Department for Environment Food & Rural Affairs

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Marine Strategy Part Two: UK Marine Monitoring Programmes

July 2014

Llywodraeth Cymru
Welsh Government

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Department of the Environment
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Any enquiries regarding this document/publication should be sent to us at: MSFD.Team@defra.gsi.gov.uk

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Part 1: Context for the UK Marine Strategy Part Two

Part 1: Section 1 – Introduction

1. This document sets out the UK's marine monitoring programmes to support the targets and indicators set out in the Marine Strategy Part One (https://www.gov.uk/government/publications/marine-strategy-part-one-uk-initial-assessment-and-good-environmental-status). In doing so it fulfils the requirement in the Marine Strategy Framework Directive (2008/56/EC) (MSFD) to establish and implement coordinated monitoring programmes for the ongoing assessment of the environmental status of our marine waters. This is the first time that a comprehensive description of the UK's marine monitoring programmes has been set out in one consolidated document. It will provide an invaluable tool to support assessment of the marine environment and help to identify pressures and impacts and how they might be addressed. Bringing the programme together will also allow us to better manage marine monitoring and to identify the most effective and efficient monitoring solutions to meet our evidence needs and the requirements of the MSFD and other policy objectives.

2. Achievement of Good Environmental Status (GES) under the MSFD is consistent with the UK Government and Devolved Administrations' objective of clean, healthy, safe, productive and biologically diverse oceans and seas. Charting Progress 2[1], 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 affected by human activity.

Part 1: Section 2 – Background to the MSFD

3. The MSFD was developed in response to concerns that although existing legislation protected the sea from some specific impacts, it was largely 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.

[1] http://chartingprogress.defra.gov.uk/

4. The MSFD requires Member States to put in place the necessary management measures to achieve GES in their marine waters by 2020. GES[2] involves protecting the marine environment, preventing its deterioration and restoring it where practical, while using marine resources sustainably. The Directive is wide-ranging and sets out 11 descriptors of GES – see table 1 below.

Table 1: MSFD descriptors of GES

MSFD descriptors of GES

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 ("Descriptor 1" or "D1").

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

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 ("Descriptor 3" or "D3").

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 ("Descriptor 4" or "D4").

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 ("Descriptor 5" or "D5").

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 ("Descriptor 6" or "D6").

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

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

9. 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").

[2] MSFD, 2008/56/EC Article 3(5) – GES 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).

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

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

5. The Directive came into force on 15 July 2008 and was transposed into UK law by the Marine Strategy Regulations 2010. [http://www.legislation.gov.uk/uksi/2010/1627/contents/made] It establishes a framework within which Member States shall take the necessary measures to achieve or maintain GES in the marine environment by 2020.

   The aims of the Directive are to:

   a. 'Protect and preserve the marine environment, prevent its deterioration or, where practicable, restore marine ecosystems in areas where they have been adversely affected;' and
   b. '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.[3]'

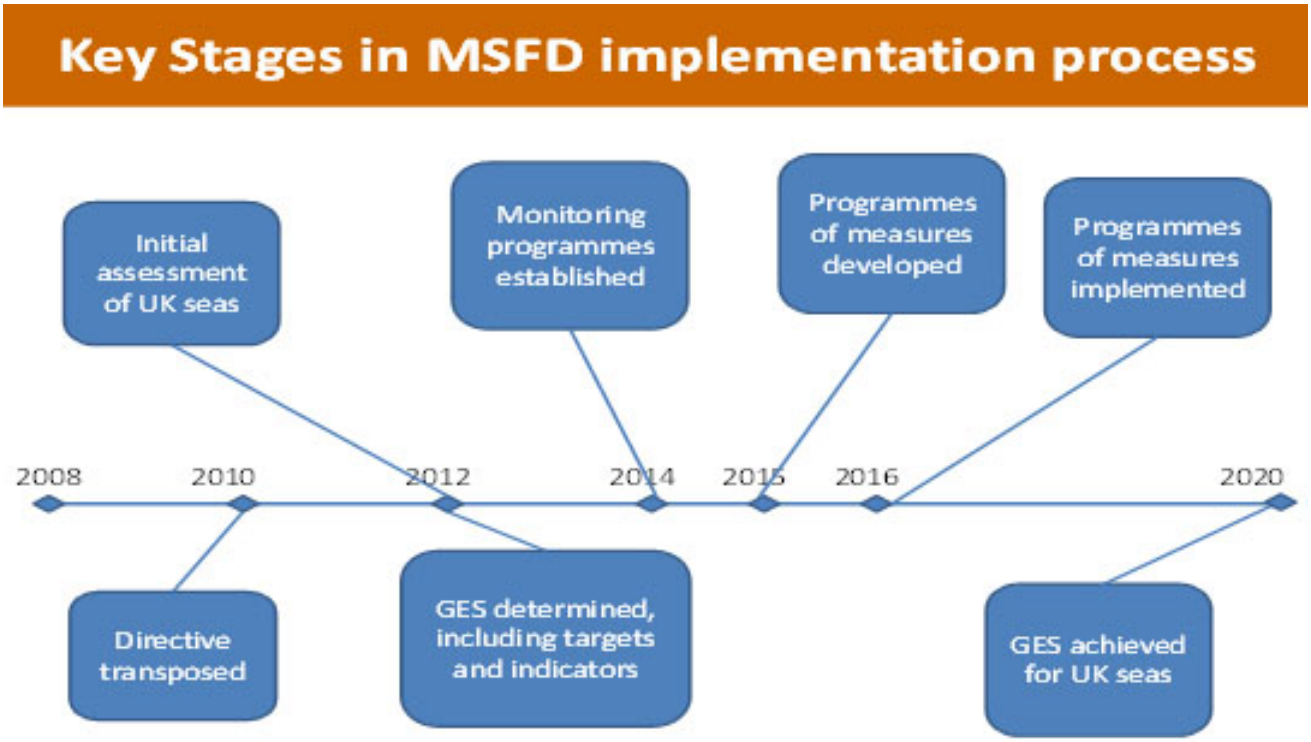
6. Member States must apply an ecosystem-based approach to the management of human activities. In this context this means ensuring that the collective pressure of human activities is kept within the levels compatible with the achievement of GES, ensuring that the capacity of the marine ecosystem to respond to human-induced changes is not compromised, whilst enabling the sustainable use of the marine environment now and in the future[4].

7. The aims of the Directive are to be delivered through the development of marine strategies covering the elements set out in Figure 1 below. The first stage was for Member States to carry out an initial assessment of the current status of their seas, determine specific characteristics of GES for their marine waters and set out specific environmental targets and indicators to underpin this (based on the 11 descriptors of GES given in the Directive which are outlined in Table 1 above). The UK completed this first stage in December 2012 with the publication of the Marine Strategy Part One. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69632/pb13860-marine-strategy-part1-20121220.pdf

8. The second stage of the MSFD, to be completed by July 2014, is for Member States to establish and implement 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.

[3] MSFD 2008/56/EC Article 1(2).
[4] MSFD 2008/56/EC Article 1(3).

Figure 1: Key stages in the MSFD implementation process

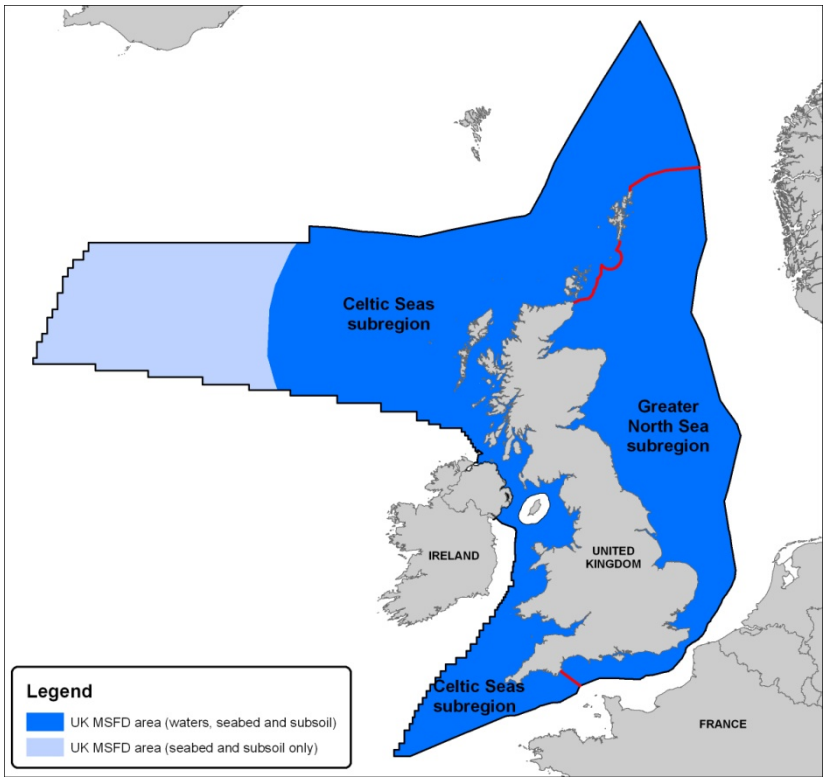


9. Each stage of the marine strategy must be reviewed every six years and revised if necessary. The monitoring programmes presented in this strategy are for the first period from 2014 to 2020. Where appropriate, they will be updated to take account of new developments and knowledge.

10. The Directive covers the extent of the marine waters over which the UK claims jurisdiction. This area extends from the landward boundary of coastal waters[5] as defined by the Water Framework Directive (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 claim[6]. The area of UK waters over which the MSFD applies is shown below in Figure 2a.

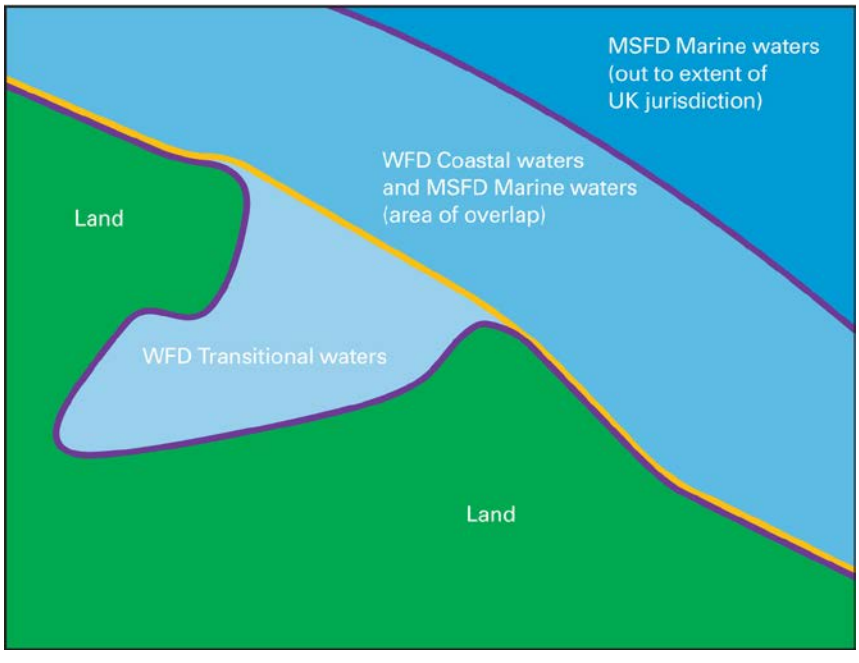
[5] The MSFD includes coastal waters (as defined by the WFD), but does not include WFD transitional waters (e.g. estuaries, sea lochs, coastal lagoons).
[6]This area is defined by the Continental Shelf Act 1964. In this area the requirements of the Directive (including the requirement to put in place measures to achieve GES) applies only to the seabed and subsoil and not to the water column.

Figure 2a: Area of UK waters over which the MSFD applies



11. There is some overlap between the waters covered by the WFD and the MSFD. The WFD relates to improving and protecting the chemical and biological status of surface waters throughout River Basin Catchments from rivers, lakes and groundwaters through to estuaries (transitional) and coastal waters to 1 nautical miles (nm) out to sea (3nm in Scotland) and overlaps with MSFD in coastal waters (12nm for chemical status). The MSFD includes coastal waters (as defined by the WFD) but does not include WFD transitional waters (e.g. estuaries, sea lochs, coastal lagoons). For estuaries, the boundary between the two directives is the “bay closing line” which is the seaward limit of “Transitional Waters” as defined under the WFD (Figure 2b).

