicators, and the thinking behind them, are set out in detail in **Part 2: Section 3** (p.113). For some Descriptors only one option for targets has been proposed. This is the case for Descriptor 3 (commercial fish), Descriptor 5 (eutrophication), Descriptor 8 (contaminants) and Descriptor 9 (contaminants in seafood), where there is strong scientific evidence to support particular ecological thresholds as suitable targets for GES based on well established methodologies in OSPAR and the International Council for the Exploration of the Sea (ICES). This is also the case for Descriptor 2 (non-indigenous species), Descriptor

³⁵ Economics for the Environment Consultancy - <http://www.eftec.co.uk/>

³⁶ This advice is summarised in the Cefas CBA Report 2012.

³⁷ 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.

³⁸

<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>

7 (hydrographical conditions) and the mammal, fish, pelagic habitat, and rock & biogenic reef components of Descriptors 1, 4 and 6, where the GES target proposals reflect the UK Government and Devolved Administrations' assessment that *current* policy approaches already provide an appropriate framework for managing the impacts of these pressures. For these Descriptors, the UK Government and Devolved Administrations would like to seek views from stakeholders on whether the proposed targets are sufficient to guide progress towards the achievement of GES, whether they are feasible and whether any additional management measures are likely to be needed to achieve them. Specific questions for stakeholders are included in **Part 2: Section 1** (p.42).

73. For Descriptor 10 (marine litter), Descriptor 11 (underwater noise), and for the bird and sediment habitat components of Descriptors 1, 4 and 6, *two* options for GES targets have been considered. This reflects the fact that the scientific understanding of these Descriptors and components is less well developed and there is much less evidence to allow experts to point to specific ecological thresholds which would be suitable targets for GES.

74. In each case, Option 1 is viewed as sufficient to guide progress towards the achievement of GES, but we have also tested whether more stringent or precautionary targets (Option 2) could be justified. In considering these further options, we have had to recognise uncertainties, as achievement of targets may be significantly affected by natural variability or climatic change, and our ability to accurately predict the effect of measures on the complex marine ecosystem remains limited. We have also considered the potential for the target options to lead to disproportionate costs which would not be justified by the risk to the marine environment.

75. With the exception of one aspect of Descriptor 10 (marine litter), the Government and Devolved Administrations have taken the view that the preferred option for the GES targets for these Descriptors is Option 1, and that the alternative targets set out under Option 2 are either too uncertain or disproportionately costly. In each case, the UK Government and Devolved Administrations would welcome views on the approach proposed, whether the proposals are feasible and what additional management measures could be needed to achieve them. Specific questions for stakeholders are included **Part 2: Section 1** (p.42).

76. The proposals for 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 **Part 2: Section 3** (p.113) and the Government and Devolved Administrations would welcome views from stakeholders on how these gaps could be filled in the future.

Part 1: Section 5 - Summary of the implications of the proposals

77. The proposals for GES characteristics and associated targets and indicators set out in this consultation 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. This consultation does not set out proposals for actual monitoring or management measures, both of which will be subject to specific consultations in due course. However, as part of this consultation process 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:

³⁹ The Impact Assessment can be found at www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

- 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.

78. Assessing the implications of the proposals in this consultation 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 proposed in this consultation – more work is needed to assess the most cost effective way of achieving the targets.

79. The Directive accepts that there may be some exceptional circumstances where it is not possible to achieve GES and includes a number of legitimate reasons⁴⁰ 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.

80. 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 deterioration⁴¹. 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 and would welcome views on its application.

Role of existing policies in supporting the achievement of GES

81. 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

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).

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 proposed GES targets and indicators.

Common Fisheries Policy

82. 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 (biodiversity), Descriptor 3 (commercial fisheries), Descriptor 4 (food-webs) and Descriptor 6 (sea-floor integrity).
83. 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 proposals for GES characteristics and associated targets and indicators contained in this consultation are consistent with the UK's approach to CFP reform.
84. 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, and on achieving sustainable use of the marine environment outside the Marine Protected Area network.
85. 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

86. The UK marine planning framework 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 and enable the sustainable use of the marine environment. Marine planning will clarify marine objectives and priorities, and direct decision-makers and users towards more consistent, evidence based decisions and sustainable use of marine resources.
87. The overarching framework for marine planning in the UK is the Marine Policy Statement (MPS). The MPS brings together and clarifies UK marine policies and reflects European legislation and wider international commitments in achieving sustainable development. Marine Plans will support the implementation of the UK's programme of measures for GES as part of their objective of achieving sustainable development. Marine Plans, which may set limits or targets for marine plan areas where appropriate, will shape activities within the UK marine area so that the Directive's goals can be achieved effectively alongside social and economic objectives.

88. Marine Planning is being carried out 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. The policies for each Plan area are being developed taking into account the proposed GES targets and indicators, and the monitoring arrangements for Marine Plans will use the monitoring programmes already in place for GES as far as possible. Marine Plans will be subject to the Strategic Environmental Assessment Directive which will include an assessment of cumulative effects.
89. Once in place across the UK, Marine Plans will act as a framework for marine licensing decisions which will be assessed through the Strategic Environmental Assessment Directive, the Environmental Impact Assessment Directive and existing nature conservation regimes. 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.
90. Marine planning is in its early stages and is being implemented in a phased approach between now and 2021. The overall impact of marine planning in helping to achieve GES will become clearer as the programme of measures for GES is developed between now and 2015, taking into account the existing policy framework (including CFP reform and the MPA network). However, marine planning and licensing and their interactions with existing regulations have been taken into account during development of the proposed GES characteristics and associated targets and indicators in this consultation. Continued close working between Defra, 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

91. The UK's network of MPAs will play a significant role in supporting the achievement of a number of the GES characteristics and targets proposed in this consultation – in particular for Descriptor 1 (biodiversity) and Descriptor 6 (sea-floor integrity).
92. 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 MPAs⁴².
93. 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.

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

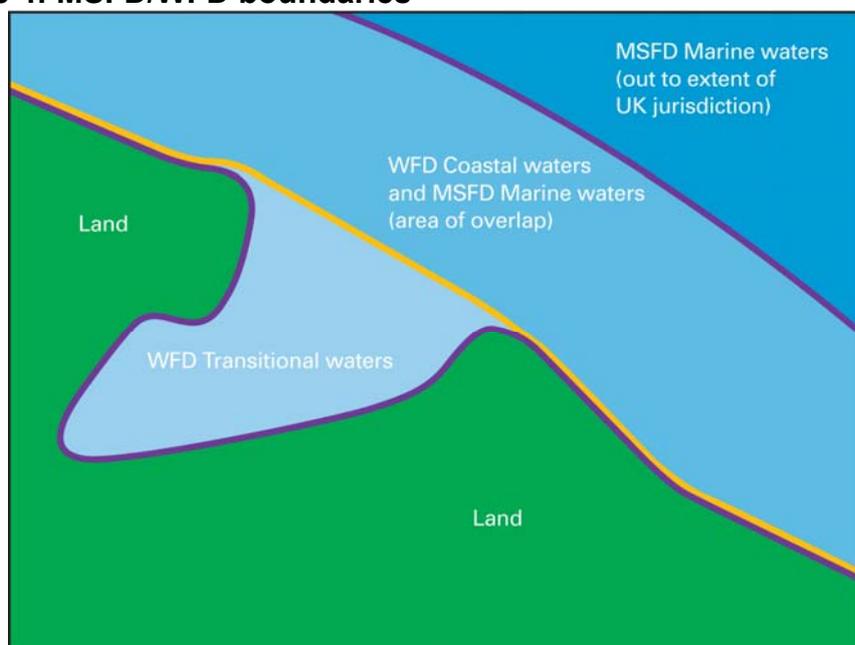
94. Defra and the Devolved Administrations will work closely with those organisations involved in developing the proposals for management measures for the UK MPA network over the next few years to ensure that those measures achieve the specific conservation objectives of the relevant site and also contribute 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

95. There are strong links between the MSFD and the WFD. WFD relates to improving and protecting the chemical and biological status of surface waters throughout a River Basin Catchment from Rivers, Lakes and Groundwaters through to Estuaries (Transitional) and Coastal Waters to 1 nautical miles out to sea (3nm in Scotland) and overlaps with MSFD in coastal waters⁴³. 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.

96. 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 mammals⁴⁴). 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 4: MSFD/WFD boundaries

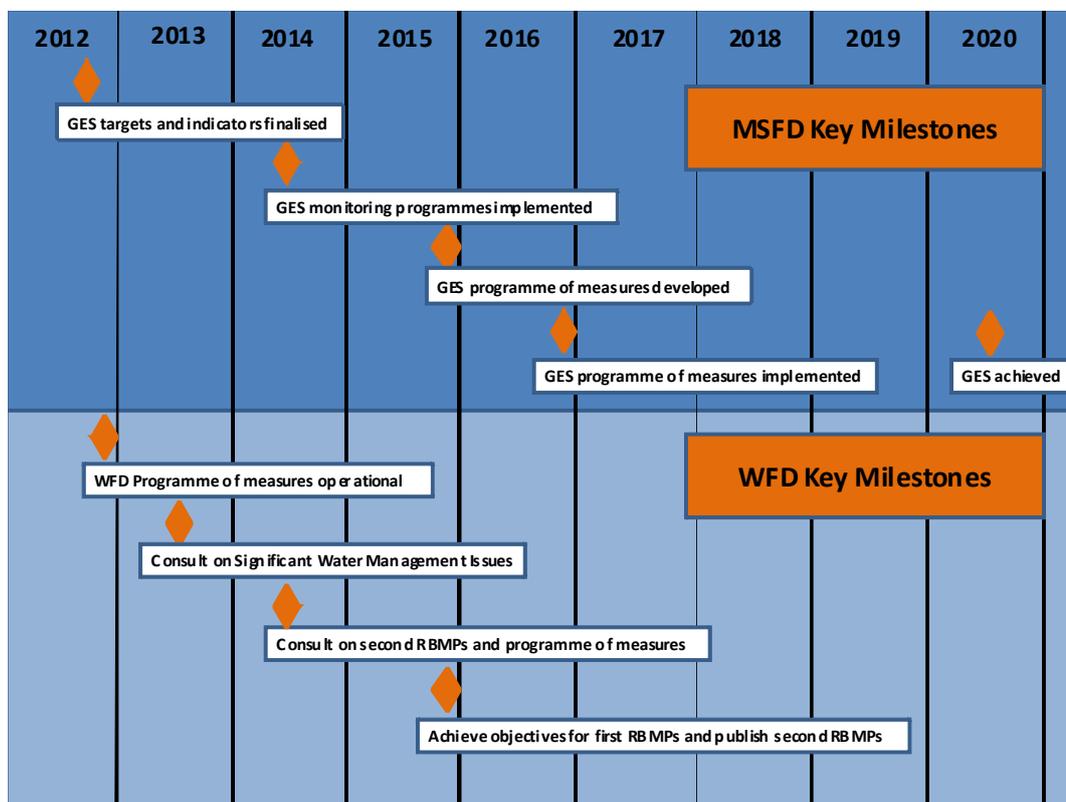


⁴³ WFD coastal waters extend from Mean High Water (Springs) out to 1 nautical mile offshore in England, Wales and Northern Ireland, and 3 nautical miles offshore in Scotland.

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.

97. 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.
98. 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 proposed for pressures such as contaminants (Descriptor 8), eutrophication (Descriptor 5) and hydrographical conditions (Descriptor 7).
99. 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.
100. In order to improve the consistency of approaches across the two Directives, the proposals for GES targets and indicators in this consultation have been aligned as far as possible with similar targets and assessment tools under the WFD. In particular, it is proposed that WFD assessment tools are 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.
101. Although the timetables for the two Directives are not entirely consistent (see Figure 5, below), every effort will be made to align the implementation of the Directives as far as possible. Particular efforts will be made to draw links to the programme of measures for MSFD when consulting on the second set of River Basin Management Plans (RBMPs) and programme of measures for the WFD in 2014.

Figure 5: Key milestones for MSFD and WFD implementation



Birds and Habitats Directives

102. 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 Status⁴⁵ (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.

103. 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 under the MSFD 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.

104. 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.

105. 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 proposed for Descriptors 1 (biodiversity), 4 (food webs) and 6

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>

(sea-floor integrity). However, additional measures are likely to 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

106. The programme of measures to achieve the GES characteristics and targets proposed in this consultation must be developed by 2015 and implemented by 2016. This consultation 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.

107. 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 significant uncertainty about the effectiveness of current policy measures in achieving their stated objectives. There are also major 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 proposed in this consultation 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.

108. 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. A summary of the proposed 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)

109. 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. Two target options are proposed for birds, with Option 2 being somewhat more precautionary than Option 1.

110. 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 proposed GES targets and it is considered possible that some additional management measures may be needed.

111. 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 and proposed in relation to predominant 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.

112. 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 rock & biogenic reef habitats that are covered by the Habitats Directive it

has been assumed that measures taken under that Directive will be sufficient to achieve the proposed targets. For the targets proposed for those habitats 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 proposed targets will be achieved through measures taken to achieve the targets for Descriptor 3 (commercial fish) and Descriptor 5 (eutrophication).

113. 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.

114. For further detail on the proposed GES targets for Descriptors 1, 4 and 6 and their implications see **Part 2: Section 3.2 Biodiversity** (p.113).

Descriptor 2 (non-indigenous species)

115. The GES targets proposed for this Descriptor are new as there are no specific targets for NIS in existing legislation. They require 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.

116. A desk based study to assess the key pathways and vectors of introduction of NIS is currently being carried out to identify where additional management measures may be necessary to achieve the proposed GES targets for this Descriptor. However, for the purposes of this consultation, a range of illustrative management measures have been considered, the costs of which would fall primarily on the shipping industry, ports and marinas, and small vessel owners.

117. However, the need for additional management measures is not yet clear and further work to inform this assessment will be carried out based on the results of the desk based study and further discussion with the relevant industries.

118. For further detail on the proposed GES targets for Descriptor 2 and their implications see **Part 2: Section 3.3** (p.124).

Descriptor 3 (commercial fish)

119. The GES targets proposed for this Descriptor are based on the approach taken to stock assessment in the CFP and would require the achievement of stocks within the safe biological limit precautionary thresholds, whilst aiming, in the medium-long term, for the more ambitious stock specific targets for fishing at levels consistent with the Maximum Sustainable Yield.

120. As described above, the proposed targets are in line 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.

121. For further detail on the proposed GES targets for Descriptor 3 and their implications see **Part 2: Section 3.4** (p.128).

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

122. The proposed 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).
123. The proposed 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.
124. The proposed 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 proposed 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.
125. It is considered likely that measures being taken under existing legislation will be sufficient ensure the GES targets proposed for these Descriptors are achieved.
126. 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.
127. For further detail on the proposed GES targets for Descriptor 5 and their implications see **Part 2: Section 3.5** (p.130). For further detail on the proposed GES targets for Descriptor 8 and their implications see **Part 2: Section 3.7** (p.135). For further detail on the proposed GES target for Descriptor 9 and their implications see **Part 2: Section 3.8** (p.137).

Descriptor 7 (hydrographical conditions)

128. The proposed GES target for this Descriptor would require developers and regulators to continue to comply with existing legislative requirements through the current marine licensing regime.
129. As the proposed 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.
130. For further detail on the proposed GES targets for Descriptor 7 and their implications see **Part 2: Section 3.6** (p.133).

Descriptor 10 (marine litter)

131. Two options for GES targets are put forward for this Descriptor. Under **Option 1** the proposed target is focussed on litter on coastlines and would require a slowing of the current rate of increase in litter items reaching UK beaches. Targets would not be established for other aspects of marine litter (e.g. litter on the seafloor, micro-particles, or the impacts of litter on marine life) and instead they would be monitored as surveillance indicators until more evidence is available to support the establishment of targets.

132. Under **Option 2** the proposed target for litter levels on coastlines would require an *absolute reduction* in litter items reaching UK beaches. Specific trend reduction targets would also be put forward for seafloor litter and the impacts of litter on marine life.
133. The **preferred option** is a mixture of Options 1 and Option 2. The more ambitious approach of an overall reduction in litter items on the beach (Option 2) is the preferred option on the basis that it is more consistent with existing Government commitments on terrestrial litter. For litter on the seafloor and the impacts of litter on marine life, the surveillance indicators set out in Option 1 are the preferred approach.
134. Both Option 1 and Option 2 would require improvement from the position assessed in the Initial Assessment, so measures will be needed to achieve the targets. New efforts to reduce terrestrial litter (a major source of marine litter) are now being taken (e.g. through the Love Where You Live campaign in England and Scotland's Zero Waste Plan) and there is scope to integrate these further with action aimed at litter in the marine and coastal environment. Measures to reduce fishing litter, such as codes of practice, can also be further encouraged.
135. For further detail on the proposed GES targets for Descriptor 10 and their implications see **Part 2: Section 3.9** (p.139).

Descriptor 11 (underwater noise)

136. Two options for GES targets are put forward for this Descriptor. These cover both impulsive sounds (e.g. those caused by seismic surveys and pile driving) and ambient sounds (e.g. those caused by shipping) – in both cases Option 1 is the preferred option. All the proposed targets are new because there are no targets for underwater noise in existing legislation.
137. For **impulsive sounds** the target proposed under **Option 1** would require 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 determine whether they may potentially compromise the achievement of GES. This approach reflects our conclusion that estimated future levels of activity do not currently appear to pose a significant threat to marine animal populations. The target proposed under **Option 2** would establish a precautionary limit on the proportion of days over a year (averaged across the entire UK hydro-carbon licence block area) where impulsive sounds generated by human activity can exceed a particular threshold. The limit would be set at a level which is broadly in line with **current** levels of activity. This is based on the hypothesis that although current levels of activity are not considered to be affecting populations significantly, there may be sufficient uncertainty to warrant a precautionary approach to any increase on current noise levels.
138. Under **Option 1** it is considered unlikely that any additional management measures will be needed to achieve the proposed target, beyond the need to create and manage a noise registry. Under Option 2 there would need to be significantly more active management and planning of noise generating activities which could result in restrictions to when and where developments can take place. This would result in significant (and potentially disproportionate) costs for both regulators and industry; e.g. through delayed projects.
139. For **ambient sounds** under **Option 1** a specific target for ambient sound levels would not be established and instead a surveillance indicator would be put forward with the UK determination of GES for noise being used as a generic, qualitative target until more evidence is available to set a specific, quantitative target. Under **Option 2** the proposed target reflects a more precautionary approach, aiming to keep ambient noise at current levels. The intention would be to revise this target once a better understanding of what constitutes GES is reached.

140. Under **Option 1** no additional management measures would be necessary in the immediate term. Under **Option 2** the nature and extent of the measures necessary to achieve this target remain somewhat unclear. Measures which have recently been agreed through the International Maritime Organization to improve the efficiency of new ships will help to reduce noise levels, but it is not clear whether these measures alone would be sufficient to achieve this target and additional international noise reduction measures for shipping may need to be taken through the IMO. This has the potential to become disproportionately costly compared to the risks to the marine environment.

141. For further detail on the proposed GES targets for Descriptor 11 and their implications see **Part 2: Section 3.10** (p.143).

Additional monitoring requirements

142. Monitoring programmes to assess progress towards the GES targets and indicators proposed in this consultation must be in place by the middle of 2014. This consultation is not about 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 UKMMAS⁴⁷ and with industries which gather data in UK marine waters.

143. 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.

144. 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.

145. 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.

146. For the purposes of this consultation 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 is summarised in the table below and covers both monitoring to assess the state of the marine environment and the pressures on it. This should be treated as a very rough initial estimate which potentially exaggerates the additional costs of monitoring because it has not considered possible efficiencies which could be made in the UK's current marine monitoring programme. Further work is being undertaken within the UKMMAS community to review of the UK's existing marine monitoring programmes and make recommendations for

⁴⁷ 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.

changes in order to monitor GES effectively – this will include a risk-based assessment of these initial estimates.

147. 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 therefore need to work closely with other Member States in the North East Atlantic to develop MSFD monitoring programmes that are consistent across the region. Most of the UK’s traditional marine monitoring programmes have been developed in the framework of the OSPAR Convention and are already comparable across the region, but for monitoring programmes needed to address new targets (e.g. noise and litter) it will be necessary to work with other countries to achieve a common approach.

Table 2: Initial estimate of possible additional monitoring requirements for state and pressure⁴⁸

Descriptor	Additional monitoring requirements	Initial cost estimate
Descriptors 1, 4 and 6 – species	Marine mammals: Extension of existing monitoring programmes on seals to ensure MSFD needs are covered ⁴⁹ . 10 yearly census of marine mammal populations ⁵⁰ .	A broad initial estimate of additional costs associate with this monitoring is between <£4.3m and £7.2m over 10 years. However, a proportion of these costs are already attributable to measures required to implement the Birds and Habitats Directives, and any additional costs that should be attributed to the MFSD cannot, as yet, be determined.
	Birds: Monitoring aggregations of seabirds and waterbirds at sea. Continuation of regular census of breeding seabird colonies. Monitoring of winter aggregations of shorebirds. Monitoring seabird by-catch.	
Descriptors 1, 4 and 6 – Habitats	Rock & biogenic reef habitats ⁵¹ : Operational ship based monitoring of deep sea biogenic structures. Rotation density assessment programme of rock and biogenic reef.	A broad initial estimate of the costs associated with this monitoring is between £20.7m and £39.2m over 10 years ⁵² .
	Sediment habitats ⁵³ : Improving information on the seabed (e.g. creating maps of the seabed, increasing data from surveys). Extension of monitoring to intertidal	

⁴⁸ The estimates provided in this table are based on estimates in the Cefas CBA Report 2012, p.243 and p.246.

⁴⁹ Additional costs presented here assume that no additional survey work is needed. Costs cover possible extra analysis costs to interpret the data to meet MSFD assessment requirements. Staff costs etc are already covered by the work undertaken for other obligations and are not included here.

⁵⁰ Large scale surveys of marine mammals have been carried out in the past (SCANS/CODA surveys) to meet the requirements of the Habitats Directive, OSPAR and ASCOBANS. The need for future surveys will be considered in light of existing commitments and of MSFD, so the cost of these surveys should at least in part be attributed to MSFD.

⁵¹ These are additional monitoring requirements over and above those of the Habitats Directive.

⁵² These estimates do not explicitly include the cost of monitoring the national MPA network – although it is likely that there will be some significant overlap between costs of monitoring GES and costs of monitoring MPAs.

⁵³ These are additional monitoring requirements over and above those of the Habitats Directive.

	habitats to improve information.	
	Pelagic habitats: Additional inshore zooplankton monitoring. Extension of monthly Continuous Plankton Recorder routes to fill gaps in UK waters.	
Descriptor 2 (non-indigenous species)	Additional monitoring primarily in relation to the abundance and distribution on NIS in high risk locations (e.g. ports).	A broad initial estimate of the costs associated with this monitoring is less than £952k over 10 years.
Descriptor 3 (commercial fish)	No additional monitoring requirements.	No additional costs.
Descriptor 5 (eutrophication)	Additional eutrophication related plankton monitoring.	A broad initial estimate of additional monitoring implications associated with this monitoring is between £86k-£861k over 10 years.
Descriptor 7 (hydrographical conditions)	Possibility of additional monitoring in order to provide a more comprehensive understanding of prevailing environmental conditions.	Currently uncosted.
Descriptor 8 (contaminants)	No additional monitoring requirements.	No additional costs.
Descriptor 9 (contaminants in seafood)	Additional monitoring in commercial fishing groups to extend the scope of current Food Standards Agency monitoring schemes.	A broad initial estimate of the costs associated with this monitoring is between £344k-689k over 10 years for England and Wales.
Descriptor 10 (marine litter)	Additional monitoring of beach-litter and litter on the seafloor.	A broad initial estimate of the costs associated with this monitoring is between £473k-£1.1m over 10 years for England and Wales. Further analysis will be carried out over the consultation process to assess costs for Scotland and Northern Ireland.
Descriptor 11 (underwater noise)	Additional monitoring to establish a baseline for current ambient sound levels.	A broad initial estimate of costs associated with this monitoring is between £861k-£1.3m over 10 years.

Part 2: Section 1- Consultation Questions

148. Part 2 is split into four sections and sets out the proposals which are the subject of this consultation. Section 1 is the consultation questions for stakeholders, Section 2 is the Initial Assessment Cover Paper, Section 3 is the proposals for GES characteristics and associated targets and indicators, and Section 4 (see separate document) is the Impact Assessment.

Consultation Questions on the Initial Assessment Cover Paper (Part 2, Section 2)

149. The evidence base supporting the UK Initial Assessment has already been extensively peer reviewed and consulted on during the development of Charting Progress 2, the Scottish Marine Atlas and the Northern Ireland State of the Seas Report and it is not the intention of this consultation to substantially review that evidence base. However, the UK Government and Devolved Administrations would like to seek views from stakeholders on the following questions:

- **Question 1:** Are the overall conclusions of the UK Initial Assessment an accurate summary of the evidence base provided by Charting Progress 2 (and its feeder reports), the Scottish Marine Atlas and the Northern Ireland State of the Seas Report?
- **Question 2:** Is there any substantive new, peer reviewed evidence which should be taken into account which may affect the conclusions of the UK Initial Assessment?

Consultation Questions on the proposals for GES characteristics and associated targets and indicators (Part 2, Section 3)

150. Stakeholders have already had significant involvement in the development of the proposals for GES characteristics and associated targets and indicators. The expert community has been involved in developing the evidence base for the proposals through the UK Marine Monitoring and Assessment Strategy. Wider industry and NGO stakeholders have been involved through a series of workshops and meetings organised by Defra and the Devolved Administrations over the last two years. For the proposals on GES characteristics and associated targets and indicators the UK Government and Devolved Administrations would like to seek views from stakeholders on the following questions. The questions should be applied to each individual GES Descriptor:

- **Question 3:** Are the proposed characteristics of GES for this Descriptor consistent with the definition of GES and the overarching aims of the Directive, whilst at the same time acknowledging gaps in our knowledge base?
- **Question 4:** Are the proposed characteristics of GES for this Descriptor consistent with other Government policies and commitments on the UK marine environment?
- **Question 5:** Are the proposed GES targets for this Descriptor sufficient to guide progress towards the achievement of GES?
- **Question 6:** Are the proposed GES targets feasible to implement (i.e. can appropriate management measures be put in place to achieve them)?
- **Question 7:** Are the proposed GES targets for this Descriptor consistent with other Government policies and commitments on the UK marine environment?
- **Question 8:** Are the proposed GES targets and indicators feasible and cost effective to monitor?
- **Question 9:** Where gaps have been identified in the proposed GES targets and indicators for this Descriptor do you have suggestions for how these could be filled?

Consultation Questions on the Impact Assessment (Part 2, Section 4)

151. For the analysis on each of the GES Descriptors stakeholders should consider the following key questions:

- **Question 10:** Are the illustrative measures considered for this Descriptor a reasonable assessment of the additional measures which might be needed to achieve the proposed GES targets?
- **Question 11:** Are there any other potential measures which might be necessary in order to achieve the proposed GES targets for this Descriptor?
- **Question 12:** Are you able to provide any more specific information on the likely costs of the illustrative measures considered for this Descriptor?

Part 2: Section 2 - UK Initial Assessment Cover Paper

2.1 Introduction and approach

Introduction

152. 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 MSFD Consultation paper. 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.

153. UK seas extend to some 867 400 km², 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 coastline⁵⁴ 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.

154. 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 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 III⁵⁵, 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, 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

⁵⁴ Based on Ordnance Survey digital measurements of 1:10000 maps using the high water line www.ordnancesurvey.co.uk/

⁵⁵ An inventory showing how the UK initial assessment addresses the indicative list of characteristics, pressures and impacts at Annex III of the Directive is given at Annex 2 of this document.

- (iii) takes account of the relevant assessments which have been made pursuant to 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

155. The UK's Initial Assessment comprises this summary report ("Cover Paper") and a substantial supporting evidence base (see Box 2).

156. This report 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.

Evidence base for environmental quality status

157. 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.

158. The Initial Assessment also includes a series of 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. In addition a strategic scoping study has been compiled to support the implementation of marine planning in English waters.

159. 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

160. 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 Cover Paper 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 Cover Paper.

161. 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: ► 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. & Hawkrigde, 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

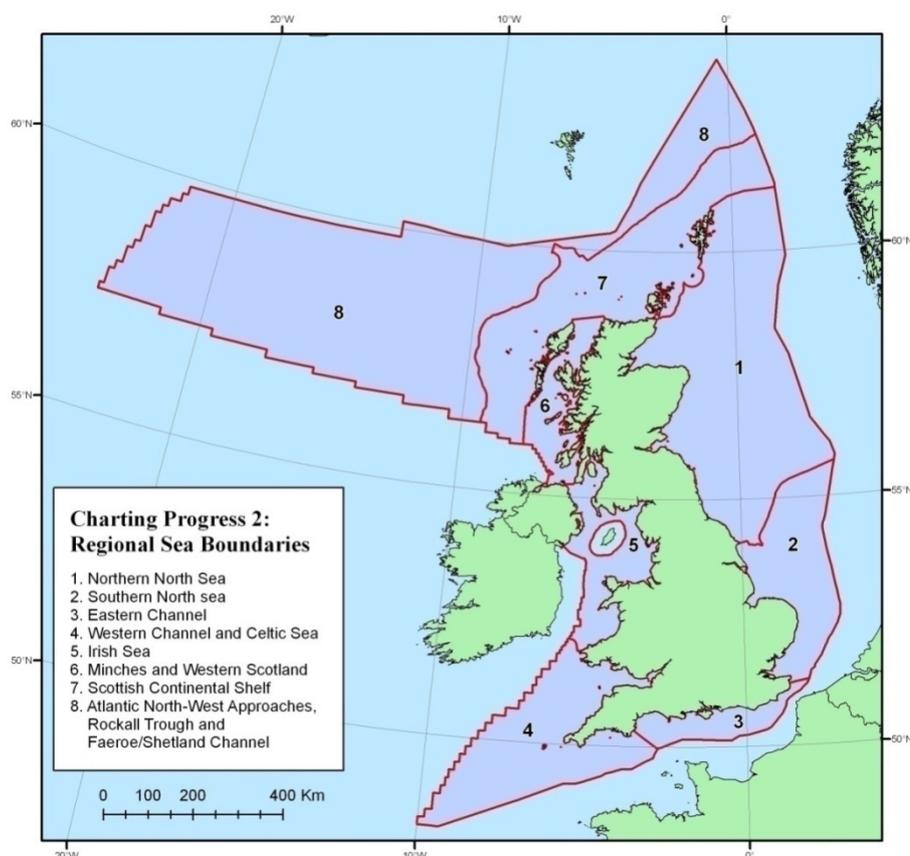
Business as Usual Study: ABP Marine Environmental Research Ltd and Economic for the Environment Consultancy (2011). Business as Usual Project Projections of the Marine Environment, to Inform the UK Implementation of the Marine Strategy Framework Directive. ABP Marine Environmental Research Ltd. 87pp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

Approach to regional assessment of UK seas

162. 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 waters lie within the North-East Atlantic region and within these marine regions, 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 occupy parts of two subregions identified in the Directive: the Greater North Sea and the Celtic Seas.
163. 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)⁵⁶ and principally using physical and biological features such as tidal fronts and seabed flora and fauna (see Figure 6).
164. In the summary of the Initial Assessment provided by 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. This allocation is without prejudice to any formal delimitation of the MSFD subregions or subdivisions in UK waters.

⁵⁶ <http://archive.defra.gov.uk/environment/biodiversity/marine/documents/rmnc-report-0704.pdf>

Figure 6. Regional assessment areas in UK seas used for the Charting Progress 2 assessment.



Regional coordination with EU Member States

165. 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. The QSR report 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 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 of the use of UK seas and the predominant pressures

Marine users and uses and their economic and social importance

166. 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 3 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

167. Table 3 below summarises the economic value (Gross Value Added or Investment), productivity trend and future outlook on growth rate of these activities.

Table 3: Principal human activities in UK seas and their Gross Value Added and productivity trend.

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		Not possible to establish monetary value	0
Storage of gases		Not possible to establish monetary value	0

^a Source: Charting Progress 2, UKMMAS (2010)

^bNot possible to establish monetary value. No temporal data, deployment rates likely to have been stable

^cNot 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>

168. 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 in England have been demonstrated in a socio-economic study for England and Wales prepared for the Marine Management Organisation (MMO)⁵⁷. This is summarised in Table 4, 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) c) deprivation and d) effect on local terrestrial environment, heritage or neighbouring uses. For details on the linkages please refer to the study.

Table 4. Summary social analysis of principal human activities⁵⁸.

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 O & G 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%	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	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	Variable dependent upon location and activities – continued operations and maintenance plus decommissioning activities will ensure employment beyond 2020. Medium to high local impacts.

⁵⁷ '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://marinemangement.org.uk/marineplanning/se.htm>

⁵⁸ Table 4 is mainly based on a study of English coastal communities (Tim *et al.* (2011) – see footnote 3) and Charting Progress 2. Column 2 has been augmented to include information on coastal communities in Scotland, although the relationships described in columns 3-6 do not necessarily hold for Scotland.

	(Ref: Oil and Gas UK)	g activities offering alternative opportunities for employment. Direct employment benefits the broader local economy as incomes are re-spent in local businesses.	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.	
Offshore renewable energy	Wave and Tidal: East and North coasts of Scotland; Northern Ireland; North Wales; South West of England. Offshore Wind: Predominantly North Sea coast.	Variable dependent upon location and 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	Variable dependent upon location and 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 GRP and standards of living in traditionally economically under developed areas of the UK.	Variable dependent upon location and activities – Medium to 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.

		skilled and semi-skilled employment, both as new employment and diversification in existing, declining maritime sectors.		
Marine Transport	Important to a large proportion of English coastal areas, especially around the south-west. Key employment hotspots are located in Plymouth, Southampton, Portsmouth, Harwich and 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.	High local – Labour catchments tend to be relatively local, and there is demand for lower skilled labour implying job creation for those skills. However, lower skill jobs make smaller contribution to productivity growth.	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 economies.	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.
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	Low local – Manufacture takes place at a small number of sites, and cable laying contractors are international. Jobs created are likely to be	Low local – Whilst telecommunication s cabling marine activity has an important role in facilitating international communications, the prevalence of related activities	Low local- It is unlikely to have significant effects on local deprivation.

	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.	highly specialised.	will not in themselves provide improvement in labour productivity for coastal communities.	
Tourism and recreation	A wide geographic spread across English coastal towns with particular importance in areas of North East and South West. Estimated that 210,000 jobs are directly supported by seaside tourism in England and Wales ⁵⁹ . Marine-related leisure activities in Scotland are particularly prevalent on the West Coast, Hebrides and Northern Isles.	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 also tend to be seasonal and part time.	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 is perceived as over dependence on tourism.	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).
Defence – Military	Overall the Royal Navy employs 38,600 people and 5,200 civilians. Defence employment is important to a number of coastal areas in England, including Plymouth and Portsmouth. In 2010, 11,920	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).

⁵⁹ Beatty, Fothergill, Gore and Wilson (June 2010) The Seaside Tourist Industry in England and Wales – Employment, economic output, location and trends Centre for regional Economic and Social Research, Sheffield Hallam University.

	Ministry of Defence personnel were stationed in Scotland and 5,830 civilians were employed, over a quarter in Argyll & Bute.			
Marine Aggregates	Important to a small number of areas in England, particularly to the east of the country. The sector employed 31,000 people in 2004	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 jobs are relatively unskilled and available to local labour.
Fisheries	Particularly important to coastal areas around south-west of England and the east coast of Scotland. The main 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). ⁶⁰	High local – Though local employment has declined over the years, changes in levels of fisheries will still have significant 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	Low local – Fisheries pay is below average, with intermittently high wages being eroded by seasonality and weather. As like other 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	High local – Jobs tend to be lower skilled in nature, creating opportunities for those at greatest risk of unemployment ⁶¹ .

⁶⁰ Employment data on fisheries industries may not pick up the high levels of self employment.

⁶¹ The fishery employment statistics should be treated with caution due to the high levels of self employment in the industry.