Figure 2b: MSFD/WFD boundaries



12. MSFD explicitly recognises the overlaps with WFD and makes it clear that in coastal waters, MSFD is only intended to apply to those aspects of GES which are not already covered by WFD (e.g. noise, litter, aspects of biodiversity). Further guidance can be found in Defra's factsheet: http://archive.defra.gov.uk/environment/marine/documents/legislation/msfd-factsheet1-waterdirective.pdf.

13. Given the strong links between the MSFD and the WFD stakeholders interested in implementation of the MSFD are encouraged to engage in the WFD cycle 2 processes and associated consultations. The WFD will be used to monitor (and deliver) certain aspects of the MSFD (including contributing to the monitoring of pollution contaminants, eutrophication and benthic habitats) in coastal waters.

14. The MSFD is being implemented in a coordinated way across the UK Administrations. The UK monitoring programmes in this strategy have been developed at a UK-wide scale with input from experts and policy-makers across the UK Administrations. Gibraltar has a separate implementation process and is developing a monitoring programme for British Gibraltar Territorial Waters.

15. The UK also participates in the work of the MSFD Common Implementation Strategy (CIS) which has working groups that are further elaborating the scope and principles for MSFD monitoring programmes and reporting. For example, the CIS has produced recommendations for implementation and reporting of MSFD monitoring programmes which to the extent possible, the UK has factored in to the programmes outlined below.

Part 1: Section 3 – The European and regional context

Regional coordination requirements of the Directive

16. 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.

17. The Directive splits Europe's waters into four marine regions and associated subregions set out in Table 2 below.

Table 2: 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

18. The UK's marine waters are in the North East Atlantic Ocean marine region, with waters to the west of the UK comprising part of the Celtic Seas subregion, and waters to the east of the UK, including the Channel, forming part of the Greater North Sea subregion. The UK shares the Celtic Seas subregion with Ireland and France, and the Greater North Sea subregion with France, Belgium, the Netherlands, Germany, Denmark, Sweden and Norway. All these countries are members of the OSPAR Regional Sea Convention[7] 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).

19. The UK has one marine strategy covering the whole of our marine waters and the UK initial assessment, characteristics of GES and associated targets and indicators set out in our Marine Strategy Part One were 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 were taken into account.

European level coordination

20. Coordination between countries is taking place both at a European-level (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.

21. **The Working Group on Good Environmental Status** – this Working Group focuses on issues concerning the characteristics of GES and the associated targets and indicators, with the aim of ensuring a comparability of approaches across the EU.

22. **The Working Group on Economic and Social Analysis** – this Working Group is co-chaired by the UK and supports Member States in meeting the economic and social assessment requirements of the Directive, with the aim of ensuring comparability of approaches across the EU.

23. **The Working Group on Data, Information and Knowledge Exchange** – this Working Group was set up to develop a coordinated MSFD information and data reporting process. It developed proposals for reporting sheets to capture Member States' data and information associated with the initial assessment, characteristics of GES and

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

associated targets and indicators. The Working Group has developed proposals for reporting monitoring programmes and will develop proposals for reporting programmes of measures. It 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 levels, working as far as possible to use existing data initiatives and to remove duplication of reporting with related Directives.

24. There are also two EU technical sub-groups, one on marine litter (Descriptor 10) and one on noise[8] (Descriptor 11) which have a remit to review monitoring methodologies and develop proposals for new monitoring, provide a platform for sharing best practice on the development of GES characteristics, targets and indicators, and recommend proposals for further research.

25. The UK has played a pro-active role in all the European Working Groups and wherever possible the recommendations and guidance produced by these Groups are reflected in this strategy.

Regional level coordination

26. 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.

27. Considerable efforts have been made to coordinate the UK approach with that of other countries in the North East Atlantic. Discussions on regional coordination are continuing and OSPAR is working to develop a series of common indicators and, where appropriate, will establish coordinated monitoring to support those indicators.

Part 1: Section 4 – What the Marine Strategy Part Two covers and how it was developed

28. The UK Marine Strategy Part Two provides summaries of the UK Monitoring programmes.This meets the requirements of the second stage of the MSFD which is to establish and implement a monitoring programme to measure progress towards achieving GES. The relevant Articles in the Directive are set out below:

According to **Article 5 (2) (a iv)** of Directive 2008/56/EC, an essential element for the preparation of marine strategies is the “establishment and implementation, by 15 July 2014 except where otherwise specified in the relevant Community legislation, of a monitoring programme for ongoing assessment and regular updating of targets, in accordance with Article 11(1)”.

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

Article 11 (1) then specifies that: “on the basis of the initial assessment made pursuant to Article 8(1), Member States shall establish and implement coordinated monitoring programmes for the ongoing assessment of the environmental status of their marine waters on the basis of the indicative lists of elements set out in Annex III and the list set out in Annex V, and by reference to the environmental targets established pursuant to Article 10. Monitoring programmes shall be compatible within marine regions or subregions and shall build upon, and be compatible with, relevant provisions for assessment and monitoring laid down by Community legislation, including the Habitats and Birds Directives, or under international agreements.”

In addition, **Article 11 (2)** provides that “Member States sharing a marine region or subregion shall draw up monitoring programmes in accordance with paragraph 1 and shall, in the interest of coherence and coordination, endeavour to ensure that: (a) monitoring methods are consistent across the marine region or subregion so as to facilitate comparability of monitoring results; (b) relevant transboundary impacts and transboundary features are taken into account.”

Also, **Annex V** sets out a list of needs for monitoring programmes
Before the monitoring programmes are finalised and notified to the Commission, Member States must publish and consult the public on summaries of the programmes (**Article 19 (2) (c)**). Then, Member States have to notify (report) their monitoring programmes to the European Commission by 15 October 2014 (**Article 11 (3)**) and the European Commission has to assess these programmes within six months of receiving all those notifications (**Article 12**). An update of the monitoring programmes is required every six years, i.e. by 15 July 2020 at the latest (**Article 17 (2) (c)**). Finally, the Commission and the EEA must receive access and use rights in respect of data and information resulting from the monitoring programmes (**Article 19 (3)**).

29. The MSFD also requires Member States to make summaries available for public comment the monitoring programmes they intend to use to measure progress toward achieving GES. To fulfil this obligation a public consultation was held between January and April 2014. This document contains updated summaries of the monitoring programmes amended, where relevant, as a result of the comments received.

30. The monitoring programmes have been developed with the Devolved Administrations and other Government Departments through the MSFD Steering Group and with scientists in the UK Marine Monitoring and Assessment Strategy (UKMMAS) community. Many of the issues are also common to other Member States sharing the same seas and wherever possible we have worked closely with them to develop common approaches to monitoring.

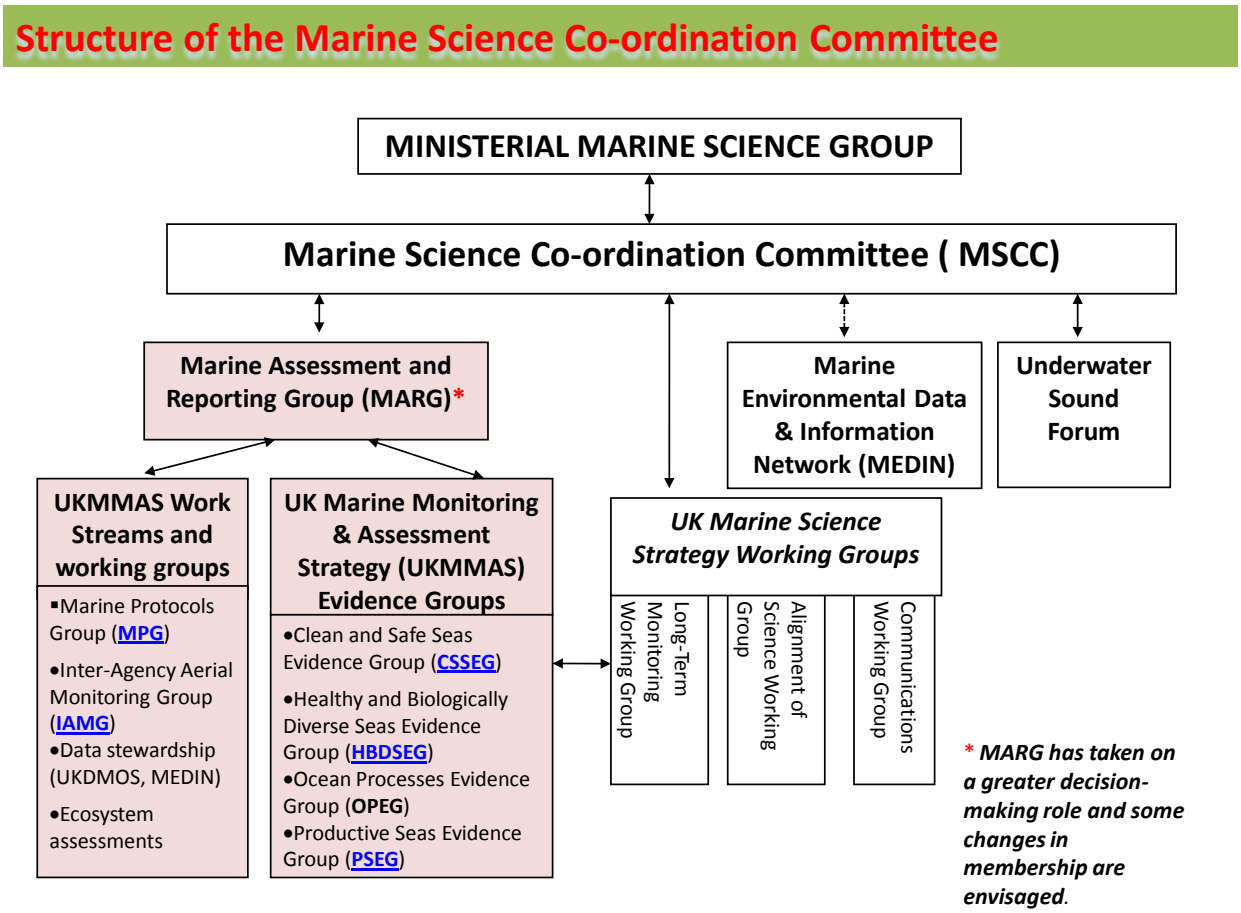
31. In developing the monitoring programmes wherever possible we have relied on existing monitoring programmes established to meet requirements for a number of EC Directives (e.g. the Habitats and Birds Directives) and for the OSPAR Convention for the Protection of the North East Atlantic. Much of the UK marine monitoring is coordinated with other Member States sharing the North East Atlantic through participation in relevant EU working groups and in OSPAR.

The framework used for monitoring the marine environment in the UK

32. The scientists working in the four evidence groups[9] of the UKMMAS community develop the methods and carry out the monitoring programmes required to assess the state of the UK Seas. The evidence groups are overseen by a science/policy committee called the Marine Assessment and Reporting Group (MARG) (see Figure 3). UKMMAS was set up in 2006 to achieve a more coordinated and systematic approach to marine monitoring, assessment and data collection across the UK. It brings together all of the UK and Devolved Administration Departments with interests in the marine environment, the environment agencies, nature conservation agencies and marine laboratories, and representatives from marine institutes and the research communities.

33. UKMMAS currently sits under the Marine Science Coordination Committee (see Figure 3).

Figure 3: Structure of the Marine Science Coordination Committee



34. UKMMAS has created a robust and coordinated framework to provide evidence and assessments to policy makers and other organisations for a variety of needs. It was the vehicle through which the MSFD initial assessment, based on Charting Progress 2, was delivered. It also provides:

[9] (Clean and Safe Seas (CSSEG); Healthy and Biologically Diverse Seas (HBDSEG), Ocean Processes (OPEG) and Productive Seas (PSEG)

- UK input to the mandatory monitoring and assessment programme under the OSPAR Convention for the Protection of the Marine Environment,
- A framework to deliver the appropriate monitoring required under the MSFD, and
- A supporting evidence base for marine planning as introduced by the UK government.