	<p>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.</p>		<p>evidence on the role of fishing in this regard will be welcomed.</p>	
Aquaculture	<p>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 in directly with majority (2200) jobs based in Scotland. The majority of Scottish aquaculture production occurs in the Minches and Malin Sea area and Scotland is one of the world's three largest producers of farmed Atlantic salmon.</p>	<p>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 creates opportunities for those at risk of unemployment but makes smaller contribution towards productivity growth.</p>	<p>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.</p>	<p>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.</p>
Surface water management and waste water treatment and	<p>Widespread locations. Most waste disposal in Scotland occurs along the east coast</p>	<p>Medium local impacts It can be assumed that a fair proportion of the workforce is made up from local employment</p>	<p>Medium local - Wage rates are slightly above average, this industry is a stable, utility function and is not going to drive local</p>	<p>Medium local – Expansion in this activity may have mild positive impacts on local deprivation</p>

disposal		markets. This would suggest employment in coastal areas would be positively affected by job expansion.	productivity to a great extent.	
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169. The linkages between marine activities and coastal socio-economic processes in Table 4 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.

170. Similarly there are likely to be some differences on how these linkages (mentioned in Table 4) hold for other Devolved Administrations. For example, there is currently no marine aggregate abstraction within Northern Ireland.

171. The 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 5 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 we when we assess social impacts of specific measures adopted under MSFD (2014/15).

Table 5. Performance on indicators of English and Scottish coastal communities⁶².

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

⁶² 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.

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 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 ⁶³

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%.

⁶³ 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.

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.						

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

172. Table 3 identifies direct uses of the UK’s marine waters. In addition to these direct users of 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 3. 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);
- 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 the any use either themselves or others, 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).

173. 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 values⁶⁴. Part five of this Initial Assessment “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

174. 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 BAU study. Table 6.

⁶⁴ 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.

provides an overview of the main pressures identified by Charting Progress 2 and a brief summary of the temporal and spatial extent of these pressures. Although there are a number of activities that result in physical damage of the sea bed and surface features through abrasion, the spatial extent of disturbance 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 6. Overview of the main environmental pressures arising from the principal marine uses in UK seas and summary information on their spatial extent and intensity and outlook for development in the period to 2020/2030.

Activity	Main Pressures (MSFD pressure categories)	Spatial extent and intensity	Outlook 2020/2030
Oil & gas	Physical damage; 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 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.	In most areas a significant expansion in infrastructure is not expected as activity will be mostly 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 damage, 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 in these regions.	A sustained gradual long-term growth in activity is expected allied with improvement in the operating framework.
Telecommunications	No significant unmanaged pressures.	Cables are widespread but spatial extent is negligible.	No major change in extent expected.
Leisure & recreation	Litter; Non-indigenous species, removal of target species.	Activity occurs in coastal waters throughout Greater North Sea and Celtic Seas subregions.	Growth in tourism expected over the longer term, but subject to short-term fluctuation.
Defence – Military	Litter; Noise; Non-indigenous species.	Large areas of UK seas are designated for exercises particularly in the Western Channel, Eastern Channel, Northern North Sea and	Prediction is difficult. Activity likely to continue at the same level, but increased use of sustainable

Activity	Main Pressures (MSFD pressure categories)	Spatial extent and intensity	Outlook 2020/2030
		Southern North Sea, but actual spatial extent of activity is confidential Intensity and frequency of activities is confidential.	development strategies likely to lead to reduced pressure.
Fisheries	Physical damage (abrasion), Litter; Non-indigenous species; Removal of target species (lethal); Removal of non-target species (lethal).	Activity widespread in the shelf seas of Greater North Sea and Celtic Seas subregions. Activity most intense in Northern North Sea, Eastern Channel (parts) North of Scotland, West of Scotland, Irish Sea and Western Channel.	No change in overall level of activity expected but revisions to CFP 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	Removal of non-target species.	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 license areas off the coasts of the Southern North Sea and Eastern Channel. Smaller amounts of activity off Wales.	A significant increase in extraction is possible.
Renewable energy : wind	Physical loss; Noise; Interference with hydrological processes.	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	Physical loss; Noise;	Small-scale installations on	Expansion expected in

Activity	Main Pressures (MSFD pressure categories)	Spatial extent and intensity	Outlook 2020/2030
energy: wave and tidal stream	Interference with hydrological processes.	the Scottish Continental Shelf and in the Minches and West of Scotland.	the Scottish Continental Shelf, the Minches and West of Scotland and Irish Sea (off Wales).
Navigational dredging	Physical damage, noise, interference with hydrological conditions.	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, Physical Loss; 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	Biological disturbance, physical damage, litter.	Activity takes place at coastal location throughout UK. Low intensity at most sites.	Activity predicted to increase.
Research and development	Biological disturbance, physical damage, litter.	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.
Storage of gases (e.g. CCS)	Noise.	One site in Southern North Sea. Others under consideration.	Outlook for activity is currently uncertain.
Biofuels	Physical loss.	Nil at present.	Future activity locations unknown at present Timing of development unknown.

► 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

175. Methodologies for the assessment of the cumulative and synergistic effects of pressures from human activities are currently the subject of research development. 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 of 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 characteristic in Sections 2.3 and 2.4 of this Cover Paper.

2.3 Current and predicted status of UK seas

176. This part of the report 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 orange shaded text boxes. 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.

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

178. 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.

179. A further section described 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 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, pCO₂ profiles or equivalent information used to measure marine acidification

180. The UK seas extend to some 867 400 km², 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)**⁶⁵.
181. 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 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)**⁶⁶.
182. 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)**⁶⁷.
183. 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

⁶⁵ http://chartingprogress.defra.gov.uk/feeder/Section_3.8_Sedimentary_Processes_and_Morphology.pdf

⁶⁶ http://chartingprogress.defra.gov.uk/feeder/Section_3.2_Temperature_and_Salinity.pdf

⁶⁷ http://chartingprogress.defra.gov.uk/feeder/Section_3.2_Temperature_and_Salinity.pdf

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)**⁶⁸.

184. 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)**⁶⁹.
185. 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)**⁷⁰.
186. Evidence suggests that the waters of the North West European shelf act as a net sink for atmospheric CO₂, but that this sink is highly variable. An apparent reduction in uptake of CO₂ 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)**⁷¹.
187. 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)**⁷². **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)

⁶⁸ http://chartingprogress.defra.gov.uk/feeder/Section_3.2_Temperature_and_Salinity.pdf

⁶⁹ http://chartingprogress.defra.gov.uk/feeder/Section_3.6_Waves.pdf

⁷⁰ http://chartingprogress.defra.gov.uk/feeder/Section_3.7_Suspended_Partuculate_Matter_and_Turbidity.pdf

⁷¹ http://chartingprogress.defra.gov.uk/feeder/Section_3.3_Carbon_Dioxide_and_Acidification.pdf

⁷² http://chartingprogress.defra.gov.uk/feeder/Section_2_Overall_Assessment.pdf

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 Characteristics:

- information on the structure of fish populations, including the abundance, distribution and age/size structure of the populations

188. More than 330 fish 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) than in with the southern and central North Sea (Greater North Sea) 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**⁷³.

Key pressures

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

190. 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 substances⁷⁴. The impacts of these additional pressures on fish communities have not been quantified at the regional assessment scale.

191. 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. Such distribution shifts will have profound consequences for commercial fisheries and for the achievement of stated conservation objectives.

⁷³ http://chartingprogress.defra.gov.uk/feeder/HBDSEG-FeederReport-sec3_4.pdf

⁷⁴ 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.

General status and trends

192. 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) have 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.
193. 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 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 Sea sub-region*: In the western Channel and Celtic Sea area (CP2 Region 4) several indices of the demersal fish community have improved since the early 1980s 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.
194. 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 over the last five years the diversity and overall abundance of these fish communities have improved appreciably in most regions. This 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.
 - *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, possibly 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*: 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 section 7)*.
- *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

195. 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 due to measures under the reformed Common Fisheries Policy (CFP) and 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.

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

State of the evidence base and development needs

197. 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, as well as to develop improved information on the causes of declines in diadromous fish species and highly migratory fish such as oceanic sharks.

► 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) 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. 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

199. 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 on cetaceans identified in Charting Progress 2 are the extraction of species through by-catch, which is of particular concern for harbour porpoises and common dolphins, and the introduction of contaminants. The impacts of by-catch have only been quantified in some regions and are decreasing in most, although 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, include whaling and drive fisheries (in the waters of other nations), prey depletion and/ or competition, pollutants, disease, vessel or propeller strikes and noise in the marine environment.

200. 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

201. 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. 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.
202. 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: good status in the Northern North Sea (CP2 Region 1) and the Southern North Sea (CP2 Region 2), poor status in the Eastern Channel (CP2 Region 3), as a result historical bycatch of harbour porpoise in fixed net fisheries, although there is some recent evidence of improvement⁷⁵.
 - Celtic Seas sub-Region: moderate status 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

203. The future status of all marine species groups is difficult to predict given the wide range of pressures on them and our lack of knowledge on species interactions. Increases in anthropogenic underwater noise, particularly as a result of percussive piling during offshore wind farm construction have the potential to temporarily 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 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.

204. 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

205. 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

⁷⁵ 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.

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.

206. 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.

207. 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): 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

208. UK seas host about 36% 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

209. 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 unregulated shooting (in some local areas) and by-catch by fisheries. 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

210. The current overall status of grey seals is generally good, 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.

211. 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.

212. 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 decline in recent years – particularly in the northern North Sea and to the north of Scotland. Harbour seal numbers have declined significantly in Shetland, Orkney and on the east coast of Scotland, by more than 50% since 2001. There has been a smaller decline in the Outer Hebrides but numbers on the west coast of Scotland have remained relatively stable. 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.

Predicted status by 2020-2030 given business as usual

213. The future status of all marine species groups is difficult to predict given the wide range of pressures on them and our lack of knowledge on species interactions. 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.

214. 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 changes in sea level. 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

215. Grey seal pup production has been monitored since the early 1960s; harbour seals have been monitored since the late 1980s. 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)

216. 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

217. 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.

218. 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

219. 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

220. 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

221. 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: 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

222. Thirty-eight species of seabird regularly occur in the seas around the UK¹. Some species occur in large numbers, but other species are only present during the breeding season, over winter or during migration. 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

223. 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 seabirds has been a significant pressure in some locations.

224. 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 of the 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. A subsequent decline in numbers of northern fulmar since the 1990s may be linked to a reduction in fisheries effort.

Current status and trends

225. The number 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, as a direct result of increased protection from hunting and persecution in the UK and overseas, but recent trends in breeding success of seabirds in the Greater North Sea and the northern Celtic Seas are of concern.
226. 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. Conversely herring gull and roseate tern numbers have declined the most since 1969 – by more than 50%. 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.
227. 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 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 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 elsewhere⁷⁶. No assessment possible in the Atlantic North-West Approaches (CP2 Region 8), due to lack of data.
228. 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.

⁷⁶ Seabird Population Trends and Causes of Change: 2011 Report.

- *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 both declined by more than 50% since 1970, although a slow recovery in numbers of roseate tern has been seen since 2000. 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

229. The future status of all marine species groups is difficult to predict given the wide range of pressures on them and our lack of knowledge on species interactions. Improved understanding of the interactions between climate, plankton, prey fish, fishing and seabirds is needed in order to predict the future status of seabirds.

230. 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.

231. 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 further declines in some species.

State of the evidence base and development needs

232. 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)

Waterbirds

233. 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

234. 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

235. 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 only slightly, with average numbers in the winter of 2006/07 still 85% higher than in the mid-1970s, when co-ordinated monitoring began. However, there have been some significant declines in numbers of some diving species and estuarine waders over the same period, for example, goldeneye, dunlin 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.

236. 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

237. The future status of all marine species groups 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

238. 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: Characteristics

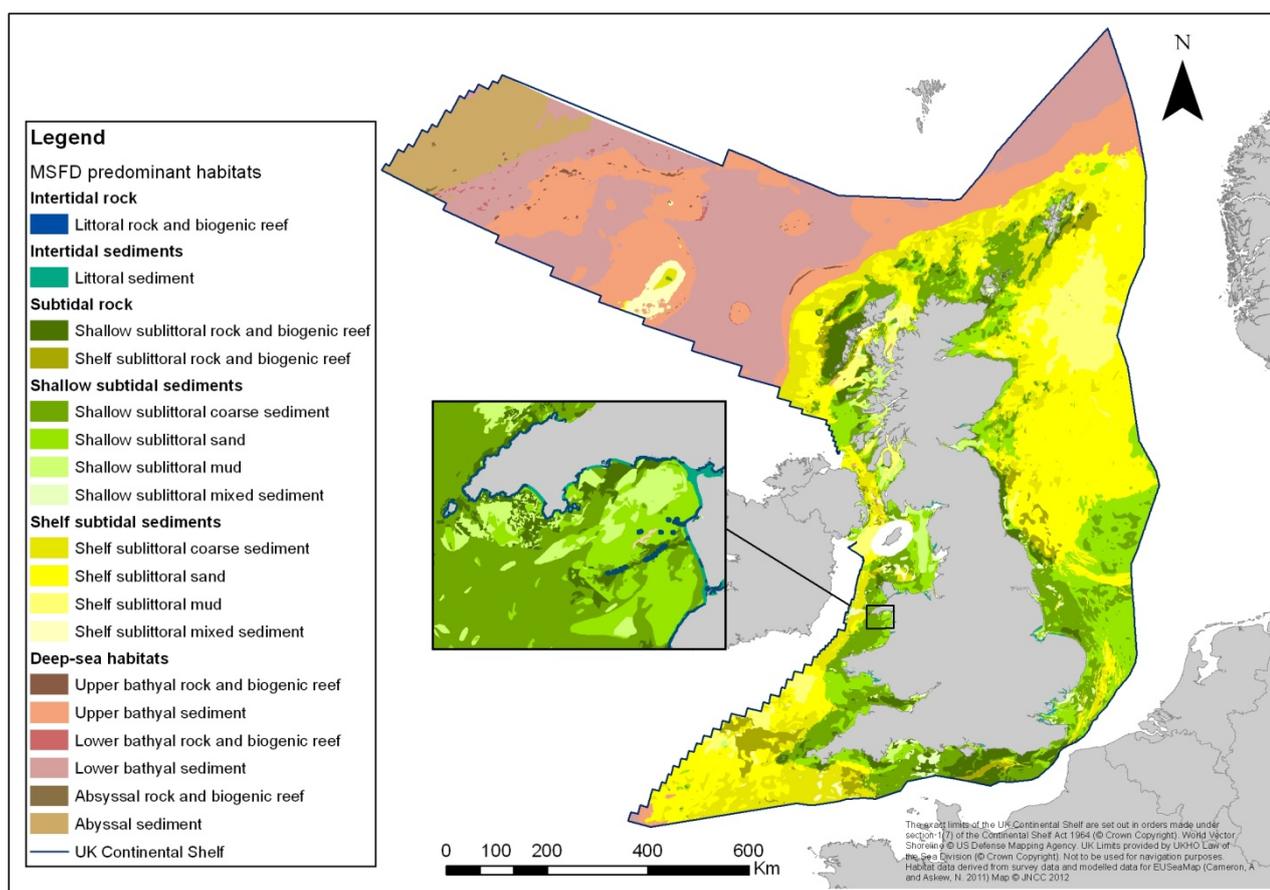
The predominant seabed and water column habitat type(s) with a description of the characteristic physical and chemical features, such as depth, water temperature regime, currents and other water movements, salinity, structure and substrata composition of the seabed,

— 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.

239. 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 (over 11 000 miles of coastline) 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.

240. 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 7.

Figure 7. 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.



Key pressures

241. 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

242. Impacts on seabed habitats are widespread and the composition of seabeds 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:

243. *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 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.
244. *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 and the construction of coastal defences and other structures 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.
245. *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, although when judged at a regional scale, the overall area impact is limited. These 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 *Sabellaria 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, coastal infrastructure or disposal of dredged materials.
246. *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. 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.

247. *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.

248. *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, biogenic⁷⁷ 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

249. 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. 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.

250. There may however be 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;
- 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.

⁷⁷ Produced by biological processes.

251. 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 2.4 p84-86.

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

MSFD Annex III Table 1:

- 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.

252. Marine protected areas are established in UK waters under a range of designations. These 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 2011 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 Reserves⁷⁸. Together these protect 5.6% of UK seas.

Predicted status in 2020 given business as usual

253. The status of seabed habitats is expected to remain stable, or improve slightly, between now and 2020. 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.

254. 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

255. 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, especially those offshore. 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.

256. 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

⁷⁸ There are also Sites of Scientific Interest and Ramsar sites that protect marine areas and will be included in the MPA network.

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: 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.

257. There are currently around 60 established non-indigenous species (NIS) in UK waters⁷⁹, and no consensus on numbers of invasive alien species.

Key driving forces

258. 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 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

259. 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

⁷⁹ ALIENS Conserving native biodiversity by raising awareness of invasive species: http://www.marlin.ac.uk/marine_alien/

survey of the southern part of Poole Harbour reported in 2007 revealed that NIS represented 60% of the wet weight of all species' present⁸⁰. There are localised impacts in other CP2 Regions, however, not all areas have been surveyed.

260. There is no up to date national overview of all marine introductions to UK waters, the last was completed over a decade ago⁸¹. 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 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.

261. 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 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.

⁸⁰ Underhill, J., & Dyrinda, P. (2007) Non native species in and around Poole harbour

⁸¹ http://www.jncc.gov.uk/pdf/pub02_nonnativereviewdirectory.pdf

Predicted status by 2020-2030 given business as usual

262. 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

263. 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: Pressures and impacts

— Selective extraction of species, including incidental non-target catches (e.g. by commercial and recreational fishing).

Key driving forces

264. 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 species

265. 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 (maximum sustainable yield). There is a lack of consistent and quality data for shellfish species from throughout the UK, which means that robust stock assessment has not so far been possible at a regional level.

266. 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.
267. 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.
268. The following sub-Regional patterns were identified.
- *Greater North Sea sub-Region*. 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.
 - *Celtic Seas sub-Region*: 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.
269. The latest available information (based on 2010 ICES advice) suggests that of those stocks of commercial interest to the UK for which a robust scientific assessment is possible, nearly 40% are being fished at the right level to achieve a maximum sustainable yield in the longer term or better and around 50% have a spawning component commensurate with maximum sustainable yield (MSY). However, this implies that at least half of stocks in UK waters will need to improve their position to ensure GES. What is more, the status of almost a third of all UK commercial finfish stocks is not quantitatively assessed – and this will need to be taken account of, in the future management of EU fisheries under the EU CFP. Although 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

270. 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. There is an absence of consistent data from throughout UK seas. Shellfish assessments in Scottish 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 its 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.

271. Underwater television camera surveys have shown a general trend of increasing burrow density of *Nephrops* from the mid-1990s to the mid-2000s in the northern part of the Greater North Sea. This is also indicated by the North Sea Commission Fisheries Partnership stock survey, which uses a questionnaire approach to determine fishermen's perceptions of year-on-year changes in abundance of *Nephrops* and other commercially important fish stocks (ICES, 2008a). A similar trend has also been observed for *Nephrops* stock to the west of Scotland, although with some between year variations.

Predicted status in 2020/2030 given business as usual

272. It is concluded that effective implementation of the CFP will 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. 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. Other factors are discussed below under uncertainties.

State of the evidence base and development needs

273. 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. 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: 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).

274. 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

275. 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

276. 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.

277. 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. However, using assessments carried out in connection with the Urban Waste Water Treatment Directive and Nitrates Directives, and the WFD, 17 small estuaries and harbours were identified as problem areas and five as potential problem areas. 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.

278. 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

279. A recent OSPAR modelling exercise⁸² 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.

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

280. 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

281. 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

⁸² OSPAR Commission (OSPAR 2008). Nutrient Reductions and Model Scenarios for the North Sea. OSPAR Commission, London. Publication 374/2008.

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 Pressures and impacts: Interferences 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

282. 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'⁸³. Many of these developments can have a permanent effect on waves, tides and currents, including activities such as navigation, flood protection, land reclamation, recreation and development. However, most permanent alterations in hydrographic conditions resulting from human developments are on a localised scale. These alterations 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

283. 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 7).

284. 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 7. 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.

⁸³ Town and Country Planning Act, 1990.

	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%
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

285. 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.

286. 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 CO₂. 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

287. 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 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 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),

288. 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 of 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

289. 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

290. 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.

291. 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.

292. 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 substances⁸⁴ 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)⁸⁵. 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.

293. 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, the levels in sediments and biota are a particular issue in estuaries 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 for the metals (cadmium, mercury and lead) and PAHs. 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.

294. 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

⁸⁴Metals (cadmium, lead and mercury), PAHs, PCBs

⁸⁵www.environment-agency.gov.uk/research/planning/40295.aspx

Scotland's Marine Atlas Chapter 3 Hazardous Substances (Page 42 - 47)

<http://www.scotland.gov.uk/Publications/2011/03/16182005/32>

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

295. 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. These surveys indicate that contaminant levels in fish and seafood 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 work⁸⁶ 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 effects of hazardous substances

296. 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:

- High 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. [► 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 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. [► Read More: Charting Progress 2 Clean Safe and Healthy Seas Feeder Report 3.1.4.1 (page 114)]
- In a number of UK estuaries levels of the blood protein vitellogenin (VTG) in male fish suggests that affected fish are gradually accumulating persistent oestrogenic compounds, which disrupt endocrine function, 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

86 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.

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

297. 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 be practicable to take remedial measures.

298. 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 currently being 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

299. 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 contaminants.

300. 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: 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),

301. 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.
302. 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.
303. 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: Pressures and Impacts: Contamination by hazardous substances
- Introduction of radio-nuclides.

304. 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: Pressures and Impacts: Biological disturbance
 - Introduction of microbial pathogens.

305. Microbial contamination of coastal waters from sewage treatment plants has fallen significantly as a result of improvements in infrastructure. For Bathing Water Quality, Table 8 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 8. 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

306. The levels of compliance reflect a significant investment in sewage treatment and infrastructure driven by the Bathing Waters and Shellfish Waters Directives. Those CP2 sites Regions within Shellfish waters and with poor hygiene quality 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: Pressures and Impacts: Other physical disturbance
- Marine litter.

307. Any persistent, manufactured or processed solid material discarded, disposed of, abandoned or lost in the marine and coastal environment can be defined as marine litter⁸⁷. 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.

Key driving forces

308. Whilst sources of litter are difficult to trace, most of it comes from adjacent land rather than ships or rigs. The Marine Conservation Society's Beachwatch programme reported that 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

309. Charting Progress 2 identifies some problems from marine litter in all sub-divisions 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 be needed to achieve GES with respect to litter in both the Greater North Sea and the Celtic Seas subregions. There is very little information on quantities in the northern part of the Celtic Seas sub-Region.

⁸⁷ Marine Litter – An analytical overview, Regional Seas Programme, UNEP.

Beached Litter

310. Quantities 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.
311. 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 sub-Region.
312. The main identified sources of litter on UK beaches include the general public, fishing, sewage discharges and shipping.

Offshore litter

313. 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.
314. 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 for the content of plastic particles in the stomachs of seabirds (*fulmaris glacialis*) in relation to an Ecological Quality Objective. The EcoQO was not met in any subregions of the North-East Atlantic.

Impacts of marine litter

315. 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.
316. 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, 2010⁸⁸).

⁸⁸ KIMO International (2010). Economic Impacts of marine litter (eds. Mouat, J., Lopez Lozano, R. and Bateson, H. KIMO International. 117pp. <http://www.kimointernational.org/Portals/0/Files/Marine%20Litter/Economic%20Impacts%20of%20Marine%20Litter%20Low%20Res.pdf>

Predicted Status by 2020/2030 given business as usual

317. 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

318. 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.

► 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: Pressures and Impacts: Other physical disturbance
-Underwater noise (e.g. from shipping, underwater acoustic equipment)

Key driving forces

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

Current status and trends

320. 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 wind turbines. Increased construction activity has taken place in parts of the Southern North Sea for offshore wind farms and further large-scale developments of offshore wind farms are likely in the future. It remains unclear whether changes in shipping activity have resulted in an increase in ambient noise levels.

321. 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.
322. 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 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

323. 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.
324. 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

325. 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.
326. 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)

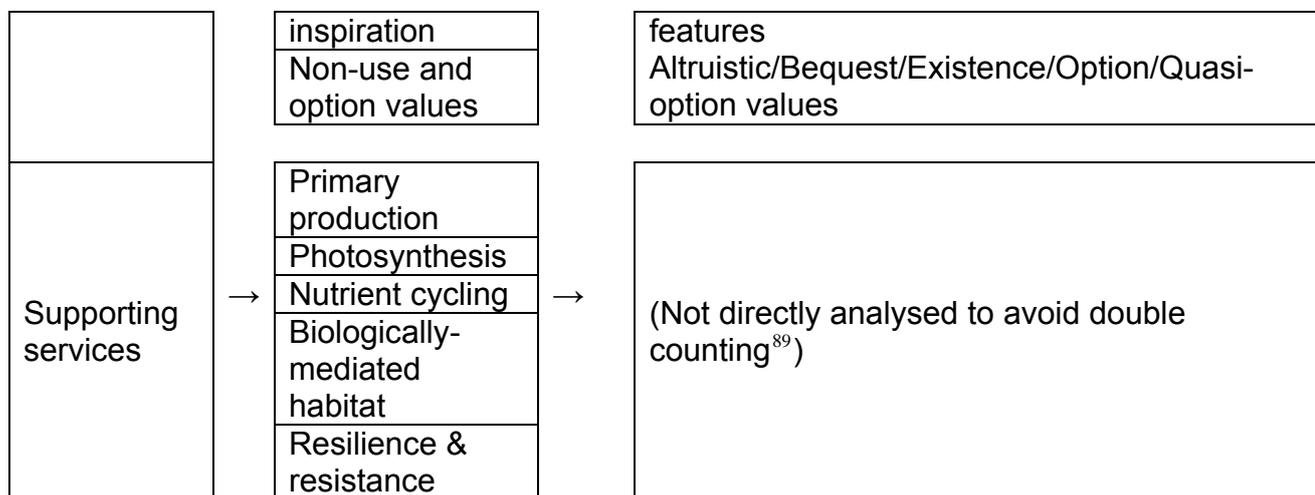
2.5 Analysis of the costs of degradation

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

327. The marine environment provides ecosystem goods and services which benefit society. The Millennium Ecosystem Assessment 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.

328. 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.

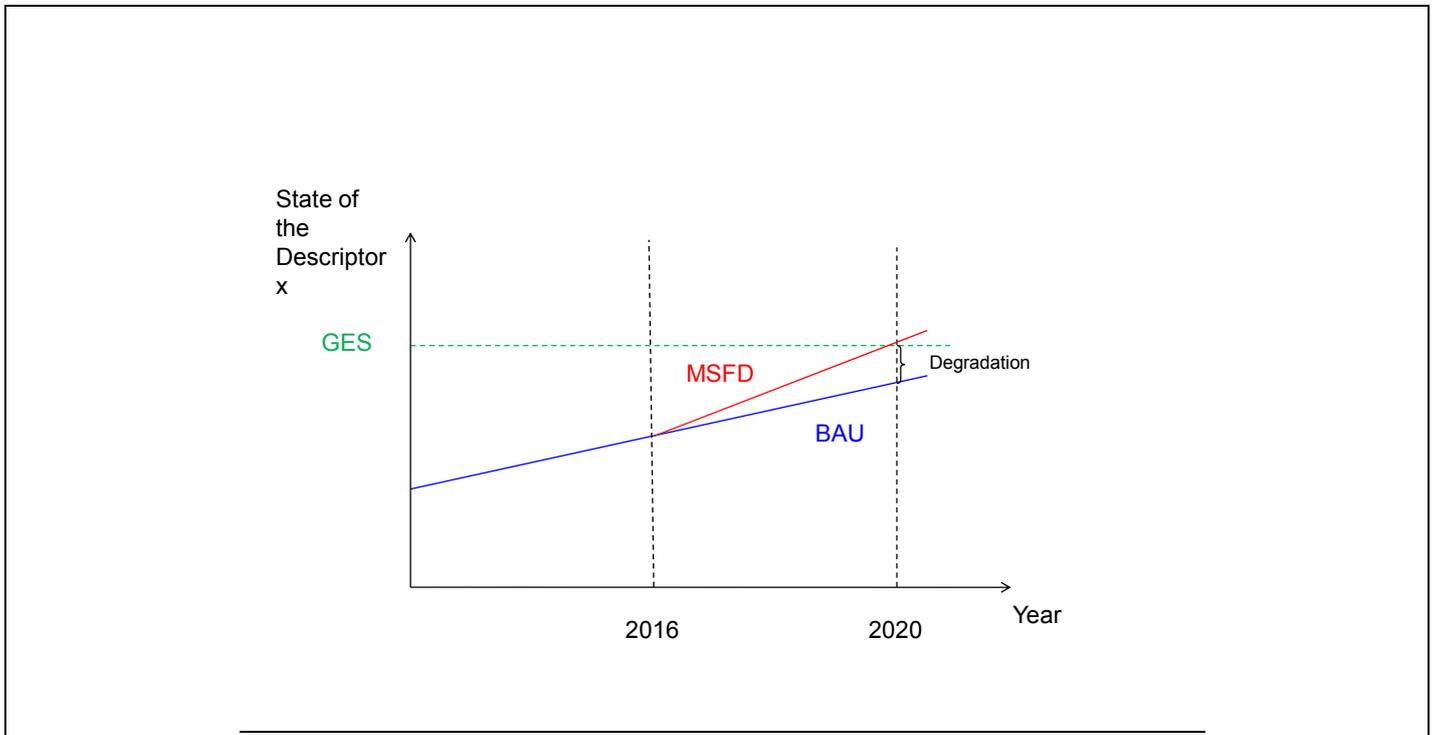
Categories	Relevant Categories	Example of Product or Service
Provisioning services	Food	Fish for human consumption
	Fibre	Fish used in animal feeds
	Biochemicals, pharmaceuticals & natural medicines	Aggregates Fish oil
Regulating services	Gas & climate	Carbon sequestration
	Bioremediation of waste	Waste 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
	Recreation Spiritual & religious	Recreational sea angling Nature-based recreation Scuba Diving Artistic work based on the marine environment
	Cultural & social	Protection of iconic sites or archaeological features
	Aesthetic &	Protection of iconic sites or archaeological



329. The underlying theoretical model is illustrated in Figure 8, however, due to lack of trend data it has not been possible to fully apply this model and only certain elements have been assessed below. 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.

Figure 8. 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.

⁸⁹ 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'.



330. In order to value the change in societal welfare (the gap in the Figure 8) 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 services⁹⁰ – 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.

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

332. 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;

⁹⁰Final ecosystem services include provisioning services, cultural and recreational services, regulating services.

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.

333. These assessments were made based on discussions with economists and policy experts in Defra (step i) and with experts from JNCC and Cefas (step ii) who have worked on developing the UK targets and indicators for GES⁹¹. The table below shows the components and pressures which are considered to relate to final ecosystem services.

Table 9: 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 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) Pelagic habitats (D1 and D4)	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 supporting services such as nutrient cycling and ecological interactions. 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.

334. 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

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

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 Appendix B of the Impact Assessment⁹². 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
- Subtidal benthic habitats
- Birds

335. 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 revenues from fish stocks not at Maximum Sustainable Yield (MSY)

336. 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).

337. Some stocks are currently in good condition i.e. around MSY, for example North Sea haddock, others 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.

338. Table 10 provides an illustrative assessment of the loss in revenue from fish stocks not reaching MSY levels, focusing on five fish stocks. This analysis provides a rough indication of the magnitude of benefits arising from improvements in the abundance of fish stocks. The key assumptions underpinning the analysis are as follows:

- The modelling underpinning yields consistent with MSY assumes that, for each stock considered, recruitment relationships and environmental conditions in future years are consistent with those in previous years. It also assumes that the stocks considered can achieve MSY simultaneously⁹³.
- Price per tonne does not change when fish stocks reach MSY. This is unlikely as with increase in supply, prices will fall. However, it is difficult to estimate what this fall in

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.

⁹³ The UK government has accepted the principle of MSY, however, MSY is a single-species target, taking no account of species interactions or the mixed nature of many EU fisheries. Therefore, given the variability inherent in the targets for single species and the difficulty of simultaneously maintaining all stocks in a mixed fishery at MSY, for some stocks MSY may be considered to be a range of exploitation rates which take into account changes in stock dynamics.

price will be. The sensitivity analysis section below looks at scenarios of a 20% and 50% fall in price.

- The analysis is a snapshot, i.e. it describes the loss in revenue from not reaching MSY tomorrow. In reality MSY will be reached over a longer time period for stocks that are not currently at MSY. In some cases in order to restore stocks to MSY levels fishing rates need to be reduced significantly in order to provide the conditions for stocks to rebuild. This is significant, as it means that catches need to significantly reduce in the short term in order to provide for these high long term yields in the future. This implies that the future benefits are overestimated in this Impact Assessment as it would take longer to get to MSY levels. Also, for the initial period the increase in benefits to fishermen will be more in terms of reduction in effort (under the same quota) and then at a later stage benefits will accrue in terms of increase catch levels (from readjustment of the quota based on higher healthy stocks).
- For some stocks the transition towards MSY will be partly driven by CFP reform (included in the BAU scenario) and hence not all the benefits from increased fish stocks (or loss in revenue from lower fish stocks in the baseline) are attributable to MSFD. Three scenarios have been considered based on attributing 50%, 25% and 10% of the benefits to MSFD rather than the CFP.

Table 10 shows that the loss in revenue from fish stocks not reaching MSY (across the five depleted stocks listed below) amounts to £175m in a given year.

Type of fish	ICES landings (2010, tonnes)	Yield at Fmsy (tonnes)	Fmsy	Increase in landings (tonnes)	£/tonne	Relative stability	Increase in revenue
IV							
Cod	50,615	280,000	0.21	229,385	£2,030	0.32	£151,000,013
Sole	12,600	16,940	0.22	4,340	£8,408	0.04	£1,557,973
Via							
Haddock	3,016	13,345	0.3	10,329	£1,316	0.78	£10,582,851
VIIa							
Cod	464	11,000	0.4	10,536	£2,030	0.43	£9,126,205
Sole	275	1,292	0.16	1,017	£8,408	0.22	£1,897,239
VIIe							
Plaice	1227	2,600	0.19	1,373	£1,114	0.29	£444,811
VII f&g							
Plaice	433	1,653	0.19	1,220	£1,114	0.23	£318,534

Notes:

1. Figures for MSY yield and Fmsy for IV Cod is based on a newer version of the ICES model. The ICES Working Group has not used the new model yet to derive MSY figures and the model is still being refined. Also note that for cod IV we have only used M values that have been observed in the historic data, but that M values at MSY may differ from these observed values, likely in the direction that would lead to lower estimates of MSY (but this is not certain since it would be extrapolating outside the bounds of existing data)
2. IV-Cod: recruitment dynamics at high stock abundance is uncertain, so the MSY yield value should be treated with caution. Fmax used as basis for Fmsy, so Hockey-stick curve was used to obtain a sustainable yield value consistent with

Fmsy=0.21.

3. VIa-Haddock: the MSY yield value has been adjusted to reflect human consumption yield only (the MSY analysis in the WGCSE 2010 report shows total removals). Fmsy=0.3 by analogy with North Sea haddock, and Ricker selected as the basis for the MSY yield value as it has a reasonable Fcrash estimate and an Fmsy value of ~0.3.
4. VIIa-Cod: the 2011 assessment is not used as a basis for short term forecasts because recent mortality values are highly uncertain due to unaccounted mortality. Furthermore, the Ricker curve is selected as the basis for MSY yeild because the WG considered it to be the most biologically plausible. Reading off a Figure is required to obtain the sustainable yield value consistent with the management plan target of 0.4.
5. VIIe-Plaice: Fmsy is selected by analogy with VIIf&g plaice. Since the Bev-Holt curve is used as a basis for Fmsy for VIIf&g plaice, it is also used for VIIe plaice, and therefore reading off a Figure is required to obtaine the sustainable yield values consistent with Fmsy=0.19.
6. IIf&g-Plaice: the 2011 assessment is a trends-only one, so there are no short-term forecasts, and no population estimates (SSB or F) for 2010. SSB and F for 2009 are based on the 2010 assessment (which excludes discards). Catch is from the 2011 ICES advice and includes discards.
7. The MSY yield is the average yield over an indefinite period, therefore catches will be both lower and (in theory) higher than this value.
8. £/tonne is based on the average price from Jan to May 2011, taken from Monthly Return Of Sea Fisheries Statistics for England, Wales, Scotland and Northern Ireland, MMO

339. This can also be expressed as the benefit⁹⁴ of achieving the GES targets for Descriptor 3. Discounting the benefits over 10 years gives a present value of £1.51bn. Based on the apportionment scenarios described above, the benefits attributable to MSFD alone would be £753bn (50%), £376m (25%) and £151m (10%) respectively.