35. The UKMMAS evidence groups and MARG have contributed significantly to the development of the MSFD monitoring programme. The evidence groups ensure that the monitoring programmes that are deployed are carried out by laboratories operating within appropriate quality assurance systems, and where available, using methods that have been agreed at European level (e.g. European Committee for Standardisation (CEN) standards) or that are accredited to ISO17025 (e.g. chemical analyses). Where appropriate the monitoring programmes are checked by statisticians to ensure that they are statistically robust and are able to detect meaningful levels of change.

Part 1: Section 5 – Cost of monitoring programmes

36. Monitoring programmes for the MSFD are generally funded directly by governments, or by government agencies, or marine institutes that are indirectly funded by government. Some elements are run by Non-Governmental Organisations (NGOs) (e.g. the beach litter monitoring carried out by the Marine Conservation Society (MCS)) and information collected by marine industries and regulators (e.g. in environmental impact assessments and compliance with marine licences) can also be relevant for several descriptors.

37. Where we are relying on existing monitoring programmes, no additional monitoring cost has been identified. This applies to the descriptors on commercial fish, eutrophication, hydrographical conditions, contaminants, contaminants in seafood, elements of marine litter, and marine mammals, birds, (non-commercial) fish and benthic habitats (where covered by the Habitats Directive and WFD).

38. For other descriptors, further work is underway to identify options for cost-effective monitoring programmes. This covers non-indigenous species, pelagic habitats, some benthic habitats, litter on the seabed and ambient noise. The Joint Nature Conservation Committee (JNCC) led Marine Biodiversity Monitoring R&D programme is developing monitoring proposals that will address marine biodiversity monitoring commitments. In doing so, it will cover MSFD biodiversity requirements. If as a result of this further work, new monitoring programmes are identified as being required in the future, the costs of these will either be met from existing resources or from external funding sources.

39. In all cases the monitoring programmes are the minimum required to meet the UK's monitoring obligations and in most cases it will be a case of business as usual. The programmes will also be regularly reviewed to achieve efficiencies, and the resources targeted at areas where there is most risk of not achieving GES.

Part 2: Monitoring programme summaries

Part 2: Section 1 – Introduction

40. The Marine Strategy Part Two provides summaries of the monitoring programmes used for the 11 descriptors of GES that will be in place by 2014. More detailed information about the specific monitoring programmes will be submitted to the Commission in October 2014. Copies of the reporting sheets will be publically available.

41. Our aim in this strategy is to show how the marine programmes will monitor progress against the UK MSFD targets and indicators. These are presented in a series of annexes for each descriptor or descriptor component which provide:

    - An overall summary of the monitoring programme;
    - The current status of the descriptor;
    - The agreed targets and indicators;
    - A more detailed description of the monitoring programme;
    - A series of questions on how the monitoring programmes meet the requirements of the Directive;
    - The degree of coordination with other countries; and
    - Gaps and issues relating to each descriptor.

42. Monitoring 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. In relation to these descriptors the annexes cover the monitoring programmes for species (mammals, fish and birds) and habitats (pelagic habitats and benthic habitats).

43. Then there are separate annexes 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).

44. It should be noted that the monitoring programmes presented in the annexes are adaptive in nature. For example, if concentrations of a contaminant are regularly below detection limits, the frequency or coverage may be reduced, or if particular problems are revealed, sampling frequencies and coverage may be changed.

Part 2: Section 2 – Annexes of monitoring programmes for the MSFD Descriptors 1 to 11

Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptors 1 and 4 Fish	
Overall summary	The monitoring programme for Descriptors 1 and 4 in relation to fish will largely be based on the IBTS. This will be supplemented by additional fish surveys, such as the English Beam Trawl Survey, and Herring Acoustic Surveys, which provide data for key pelagic species. There is currently no single coordinated survey across the Celtic Seas region. Several different surveys operate using different gears and are done at different times which attempt as far as possible to conform to the International Beam Trawl Survey (IBTS) protocols. There is a large number of smaller, local-scale monitoring programmes in place around the UK. The data these provide will support our wider understanding of the fish in our seas. Further research is underway to establish targets and indicators for cephalopods which will be reported in October 2014.
Status of fish in UK waters	The UK initial assessment (https://www.gov.uk/government/publications/marine-strategy-part-one-uk-initial-assessment-and-good-environmental-status) is extracted from the report "Charting Progress 2" (http://chartingprogress.defra.gov.uk/) The UK initial assessment states that all parts of the marine fish community have been impacted by human activities. There have been recent improvements in the status of some fish communities. Improvements in the status of demersal fish are predominantly a result of a reduction in fishing pressure. Fish communities in estuaries have also benefitted from improved water quality. There are concerns over the status of threatened and vulnerable species such as sharks, skates and rays and deep sea species, which are

	especially vulnerable to fishing pressure. There are similar concerns over diadromous fish species such as the European eel and salmon that move between fresh and salt water during their life cycle. Improved information is needed on the causes of declines in diadromous fish species and highly migratory fish, such as oceanic sharks. Further regional detail can be found in: Scotland's Marine Atlas www.scotland.gov.uk/Topics/marine/education/atlas and the Northern Ireland "State of the Seas report" www.doeni.gov.uk/niea/water-home/state_of_the_seas_ni_report.htm
Section 1: UK Marine Strategy Part 1 targets, indicators and monitoring programmes	
MSFD Criterion 1.1 Species Distribution	**TARGET:** At the scale of the MSFD subregions distribution of sensitive fish species is not significantly impacted by human activities: the geographic and depth distribution of sensitive fish should meet individual indicator targets in a statistically significant proportion of species monitored. **MSFD Indicator 1.1.1:** Distributional range (Continental Shelf Seas and Shelf-edge Seas) **MSFD Indicator 1.1.2:** Distributional pattern within range (Continental Shelf Seas and Shelf-edge Seas)
MSFD Criterion1.2 Species Abundance MSFD Criterion1.3 Population condition[10]	**TARGET:** At the scale of the MSFD subregions populations of sensitive fish species are not significantly impacted by human activities: the population abundance density and population biomass density of sensitive species should meet individual indicator targets for recovery in a statistically significant proportion of species monitored. **MSFD Indicator 1.2.1:** Population abundance **MSFD Indicator 1.2.1:** Population biomass based on Fish population biomass **MSFD Indicator 1.3.1:** Populations demographic characteristics

[10] These are considered together due the close similarity of the targets.

Criterion 1.7 Ecosystem Structure – fish relative abundance Criterion 4.2 Proportion of selected species at the top of food webs MSFD Criterion 4.3 Abundance/distribution of key trophic groups/species	**TARGET: The size composition of fish communities should not be impacted by human activity such as to indicate any adverse change in trophic function within the community: A specified proportion (by weight) of fish in any defined marine region should exceed a stipulated length threshold** [11] **MSFD Indicator 1.7.1:** Composition and relative proportions of ecosystem components **MSFD Indicator 4.2.1:** Large fish by weight **MSFD Indicator 4.3.1:** Abundance trends of functionally important selected groups/species
Monitoring programme name	**Description of monitoring programme**
International Council for the Exploration of the Sea's (ICES) International Bottom Trawl Survey English Beam trawl and Herring Acoustic Surveys. Marine Scotland Science deep water trawl survey (1998 – present)	The monitoring outlined below will contribute metrics that are being used to construct each of the indicators listed above. The ICES IBTS in the North Sea has been undertaken during January/February since about 1983 and since 1998 there has been an additional third quarter IBTS (this is fourth quarter in western waters). These bottom trawl surveys mainly provide data on demersal species. UK research vessels participate in both these IBTS surveys, which are coordinated through ICES. Scotland and England operate additional fish surveys, such as the English Beam Trawl survey mainly covering English waters, the Marine Scotland Science deep water trawl survey, and the herring acoustic surveys, which provide distribution and abundance data for key pelagic species. The Northern Ireland Agriculture and Food Biosciences Institute (AFBI) also operates a herring and sprat acoustic survey in the Irish Sea and north Channel regions. Although there is no single coordinated survey that covers the Celtic Seas region, it is covered by several different surveys, using different gears and done at different times. The surveys conform as far as possible with the IBTS protocols.

[11] This target is a summary of two targets: the ecosystems structure targets and proportion of selected species at the top of food webs

Regional coordination	Currently eight nations (Scotland, Norway, Sweden, Denmark, Germany, France, the Netherlands and England) participate in the North Sea surveys, and wherever possible fishing gear and protocols are standardised. These surveys form the IBTS series. At a regional level, the UK will continue to participate within OSPAR and especially in the Intersessional Group on Coordination of Biodiversity Assessment and Monitoring (ICG-COBAM) and its Expert Groups for Fish and Food Webs, to ensure a coordinated approach for Fish across Descriptors 1 & 4. Data from the Dutch beam trawl survey will also be used. This survey is the most comprehensive flat fish survey of the southern north sea. It collects data from across large parts of the North Sea, which in a collaborative process provide monitoring information from the southern parts of the area, which is less adequately sampled by the other trawl used in the IBTS. Through the North East Atlantic Geographical Intercalibration Group and the interactions with the Republic Of Ireland there is a well-established model for interactions with Member States bordering the North East Atlantic.
Section 2: How does the monitoring programme meet the requirements of the directive?	
(i) How does the monitoring programmes evaluate whether the targets have been achieved?	The standardised coordinated IBTS runs during the first quarter of each year and has been running since 1983. This is sufficient to evaluate whether the GES targets submitted to the Commission for demersal continental shelf fish and demersal shelf edge fish are achieved. The UK will also use data from the third quarter IBTS survey. Starting in 1998 (as a standardised survey), it can support a trends-based target methodology and provide information on recruitment issues. It is also captures pelagic fish issues, as some key pelagic species are not present at the time of the Q1 survey. It also provides explicit estimates of species-specific catchability and this will help interpret food web trophic guild indicators. At present, deep water fish species, coastal fish species, and cephalopods do not have supporting indicators. Although datasets from a specific survey or surveys covering small parts of the regions have been identified, there is no regional-scale coverage. Further work is needed to consider how these could be used for the purposes of MSFD assessment.

(ii) How does the monitoring programme meet the requirements of Annex III (indicative lists of characteristics, pressures and impacts) of the Directive?	The monitoring programmes will monitor the (Annex III) characteristics of the relevant biological features, namely a description of the population dynamics; and the natural and actual range and status of species of fish. The monitoring will be able to detect changes due to the (Annex III) pressures and impacts causing biological disturbance, namely the selective extraction of species, including incidental non-target catches (e.g. by commercial and recreational fishing)
(iii) How will the monitoring programme assess the effectiveness of measures?	The indicators selected are sensitive to changes in the abundance, size-composition and distribution of fish at both the population and community level. The indicators will reflect changes to fish communities that are the result of management measures, although certain fish communities and populations may be slow to respond to any such measures.

SECTION 3: GAPS AND ISSUES

The monitoring described in Section 1 is confined to offshore waters: otter trawl surveys conducted under the IBTS do not sample within 6nm of the coast and beam trawl surveys, which do operate closer to the coast in some locations, do not currently operate in water shallower than 16m. Shallow water rocky reefs (at <50m depth) are also excluded from existing trawl surveys. A workshop is to be held in 2014/15 to investigate whether other surveys have been effective at providing comprehensive data on fish species and communities in the inshore area, and if there are data gaps, whether these relate to important 'impacts and threats to marine ecosystems and its communities'. The workshop will identify recommendations on what additional inshore monitoring may be required for the development of relevant indicators by 2018.

In the UK the following work is also currently underway to address the identified gaps:

- Workshop for the development of inshore fish indicators (see above);
- Development of indicators for the status of deep water fish based on existing surveys has been initiated;
- Research on cephalopods to enable the UK to develop appropriate targets and indicators. This will report in 2014;
- Development of concept papers for coastal fish and deep water fish for research programmes to investigate how monitoring might best be achieved for these two components of the fish community; and

- Work on how best to develop a regional scale survey for the Celtic Seas region based on existing surveys.
- National evaluation of populations of threatened and uncertain elasmobranch stocks (including oceanic sharks). This will report in 2015.
- Investigate the possible use of existing freshwater monitoring stocks to assess the status and health of offshore stocks of certain diadromous species.

Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptors 1 and 4 Marine mammals	
Overall summary	The monitoring programme for marine mammals in relation to Descriptors 1 and 4 will largely be based on four existing monitoring programmes. They will be used to evaluate whether targets have been achieved for those indicators that are operational by 2014. The programmes are the: (i) UK Seals monitoring programme; (ii) UK Bycatch monitoring scheme; (iii) UK stranding scheme (CSIP); and (iv) Inshore bottlenose dolphin population monitoring scheme. For seals, this involves the measurement of distribution, abundance and productivity of both seal species (grey and harbour seals) that regularly occur in UK coastal and marine waters, for which an existing monitoring programme is already established. For cetaceans, there are a number of monitoring programmes already in place to meet existing requirements including, for example, assessments of bottlenose dolphin populations in Special Areas of Conservation (SACs), large-scale surveillance of cetacean population abundance through surveys like Small Cetaceans in the European Atlantic and North Seas(SCANS), and ongoing monitoring of key threats like incidental bycatch. Research work is currently underway to develop options for a more cost effective, comprehensive biodiversity monitoring programme which will meet existing and future legal requirements including those under: • the Habitats Directive, • MSFD, • EU Regulation 812/2004 concerning incidental catches of cetaceans in fisheries, and • The obligations under ASCOBANS (Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas).

	The seal monitoring is coordinated by the Natural Environment Research Council (NERC), through its Special Committee on Seals (SCOS). Additional work is also funded by the Scottish Government, Scottish Natural Heritage and Natural England with some work being carried out by NGOs. All other work will be coordinated by the JNCC with the relevant Devolved Administrations and NGOs.
Status of Marine Mammals in the UK	**Cetaceans** The UK initial assessment (https://www.gov.uk/government/publications/marine-strategy-part-one-uk-initial-assessment-and-good-environmental-status) is based on the report "Charting Progress 2" (http://chartingprogress.defra.gov.uk/). This states that 28 species of cetacean have been recorded in UK waters and are mostly part of a much larger biological population whose range extends beyond UK waters. 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. The main pressures vary to some extent by species and include the extraction of species through by-catch, prey depletion and/or competition, pollutants, vessel or propeller strikes and noise in the marine environment. The initial assessment concluded that the status is 'favourable' for the five most abundant cetacean species in UK waters: (i) harbour porpoise; (ii) bottlenose dolphin; (iii) white-beaked dolphin; (iv) fin whale; and (v) 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 rare or vagrant and therefore it was not possible to assess their conservation status in UK waters. There is no indication that at present, pressures are threatening or depleting these populations, although since these assessments, construction in the marine environment (e.g. in relation to renewable energy) has increased significantly. **Seals** The UK seas host about 38% of the world's population of grey seals and about 4% of the world's population

	of harbour (or common) seals. Both species are seen off all UK coasts, though they are considerably more abundant in some areas than others with the majority present around Scotland. The main anthropogenic pressures known to affect seal populations include illegal shooting (in some localities), fisheries bycatch, pollutants, vessel or propeller strikes and noise in the marine environment. The grey seal population in the North Sea is increasing, particularly south of the Humber Estuary, the Orkney population shows a considerably reduced rate of increase while west Scotland populations have not increased since the early 1990s. In contrast, the declines in harbour seal populations on the Scottish east and north coasts and in the Northern Isles need further investigation.
Section 1: UK Marine Strategy Part 1 targets, indicators and monitoring programmes	
Criterion 1.1 Species Distribution - Seals	**TARGET:** At the scale of the MSFD subregions, the distribution of seals is not contracting as result of human activities: in all of the indicators monitored there is no statistically significant contraction in the distribution of marine mammals caused by human activities. **MSFD Indicator1.1.1:** Distributional range **MSFD Indicator 1.1.2:** Distributional pattern within range
Criterion 1.1 Species Distribution - Cetaceans	**TARGET:** At the scale of the MSFD subregions the distribution of Cetaceans is not contracting as result of human activities: in all of the indicators monitored there is no statistically significant contraction in the distribution of marine mammals caused by human activities. **MSFD Indicator 1.1.2:** Distributional pattern within range.
Criterion 1.2 Population size Criteron 4.3 Abundance/distribution of key trophic groups/species – Seals	**TARGET:** At the scale of the MSFD subregions abundance of seals is not decreasing as a result of human activity: in all of the indicators monitored, there should be no statistically significant decrease in abundance of marine mammals caused by human activities. **MSFD Indicator 1.2.1:** Population abundance **MSFD Indicator 4.3.1:** Abundance trends of functionally important selected groups/species.

Criterion 1.2 Population size Criterion 4.3 Abundance/distribution of key trophic groups/species – Cetaceans	**TARGET:** At the scale of the MSFD subregions abundance of cetaceans is not decreasing as a result of human activity: in all of the indicators monitored, there should be no statistically significant decrease in abundance of marine mammals caused by human activities. **MSFD Indicator 1.2.1:** Population abundance **MSFD Indicator 4.3.1:** Abundance trends of functionally important selected groups/species
Criterion 1.3 Population condition Criterion 4.1 Productivity (production per unit biomass) of key species or trophic groups – Grey and Harbour Seals:	**TARGET:** At the scale of the MSFD subregions, seal populations are in good condition: mortality of seals due to fishing by-catch is sufficiently low so as not to inhibit conservation objectives being met. **MSFD Indicator 1.3.1:** Population demographic characteristics **MSFD Indicator 4.1.1:** Performance of key predator species using their production per unit biomass (productivity)
Criterion 1.3 Population condition – Cetaceans	**TARGET:** At the scale of the MSFD subregions cetacean populations are in good condition: mortality of cetaceans due to fishing by-catch is sufficiently low so as not to inhibit conservation objectives being met. **MSFD Pressure Indicator:** Population condition pressure indicators based Harbour porpoise bycatch and short-beaked common dolphin bycatch
Monitoring programme name	**Description of monitoring programme**
Seal Population Monitoring Marine mammal bycatch	The UK seal monitoring programme is run by the Sea Mammal Research Unit (SMRU) at the University of St Andrews and is funded by NERC. SMRU undertakes systematic monitoring of core areas. Monitoring in other areas is undertaken by a variety of groups with information collated by SMRU. The results are published annually through the SCOS. Harbour seal monitoring occurs at each major haul-out site at least once every five years (grey seal summer distribution is included). The major grey seal breeding colonies are monitored at least once every two years. The UK Bycatch Monitoring Scheme undertakes observations of incidental cetacean bycatch by

mortality monitoring.	commercial fishing vessels in relation to EU Regulation 812/2004 and the Habitats Directive. The scheme is currently operated by SMRU under contract to Defra. EU Regulation 812/2004 is currently being reviewed by the European Commission and it is anticipated that the outcome of this review will determine bycatch monitoring requirements in the future.
Bottlenose dolphin inshore population monitoring	Inshore bottlenose dolphin populations in SACs are monitored by existing schemes on the east coast of Scotland and in the wider Cardigan Bay area, Wales. These schemes are funded and run separately by Scottish Natural Heritage and Natural Resources Wales (NRW) respectively.
UK Cetacean Strandings Investigation Programme (CSIP).	The CSIP programme conducts post-mortems on cetaceans stranded on the UK coastline and is currently coordinated by the Institute of Zoology under contract to Defra. Defra, the Governments of Scotland and Wales currently fund 100 such post-mortems per year. Additional work on seals is funded by the Scottish Government, NRW and the Welsh Government on an ad-hoc basis. The results from the post-mortems help to identify the major causes of death, including fishing bycatch.
Regional coordination	There has been a concerted effort to coordinate UK monitoring programmes with those of other Member States sharing the North East Atlantic to ensure that the assessments carried out are comparable. This work has been carried out both in the OSPAR Convention (primarily ICG-COBAM) and through the Marine Mammal Technical Sub-Group. In the OSPAR Convention, work has focussed on the harmonisation of targets and indicators, potential measures, monitoring programmes and areas for further research. The UK will continue to participate within OSPAR and especially ICG-COBAM and its Expert Group for Mammals, to ensure a coordinated approach for marine mammals across Descriptors 1 & 4.
Section 2: How does the monitoring programme meet the requirements of the directive?	
(i) How will the monitoring programmes evaluate whether the targets have	The monitoring programmes (below) are of sufficient maturity and have enough data to be able to evaluate whether targets have been achieved for those indicators that are operational by 2014.

been achieved?	• UK Seals monitoring programme • UK cetacean bycatch monitoring scheme • Inshore bottlenose dolphin population monitoring As outlined in the UK's initial assessment in the UK Marine Strategy Part 1, consideration is being given to adding further cetacean populations by 2018. Additional work needs to be completed to enable the definition of baselines and trends for these species and whether or not the proposed indicators and targets are appropriate. It should be noted that though CSIP is operational, the indicators it will support are still in development to be ready for 2018. CSIP is not needed for the evaluation of those indicators operational by 2014.
(ii) How does the monitoring programme meet the requirements of Annex III (indicative lists of characteristics, pressures and impacts) of the Directive	Annex III Table 1 – Characteristics The current monitoring programmes will monitor the (Annex III) characteristics of Biological features; namely a description of the population dynamics, natural and actual range and status of species of marine mammals occurring in the marine region or subregion. Annex III Table 2 – Pressures and impacts The impact of fishing is to be monitored directly by measuring mortality of marine mammals due to accidental bycatch, which is a key pressure and for which an indicator has been established.
(iii) How will the monitoring programme assess the effectiveness of measures	The monitoring programmes will provide data that will contribute to the assessment of links between individual pressures and measures although it is acknowledged that identifying direct links is challenging. Any assessments will need to take account of natural variation in populations.
Section 3: Gaps and issues	
Most of the targets and indicators for cetaceans will not be operational in 2014 because further work needs to be completed to enable the definition of suitable baselines and trends at the international level. This includes the work already being done through the marine mammal group within ICG-COBAM under the OSPAR Convention. These targets and indicators will be developed as soon as possible after 2014 to cover those cetacean species for which there is sufficient data to enable estimates of abundance and trends over time.	

These are expected to be operational by 2018.

The UK has a number of other existing cetacean monitoring programmes, which will indirectly support the MSFD targets operational in 2014. SCANS is an approximately decadal multilateral survey conducted in northern European waters to assess cetacean abundance: SCANS III is currently in the planning stages with the survey expected to take place in July 2016. Other cetacean surveys conducted by government, marine industries and NGOs have been contributing to the Joint Cetacean Protocol, which is expected to deliver information on the distribution, abundance and population trends of cetaceans

Regulation 812/2004, which sets out cetacean bycatch monitoring requirements, is being reviewed at an EU level and is likely to be integrated into future Common Fisheroes Policy (CFP) measures. Bycatch monitoring requirements should therefore continue although it is not yet clear what these will be. The UK will be seeking future bycatch monitoring requirements that take a more risk-based and regionalised approach to ensure the right fisheries are monitored, enabling better targeting of mitigation measures. Further, we will be seeking improved join-up with other monitoring requirements, such as seabird bycatch, where possible.

Research work is currently underway to develop options for a more cost effective, comprehensive biodiversity monitoring programme which will meet existing and future legal requirements including those under the Habitats Directive and MSFD. In relation to cetaceans, this will assess the effectiveness of all the current approaches to monitoring (includes dedicated and opportunistic survey data, CSIP, bycatch monitoring and the bottlenose dolphin work) and, where necessary, indicate areas where monitoring could be better targeted. For example, improving join-up between existing cetacean monitoring programmes, utilising novel methodologies that enhance cost-effectiveness.

Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 1 and 4 Birds	
Overall summary	The monitoring programmes in relation to birds for Descriptors 1 and 4 are: (i) The Seabird Monitoring Programme (SMP); (ii) The Wetland Bird Survey (WeBS); and (iii) The Breeding Bird Survey (BBS). These programmes will be supplemented by data from periodic surveys to monitor indicators of change in the distribution of seabird breeding colonies, waterbird coastal breeding sites and intertidal wintering or migration sites of shorebirds. It will integrate existing monitoring activities i.e. site specific monitoring for Natura 2000 sites (Special Protected Areas) and other marine protected areas (Marine Conservation Zones, Sites of Special Scientific Interest and Ramsar sites); and involve the measurement of the distribution, abundance, and productivity (breeding success) of a range of key seabird and waterbird species in UK coastal and marine waters. A research project is also underway to identify potential hotspots for seabird bycatch in UK waters and to help inform further development of the seabird bycatch indicator.
Status of birds in UK waters	The UK initial assessment (https://www.gov.uk/government/publications/marine-strategy-part-one-uk-initial-assessment-and-good-environmental-status) was based on "Charting Progress 2" (http://chartingprogress.defra.gov.uk). Regional detail is provided for Northern Ireland in their Northern Ireland State of the Seas Report http://www.doeni.gov.uk/niea/2_marine_biodiversity.pdf and for Scotland in Scotland's Marine Atlas www.scotland.gov.uk/Topics/marine/education/atlas. Separate assessments were made for seabirds and waterbirds. The initial assessment states that although the numbers of seabirds breeding in the UK had increased from the 1960s to the end of the 1990s, recent downward trends in breeding success of seabirds in the Greater North Sea and the northern Celtic Seas are of concern. 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. 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. 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.
Section 1: UK Marine Strategy Part 1 targets, indicators and monitoring programmes	
Criterion 1.1 Species distribution	**TARGET:** At the scale of the MSFD subregions distribution of marine birds is not significantly affected by human activities: No major shifts or shrinkage in the population distribution of marine birds in 75% of species monitored. **MSFD Indicator 1.1.2:** Distributional pattern within range
Criterion 1.2 Population size Criterion 4.3 Abundance/distribution of key trophic groups/species	**TARGET:** At the scale of the MSFD subregions abundance of marine birds is not significantly affected by human activities: Changes in abundance of marine birds should be within individual target levels in 75% of species monitored. **MSFD Indicator 1.2.1:** Population abundance **MSFD Indicator 4.3.1:** Abundance trends of functionally important selected groups/species.
Criterion 1.3 Population Condition Criterion 4.1 Productivity (production per unit biomass) of key species or trophic groups	**TARGETS:** • At the scale of the MSFD subregions marine bird productivity is not significantly affected by human activities: Annual breeding success of black-legged kittiwakes should not be significantly different, statistically, from levels expected under prevailing climatic conditions (i.e. sea surface temperature), and widespread seabird colony breeding failures should occur rarely in other species that are sensitive to changes in food availability. • At the scale of the MSFD subregions, the risks to island seabird colonies from non-native mammals are reduced. **MSFD Indicator 1.3.1:** Population demographic characteristics. **MSFD Indicator 4.1:** Performance of key predator species using their production per unit biomass

	(productivity)
Monitoring programme name	**Description of monitoring programme**
	The key monitoring programmes to be used are outlined below.
Seabird Monitoring Programme (SMP)	The SMP (led by the JNCC) and WeBS scheme (a partnership between Royal Society for the Protection of Birds (RSPB), British Trust for Ornithology (BTO) and JNCC) provide year to year trends in abundance and breeding success of seabirds at breeding colonies; and trends in numbers of waterbirds at a sample of estuaries and coastal sites where they stop-over on migration or spend the winter. Both schemes monitor protected sites, including Special Protection Areas. Relevant parts of the BBS also run in partnership between RSPB, BTO and JNCC, will also be used to contribute data on breeding waterbirds at coastal sites.
Wetland Bird Survey (WeBS).	Data from periodic surveys, that provide more comprehensive coverage than the annual schemes above, will supplement the data from the annual schemes and be used to monitor indicators of change in the distribution of seabird breeding colonies, waterbird coastal breeding sites and intertidal wintering or migration sites of waterbirds. These surveys are: • Breeding seabird census (conducted three times, approximately 15 years apart); • Bird Atlas of Britain and Ireland (conducted three times and over 20 years apart); and • Non-estuarine Wader Survey (NEWS) (conducted three times, 9-13 years apart).
Breeding Bird Survey (BBS)	The next seabird breeding census 'Seabirds Count' is planned to start early in 2016 (subject to funding) and the next NEWS is planned for winter 2015/16. The latest Bird Atlas (2007-11) has just been published. In 2014, the target for MSFD Criterion 4.1 on productivity will be assessed by the same supporting indicator of kittiwake annual breeding success that will be used under MSFD Criterion 1.3 on Population Condition.

	Currently, the presence of non-native and invasive mammals are monitored at a limited number of island seabird colonies, where quarantine measures are employed to keep the islands free from these predators of seabird eggs, chicks and sometimes adults.
Regional coordination	The UK and Republic of Ireland collaborate on the SMP and on the Bird Atlases. There has been a concerted effort to further improve the coordination of UK monitoring programmes with those of other Member States sharing the North East Atlantic. A common approach is being developed for birds through OSPAR. In June 2014, common bird indicators for abundance and for breeding success/failure were agreed in OSPAR, and efforts to establish international data sharing were underway. Data that are collected by different Member States are collated centrally in the European Seabirds at Sea Database (hosted by JNCC, UK) and in the International Waterbird Census Database (hosted by Wetlands International, NL).
Section 2: How does the monitoring programme meet the requirements of the directive?	
(i) How will the monitoring programmes evaluate whether the targets have been achieved?	The monitoring programmes (set out below) are of sufficient maturity and have enough data to be able to evaluate whether targets have been achieved for those indicators that are operational in 2014: • seabirds that breed in the UK; • waterbirds that breed, stop-over on migration, or overwinter; and • kittiwake breeding success and seabird breeding failure rates.
(ii) How does the monitoring programme meet the requirements of Annex III (indicative lists of characteristics, pressures and impacts) of the Directive	The current monitoring programme will enable us to assess 'biological features — a description of the population dynamics, natural and actual range, and status of species of seabirds occurring in the marine region or sub region'. Monitoring seabird breeding success/failure will contribute to the assessment of indicators of the different impacts of biological disturbance; i.e. selective extraction of species, including incidental non-target catches (e.g. by commercial fishing). The supporting indicators for MSFD criteria 1.3 and 4.1 (see above) use data on species that are sensitive to changes in food availability.

	The monitoring of abundance and distribution of marine birds will provide indicators of population state that will respond to multiple pressures. Monitoring changes in the distribution of marine birds will also help distinguish the effects of climate change from those of human pressures such as habitat damage and loss due to activities such as coastal development, recreation and offshore renewable energy development. The continued collection of the above data will help develop a better understanding of how human impacts affect marine birds. Crucially, they will help us better understand the links between climate, fishing and availability of prey species.
(iii) How will the monitoring programme assess the effectiveness of measures	The indicators selected are considered to be sufficiently sensitive to changes arising from the implementation of management measures. Any impacts of measures implemented via the CFP that aim to directly or indirectly conserve seabird prey species, should be evident in the indicators of kittiwake breeding success and of seabird breeding success/failure. The effects on seabirds of measures to conserve fish stocks under CFP (i.e. a ban on discards) will also be evident in indicators of breeding success and abundance of those species that rely heavily on fishery discards for food. Monitoring of non-native/invasive mammal presence on seabird islands will provide a direct indicator of the success or failure of any quarantine measures employed on each island.
Section 3: Gaps and issues	
The monitoring programmes set out above are sufficient for assessing progress against the UK indicators. We are exploring whether there is scope to improve the UK's ability and confidence in assessing progress towards GES. Discussions with JNCC and other experts will continue to determine the need for and practicality of any additional monitoring requirements. R&D is underway, as part of the JNCC-led Marine Biodiversity Monitoring R&D Programme, to investigate the feasibility of monitoring, beyond 2014, inshore and offshore aggregations of seabirds and waterbirds. This may mean more species of marine bird could be included in the next assessment of GES in 2018.	

Research is also currently underway to establish the vulnerability of marine birds to bycatch in fisheries in UK waters. If a significant risk from bycatch is demonstrated, options for additional monitoring of the numbers of birds killed by fishing in the UK might be necessary. The European Commission is currently considering whether to propose that additional data collection requirements should be placed on Member States to this effect as part of a reformed Common Fisheries Policy in order to deliver the EU Plan of Action for Seabird Bycatch.

In support of the target on the risks to island seabird colonies from non-native mammals, the UK submitted to the Commission an indicator of the presence or absence of non-native or invasive mammals on island seabird colonies. This indicator will be used to inform measures to prevent or alleviate major impacts from non-native and invasive native mammalian predators on island seabird colonies. Currently, only a limited number of islands are regularly monitored for mammal presence. Further research is required to identify options for improving the scope of the monitoring currently in place and to develop a set of standard monitoring methods.

Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptors 1, 4 and 6 Pelagic habitats	
Overall summary	Plankton (microscopic plants and animals) play a fundamental role in the marine food web. Monitoring plankton communities can contribute to demonstrating the achievement of GES not only in the plankton itself but also for other species and habitats. There are currently two programmes collecting and monitoring plankton samples: a network of up to 15 fixed sampling stations; and the Continuous Plankton Recorder (CPR) survey. The CPR provides large scale information while the fixed stations provide local information; when used together the two complimentary types of monitoring provide a picture of the UK plankton community. Defra and the Devolved Administrations will coordinate an integrated UK monitoring and assessment programme for the planktonic component of the pelagic ecosystem in relation to descriptors 1, 4 and 6 to assess whether the targets set for those descriptors relating to pelagic habitats (plankton) have been met and whether Good Environmental Status has been achieved in the Greater North Sea and the Celtic Seas. The samples collected will provide information on the species present and their abundance. The main features of the method which will be used to detect changes in the plankton are: the grouping of species of planktonic organisms into functional types or lifeforms; the graphical display of changes in the abundance of each of these lifeforms using a state-space approach; the calculation of a plankton index for each of the plankton components in descriptors 1, 4 and 6 and an overall plankton index to quantify possible changes in the state of the plankton relative to baseline conditions. Reporting will be via a purpose built integrated assessment and reporting procedure based on the based on the European Marine Ecosystem Observatory (EMECO) data tools. The monitoring programme set out below uses some current monitoring programme activities. Defra is sponsoring an R&D Lifeform project to identify options for improving the existing monitoring programme to deliver a full monitoring programme for 2016.