340. Although this is a relatively simplistic model, it does give an indication of the magnitude of benefits that could be expected if all the relevant fish stocks and crustaceans were included in the assessment.

341. There are also likely to be losses in recreational services from fish stocks not reaching MSY. While evidence is available on expenditure the economic impact of recreational sea⁹⁵ angling in different nations of the UK,⁹⁶ it is not currently possible to estimate the scale and significance of the value of losses from reduction of recreational benefits due to stocks not reaching MSY levels.

Sensitivity analysis

342. Some sensitivity analysis was carried out on the assumptions outlined in paragraph 337. This considered a scenario of a 20% and 50% fall in price (following a rise in the abundance of fish stocks) and assesses the impact this would have on the loss of revenues. A 20%

⁹⁴ These benefits are presented comprised of revenues from fishing at MSY. A more accurate presentation of these benefits would be in terms of GVA or profits affected (further discussions will be required to decide which of the two approaches will be appropriate). Adopting such an approach would imply that the economic benefits to the fishing industry associated with these indicative measures are likely to be lower than presented here. Benefits are presented in terms of revenues to ensure comparability with the current presentation of estimates of the costs of indicative measures for Descriptor 3. This will be revisited if possible in the final Impact Assessment.

⁹⁶ For instance, see Drew Associates, 2004 (Crabtree et al. 2004). Research into the economic contribution of sea angling, final report to the Department for Environment, Food and Rural Affairs, 71 pp. plus 7 Annexes, and Scottish Government (2009), Economic Impact of Recreational Sea Angling in Scotland, www.scotland.gov.uk/Publications/2009/07/31154700/4

reduction in price would imply loss of revenue of £1.13bn over 10 years (£566m for 50% apportionment scenario, £283m for 25% apportionment scenario and £113m for 10% apportionment scenario), while a 50% reduction in price would imply loss of revenue of £571m over 10 years (£285m for 50% apportionment scenario, £143m for 25% apportionment scenario and £57m for 10% apportionment scenario). Both these figures show that in spite of a decline in prices (due to increased supply of fish) the provisioning benefits to society from increased fish stock abundance are likely to be high. Table 11 shows the benefits for each scenario of apportionment:

Table 11: Sensitivity analysis under different apportionment scenarios

% Fall in price following a rise in supply	50% apportionment to MSFD	25% apportionment to MSFD	10% apportionment to MSFD
20%	£566m	£283m	£113m
50%	£285m	£143m	£57m

343. Table 11 demonstrates that there will be a lower loss in revenue from not achieving MSFD targets under a 10% apportionment scenario and a 50% reduction in price.

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

344. 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.

345. 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

346. 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:

347. 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).

348. 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.

349. 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

350. 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 techniques⁹⁷.

351. A willingness to pay study by Susana Mourato et al⁹⁸ 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 years⁹⁹ for the whole of UK.

352. 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

353. 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 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.

354. 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 reduced fishing time. Based on the values reported by 18 vessels, the average costs of marine litter per vessel, per annum have been calculated and used to estimate the total costs of marine litter to Scottish fisheries.

⁹⁷ 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.

⁹⁸ 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

⁹⁹ 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/livatables-households/>

355. Based on these estimates, the total costs to the UK fishing industry of the impacts of marine litter can be estimated to be between £30.5million and £33.9 million¹⁰⁰ per annum. This is equivalent to a 5% reduction (approximately) in the total revenues that are generated by the UK fleet in comparison to 2009 UK vessels landed value. If a 5% increase in litter levels over future years is assumed¹⁰¹, then the costs to the fishing industry would amount to £344m over 10 years. The GES targets for litter do not aim at a complete removal of litter in the marine environment, so it is not possible to attribute all of the £344m avoided damage costs as benefits to MSFD. To model benefits attributable to the achievement the GES a 5% reduction in overall future levels of litter is assumed i.e. from litter increase at 5% p.a. in this scenario it now decreases 5% p.a. This would result in benefits to the fishing industry of £118m over 10 years¹⁰².

Costs to other sectors from impacts of litter

356. The litter-related costs to other sectors have been listed below:

- Aquaculture – KIMO International has estimated that marine litter costs the aquaculture industry in Scotland £135,094 per year on average, due to time spent removing debris from fish farm sites and fouled propellers on work boats. This would mean costs to Scottish aquaculture from marine litter £1.2m over 10 years.
- Harbours and marinas – there are costs associated with having to remove marine litter to ensure that port facilities remain clean, safe and attractive for users. KIMO International has estimated the average cost of marine litter removal 8 per harbour per year with total cost for active ports and harbours in 2010 in the UK up to £19m over 10 years.

Summary

357. The total costs of litter are estimated to be at least £1.7bn-£1.8bn over 10 years. However, the benefits of achieving GES and the cost of degradation associated with marine litter, will be notably lower than these values, as GES targets for litter aim to reduce litter levels rather than remove litter completely. However, these figures clearly indicate that there will be costs to society from increasing litter levels and the measures to achieve the GES targets will reduce these litter levels delivering additional benefits to society. In other words, the absence of measures to achieve the GES targets is likely to lead to significant degradation costs to society due to reduction in societal welfare from increasing litter levels. We have used scenarios to estimate a part of these degradation costs – additional damage costs to boats from increasing litter levels in marine waters. These are estimated to be around £118m over 10 years. The other non-monetised degradation costs are likely to be significant.

Benefits - improvements to seabed habitats

¹⁰⁰ For the purposes of this analysis, the cost of marine litter to UK fisheries is calculated using the average cost of marine litter reported by Scottish vessels. The average cost of marine litter per vessel is split between original survey categories in order to separate out the average cost of fouling incidents per vessel per annum from the rest of the cost categories. Fouling incidents are more likely to be related to marine litter in the water column whilst the rest of the cost categories are more applicable to marine litter that is deposited on the seabed. The total cost of fouling incidents for UK fishing fleet was estimated separately by applying the average cost of fouling incidents for the whole UK active fishing vessel number recorded in 2010. The total cost of fouling incidents is for UK fisheries between £763,111 and £770,282. In estimating the cost of marine litter excluding the cost of fouling incidents for the UK industry, the fisheries that are most likely to be affected by marine litter on the seabed were identified. These fisheries were dredges, nets, seines and demersal trawls. The cost of marine litter excluding the fouling incidents cost was calculated using the average figures per vessel and the number of boats in affected fisheries. Therefore, the total costs excluding fouling incidents are between £29.75million and £33.14 million per annum for UK sea fisheries.

¹⁰¹ We assume increase in litter causes a proportional increase in damage costs to vessels (i.e. a 5% increase in damage costs). There is not information on trends of floating marine litter 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).

¹⁰² 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).

Subtidal benthic habitats, intertidal rocky habitats and intertidal sediment habitats

358. 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 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).

359. The table below lists the specific regulating services provided by these habitats:

1. Any littoral and intra-littoral rock habitat provides coastal protection through reducing the rate of coastal erosion.
2. All littoral sediment could be considered important in flood control, but it depends on a combination of sediment type, coastal topography and local hydrodynamics.
3. All predominant benthic habitats can be considered as being instrumental in the long term (decadal) bio-remediation of pollution events (e.g. oil spills, fish farms) and the on-going (daily) purification of water through microbial breakdown of pollutants / toxins
4. Sub-littoral and deep sea sediments are a major site of detrital breakdown (purification) and carbon/nutrient recycling.
5. Biogenic reefs are typically built by filter feeding organisms which are instrumental in removing particulate matter from water - hence instrumental in purification.
6. Aquatic plant habitats are instrumental in coastal water purification.
7. Biotic and geochemical processes in all predominant benthic habitats are fundamental to the carbon cycle and so implicated in climate regulation. This is nature's equivalent of 'Carbon Capture & Storage'.
8. Some habitats will be more important than others in climate regulation; the total productivity of the habitat and /or the 'production:biomass ratio' might be used as an indicator of that relative importance.

360. On comparing the BAU scenario and the achievement of GES targets, it is clear that there is likely to be degradation of subtidal benthic 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 these 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.

Benefits - Increase in aesthetic services from abundance of birds

361. 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.

362. An RSPB study¹⁰³ estimates that in 2009, there were more than 142,000 visitors to the four RSPB sites that have the most significant population of seabirds¹⁰⁴. The total expenditure for such visits was estimated to be £5m- £10m. This would imply cultural and aesthetic benefits from seabirds in the range of £51m - £102m over 10 years¹⁰⁵. This valuation is an under-estimate as it only looks at expenditure in four bird reserves and it fails to take into account the

¹⁰³ 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

¹⁰⁴ 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.

¹⁰⁵ The average expenditures are inflated to 2010 prices using GDP deflator figures.

value people place on conserving bird colonies for future generations, or the value people derive from knowing that healthy bird populations exist.

363. 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 component¹⁰⁶.

Conclusions on costs of degradation

364. 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). Reductions in these services 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 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.

¹⁰⁶ 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.

Part 2: Section 3 - Proposals for GES characteristics and targets and indicators

3.1 Introduction

365. This section sets out the proposed characteristics of Good Environmental Status (GES) and associated targets and indicators for each of the GES Descriptor and describes how these proposals have been developed and why they are being put forward. 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.

366. Proposals 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 proposals 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 describing the proposed targets for species (mammals, fish and birds), and the proposed targets for habitats (pelagic habitats, sediment habitats and rock & biogenic reef habitats).

367. There are then separate sub-sections setting out proposals 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
- Proposed GES characteristics and associated targets and indicators – in tabular format.
- Approach to setting GES targets
- Implications of the proposed targets
- Key gaps and development needs

368. Further details on the approach to setting targets for each of the Descriptors can be found in the **Cefas CBA Report 2011, Part 3**¹⁰⁷. Further details and cost implications can be found in the **MSFD Impact Assessment, Part 2, Section 4, p.49**¹⁰⁸.

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

369. 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.

370. 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.

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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>

¹⁰⁸ www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

371. 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.

Background

372. *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) upon each of 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.

373. *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 rate and directions of energy transfer, and levels of productivity. There is not currently enough known about energy transfer between trophic levels¹⁰⁹ 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 groups¹¹⁰ within the food web. This means there is significant overlap with Descriptor 1.

374. *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 habitats¹¹¹ underpin much of the biodiversity within the seas. Scientific research continues to emphasise the importance of benthic fauna to coastal ecosystems, detrital decomposition, nutrient cycling and energy flow to higher trophic levels, 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.

375. The draft determination of GES for these Descriptors is 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

376. Current status of the UK's marine biodiversity is described in the initial assessment and is summarised in **Part 1: Section 4** (p.20).

Proposed characteristics of GES

Table 12 – Proposed characteristics for descriptors 1, 4 and 6

Proposed characteristics of GES for Descriptor 1	The proposed UK characteristics of GES for this Descriptor are as follows: <ul style="list-style-type: none"> • Biodiversity¹¹² loss is halted and where possible restored, with key ecosystems maintained or recovered¹¹³. • The abundance, distribution and condition of species and habitats in UK
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¹⁰⁹ The **trophic level** is the position that an organism occupies in a food chain - what it eats, and what eats it.

¹¹⁰ Trophic group refers to a category of organisms within a trophic structure, defined according to their mode of feeding (e.g. primary producers).

¹¹¹ Benthic habitats are those on the seafloor. It is a generic term that refers to both rocky and sedimentary seafloor habitats.

¹¹² 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".

¹¹³ 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."

(biodiversity)	<p>waters reflects, or is consistent with, prevailing environmental conditions¹¹⁴, taking into account sustainable use of the marine environment.</p> <ul style="list-style-type: none"> • The extent and natural range of habitats and species is not being significantly reduced (nor likely to be so in the foreseeable future) and the specific structures and functions necessary for their long-term maintenance exist and are likely to exist for the foreseeable future. • Habitats and species defined as rare or threatened under existing national or international agreements are conserved effectively through appropriate national or regional¹¹⁵ mechanisms. • Impacts of human activities do not lead to significant degradation of marine habitats or adversely affect species at the population or key functional group level.
<p>Proposed Characteristics of GES for Descriptor 4 (food webs)</p>	<p>The proposed UK characteristics of GES for this Descriptor are as follows:</p> <ul style="list-style-type: none"> • Populations of key species groups within the food web occur at levels that ensure the long-term sustainability of the marine ecosystem of which they are part with an age and size structure for these and other key species, indicative of sustainable populations e.g. a high proportion of larger, more mature individuals in fish populations. • The bycatch of non-target species in fisheries is reduced to a level which does not threaten food web structure, taking account of other pressures on the respective populations.
<p>Proposed Characteristics of GES for Descriptor 6 (sea-floor integrity)</p>	<p>The proposed UK characteristics of GES for this Descriptor are as follows:</p> <ul style="list-style-type: none"> • The sea-floor habitats (physically and structurally) are both productive and sufficiently extensive at the UK seas level, to carry out natural functionality, including the necessary ecological processes (e.g. cycling carbon and nutrients) and to provide ecological goods and services (e.g. food security and climate regulation) - and are capable of supporting a healthy and sustainable ecosystem for the long term. • The seafloor habitats most susceptible to the significant detrimental impacts of human activity are protected to ensure their extent and functioning is maintained.

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

377. Advice on targets for these Descriptors has been developed by 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). The advice, which is summarised in Section 3 of the Cefas CBA Report 2011, has been organised according to six ecosystem components: three species components (fish, birds, marine mammals), and three habitats groups (pelagic habitats, sediment habitats, rock and biogenic reef habitats).

378. The proposed targets are shown in the tables below, divided into the six species and habitat groups. Experts have also proposed a range of more detailed indicators, following the

¹¹⁴ 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. Implementation of the MSFD and other policies will help to increase the resilience of marine ecosystems to changes in climatic conditions.

¹¹⁵ The term ‘regional’ refers to the scale of the regions and subregions in the Directive e.g. the Greater North Sea, The Celtic Seas.

indicators in the Commission Decision document, which underpin the targets and explain how they would be assessed and monitored. These indicators are still being refined between now and July 2012, with further work planned for 2014 - the latest versions of the draft can be found in the **Cefas CBA Report 2012, Appendices, p.230**¹¹⁶.

379. 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 being proposed in this consultation, but there is currently little information available about the detailed proposals other Member States are likely to put forward. The proposals outlined here may therefore need to be reviewed in the light of further information about approaches being put forward by other OSPAR countries.

Approach to setting GES targets - Species

380. All the GES targets proposed by experts in the Cefas CBA Report for species (fish, birds and marine mammals) have been put forward in this consultation. Experts have developed targets and indicators 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).

381. 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. The baselines proposed for the targets vary for the different species groups. For birds it is proposed that they are set in the past at a time when human pressures were thought to be minimal. For mammals it is also recommended that they are set in the past, either based on best available data, or closely linked to those for existing OSPAR objectives on seals. For fish it is proposed that the baseline is set as the mean value for each species throughout the entire time series of available data. The GES targets are set as a *deviation* from these baselines, recognising that achieving GES is consistent with sustainable use of the marine environment. Experts have proposed GES target options which they believe are necessary and sufficient to achieve GES for these Descriptors.

382. For birds, *two* options for targets are put forward in this consultation, based on a range proposed by experts in the Cefas CBA Report. Option 2 represents a somewhat more precautionary approach than Option 1, but both options are considered sufficient to achieve GES. For example:

- a) OPTION 1 - 'No major shifts or shrinkages in the population distribution of marine birds in **75% of species** monitored'.
- b) OPTION 2 - 'No major shifts or shrinkages in the population distribution of marine birds in **90% of species** monitored'.

383. Given the natural variability in bird distribution and abundance (caused by things such as climate change, prey distribution etc) it is felt that Option 1 is still ambitious, whilst ensuring the proposed targets are not overly sensitive to natural variability. Option 2 would provide more confidence that bird populations are not being impacted by anthropogenic pressures, but given the natural variability in bird distribution and abundance it is felt that this option would be overly sensitive to natural variability of these species. For this reason the targets proposed under Option 1 are the Government and Devolved Administrations preferred option.

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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>

384. There is a strong evidence base to support the proposed species targets and many of the targets are already commitments from existing legislation such as the Habitats Directive or OSPAR. The targets for fish, whilst the targets are relatively complex, they are based on principles already well established as part of the scientific process underpinning the CFP and are considered suitably robust.

385. For more detail on the approach to target setting for marine mammals, birds and fish see **Section 3.4 of the Cefas CBA Report 2012, p117¹¹⁷**.

Implications of the proposed targets – Species

386. Based on the initial assessment it is concluded that GES is probably not being achieved for these Descriptors at the present time.

387. 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 proposed for species. These include measures required under the Birds and Habitats Directives, implementation of the UK MPA network, measures to achieve more sustainable fisheries or the protection of individual fish and other species under the Common Fisheries Policy (CFP), and measures to reduce levels of contaminants.

388. 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 through by-catch (of birds, fish and mammals) and through competition for prey species. The targets proposed under Descriptor 3 for achieving Maximum Sustainable Yield (MSY) in commercial fish stocks will support the achievement of these targets. However, they could imply additional costs of moving toward MSY more quickly than necessary simply to protect fish species. For birds, predation by non-indigenous species (e.g. rat, mink) on key seabird island colonies is also considered to be a significant pressure and additional measures may be needed to manage this.

389. The implications of the Option 2 targets for birds are the same as those described above, but under this option the potential additional measures for birds may need to be applied more extensively or more quickly in order to improve the status of more species by 2020. Additional specific fisheries measures may also be needed to reduce pressure on particular bird species or colonies (beyond those identified for Descriptor 3). However, even if additional measures were taken, it is uncertain whether they would have an impact, given the difficulty of predicting ecosystem responses to management measures and the influence of natural environmental change. The need for additional measures and the costs and benefits associated with these will become clearer once the monitoring is in place for these targets. More information on the potential costs and benefits associated with these target proposals can be found in the **MSFD Impact Assessment, Section D, p.52¹¹⁸**.

390. A broad initial estimate of additional costs associated with monitoring the proposed targets and indicators for species is between <£4.3m and £7.2m over 10 years¹¹⁹. However, a proportion of these costs are already attributable to measures required to implement the Birds

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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>

¹¹⁸ www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

¹¹⁹ This is based on estimates provided in the Cefas CBA Report 2012, p.243.

and Habitats Directives, and any additional costs that should be attributed to the MFSD cannot, as yet, be determined.

Proposed GES Targets for Species

Table 13 – Proposed targets for Marine Mammals (Descriptors 1 and 4)	
Marine mammal targets – Species distribution Reference BDMM1	<ul style="list-style-type: none"> In all of the indicators monitored, there should be no statistically significant¹²⁰ contraction in the distribution of marine mammals caused by anthropogenic activities¹²¹.
Marine mammal targets – Population size Reference BDMM2	<ul style="list-style-type: none"> In all of the indicators monitored, there should be no statistically significant decrease in abundance of marine mammals caused by anthropogenic activities¹²².
Marine mammal targets – Population condition Reference BDMM3	<ul style="list-style-type: none"> There should be no statistically significant decline in seal pup production and bottlenose dolphin calf production; and mortality of marine mammals due to fishing by-catch should be sufficiently low so as not to inhibit population size targets being met¹²³.
Marine mammal targets – Productivity of key species Reference BDMM4	<ul style="list-style-type: none"> There should be no statistically significant decline in seal pup production and bottlenose dolphin calf production caused by anthropogenic activities¹²⁴.
Marine mammal targets - Abundance/ distribution of key species/ trophic groups Reference BDMM5	<ul style="list-style-type: none"> In all of the indicators monitored, there should be no statistically significant decrease in abundance of marine mammals caused by anthropogenic activities¹²⁵.

Table 14 – Proposed GES targets for birds (Descriptors 1 and 4)		
	OPTION 1 (preferred option)	OPTION 2
Bird targets – Species distribution Reference BDB1	<ul style="list-style-type: none"> No major shifts or shrinkage in the population distribution of marine birds in 75% of species monitored¹²⁶. 	<ul style="list-style-type: none"> No major shifts or shrinkage in the population distribution of marine birds in 90% of species monitored¹²⁷.
Bird targets – Population size	<ul style="list-style-type: none"> Changes in abundance of marine birds should be within individual 	<ul style="list-style-type: none"> Changes in abundance of marine birds should be within individual

¹²⁰ The way in which statistical significance of an event is determined will vary depending on the target, because some are set on indicators that are based on very different types of data e.g. trends, or proportions etc. However in every case, a statistically significant event is one which would have less than a 5% chance of occurring, if the null hypothesis were true. Given that <5% is a low probability, one could reject the null hypothesis and accept an alternative. In the case of a trend, the null hypothesis would be that a parameter stays the same in each year, but if a value from one or more years is shown to have less than a 5% chance of occurring, one would accept an alternative hypothesis that the value is significantly different statistically from the other values with which it is being compared.

¹²¹ In 2012 this target will be based on indicators for grey seals and harbour seals distributional range only. Cetacean species indicators are likely to be added in 2018.

¹²² 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.

¹²³ In 2012 this target will be based on indicators for grey seal and harbour seal pup production and bottlenose dolphin calf production, and by-catch threshold targets for harbour seal, grey seal, harbour porpoise and common dolphin.

¹²⁴ In 2012 this target will be based on indicators for grey seal and harbour seal pup production and bottlenose dolphin calf production only.

¹²⁵ 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.

¹²⁶ 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.

¹²⁷ 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.'

Reference BDB2	target levels in 75% of species monitored ¹²⁸ .	target levels in 90% of species monitored ¹²⁹ .
Bird targets – Population condition Reference BDB3	<ul style="list-style-type: none"> 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); widespread seabird colony breeding failures should occur rarely (i.e. at <5-15%¹³⁰ of colonies in no more than three years out of six); and mortality of marine birds due to fishing bycatch and aquaculture should be sufficiently low to not inhibit population size targets being met. 	<ul style="list-style-type: none"> Same as Option 1
Bird targets – Productivity of key species Reference BDB4	<ul style="list-style-type: none"> 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). 	<ul style="list-style-type: none"> Same as Option 1
Bird targets Abundance/distribution of key species/trophic groups Reference BDB5	<ul style="list-style-type: none"> Changes in abundance of marine birds should be within individual target levels in 75% of species monitored¹³¹. 	<ul style="list-style-type: none"> Changes in abundance of marine birds should be within individual target levels in 90% of species monitored¹³².

Table 15 – Proposed targets for fish (Descriptors 1 and 4)

Fish targets – Species distribution Reference BDF1	<ul style="list-style-type: none"> The geographic and depth distribution of fish should meet individual indicator targets in a statistically significant proportion of species monitored.
Fish targets – Population size Reference BDF2	<ul style="list-style-type: none"> The population abundance density and population biomass density of fish should meet individual indicator targets in a statistically significant proportion of species monitored.
Fish targets – Ecosystem structure Reference BDF3	<ul style="list-style-type: none"> More than 30% (by weight) of fish in the Greater North Sea and 40% (by weight) of fish in the Celtic Seas exceed a length of 40cm and 50cm respectively.
Fish targets – Proportion of selected	<ul style="list-style-type: none"> A specified proportion (by weight) of fish in any defined marine region should exceed a stipulated length threshold.

¹²⁸ 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.'

¹²⁹ 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.'

¹³⁰ Further work is planned between now and the final impact assessment to define the appropriate % of colonies

¹³¹ 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.'

¹³² 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.'

Approach to setting GES targets – habitats

391. Experts have proposed GES targets and indicators 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 proposed targets and indicators for pelagic habitats also cover the abundance/distribution of key trophic groups.
392. For benthic habitats (rock and biogenic reef and sediment habitats) existing targets under the Habitats Directive and the Water Framework Directive (WFD) have been used wherever possible, but new targets have been developed and proposed for predominant sediment habitats¹³³, which are not covered by the Habitats Directive. The proposed baselines for benthic habitats are reference conditions which equate to minimal disturbance from human activity. Targets are set as a *deviation* from that baseline, recognising that achieving GES is consistent with sustainable use of the marine environment.
393. For pelagic habitats¹³⁴, there are no suitable targets in existing legislation and all the proposals for targets are new. The proposed 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 proposed targets and indicators are designed to identify changes in plankton caused by human pressures.
394. Experts have proposed targets which they believe are necessary and sufficient to achieve GES for these Descriptors. However, particularly for sediment habitats and pelagic habitats it is recognised that there is a significant lack of evidence and understanding on both current and desired state, and ecologically meaningful GES target thresholds are uncertain. The proposals that have been put forward are based primarily on expert judgement.
395. For rock & biogenic reef habitats and pelagic habitats one option for GES targets is proposed in this consultation, based entirely on the advice in the Cefas CBA Report. However, for predominant sediment habitats two options are put forward, recognising the lack of evidence behind the target thresholds proposed in the Cefas CBA Report.
396. Under **Option 1** for predominant sediment habitats the quantitative target thresholds proposed in the Cefas CBA Report would not be implemented at this stage. Instead a higher-level, qualitative target is proposed, emphasising the fact that sediment habitats are under threat but recognising that we do not currently have sufficient evidence to set specific quantitative targets. Under this proposal, predominant sediment habitats would also be monitored as surveillance indicators using the approach recommended in the Cefas CBA Report. Further work would be carried between now and the next cycle of the Directive in 2018 with the aim of setting robust, quantitative targets for these habitats. Under **Option 2** the quantitative target for sediment habitats proposed in the Cefas CBA Report would be

¹³³ These are broadscale, sediment habitats which cover a large % of the UK's seafloor. They are not currently protected by any existing legislation.

¹³⁴ 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.

implemented. Option 1 is the Government and Devolved Administrations preferred option, on the basis that there is felt to be insufficient evidence to support Option 2.

397. For more detail on the approach to target setting for pelagic habitats see **Section 3.3 of the Cefas CBA Report 2012, p.97**¹³⁵. For more detail on rock & reef habitats and sediment habitats see **Section 3.2 of the Cefas CBA Report 2012, p.61**¹³⁶.

Implications of the proposed targets – habitats

398. Based on the initial assessment it is concluded that GES is probably not being achieved for these Descriptors at the present time.

399. 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 proposed targets. 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.

400. For those rock & biogenic reef habitats that are covered by the Habitats Directive it has been assumed that measures taken under that Directive will be sufficient to achieve the proposed GES targets. However, for those seafloor habitats not covered by the Habitats Directive (primarily sediment habitats), although MPAs designated under national legislation are likely to play a key role in achieving the proposed targets, additional measures may be needed to further reduce the key human pressures on them. 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). The implications of the Option 2 targets are the same as those described above, but under this option the potential additional measures would probably need to be applied more extensively than under Option 1.

401. For pelagic habitats, the measures proposed under Descriptor 3 and Descriptor 5 are likely to support the achievement of the proposed targets and provided the targets for Descriptors 3 and 5 are achieved it is unlikely that additional measures would be necessary in relation to pelagic habitats.

402. The need for additional management measures and the costs and benefits associated with these will become clearer once all the necessary monitoring is in place for these proposed targets and indicators. More information on the potential costs and benefits associated with these target proposals can be found in the **MSFD Impact Assessment, Section D, p.64**¹³⁷.

403. A broad initial estimate of the costs associated with monitoring the proposed targets for habitats is between £20.7m and £39.2m over 10 years. These estimates do not explicitly include the cost of monitoring the national MPA network – although it is likely that there will be some significant overlap between costs of monitoring GES and costs of monitoring MPAs.

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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>

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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>

¹³⁷ www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

Proposed GES Targets for Habitats

Table 16 – Proposed GES targets for pelagic habitats (Descriptors 1, 4 and 6)

Pelagic habitat targets - <i>Habitat distribution</i> Reference BDP1	<ul style="list-style-type: none"> • Distribution of plankton community not significantly influenced by anthropogenic drivers
Pelagic habitat targets - <i>Habitat condition</i> Reference BDP2	<ul style="list-style-type: none"> • Condition of plankton community not significantly influenced by anthropogenic drivers
Pelagic habitat targets - <i>Ecosystem structure</i> Reference BDP3	<ul style="list-style-type: none"> • Structure of plankton community not significantly influenced by anthropogenic drivers
Pelagic habitat targets - <i>Abundance/distribution of key species/trophic groups</i> Reference BDP4	<ul style="list-style-type: none"> • Abundance/distribution of plankton community not significantly influenced by anthropogenic drivers
Pelagic habitat targets - <i>Condition of the benthic community</i> Reference BDP5	<ul style="list-style-type: none"> • Condition of the meroplanktonic (plankton with benthic life phase) community not significantly influenced by anthropogenic drivers

Table 17 – Proposed GES targets for rock and biogenic reef habitats (Descriptors 1 and 6)

Rock & Reef targets - <i>Habitat distribution</i> Reference BDRBR1	<ul style="list-style-type: none"> • All listed (special) and predominant habitat types - Range and distribution are stable or increasing and not smaller than the baseline value (Favourable Reference Range¹³⁸ for Habitats Directive habitats).
Rock & Reef targets - <i>Habitat extent</i> Reference BDRBR2	<ul style="list-style-type: none"> • All listed (special) and predominant habitat types - Area is stable or increasing and not smaller than the baseline value (Favourable Reference Area¹³⁹ for Habitats Directive habitats).

¹³⁸ Favourable Reference Range is part of the assessment of Favourable Conservation Status under the Habitats Directive.

¹³⁹ Favourable Reference Area is part of the assessment of Favourable Conservation Status under the Habitats Directive.

Rock & Reef targets - <i>Habitat condition;</i> <i>Physical damage;</i> <i>Condition of the benthic community</i> Reference BDRBD3	<ul style="list-style-type: none"> • All listed (special) & predominant habitat types - Area of habitat below GES (as defined by condition indicators) must not exceed 5% of the baseline value (Favourable Reference Area for Habitats Directive habitats)
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Table 18 – Targets for sediment habitats (Descriptors 1 and 6)

	OPTION 1 (preferred option)	OPTION 2
Sediment habitat targets - <i>Habitat distribution</i> Reference BDSH1	<ul style="list-style-type: none"> • Predominant habitat types - No target proposed – see qualitative target below for habitat condition • All listed (special) habitat types - Range and distribution is stable or increasing and not smaller than the baseline value (Favourable Reference Range for Habitats Directive habitats) 	<ul style="list-style-type: none"> • All listed (special) & predominant habitat types - Range and distribution is stable or increasing and not smaller than the baseline value (Favourable Reference Range for Habitats Directive habitats)
Sediment habitat targets - <i>Habitat extent</i> Reference BDSH2	<ul style="list-style-type: none"> • Predominant habitat types – No target proposed – see qualitative target below for habitat condition • All Listed (special) habitat types: <ul style="list-style-type: none"> ○ Area 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. 	<ul style="list-style-type: none"> • Predominant habitat types - area of habitat lost, plus area of habitat below GES (as defined by condition indicators) is ≤15%. • All Listed (special) habitat types: <ul style="list-style-type: none"> ○ Area 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 - <i>Habitat condition;</i> <i>Physical damage;</i> <i>Condition of the benthic community</i> Reference BDSH3	<ul style="list-style-type: none"> • Predominant habitat types – Improve the condition of benthic habitats, taking action to reduce impacts where these have been identified as unacceptable. • All Listed (special) habitat types: <ul style="list-style-type: none"> ○ Area of habitat below GES (i.e. unacceptable impact / unsustainable use) as defined by condition indicators must not exceed 5% of baseline value (favourable reference area for HD habitats) 	<ul style="list-style-type: none"> • Predominant habitat types - area of habitat lost, plus area of habitat below GES (as defined by condition indicators) is ≤15%. • All Listed (special) habitat types: <ul style="list-style-type: none"> ○ Area of habitat below GES (i.e. unacceptable impact / unsustainable use) as defined by condition indicators must not exceed 5% of baseline value (favourable reference area for HD habitats) ○ WFD targets (km2)

	<ul style="list-style-type: none"> ○ WFD targets (km² thresholds) for area of unacceptable impact for benthic invertebrates, macroalgae, saltmarsh and seagrass should be used within WFD boundaries as appropriate. 	<p>thresholds) for area of unacceptable impact for benthic invertebrates, macroalgae, saltmarsh and seagrass should be used within WFD boundaries as appropriate.</p>
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Gaps and development needs

404. No targets have been proposed regarding cephalopods and very vulnerable species, 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.
405. For short term development both the pelagic habitat and fish component groups have identified spatial gaps in monitoring within the inshore areas. The proposed targets for fish are therefore based on offshore assessments. More information is required regarding zooplankton and inshore fish species within inshore areas.
406. Additional monitoring or changes to existing monitoring activities will be needed for a number of the targets proposed, although these could be combined with other legislative commitments and developments at the OSPAR level.
407. 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

408. 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.
409. Invasive NIS may alter ecosystem processes, decrease native species abundance and richness via competition, predation, hybridization and indirect effects¹⁴⁰, change community structure¹⁴¹ and alter genetic diversity.
410. 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

¹⁴⁰ Gaertner et al., (2008) Understanding biodiversity consequences of habitat change, *Journal of Applied Ecology* **45** pp883-893

¹⁴¹ 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

parts of the vessel). Aquaculture activities can also cause unintended introduction of NIS when transporting species intended for cultivation.

411. 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

412. 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.

Proposed GES characteristics and associated targets and indicators

Table 19 – Proposed GES characteristics for non-indigenous species (Descriptor 2)

<p>Proposed characteristics of GES for Descriptor 2 (non-indigenous species)</p>	<p>The proposed UK characteristics of GES for this Descriptor are as follows:</p> <ul style="list-style-type: none"> • 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. Achievement of this will be based on an assessment of high risk areas and known pathways/vectors aiding the spread for such species.
<p>Proposed GES targets and indicators for non-indigenous species (Descriptor 2)</p>	
<p>Proposed targets for Descriptor 2 - Abundance and state characterisation of non-indigenous species</p>	<ul style="list-style-type: none"> • Reduction in the risk of introduction and spread of non native species through improved management of the main pathways and vectors. • Surveillance indicator looking at the abundance and distribution of NIS in areas which are at a high risk of new introductions (with a view to being able to develop a baseline for the rate of establishment of new NIS).
<p>Proposed targets for Descriptor 2 – Environmental impact of invasive non-indigenous species</p>	<ul style="list-style-type: none"> • Species specific action plans are developed for key high risk marine non indigenous species by 2020.

Approach to setting GES targets for NIS

413. 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 proposed 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.

414. The proposed 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 consultation 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: 'Species specific 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.

415. It is also proposed that the abundance and distribution of NIS in areas which are at a high risk of new introductions (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.
416. The proposed targets and surveillance indicator are in line with the GB Non Native Species Strategy 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.
417. For further detail on the approach to setting targets for this Descriptor see **Section 2.1 of the Cefas CBA Report 2012, p.20**¹⁴².

Implications of the proposed targets

418. Some 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 ban the deliberate release of NIS into the wild¹⁴³. However, additional measures are likely to be necessary to achieve the targets proposed for this Descriptor, but at this stage it is difficult to say what these might be. For the purposes of this consultation, a range of illustrative management measures have been considered, the costs of which would fall primarily on the shipping industry, ports and marinas, and small vessel owners. Many measures to reduce the risk of introductions of NIS need to be implemented at an international scale through the International Maritime Organization (e.g. additional management of hull cleansing or ballast water for large vessels). Further analysis of the key pathways and vectors of introduction of marine NIS is currently being carried out in order to establish which, if any, additional management measures are necessary.
419. Development of species specific action plans for key species is something which has already been committed to in the GB Non Native Species Strategy 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 (and costs) they put forward will vary from for different species and locations. More information on the potential costs and benefits associated with these target proposals can be found in the **MSFD Impact Assessment, Section D, p.74**¹⁴⁴.

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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>

¹⁴³ Section 14 of the Wildlife and Countryside Act (1981), The Conservation of Habitats and Species Regulations (2010), and the Offshore Marine Conservation Regulations (2009)

¹⁴⁴ www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

420. The proposed targets and surveillance indicator 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). A broad initial estimate of these costs is >£952k over 10 years, however a review will be carried out to look at how far it is possible to reduce the costs of additional monitoring by using data on NIS from existing monitoring programmes or adapting existing monitoring to include assessment of NIS (e.g. monitoring which is already carried out in Marine Protected Areas which are in high risk locations).