Current status of the pelagic habitat.	The UK initial assessment for the MSFD published last year (http://cdr.eionet.europa.eu/gb/eu/msfd8910) based on the report "Charting Progress 2" (http://chartingprogress.defra.gov.uk/chapter-4-clean-safe-seas) indicates that there is evidence of changes in the composition, abundance and spatial and temporal abundance of both phytoplankton and zooplankton in waters adjacent to the UK and in the North-East Atlantic. However, based on the large amount of data gathered on plankton from long-term observations, plankton as a whole are considered healthy and are subject to few direct human pressures. Scotland's Marine Atlas (www.scotland.gov.uk/Topics/marine/education/atlas) and the Northern Ireland "State of the Seas report" (www.doeni.gov.uk/niea/water-home/state_of_the_seas_ni_report.htm) provide greater regional detail.
Section 1: UK Marine Strategy Part 1 targets, indicators and monitoring programmes	
Criterion 1.4: Habitat distribution	**TARGET:** At the scale of the MSFD subregions, distribution of plankton community is not significantly adversely influenced by anthropogenic pressures, as assessed by indicators of changes in plankton functional types (life form) indices. **MSFD Indicator 1.4.1:** Distributional range **MSFD Indicator 1.4.2:** Distributional pattern
Criterion 1.6: habitat condition	**TARGET:** At the scale of the MSFD subregions, condition of plankton community is not significantly adversely influenced by anthropogenic pressures. **MSFD Indicator 1.6.1:** Condition of the typical species and communities **MSFD Indicator 1.6.2:** Relative abundance and biomass.
Criterion 1.7: Ecosystem structure	**Target:** At the scale of the MSFD subregions, structure of plankton community is not significantly adversely influenced by anthropogenic drivers, as assessed by indicators of changes in plankton functional types (life form) indices. **MSFD Indicator 1.7.1:** Composition and relative proportion of ecosystem components
Criterion 4.3: Abundance/Distribution of	**TARGET:** At the scale of the MSFD subregions, abundance/distribution of plankton community is not significantly adversely influenced by anthropogenic pressures, as assessed by indicators of changes in

key trophic groups/species	plankton functional types (life form) indices. **MSFD Indicator 4.3.1:** Abundance trends of functionally important selected groups/species
Criterion 6.2 – Condition of benthic community	**TARGET:** At the scale of the MSFD subregions, condition of the plankton that have a direct link to the benthos is not significantly adversely influenced by anthropogenic pressures. **MSFD Indicator 6.2.2:** Multi-metric indexes assessing benthic community condition and functionality.
Monitoring programme name	**Description of monitoring programme**
Sampling stations	A network of up to 15 fixed sampling points in marine waters around the UK. Samples will be collected at regular intervals throughout the year to gather quantitative information on the abundance of species that make up the plankton. The sampling points will be selected to ensure they encompass all of the different water types found in UK coastal and shelf waters. Where appropriate, the monitoring programme will make use of existing monitoring programmes run by AFBI, the Centre for Environment, Fisheries and Aquaculture Science (Cefas), Environment Agency, Marine Scotland, Department for the Environment, Northern Ireland, Plymouth Marine Laboratory and the Scottish Environmental Protection Agency. Instrumented moorings at some of these fixed sampling points will provide additional supporting physical and chemical data.
Continuous Plankton Recorder	CPR surveys, operated by the Sir Alister Hardy Foundation for Ocean Science (SAHFOS) provide long-term time-series data on the state of the plankton (including both phytoplankton and zooplankton) in offshore locations and at a larger scale.
Regional coordination	Currently few international monitoring efforts exist. However, the CPR provides regional (NE Atlantic) and subregional scale (North Sea, Bay of Biscay, Celtic Seas) phytoplankton and zooplankton data that could be used for reporting by other Member States. The OSPAR ICG-COBAM expert group on pelagic habitats (chaired by the UK) is coordinating the development of subregional and regional monitoring proposals as well as the adoption of common targets and indicators of which the Lifeform method has been selected for further development.

Section 2: How does the monitoring programme meet the requirements of the directive?	
(i) How will the monitoring programmes evaluate whether the targets have been achieved?	The data collected will be used to monitor changes in the state of the plankton relative to baseline conditions. The main features of the method which will be used to detect changes in the plankton are: • Grouping species of planktonic organisms into functional types or lifeforms; • The graphical display of changes in the abundance of each of these lifeforms using a state-space approach. This captures changes in the abundance of different lifeforms relative to each other over a seasonal cycle; and • Calculation of a plankton index for each of the plankton components in Descriptors 1, 4 and 6. The index is calculated from the difference between the abundance of lifeforms in any one year and baseline conditions. Calculating the index for successive years will allow any trend away from baseline conditions to be quantified.
(ii) How does the monitoring programme meet the requirements of Annex III (indicative lists of characteristics, pressures and impacts) of the Directive?	The targets set are based on no change in the plankton communities beyond that driven by climate/natural variability. The supporting indicators listed above are intended to capture characteristics of plankton communities and determine if they are changing in response to pressure, climate or natural variability. From the characteristics set out in Annex III (table1) of the Directive, plankton monitoring will primarily contribute to assessing: • Biological features: a description of the biological communities associated with the water column habitats and seabed. This would include information on the phytoplankton and zooplankton communities, including the species, seasonal and geographical variability. This monitoring will also contribute to: • 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 sub region. The pressures and impacts set out in Annex III for plankton may be related to some of the following:

	• Changes in salinity regime, • Changes in thermal regime, • Inputs of fertilisers and other Nitrogen- and Phosphorus-rich substances, • Inputs of organic matter, • Introduction of microbial pathogens, • Introduction of non-synthetic substances & compounds, and • Selective extraction of species, including non-target catches.
(iii) How will the monitoring programme assess the effectiveness of measures?	The monitoring programme has been designed to detect temporal changes in the state of the plankton and to relate such change to trends in anthropogenic pressure (e.g. fishing and nutrient loading) using correlation analysis. Evidence of a correlation will be used to examine the data in greater detail for cause and effect. Confirmation of cause and effect will indicate a failure to meet the target.
Section 3: Gaps and issues	
It is recognised that a number of gaps exist in terms of data availability, monitoring and analysis both at a national and sub/regional (i.e. OSPAR) level. In the UK work is currently underway to present options for addressing these gaps. The issues include: • Limited zooplankton data for UK coastal waters. Work is needed to identify suitable sampling and sample analysis methods; • Picoplankton, nanoplankton and bacteria are important components of the plankton and a quantitative method is required to allow the routine determination of their abundance; and • For relative abundance and biomass there are temporal gaps in the UK's current sampling of the spring phytoplankton bloom. The results of this work will, through the UK's active engagement with OSPAR, be used to help develop options for addressing these gaps at a regional level.	

Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptors 1 and 6 Benthic habitats	
Overall summary	The assessment of seabed habitats in the initial assessment is based on a combination of data and expert judgement, drawing upon the limited evidence available at the time from monitoring studies and research. The assessment considers the relationships between habitats and pressures. Habitat monitoring will be supported by a strategy developed by the JNCC-led Marine Biodiversity Monitoring R&D Programme. This is expected to provide the framework for further development and integration of monitoring in both the wider environment and within Marine Protected Areas (MPAs), including for benthic habitats. It is anticipated that existing monitoring programmes for Habitats Directive, Water Framework Directive (WFD) and others will be incorporated and adapted where necessary to develop integrated options for monitoring to fulfil the requirements of MSFD and other drivers. There are a number of the monitoring programmes already well established with indicators (tools under the WFD approach) in place. These include monitoring within coastal water bodies using WFD tools for: • intertidal sediment habitats (opportunistic macroalgae blooming tool); • subtidal sediment habitats (Infaunal Quality Index); • intertidal rocky habitats (rocky shore macroalgal index); and • saltmarshes and intertidal seagrass beds. These will be continued. Other indicators and related monitoring programmes are at different stages of development. These will be made operational between 2014 and 2018, as proposed under the UK Marine Strategy part One. Whilst not yet providing operational monitoring or indicators, very significant survey programmes have been undertaken to support the designation of national MPAs. Data gained through these programmes should support the development of further indicators, particularly those related to habitat extent, and condition.

Status of benthic habitats in UK waters	The UK initial assessment (https://www.gov.uk/government/publications/marine-strategy-part-one-uk-initial-assessment-and-good-environmental-status) is based on the report "Charting Progress 2" (http://chartingprogress.defra.gov.uk), which identified the main pressures affecting the condition of benthic habitats. The assessment of seabed habitats in the initial assessment is based on a combination of data and expert judgement, drawing upon the limited evidence available at the time from monitoring studies and research. The assessment considered the relationships between habitats and pressures. Although future assessments will be based on more evidence, they will still need to use existing data (such as from the National Marine Monitoring Programme) as well as expert judgement. Key priority pressures for benthic habitats are physical damage or loss, and the removal of species. The main sources of these pressures arise from demersal fishing activity. Although there are a number of other activities that result in physical damage of the sea bed through abrasion, the spatial extent of damage from bottom fisheries is considered to be the main pressure. Intertidal and shallow habitats are most likely to be affected by pressure from climate change, nutrient enrichment and pollution. 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. The area of benthic habitats likely to be impacted by fishing remains significant, particularly for sediment habitat types. The development of tidal range devices may result in locally significant impacts on intertidal habitats and coastal squeeze may be exacerbated by projected sea-level rise.
Section 1: UK Marine Strategy Part 1 targets, indicators and monitoring programmes	
Criterion 1.4: habitat distribution	Targets have been set separately for sediment and for rocky & biogenic habitats and a further differentiation is made between listed (under the Habitats Directive) and predominant habitats(http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1992:206:0007:0050:EN:PDF) **TARGETS: Sediment habitats** • Listed: at the scale of the MSFD subregions the range and distribution of listed (special) sediment

	habitat types is stable or increasing and not smaller than the baseline value (Favourable Reference Range for Habitats Directive habitats). • Predominant: no target proposed **TARGETS: Rocky & biogenic habitats** • Listed: at the scale of the MSFD subregions, range and distribution are stable or increasing and not smaller than the baseline value (Favourable Reference Range for Habitats Directive habitats). • Predominant: as per listed **MSFD Indicator 1.4.1:** distributional range **MSFD Indicator 1.4.2:** distributional pattern
Criterion 1.5: habitat extent	**TARGETS: Sediment habitats** • Listed: at the scale of the MSFD subregions the area of listed (special) sediment habitats is stable or increasing and not smaller than the baseline value (Favourable Reference Area for Habitats Directive habitats). Water Framework Directive extent targets for saltmarsh and seagrass should be used within WFD boundaries as appropriate. • Predominant: no target proposed **TARGETS: Rocky & biogenic habitats** • Listed: at the scale of the MSFD subregions, area is stable or increasing and not smaller than the baseline value (Favourable Reference Area for Habitats Directive habitats). • Predominant: as per listed **MSFD Indicator 1.5.1:** habitat area
Criterion 1.6: habitat condition	**TARGETS: Sediment habitats** • Listed: at the scale of the MSFD subregions, the area of listed (special) sediment habitat types which is unsustainably impacted by human activities (as defined by condition indicators) must not exceed 5% of baseline value (favourable reference area for HD habitats). WFD targets (km^2 thresholds) for areas of unacceptable impact for benthic invertebrates, macroalgae, saltmarsh and seagrass should be used within WFD boundaries as appropriate.

	• Predominant: at the scale of the MSFD subregions damaging human impacts on predominant sediment habitats are reduced: The area of habitat which is unsustainably impacted by human activities (as defined by vulnerability criteria) is reduced and the precautionary principle is applied to the most sensitive habitat types and/or those which are most important for ecosystem functioning. **TARGETS: Rocky & biogenic habitats** • Listed: at the scale of the MSFD subregions, habitats are not significantly affected by human activities; the area of habitat in poor condition (as defined by condition indicators) must not exceed 5% of the baseline value (Favourable Reference Area for Habitats Directive habitats). • Predominant – Rock and biogenic as per listed. **MSFD Indicator 1.6.1**: condition of the typical species and communities. **MSFD Indicator 1.6.3**: physical, hydrological & chemical conditions
Criterion 6.1: Physical damage **Criterion 6.2: habitat condition**	**TARGETS: Sediment habitats** • Listed: at the scale of the MSFD subregions, the area of listed (special) sediment habitat types which is unsustainably impacted by human activities (as defined by condition indicators) must not exceed 5% of baseline value (favourable reference area for HD habitats). WFD targets (km^2 thresholds) for areas of unacceptable impact for benthic invertebrates, macroalgae, saltmarsh and seagrass should be used within WFD boundaries as appropriate. • Predominant: at the scale of the MSFD subregions damaging human impacts on predominant sediment habitats are reduced: The area of habitat which is unsustainably impacted by human activities (as defined by vulnerability criteria) is reduced and the precautionary principle is applied to the most sensitive habitat types and/or those which are most important for ecosystem functioning. **TARGETS: Rocky & biogenic habitats** • Listed: at the scale of the MSFD subregions, habitats are not significantly affected by human activities; the area of habitat in poor condition (as defined by condition indicators) must not exceed 5% of the baseline value (Favourable Reference Area for Habitats Directive habitats). • Predominant: as for listed **MSFD Indicator 6.1.1:** Type, abundance, biomass and areal extent of relevant biogenic substrate