Gaps and development needs

421. 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.

422. In the short term consideration will be given to the pathways and vectors of introduction, so that effective, risk-based monitoring. 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.

423. 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

424. 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.

425. The CFP is the principle legal mechanism for managing fish stocks in EU waters, ensuring consistency across Member States. There is limited scope for the UK to take unilateral action to improve fisheries management within its 12 nautical mile baselines (this is set out under a derogation within the current CFP). For this reason, achieving GES will, with the exception of those stocks where there is scope for national or local measures, be dependent on the success of the fisheries management measures that will be determined and agreed under the reformed CFP¹⁴⁵.

Summary of current status from Initial Assessment

426. 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.

Proposed GES characteristics and associated targets and indicators

Table 20 – Proposed GES characteristics for commercial fish (Descriptor 3)

Proposed characteristics of GES for Descriptor 3 (commercial fish)	<p>The proposed UK characteristics of GES for this Descriptor are as follows:</p> <ul style="list-style-type: none"> • The level of stock mortality generated by fishing activity (F) is equal to or lower than F_{msy} - the level capable of producing Maximum Sustainable Yield (MSY) for the long-term. Where F_{msy} is not known, the proxy will be the catch/biomass ratio that is consistent with MSY. • The spawning stock (SSB) is at a level capable of delivering MSY. • Each fish stock contains a high proportion of mature fish and an appropriate age structure.
Proposed GES targets and indicators for commercial fish (Descriptor 3)	
Proposed targets for Descriptor 3 – Fishing Mortality	<ul style="list-style-type: none"> • As a first step, all stocks must be exploited at F_{pa} or lower (short-term objective by 2015). • Subsequently, the exploitation rate of each stock is either at F_{MSY} for each stock, or where specified, within the range of possible fishing mortalities consistent with F_{MSY} for each stock (medium- to long-term objective)¹⁴⁶
Proposed targets for	<ul style="list-style-type: none"> • It is proposed that the target would be the spawning stock biomass / total biomass/ biomass proxy is above the agreed stock specific threshold.¹⁴⁷

¹⁴⁵ 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.

¹⁴⁶ For stocks with analytical estimates of fishing mortality targets will be based on the agreed management plan long-term target fishing mortality/exploitation rate or the ICES estimate of F_{MSY} or optimum exploitation rate. For stocks without analytical estimates of fishing mortality the targets will be based on an agreed proxy for exploitation rate derived from the stock age/length structure.

¹⁴⁷ For stocks with analytical estimates of spawning/total biomass, or proxies for them, the base line would be the agreed, stock specific management threshold. Currently ICES uses the threshold $B_{trigger}$ in association with the F_{MSY} target value.

Approach to setting GES targets setting for commercial fish

427. 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).
428. For this Descriptor experts have proposed that MSFD targets are based on the achievement of stocks within the safe biological limit precautionary thresholds, whilst aiming, in the medium-long term, for the more ambitious 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.
429. The UK government has accepted the principle of MSY under a number of different commitments including the World Summit on Sustainable Development (WWSN). However, MSY is a single-species target, taking no account of species interactions or the mixed nature of many EU fisheries. Therefore, given the variability inherent in the targets for single species and the difficulty of simultaneously maintaining all stocks in a mixed fishery at MSY, for some stocks MSY may be considered to be a range of exploitation rates which take into account changes in stock dynamics. The proposed targets will not be directly applied to all fish and shellfish stocks exploited in UK waters but instead to a selection of stocks chosen to be representative of all commercial stocks, based on scientific advice.
430. There is currently little detailed information about the approach other Member States are likely to take to setting targets for this Descriptor. However, ICES is in the process of developing advice on methodologies for GES targets for commercial fish and the approach proposed in this impact assessment has been put forward by UK scientists in ICES.
431. For further detail on the approach to setting targets for this Descriptor see **Section 2.2 of the Cefas CBA Report 2012, p.24**¹⁴⁸.

Implications of the proposed targets

432. Delivering the proposed targets for GES under this descriptor will, with the exception of measures for shellfish and other stocks where there is some scope for national measures, be dependent on the success of the fisheries management measures that will be determined and agreed under the reformed CFP¹⁴⁹. The UK’s approach to CFP reform is consistent with the approach to targets proposed for this Descriptor. Additional management measures necessary

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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>

¹⁴⁹ 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.

to achieve MSY could include things such as limits on landings and various technical measures.

433. For shellfish, as most commercial species 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 conservation¹⁵⁰, limits to landings, use of less destructive gear and the protection of key shellfish life stages.
434. More information on the potential costs and benefits associated with these target proposals can be found in the **MSFD Impact Assessment, Section D, p80**¹⁵¹.
435. No new monitoring programmes will be required in relation to these targets for finfish stocks, provided the stocks selected as indicators are those already covered by the EU Data Collection Framework. There could however be some additional monitoring and assessment costs in relation to shellfish stocks (e.g. for scallops, crab and lobster). These costs will vary depending on which stocks are included in the assessment of GES.

Gaps and development needs

436. 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.
437. 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

438. 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.
439. 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.

Summary of current status from Initial Assessment

440. There is high confidence in the assessment of eutrophication in UK coastal and offshore areas¹⁵² due to the availability of extensive datasets and the enhanced monitoring employed in regions previously reported as being of concern.

¹⁵⁰ For instance changes to fishing gear and minimum and maximum landing sizes.

¹⁵¹ www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

¹⁵² 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).

441. 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.

Proposed GES characteristics and associated targets and indicators

Table 21 – Proposed GES characteristics for eutrophication (Descriptor 5)

<p>Proposed characteristics of GES for Descriptor 5 (Eutrophication)</p>	<p>The proposed UK characteristics of GES for this Descriptor are as follows:</p> <ul style="list-style-type: none"> • Nutrient concentrations do not lead to an undesirable disturbance¹⁵³ 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. 	
<p>Proposed GES targets and indicators for eutrophication (Descriptor 5)¹⁵⁴</p>		
	<p>Non Problem Areas 2007/2010</p>	<p>Problem Areas 2007/2010</p>
<p>Proposed targets for Descriptor 5 – Nutrient levels</p>	<ul style="list-style-type: none"> • No increase in the assessed dissolved inorganic nitrogen and phosphorous concentration, resulting from anthropogenic nutrient input using data from periodic surveys. 	<ul style="list-style-type: none"> • A downward trend in dissolved inorganic nitrogen and phosphorous concentration, resulting from decreasing anthropogenic nutrient input, over a 10 year period.
<p>Proposed targets for Descriptor 5 – Direct effects of nutrient enrichment</p>	<ul style="list-style-type: none"> • No increase in the chlorophyll 90 percentile in the growing season (linked to increasing anthropogenic input) based on periodic surveys. <p>AND</p> <ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • A downward trend in the chlorophyll 90 percentile in the growing season, over a 10 year period (linked to decreasing anthropogenic input). <p>AND</p> <ul style="list-style-type: none"> • Changes in a eutrophication relevant plankton index that is attributable to decreases in nutrient loading, winter nutrient concentrations or trends in nutrient ratios¹⁵⁵.

¹⁵³ 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.

¹⁵⁴ 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.

¹⁵⁵ Further work required as indicator has not been tested in operation

<p>Proposed targets for Descriptor 5 – Indirect effects of nutrient enrichment</p>		<ul style="list-style-type: none"> • 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.
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Approach to setting GES targets for eutrophication

442. The proposed targets are all based on existing OSPAR or WFD targets and how these are used to assess eutrophication. They have therefore already been coordinated regionally and we have high confidence that similar targets will be adopted by other Member States.

443. A risk-based approach is been proposed for the establishment of targets. A more comprehensive set of targets has been proposed for areas which have been identified as eutrophication problem areas in order to bring them to non-problem area status. Where problems do not exist then the target is to maintain non-problem area status.

444. It should be noted that the targets proposed here must be considered holistically with the overall eutrophication goal of ensuring no undesirable disturbance (adverse effects) at the scale of the (sub) region resulting from anthropogenic 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 problems¹⁵⁶.

445. For further detail on the approach to setting targets for this Descriptor see **Section 2.3 of the Cefas CBA Report 2012, p.30**¹⁵⁷.

Implications of the proposed targets

446. Any measures which would be required to meet our targets for GES 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.

447. The UK will utilise existing monitoring programmes under the WFD and OSPAR to meet monitoring requirements for MSFD. There are likely to be small additional monitoring costs of between £86k-£861k over 10 years to cover the cost of plankton related eutrophication monitoring¹⁵⁸.

¹⁵⁶ 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.

¹⁵⁷

<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>

¹⁵⁸ Cefas CBA Report 2011, page 247.

448. More information on the potential costs and benefits associated with these target proposals can be found in the **MSFD Impact Assessment, Section D, p.86**¹⁵⁹.

Gaps and development needs

449. Targets have not been proposed 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).

450. 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 OPSPAR 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

451. 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.

452. 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.

453. 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

454. 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

¹⁵⁹ www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

scale shifts in hydrographic conditions as a result of changing climate and increased levels of atmospheric CO₂.

Proposed GES characteristics and associated targets and indicators

Table 22 – Proposed GES characteristics for hydrographical conditions (Descriptor 7)

<p>Proposed characteristics of GES for Descriptor 7 (Hydrographical conditions)</p>	<p>The draft UK characteristics of GES for this Descriptor are as follows:</p> <ul style="list-style-type: none"> • 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.
<p>Proposed GES targets and indicators for hydrographical conditions (Descriptor 7)</p>	
<p>Proposed targets for Descriptor 7 – <i>Spatial Characteristics of Permanent Alterations / Impact of Permanent Hydrographical Changes</i></p>	<p>267. 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.</p>

Approach to setting GES targets for hydrographical conditions

455. 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.

456. The proposed target reflects the fact that we expect to achieve GES under current licensing regimes. It would require all new developments to continue to comply with the existing regulatory regime, and guidance should 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.

457. Discussions at an EU level and advice generated within OSPAR has indicated that a large proportion of other Member States are likely to adopt a similar approach to target setting.

458. For further detail on the approach to setting targets for this Descriptor see **Section 2.4 of the Cefas CBA Report 2012, p.35¹⁶⁰**.

Implications of the proposed target

459. 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

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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>

developments to cause changes to hydrographical conditions, and guidance for developers and licensing authorities may need to be updated to reflect this.

460. 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.
461. More information on the potential costs and benefits associated with these target proposals can be found in the **MSFD Impact Assessment, Section D, p.89**¹⁶¹.

Gaps and development needs

462. 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 will be 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.
463. 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

464. This Descriptor is intended to ensure the presence of contaminants in the marine environment and their biological effects are kept within acceptable 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 compounds (e.g. heavy metals, hydrocarbons etc), and other substances considered pollutants, whether solid, liquid or gas.
465. 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.
466. 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. The current programme is, however, limited in terms of robust biological effects measurements (although there is an excellent example of a robust measurement in the impact of tributyl tin on marine snails).

Current Status from the Initial Assessment

¹⁶¹ www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

467. 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.

Proposed GES characteristics and associated targets and indicators

Table 23 – Proposed GES characteristics for contaminants (Descriptor 8)

Proposed characteristics of GES for Descriptor 8 (Contaminants)	<p>The draft UK characteristics of GES for this Descriptor are as follows:</p> <ul style="list-style-type: none"> • Concentrations of contaminants in water, sediment, or biota are kept within agreed¹⁶² 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 agreed¹⁶³ levels.
Proposed GES targets and indicators for contaminants (Descriptor 8)	
Proposed targets for Descriptor 8 – Concentration of Contaminants	<ul style="list-style-type: none"> • 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 Ecological Quality Standards applied within the Water Framework Directive and Environmental Assessment Criteria applied within OSPAR).
Proposed targets for Descriptor 8 – Effects of Contaminants	<ul style="list-style-type: none"> • The intensity of biological or ecological effects due to contaminants is below the toxicologically-based standards agreed by OSPAR as appropriate for MSFD purposes in a statistically significant number of samples at relevant monitoring stations • For oil/chemical spills - As a wide range of oils and chemicals may be spilled, targets will be incident-specific and will need to be derived at the time. For spilled chemical compounds relevant assessment criteria (e.g. established EQS and EACs) will be used to help establish significance of impact and appropriate response.

Approach to setting GES targets for contaminants

468. The targets proposed 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 we have high confidence that other countries in OSPAR will follow a similar approach to setting targets.

469. For further detail on the approach to setting targets for this Descriptor see **Section 2.5 of the Cefas CBA Report 2012, p.39¹⁶⁴**.

Implications of the proposed targets

470. It is likely that any measures which would be required to meet the proposed GES targets for this Descriptor would already be taken under existing legislation (e.g. the Urban Waste Water Treatment Directive (UWWTD), the WFD, the Integrated Pollution Prevention and Control

¹⁶² Agreed at a national/EU/International level e.g. within domestic legislation, Regional Seas Conventions etc.

¹⁶³ Agreed at a national/EU/International level e.g. within domestic legislation, Regional Seas Conventions etc.

¹⁶⁴

<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>

(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.

471. The UK will utilise existing monitoring programmes under the Water Framework Directive 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.

472. More information on the potential costs and benefits associated with these target proposals can be found in the **MSFD Impact Assessment, Section D, p.91**¹⁶⁵.

Gaps and development needs

473. 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.

3.8 Descriptor 9 – Contaminants in fish and other seafood

Background

474. 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. Biotoxins¹⁶⁶ and microbiological contamination are not expressly included under this Descriptor, nor elsewhere in the assessment of GES¹⁶⁷.

475. 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).

476. 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.

Summary of current status from the Initial Assessment

¹⁶⁵ www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

¹⁶⁶ Paralytic, Diarrhetic and Amnesic Shellfish Poisoning toxins

¹⁶⁷ 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.

477. 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.

Proposed GES characteristics and associated targets and indicators

Table 24 – Proposed GES characteristics for contaminants in seafood (Descriptor 9)

<p>Proposed characteristics of GES for Descriptor 9 (Contaminants in seafood)</p>	<p>The draft UK characteristics of GES for this Descriptor are as follows:</p> <ul style="list-style-type: none"> • 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 increasing¹⁶⁸.
<p>Proposed GES targets and indicators for contaminants in seafood (Descriptor 9)</p>	
<p>Proposed targets and indicators for Descriptor 9 - <i>Levels, numbers and frequency of contaminants</i></p>	<ul style="list-style-type: none"> • 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.

Approach to setting GES targets for contaminants in seafood

478. The proposed 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 proposed reflect existing agreed standards, we have high confidence that other Member States will take a similar approach.

479. For further detail on the approach to setting targets for this Descriptor see **Section 2.6 of the Cefas CBA Report 2012, p.43**¹⁶⁹.

Implications of the proposed targets

480. It is unlikely that additional measures will be needed 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).

481. 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. A broad initial estimate of the costs associated with this monitoring is between £344k-689k over 10 years, with some smaller additional monitoring costs for Scotland also anticipated.

482. More information on the potential costs and benefits associated with these target proposals can be found in the **MSFD Impact Assessment, Section D, p.93**¹⁷⁰.

¹⁶⁸ With the exception of fish liver, for which a high rate of non-compliance is expected.

¹⁶⁹

<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>

Gaps and development needs

483. 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 should be adequately covered under the target established for the Commission Indicator relating to actual levels of contaminants detected.
484. 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.
485. 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

486. Significant amounts of litter¹⁷¹ 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 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.
487. 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.¹⁷² 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

488. 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.

Proposed GES characteristics and associated targets and indicators

Table 25 – Proposed GES characteristics for marine litter (Descriptor 10)

Proposed	The draft UK characteristics of GES for the Descriptor are as follows:
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¹⁷⁰ www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

¹⁷¹ “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.

¹⁷² Marine Litter – An analytical overview, Regional Seas Programme, UNEP.

characteristics of GES for Descriptor 10 (Marine Litter)	<ul style="list-style-type: none"> The amount of litter, and its degradation products¹⁷³, 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. 	
Proposed GES targets and indicators for marine litter (Descriptor 10)		
	OPTION 1	OPTION 2
Proposed targets and indicators for Descriptor 10 – Characteristics of Litter in the Marine Environment	<ul style="list-style-type: none"> Decreasing trend (where litter levels are shown to be rising or unacceptable) in the number of visible litter items within specific categories/types on the coastline from 2010 levels by 2020. 	<ul style="list-style-type: none"> Overall reduction in the number of visible litter items within specific categories/types on coastlines from 2010 levels by 2020 (preferred option).
	<ul style="list-style-type: none"> Surveillance indicator to monitor the quantities of litter on the seafloor (preferred option). 	<ul style="list-style-type: none"> Decreasing trend (where litter levels are shown to be rising or unacceptable) in the number of visible litter items within specific categories/types on the seafloor from 2010 levels by 2020.
Proposed targets and indicators for Descriptor 10 – Impacts of litter on marine life	<ul style="list-style-type: none"> Surveillance indicator to monitor the amounts of plastic found in the contents of fulmars stomachs (in line with the OSPAR Ecological Quality Objective) (preferred option). 	<ul style="list-style-type: none"> Trends in the amounts of plastic found in the stomachs of northern fulmars are moving towards the levels indicated in the OSPAR Ecological Quality Objective.

Approach to setting GES targets for marine litter

489. 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. They have instead recommended trend based targets.

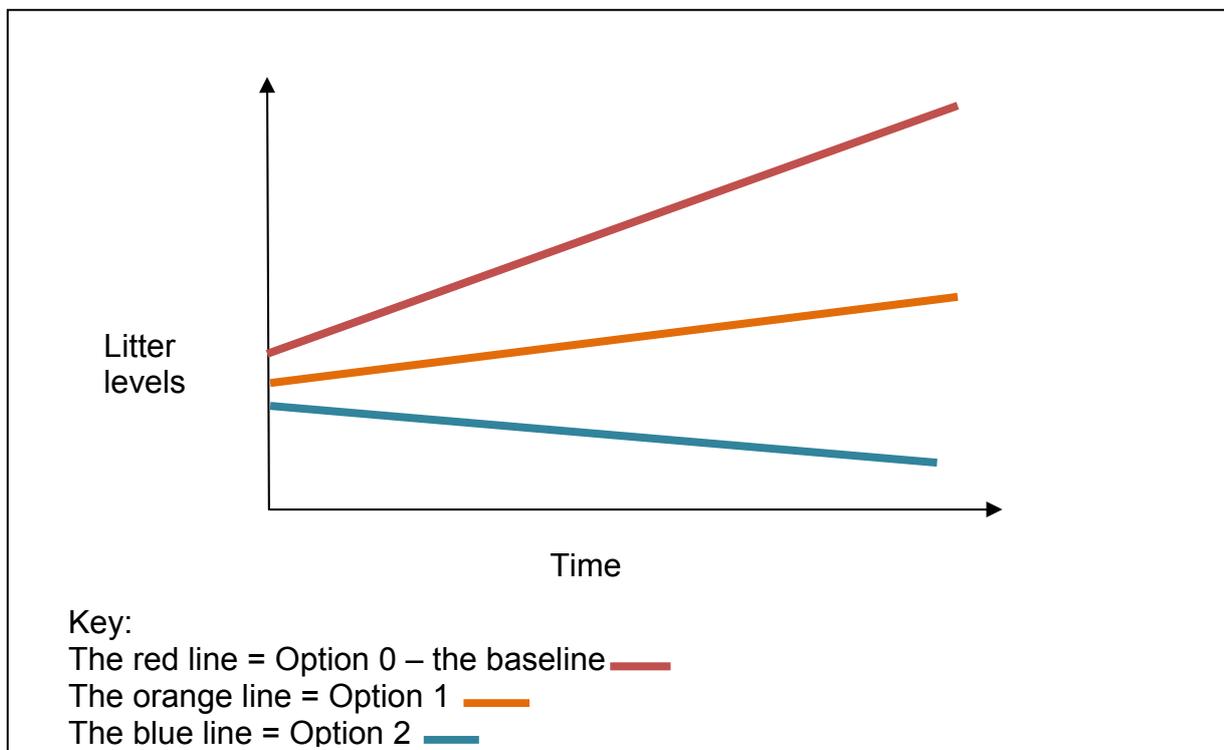
490. With this in mind experts and officials have identified two options for GES targets and indicators which reflect our current levels of understanding. More ambitious targets for specific percentage reductions in litter levels have also been considered but were ruled on the basis that it is still unclear what level of reduction would be equivalent to the achievement of GES at this time.

491. For levels of litter on coastlines, target **Option 1** would require a slowing of any rate of increase in visible litter items on beaches where litter levels are shown to be rising or unacceptable. In effect this would still allow litter levels to increase, just at a slower rate. Target **Option 2** is an absolute reduction in visible litter items on beaches where litter levels are shown to be rising or unacceptable. Option 2 is the Government and Devolved Administration's preferred option. Whilst more ambitious, this approach is justified by the conclusions of the Initial Assessment and is more consistent with the goals of the Natural Environment White Paper and the Government's terrestrial litter policy.

¹⁷³ Degradation products of litter include small plastic particles and micro plastic particles

492. The **illustrative** diagram below (Fig.9)¹⁷⁴ sets out the potential effects on coastline litter levels of the two options, and also if no target were set at all. Option 1 will result only in slowing the rate of increase in litter levels, whereas Option 2 would result in an overall reduction.

Figure 9 – Litter levels over time under the different target options (illustrative only)



493. For levels of litter items on the seafloor and in the water column Option 1 proposes the establishment of a surveillance indicator in this initial MSFD management cycle. This approach will allow us to collect more data and improve our understanding of trends and sources with the intention of setting a target in 2018. Option 2 would establish a target of a decreasing trend in the number of litter items on the seafloor and in the water column. However, due to the current lack of understanding i.e. current levels, sources, behaviour, impacts etc, the difficulties associated with robustly monitoring these aspects of litter, and the level of uncertainty surrounding the effectiveness of potential management measures Option 2 is considered impractical to implement at the current time and Option 1 is the Government and Devolved Administrations' preferred option.

494. For the impacts of litter on marine life Option 1 proposes the establishment of a surveillance indicator based on the current OSPAR EcoQO addressing the levels of plastic particles within fulmars' stomachs. Option 2 would establish this indicator as a target. However, due to high levels of uncertainty with respect to the occurrence of harm, the actual levels which would equate to GES, sources, and the effectiveness of potential management measures, Option 2 is considered impractical to implement at the current time and Option 1 is the Government and Devolved Administrations' preferred option.

¹⁷⁴ Not to scale

495. There is also a requirement within this Descriptor to measure ‘trends in the amount, distribution and, where possible, composition of microparticles (including microplastics)’. 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 with a view to setting targets and indicators in the future should this prove necessary.
496. Discussions at an EU level and advice generated within OSPAR has indicated that some member States are likely to adopt a similar approach to target setting. Further coordination will be carried out with other Member States within the relevant EU and OSPAR groups between now and mid-2012 and it may be necessary to review the UK target proposals as more information becomes available.
497. For further detail on the approach to setting targets for this Descriptor see **Section 2.7 of the Cefas CBA Report 2012, p.46**¹⁷⁵.

Implications of the proposed targets

498. The proposals for GES targets imply that additional measures will be needed to achieve GES for this Descriptor. It should be noted that given the transboundary nature of marine litter achieving GES under this Descriptor will also rely on measures implemented by other Member States.
499. It is likely that currently planned measures to reduce terrestrial litter will need to be tailored to specifically address litter in the marine and coastal environment. For example, public behaviour and education programmes under the Love Where You Live campaign could be tailored to include a specific focus on beach litter in coastal areas. There may also be a need to establish specific marine orientated measures such as those focussed on working with the fishing industry to reduce fishing litter, or working with national and local businesses, as well as Non Governmental Organisations, to improve the provision of bins on beaches. It is not currently possible to assess exactly what measures will be sufficient to meet the targets proposed under this option, although more evidence on this is being gathered.
500. The proposed targets and indicators will also require some additional monitoring. A broad initial estimate of the costs associated with this monitoring is between £473k-£1.1m over 10 years for England and Wales. Further analysis will be carried out over the consultation process to assess costs for Scotland and Northern Ireland.
501. More information on the potential costs and benefits associated with these target proposals can be found in the **MSFD Impact Assessment, Section D, p.95**¹⁷⁶.

Gaps and Development Needs

502. Under the preferred option, targets have not been specifically proposed for the Commission Indicators relating to litter in the water column & on the seafloor (10.1.2), and animal ingestion (10.2.1) 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 the preferred option proposes putting in place surveillance indicators in order to collect relevant monitoring data with a view to developing targets for 2018. With respect to micro-

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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>

¹⁷⁶ www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

particle trends (10.1.3), no target has been proposed under either option due to current levels of scientific uncertainty, however these will be addressed by way of appropriate research.

503. Over the short term there is a need for additional socioeconomic analysis in support of the final Impact Assessment, in particular with respect to the costs and effectiveness of different management measures e.g. beach cleaning, waste facilities, behavioural change etc.
504. There needs to be a review of whether existing programmes of monitoring currently allow for a robust assessment of GES or whether additional monitoring will be required, in particular for surface, water column, and seabed monitoring.
505. Over the longer term there is a pressing need to develop our understanding of the types and amounts of marine litter in the marine environment and how these relate to GES, in particular with respect to ecosystem harm. There is also a need to develop appropriately sensitive and fit for purpose indicators of impact to complement the currently proposed OSPAR EcoQO.
506. Finally, further work will be needed on identifying appropriate and cost effective management measures and ensuring an integrated approach is developed to tackling marine and terrestrial sources of litter.

3.10 Descriptor 11 – Introduction of energy, including underwater noise

Background

507. According to the Commission Decision 2010¹⁷⁷, 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 sound¹⁷⁸, caused primarily by activities such as oil and gas seismic activity and pile driving for wind farms, and ambient sound¹⁷⁹ caused primarily by shipping.
508. 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 breeding areas, or may result in physiological effects such as temporary or permanent damage to hearing organs, and at very high levels, even death.
509. The potential physical effects of such sounds on marine life i.e. hearing loss, death etc could only occur close to these sources and are recognised and managed in the existing licensing regime; for example, through the use of marine mammal observers, temporal restrictions on when activities can take place, and “soft starts¹⁸⁰”. 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, through consideration of noise levels, and their distribution in space and time.
510. There remain significant gaps in our understanding of levels of noise in the marine environment, its impacts on species and populations, and the thresholds at which noise is

¹⁷⁷ Commission Decision of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters (2010/477/EU)

¹⁷⁸ Impulsive sounds are loud, low and mid frequency impulsive sounds which tend to be caused by activities such as pile driving.

¹⁷⁹ Ambient sounds are continuous low frequency sounds.

¹⁸⁰ 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.

considered to be having a ‘significant’ impact on organisms. Furthermore, underwater noise is not currently monitored or recorded systematically in the UK.

Summary of current status from Initial Assessment

511. 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 noise levels, whilst it remains unclear whether changes in shipping activity have resulted in an increase in ambient noise levels.

512. 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.

Proposed GES characteristics and associated targets and indicators

Table 26 – Proposed GES targets for noise (Descriptor 11)

<p>Proposed characteristics of GES for Descriptor 11 (underwater noise)</p>	<p>The draft UK characteristics of GES for this Descriptor are as follows:</p> <ul style="list-style-type: none"> • 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 <i>at</i> 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 	
<p>Proposed GES targets and indicators for noise (Descriptor 11)</p>		
<p>Proposed targets for Descriptor 11 - <i>Distribution in time and place of loud, low and mid frequency sounds</i></p>	<p>• OPTION 1 (preferred option)</p> <ul style="list-style-type: none"> • 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 $\mu\text{Pa}^2 \text{m}^2 \text{s}$; or the zero to peak source level of 224 dB re 1 $\mu\text{Pa}^2 \text{m}^2$ over the entire UK hydrocarbon licence block area. 	<p>• OPTION 2</p> <ul style="list-style-type: none"> • The mean annual number of pulse-block-days¹⁸¹ within each UK relevant MSFD Subregion should not exceed [x, y, z]. • These numbers would be precautionary and based on current levels of activity.
<p>Proposed targets for Descriptor 11 - <i>Continuous low frequency sound</i></p>	<ul style="list-style-type: none"> • Surveillance indicator to monitor trends in the ambient noise level within the 1/3 octave bands 63 and 125 Hz (centre frequency) (re 1μPa 	<ul style="list-style-type: none"> • 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)

¹⁸¹ One pulse-block-day occurs when a sound impulse, measured over the frequency band 10 Hz to 10 kHz, exceeds the energy source level 183 dB re 1 $\mu\text{Pa}^2 \text{m}^2 \text{s}$; or the zero to peak source level of 224 dB re 1 $\mu\text{Pa}^2 \text{m}^2$ within one UK hydrocarbon licensing block on one day.

	RMS; average noise level in these octave bands over a year) measured by observation stations.	measured by observation stations do not show a statistically significant annual increase above natural variation.
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Approach to setting GES targets for underwater noise

513. 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, experts have put forward two different options for approaches to target setting, which are designed to enable us to better monitor, understand and manage the impacts of noise.

514. We do not yet know other Member States' positions, but believe that most other member states are likely to take a similar approach to Option 1 although we are aware that some may be proposing to set specific, quantitative targets.

Approach to setting GES targets for underwater noise – impulsive sounds

Option 1 (preferred option)

515. Setting a specific target representing GES is difficult, given current uncertainties. The proposed approach under Option 1 reflects the conclusion that estimated future levels of activity do not currently appear to pose a significant threat to marine animal populations¹⁸² and address the need to record, assess, and manage the distribution and timing of impulsive sounds in the future.

516. The proposed target requires a 'noise registry' to be established and maintained in order to record in space and time those activities generating impulsive sounds over a given noise threshold¹⁸³. These can then be analysed to determine whether they may potentially result in significant behavioural effects, thus compromising the achievement of GES. Such a registry would likely be managed by regulators and require a degree of coordination from regulating authorities around the UK. It would enable a better understanding of the potential for 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.

517. This option is the Government and Devolved Administrations' preferred option.

Option 2

518. The target proposed under Option 2 reflects a precautionary limit on impulsive sound. This would mean placing a limit on the number of days per year averaged across all the UK hydrocarbon licence blocks¹⁸⁴ on which impulsive sound from anthropogenic activity could exceed a particular threshold¹⁸⁵. The proportion of days proposed under this option is broadly in line with **current** levels of activity.¹⁸⁶ This is based on the hypothesis that although current levels

¹⁸² Based on the findings of the previously referenced Cefas/JNCC study and further expert judgement.

¹⁸³ The threshold for noise levels to be included in the registry is currently activities generating noise within the frequency band 10 Hz to 10 kHz, exceeding the energy source level 183 dB re 1 $\mu\text{Pa}^2 \text{m}^2 \text{s}$; or the zero to peak source level of 224 dB re 1 $\mu\text{Pa}^2 \text{m}^2$. This threshold has been proposed as it would ensure the most pervasive noise sources (pile driving and oil and gas seismic surveys) would be recorded, but further discussions are needed to establish whether this is the most appropriate threshold.

¹⁸⁴ Hydrocarbon licensing blocks are existing administrative areas 10 nm N/S and c.5 nm E/W (12 minutes longitude) which cover the whole UK marine area. They offer a practical and consistent delineation of UK waters.

¹⁸⁵ The proposed threshold is sound exceeding the energy source level of 183dB re 1 $\mu\text{Pa}^2 \text{m}^2 \text{s}$ or the zero to peak source level of 224 dB re 1 $\mu\text{Pa}^2 \text{m}^2$.

¹⁸⁶ Note that this would not include planned offshore wind installations for Round 3

of activity are not considered to be affecting populations significantly, there may be sufficient uncertainty to warrant a precautionary approach to any increase on current noise levels. However there is currently no evidence of a need for such an approach and the assessment of the Government and Devolved Administrations is that it would be disproportionate.

519. For further detail on the approach to setting targets for this Descriptor see **Section 2.8 of the Cefas CBA Report 2012, p.51**¹⁸⁷.

Implications of the proposed targets – impulsive sounds

Option 1 (preferred option)

520. It is estimated that the administrative and financial burden of establishing 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.

Option 2

521. This option would be likely to require active management and restriction of noise generating activities which would, in turn, result in high costs for both the regulator and industry. It would potentially result in significant restrictions, given that very tight coordination of activities would be very difficult. This could prevent or slow the identification and development of hydrocarbon reserves and the installation of off-shore wind farms, and risk failure to meet Government's domestic and EU commitments on renewable energy. Based on current evidence it is considered that the costs associated with it would be disproportionate considering likely risks to marine animal populations. Expert opinion has indicated that this would be an overly precautionary and restrictive option and thus is not considered appropriate at this time.

522. No additional monitoring costs are envisaged.

523. More information on the potential costs and benefits associated with these target proposals can be found in the **MSFD Impact Assessment, Section D, p.102**¹⁸⁸.

Approach to setting GES targets for underwater noise – ambient sounds

524. The main source of anthropogenic ambient noise in the marine environment is from shipping activity. The effects of ambient noise on marine life are largely unknown so no specific exposure thresholds can be proposed which equate to GES¹⁸⁹.

Option 1 (preferred option)

525. Under Option 1, given uncertainties with respect to current levels and impacts of ambient noise a specific target would not be established and instead a surveillance indicator would be put forward with the UK determination of GES for noise being used as a generic, qualitative target. This approach would ensure appropriate monitoring was put in place in order that a more specific target could be established at a later date when sufficient evidence has been collected. Option 1 is the Government and Devolved Administrations' preferred option.

Option 2

526. The proposed target under this option would establish a precautionary target aiming for no statistically significant increase in ambient noise levels above natural variation against a

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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>

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

189 Tasker et al. 2010

baseline determined over 3-4 years of recent data. The intention would be to revise this target once a better understanding of what constitutes GES is reached.

527. For further detail on the approach to setting targets for this Descriptor see **Section 2.8 of the Cefas CBA Report 2012, p.51**¹⁹⁰.

Implications of the proposed targets – ambient sounds

Option 1 (preferred option)

528. Some additional monitoring will be needed in order to provide an improved understanding of the current levels and potential impacts of ambient noise in UK waters. This requirement could be met most cost effectively through the adaptation of existing monitoring stations. A broad initial estimate of costs associated with this monitoring is between £861k-£1.3m over 10 years. This approach would provide suitable baseline information from which current trends in ambient noise can be determined and a robust assessment made of potential impacts before any measures are taken.

Option 2

529. The nature and extent of the measures necessary to achieve the target proposed for Option 2 remain somewhat unclear. Measures already being taken through the International Maritime Organization to improve the fuel efficiency of new ships should contribute towards the achievement of the targets. The International Fund for Animal Welfare (IFAW) has estimated that 'the noisiest 10% of ships account for between 50% and 90% of noise pollution generated by shipping' and therefore as these vessels are decommissioned through age or as the IMO mandatory efficiency standards are adopted it is hoped that noise levels should at least remain stable. However, it is not possible to categorically state that these measures alone will be sufficient to offset predicted future increases in shipping activity and so there is a possibility that additional measures to apply noise reduction technologies to new and existing vessels may be needed. This has the potential to become prohibitively expensive.

530. In addition this target could not be met by the UK taking unilateral action, given that national measures can only be applied to UK vessels rather than all vessels in UK waters. Adopting any UK based measure would be ineffective in meeting the proposed target (given the international nature of shipping) whilst at the same time putting the UK fleet at a competitive disadvantage. Therefore any additional measures needed to meet this proposed target would have to be progressed and agreed through the IMO and adopted internationally.

531. The additional monitoring costs associated with this option are the same as under Option 1.

532. More information on the potential costs and benefits associated with these target proposals can be found in the **MSFD Impact Assessment, Section D, p.102**¹⁹¹.

Gaps and development needs

533. Under the preferred option, targets have not been specifically proposed for the Commission Indicator relating to trends in ambient noise levels as outlined in the Commission Decision on GES. Instead a surveillance indicator has been proposed to ensure further monitoring data is collected with a view to developing an appropriate target for 2018.

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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>

¹⁹¹ www.defra.gov.uk/consult/2012/03/27/marine-strategy-framework-1203/

534. In the short term there will be a need for some additional socioeconomic analysis to support the final Impact Assessment, in particular with respect to potential costs to developers associated with implementing the proposed targets.
535. 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.
536. Over the longer term there will be a need to develop an ambient noise monitoring programme which is coordinated with neighbouring Member States.
537. 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.