	MSFD Indicator 6.1.2: Extent of the seabed significantly affected by human activities for the different substrate types. **MSFD Indicator 6.2.1:** condition of the typical species and communities
Monitoring programme name	**Description of monitoring programme**
Benthic monitoring programme	Several aspects of the benthic habitat monitoring programme are well established with indicators (or 'tools' under the WFD approach) and monitoring programmes in place and these will be continued. This includes monitoring within coastal water bodies using WFD tools on intertidal sediment habitats (opportunistic macroalgae blooming tool), subtidal sediment habitats (Infaunal Quality Index), intertidal rocky habitats (rocky shore macroalgal index), saltmarshes and intertidal seagrass beds. Data from the surveillance monitoring programme MarClim will also be used, as will monitoring established for other inshore habitats covered under the Habitat Directive. For certain indicators additional evidence is required to develop suitable, cost effective monitoring programmes. Some are in development and are planned to be operational by 2014 including Habitats Directive habitats, with on-going monitoring within SACs also contributing to WFD indicators). Others need further research and development work and are not expected to be operational until 2018. For example, data will also be gathered during 2014 and combined with multibeam acoustic data. These will be modelled using analytical software packages to produce high resolution habitat maps to help address the indicators on habitat distributional range, patterns and habitat area. The Marine Environmental Change Network (MECN) provides information on baselines and prevailing conditions which, although not directly linked to particular indicators, will provide key information in terms of context for a number of state indicators. For 2014 the following elements of the monitoring programme will be in place: a. Distributional range and pattern: saltmarshes based on the WFD saltmarsh tool. Indicators for distributional range for listed inshore and offshore habitats are under development and will be added in 2018.

	b. Extent of listed sediment habitats and both listed and predominant rocky and biogenic reef habitats: this will be based on WFD monitoring programmes for intertidal seagrass tools and saltmarsh tools supported by data collected under Habitats Directive. In addition the WFD subtidal seagrass tool is expected to be operational after 2014. Current SACs monitoring will provide data on habitat extent for certain habitat features that will be used to support the collection of data for listed habitats. Indicators for habitat area for listed and predominant habitats are under development and expected to be operational in 2018. c. Habitat condition: will be based on monitoring for WFD macroalgae tools, intertidal seagrass tool, Infaunal Quality Index, saltmarsh tool and data from MarClim. The WFD subtidal seagrass tool is expected to be operational after 2014. Across all other habitats, work on developing indicators and designing monitoring schemes is currently ongoing and they are expected to be made operational by 2018. d. Physical damage and habitat condition: this will be based on Habitat Directive SAC monitoring programmes. Indicators on the density of biogenic forming structures and physical damage to predominant and special habitats are under development and likely to be added in 2018.
Regional coordination	Work is underway within the OSPAR's Intersessional Correspondence Group on Biodiversity Assessment and Monitoring to develop a set of common indicators for biodiversity and the establishment of coordinated monitoring programmes to implement and make those indicators operational. At present there is some coordination on management and monitoring of MPAs between Member States with cross-border sites e.g. Dogger Bank.
Section 2: How does the monitoring programme meet the requirements of the directive?	
(i) How will the monitoring programmes evaluate whether the targets have been achieved?	**Distributional range and pattern:** For saltmarshes this will be evaluated using the WFD saltmarsh tool. **Extent:** Listed sediment habitats and both listed and predominant rocky and biogenic reef habitats will be assessed on the basis of WFD monitoring programmes for intertidal seagrass tools and saltmarsh tools

	supported by data collected under Habitats Directive. Current SACs monitoring will provide data on habitat extent for certain habitat features that will be used to support the collection of data for listed habitats. **Habitat condition:** Will be assessed using data from monitoring for WFD macroalgae tools, intertidal seagrass tool, Infaunal Quality Index, saltmarsh tool, and data from MarClim. **Physical damage and habitat condition:** Will be assessed using data from Habitat Directive SAC monitoring programmes. Current monitoring programmes (e.g. under the WFD, the Habitats Directive and MarClim) partially fulfil monitoring requirements to enable assessment against targets. Some of the indicators submitted under the Marine Strategy Part 1 are not developed sufficiently for monitoring requirements to be established yet. We are in the process of addressing the existing gaps, and some indicators are likely to be made operational during the late part of this MSFD cycle. The JNCC-led UK Marine Biodiversity Monitoring R&D Programme is expected to develop options for monitoring to address, inter alia, gaps in relation to assessment of targets.
(ii) How does the monitoring programme meet the requirements of Annex III (indicative lists of characteristics, pressures and impacts) of the Directive?	Marine biotope classification and UK-wide seabed habitat maps produced from survey and modelled data provide information on the characteristics of predominant and special habitats. JNCC and Cefas are currently updating the methodologies for the mapping of pressures caused by human activities. Information collected as part of the monitoring programme will be used to update habitat maps and pressure information. Environmental and pressure data are included as part of the data requirement for the assessment of certain indicators, and are key to the analysis and interpretation of the biodiversity indicators monitored.
(iii) How will the monitoring programme assess the effectiveness of measures?	Monitoring of extent and condition indicators will be associated with pressure from human activities, and will provide evidence of the effect of those activities on the benthic communities. For example, the Infaunal Quality Index's benthic invertebrate index responds to pressure and any alleviation of these pressures ought to be reflected in an improvement in the associated classification scores. As part of the development of indicators we are incorporating pressure information and effects of pressures on sensitive habitats as a

	proxy for habitat condition. This approach will be tested by directly measuring condition indicators on the seabed.

Section 3: Gaps and issues

Within the UK it is expected that indicators to assess the condition of sediment, biogenic and rocky habitats and of listed and predominant habitats will be made operational between 2014 and 2018, as proposed under the UK Marine Strategy Part One. Indicators for the distributional range and extent for listed inshore and offshore habitats, and condition indicators for sediment habitats are under development and likely to be made operational during the late part of this cycle (2017). It is anticipated that other indicators could also be developed and made operational during the late part of this cycle, or the next cycle (2018-2024), as a result of the on-going assessment of gaps on biodiversity indicators, and the evaluation of progress for the determination and assessment of GES in benthic ecosystems.

OSPAR ICG-COBAM is developing proposals for common indicators to assess community condition and functionality, such as species diversity and richness, and the proportion of opportunistic to sensitive species by adapting existing WFD tools currently being used to analyse condition of benthic infauna within WFD water bodies. It is expected these indicators will be made operational between 2014 and 2018.

ICG-COBAM is also working on a selection of candidate indicators based on the Habitats Directive typical species approach to address the criterion of condition of benthic communities, and specifically indicators on the proportion of biomass/number of individuals above specified length/size. ICG-COBAM is also developing indicators of area of habitat loss and physical damage to assess the extent of damage to the sea bed and its communities from the impacts of human activities, in particular abrasion. These indicators are aligned with the UK proposals for this descriptor, and it is hoped that they will be made operational by 2018.

Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 2 Non-indigenous species	
Overall summary	As stated in the UK's Marine Strategy Part 1, more information is needed to better understand the abundance, distribution and pathways of introduction for marine Non-Indigenous Species (NIS). Work has been conducted to help identify high risk areas and review existing monitoring programmes in UK territorial waters and to assess their potential suitability for detection of NIS. Options for developing monitoring programmes by 2014 for the abundance and distribution of NIS in high risk areas are currently being considered. The UK will continue to play a leading role in Europe and OSPAR to help coordinate UK programmes with those of other Member States and OSPAR Contracting Parties.
Status of Non Indigenous Species in UK seas	The UK initial assessment (http://cdr.eionet.europa.eu/gb/eu/msfd8910) based on the report "Charting Progress 2" (http://chartingprogress.defra.gov.uk/chapter-4-clean-safe-seas) recommends further research in this area. To be able to reduce the risk from NIS more information is needed to better understand the abundance, distribution and pathways of introduction. This will help determine the current status of marine NIS in the UK and assist with the development of risk-based monitoring and measures programmes. Scotland's Marine Atlas (www.scotland.gov.uk/Topics/marine/education/atlas) and the Northern Ireland "State of the Seas report" (http://www.doeni.gov.uk/niea/3_invasive_alien_species.pdf) provide greater regional details. In 2012 there was a repeat of the 2006 Rapid Marina Survey for Northern Ireland. A number of new NISs have been identified as now being present in high risk areas.
Section 1: UK Marine Strategy Part 1 targets, indicators and monitoring programmes	
MSFD Criterion 2.1 Abundance and state characterisation of non-indigenous species, in particular invasive species	**TARGET:** Reduction in the risk of introduction and spread of non-native species through improved management of high risk pathways and vectors. **MSFD Indicator 2.1.1:** Trends in abundance, temporal occurrence and spatial distribution in the wild of NIS, particularly invasive NIS, notably in risk areas, in relation to the main vectors and pathways of spreading of such species

MSFD Criterion 2.2 Environmental impact of invasive NIS	**TARGET:** Action plans are developed for key high risk marine non indigenous species by 2020 **MSFD Indicator 2.2.2:** Impacts of non-indigenous invasive species at the level of species, habitats and ecosystem, where feasible
Monitoring programme name	**Description of monitoring programme**
Non-Indigenous Species monitoring programme.	The results of a project to identify high risk areas and options for monitoring programmes in UK territorial waters for detection of NIS are currently being considered. These will be supported, where applicable, by the following existing monitoring activities: • The Department of Environment (DOE) Northern Ireland published an NIS Strategy for NI in May 2013. The Northern Ireland NIS programme primarily focuses on monitoring of harbours and marinas and control management programmes for Spartina anglica and Didemnum vexillum. Occurrences of established and new introductions of these and other species are picked-up by a number of specific programmes. The next Northern Ireland marina and harbour survey period will be 2015. DOE plan to repeat this survey every 3 years. These surveys establish baselines for introductions and flag trends in abundance, temporal occurrence, distribution and impacts particularly in relation to the main pathways and vectors of spreading. • In Wales, marina surveys were started as a direct result of the Didemnum vexillum invasion and are part of an inshore Early Warning System (EWS). • In Scotland NIS monitoring by Orkney Islands Council is being conducted as part of their proposed revised Ballast Water Management Policy and by the North Atlantic Fisheries College (NAFC) Marine Centre in Shetland as part of a Biosecurity Plan. A Scottish element of the EWS Pathways project involving Marine Scotland, Scottish Association for Marine Science and Scottish Natural Heritage is currently progressing and Biosecurity Plans are being developed by the Firth of Clyde Forum and the Solway Firth Partnership which will focus on identifying high risk areas and monitoring of NIS.

Regional coordination	The UK leads the OSPAR ICG -COBAM expert group on NIS. The role of this group is to develop common indicators between contracting parties to support a coherent approach towards the achievement of GES. In June 2013 an indicator for the rate of new introductions of NIS was put forward as a priority candidate indicator with the UK leading on the development work. Northern Ireland has a good working relationship with the Republic of Ireland in relation to the monitoring and control of invasive NIS through the Invasive Species Ireland Project. In 2004 Northern Ireland Environment Agency (NIEA) and National Parks & Wildlife Service jointly commissioned a review of invasive species on the island of Ireland. This review 'The Invasive Species in Ireland Report' made 10 key recommendations to Government to take forward action to address invasive species. In implementing these recommendations the Invasive Species Ireland Project was established in 2006.
Section 2: How will the monitoring programme meet the requirements of the directive?	
(i) How will the monitoring programmes evaluate whether the targets have been achieved?	Options for a monitoring programme are still being developed. The key requirement of any monitoring programmes will be to assess a reduction in the risk of introduction and spread of NIS and inform improved management of high risk pathways and vectors.
(ii) How does the monitoring programme meet the requirements of Annex III (indicative lists of characteristics, pressures and impacts) of the Directive?	Monitoring will initially provide baseline data to contribute to the assessment of biological disturbance pressures. It will subsequently be used to determine the effectiveness of any implemented measures.
(iii) How will the monitoring programme assess the effectiveness of measures?	This will be dependent on the data collected/baselines used. A baseline will need to be established before the link between uptake of measures and number of NIS in high risk areas can be determined.

Section 3: Gaps and issues
It was not possible to set targets due to a lack of data and understanding in respect of species abundance, distribution and impacts of NIS on the marine environment. This has meant that assessments have been limited, leading to a lack of baseline information. The surveillance indicators adopted will help to support the gathering of information needed for options for targets to be developed. Work to identify high risk areas and to review existing monitoring programmes has been completed and results and options for a NIS monitoring programme are currently being considered. The Marine Pathways project is looking at management of pathways by which marine invasive NIS may be introduced into the UK and Ireland. All high risk pathways are being looked at, including commercial shipping, recreational boating and aquaculture. Specific aspects of the project include inshore EWS, offshore monitoring and trialling monitoring methods.

Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 3 Commercially exploited fish and shellfish	
Overall summary	For UK commercially exploited fish and shellfish the monitoring programme will be based on existing monitoring programmes required under the CFP and existing national monitoring programmes for certain shellfish stocks. These monitoring programmes, which will be updated where necessary in the light of new knowledge, will provide a sound basis for the monitoring requirements for Descriptor 3 and robust data to assess progress against UK targets for Descriptor 3. The approach to Descriptor 3 reflects the commitments agreed during the negotiations on the reform of the CFP to fish sustainably and the achievement of sustainable stock levels.
Status of Commercial Fish and Shellfish in UK seas	Since publication of the UK initial assessment (http://cdr.eionet.europa.eu/gb/eu/msfd8910) further advice has been received from ICES. This states that: For the North Sea MSFD subregion for analytically assessed stocks 64% met GES for fishing mortality and 91% met GES for reproductive capacity of stocks. Nephrops (Norway lobster) were the only shellfish species in the North Sea covered by stock assessments for the MSFD initial assessment. Four of the nine Nephrops stocks in the North Sea were assessed. Of these 25% met GES for fishing mortality and 75% met GES for reproductive capacity of stocks. For the Celtic Sea MSFD subregion for assessed stocks, 61% met GES for fishing mortality and 72% met GES for reproductive capacity of stocks. Again Nephrops (Norway lobster) were the only shellfish in the Celtic Sea covered by stock assessments for the MSFD initial assessment. Seven of the eight Nephrops stocks in the Celtic Sea were assessed in relation to fishing mortality, of these 70% met GES for fishing mortality. Four of the eight stocks were assessed in relation to reproductive capacity of stocks, of these 100% met GES for reproductive capacity of stocks. The most recent stock assessments for crab and lobster stocks around the English and Scottish coast show that they are being fished at a rate either around or, more often, above Maximum Sustainable Yield (MSY) levels.

	Scotland's Marine Atlas (http://www.scotland.gov.uk/Topics/marine/science/atlas) and the Northern Ireland "State of the Seas report" (http://www.doeni.gov.uk/niea/water-home/state_of_the_seas_ni_report.htms) provide greater detail at a regional level.
Section 1: UK Marine Strategy Part 1 targets, indicators and monitoring programmes	
MSFD Criterion 3.1 Level of pressure of the fishing activity	**TARGET:** The exploitation rate of each stock is either at or below Fisheries Mortality Rate - Maximum Sustainable Yield (F_{MSY}), or within the range of plausible fishing mortalities consistent with $F_{MSY.}$ Where data does not allow F_{MSY}, or F_{MSY} proxies, to be calculated exploitation of each stock will be based on the precautionary approach with limits defined by agreed proxies for sustainable exploitation. **MSFD indicator 3.1.1:** Fishing mortality **MSFD indicator 3.1.2:** Ratio between catch and biomass index
MSFD Criterin 3.2 Reproductive capacity	**TARGET:** The reproductive capacity of the stock shall be maintained at, or above levels that will support the long term exploitation of stocks at F_{MSY}, as indicated by spawning stock biomass of all stocks being above Biomass (Bpa). **MSFD indicator 3.2.1:** Spawning Stock Biomass (SSB) **MSFD indicator 3.2.2:** Biomass indices
Monitoring programme name	**Description of monitoring programme**
Common Fisheries Policy (CFP) monitoring.	Commercial stocks already managed under the CFP will be monitored under existing monitoring arrangements. Only stocks that are covered by the Total Allowable Catches (TACs) and quotas regulation **AND** for which

	the UK has an obligation to provide biological sampling data under the Data Collection Framework (DCF) are being included in the initial reporting[12]. These are those stocks for which ICES provides assessments; the UK contributes to this through DCF. Data collection on these stocks will be conducted in accordance with the requirements for national monitoring programmes specified under the Data Collection Framework (DCF) 2008/949/EC. There will be changes to the current data collection regulations as these are being revised. The new Data Collection Multi Annual Plan (DC-MAP) will be agreed during the period 2014-2016 and is expected to come into operation in 2017. Sampling data come from research surveys, on-board commercial sampling of commercial catches and shore-based sampling of landings. For the majority of fisheries, sampling is conducted on a quarterly basis. However, where the fishery is more seasonal these are sampled on an annual basis. Cefas holds data for England and Wales, Marine Scotland hold Scottish data and AFBI holds data for Northern Ireland. All data records related to specific stocks are submitted to ICES. Outputs of stock assessments are publically available in ICES advice documents and working group reports. These monitoring programmes are reviewed by the Scientific, Technical and Economic Committee for Fisheries (STECF). Quality control procedures have been established by ICES.
Shellfish monitoring.	Shellfish monitoring will cover the main UK commercially exploited species e.g. crabs, lobsters and scallops.

[12] Current links:

- TACs and quotas - Listed in the Annex of the Council Regulation (EU) No 43/2014 - http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32014R0043 and in the Annex of the **Council Regulation (EU) No 1262/2012 -** http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1406637985749&uri=CELEX:32012R1262.
- DCF - Listed in Annex 7 of Council Regulation (EC) No 665/2008 - http://datacollection.jrc.ec.europa.eu/dcf-appendix

	England Monitoring programmes for shellfish in English waters take the form of stock assessments and no surveys are conducted on a national scale. Cefas conducts stock assessments on crabs, lobsters and scallops. Biological data are collected for crab and lobster stocks under the DCF obligations and are used to undertake regular stock assessments. A continual program of research is running to improve the robustness of the crab and lobster stock assessment and ongoing work with ICES will provide further scientific support. Where applicable information from the 10 Inshore Fisheries and Conservation Authorities (IFCAs) surveys and assessments of shellfish stocks lying within their districts (0-6n) for various species including whelks, cockles and mussels will contribute to the monitoring programme. **Northern Ireland** AFBI conducts surveys of lobsters and crabs captured in pots and carries out specific annual stock assessment surveys of scallops in Northern Irish waters. This has recently been extended to include queen scallops. Cockle surveys are regularly carried out, to determine potential fishing opportunities, while twice-yearly surveys of wild mussels are carried out at a number of inshore locations. The Loughs Agency under take annual stock assessment surveys on the native oyster population in Lough Foyle and also annual seed mussel assessment within the Foyle and Carlingford Irish Lights Commission (FCILC) area. **Wales** The Welsh Government is compiling an additional monitoring plan, above the requirements of the DCF, for all commercially exploited shellfish in Welsh Waters. This will include at-sea sampling of the pot fisheries but will also extend to annual stock assessment and additional monthly monitoring of intertidal hand-gathered cockle and mussel fisheries. The aim is that shellfish stocks will be assessed in as much detail as possible to include juvenile surveys. **Scotland**

	Marine Scotland Science conducts stock assessments for brown and velvet crabs, lobsters (tri-annually) and King scallops (biannually) in Scottish waters. The assessments are based on biological data, collected throughout the year, and landings data as reported and recorded on the Scottish Fisheries Information Network FIN. The scallop assessment also uses data collected during research vessel surveys (three each year). It provides estimates of fishing morality, total and spawning stock biomass for the main stock units. Reports of the assessments are publically available on Marine Scotland Science's web site. The NAFC in Scalloway periodically undertake assessments of shellfish stocks in waters around Shetland.
Regional coordination	The DCF is designed as a coordinated international monitoring programme.
Section 2: How does the monitoring programme meet the requirements of the directive?	
(i) How will the monitoring programmes evaluate whether the targets have been achieved?	Assessment of the exploitation of commercial stocks managed under the CFP will be based on assessments conducted by ICES. ICES conduct assessments with data collected under the CFP DCF. The DCF is a mature internationally coordinated data collection programme which specifies monitoring and data collection programmes for commercial stocks under the CFP. Some stocks are assessed in relation to the primary indicator (fishing mortality) for criterion 3.1, some stocks are assessed in relation to secondary indicators for 3.1 (catch/biomass ratio) and some stocks are not currently assessed. Work on 'data-limited' stock assessment methods in ICES is ongoing and the range of stocks assessed in relation to the primary or secondary indicators is increasing. Information for individual stocks can be found in ICES advice; http://www.ices.dk/community/advisory-process/Pages/Latest-advice.aspx The existing monitoring programmes for crab and lobster stocks directly feed stock assessment methods which allow evaluation of stock and fishery against the primary indicators (fishing mortality and reproductive capacity). However, the spawning stock biomass estimates provided for primary indicator 3.2 are only relative values as the data are not substantial enough to provide actual values. Data from the scallop monitoring programme will be used in stock assessment methodologies developed within the ICES in order to determine stock and fishery status. Indicators for GES specific to scallop stocks will also be developed within this group.

(ii) How does the monitoring programme meet the requirements of Annex III (indicative lists of characteristics, pressures and impacts) of the Directive?	For commercial stocks the DCF and other national monitoring programmes provide information on: • Characteristics and Biological features: information on the structure of fish and shellfish populations, including the abundance, distribution and age/size structure of the populations; and • Pressures and Impacts and Physical damage: selective extraction.
(iii) How will the monitoring programme assess the effectiveness of measures?	Ongoing fisheries stock assessments undertaken by ICES will inform on the effectiveness of measures. The extent to which the effectiveness of measures can be determined depends on the level of assessment that is conducted for specific stocks. Crab and lobster stock assessments (and a monitoring programme for scallops) will be conducted regularly by the relevant UK fishery laboratories in order to monitor stock status. The effectiveness of management measures on species such as lobster will take a long time to evaluate due to biological traits (i.e. slow growth rate means that it takes several years to go from hatching to appearing in the fishery).
Section 3: Gaps and issues	
DCF data are considered insufficient for monitoring scallops; therefore a national monitoring programme was devised over and above the DCF requirements. Due to the problems encountered, the programme did not achieve its target for the number of samples collected so was put on hold. Further work will consider alternative data collection methods and inform next steps in data collection for scallops. This will be supported by work in ICES on scientific support for assessment methods. Defra is also exploring whether additional shellfish species (such as whelks and cuttlefish) should be considered in the context of this work. There are no targets for Criterion 3.3 Population age and size distribution. This is on the basis that there is currently no scientific agreement on whether the population age and size distribution can be defined for single species/stocks in isolation. Work within the UK and at ICES is ongoing to determine indicators that can be used to classify the stocks according to Criterion 3.3, especially for shellfish stocks where this may be more relevant. For finfish stocks it is considered that achieving “safe biological limits” will lead to a “healthy” age and size distribution.	

Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for 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	
Overall summary	The eutrophication problems in UK Seas are restricted to a small number of areas in coastal waters, particularly estuaries and embayments where circulation is restricted. The existing programmes for assessing the eutrophication status for coastal and marine waters developed under the WFD and the OSPAR Convention are both regionally coordinated to a large extent and have already been applied successfully. Integration of these programmes will provide a sound basis for the monitoring requirements of Descriptor 5, and provide a robust assessment of the extent that eutrophication in UK waters has been minimised.
Status of eutrophication in UK Seas	The UK initial assessment (http://cdr.eionet.europa.eu/gb/eu/msfd8910) based on the report "Charting Progress 2" (http://chartingprogress.defra.gov.uk/chapter-4-clean-safe-seas, section 3.3) showed that UK coastal and offshore waters in each of the 8 UK regions are currently considered non-problem areas with respect to eutrophication. Although there is nutrient enrichment in some of the areas, there is no evidence of undesirable disturbance, and the risk is not considered to be increasing. There are a small number of small estuaries, loughs and harbours which are identified as problem areas or potential problem areas. Scotland's Marine Atlas (www.scotland.gov.uk/Topics/marine/education/atlas) and the Northern Ireland "State of the Seas report" (www.doeni.gov.uk/niea/water-home/state_of_the_seas_ni_report.htm) provide greater regional details.
Section 1: UK Marine strategy part 1 targets[13], indicators and monitoring programmes	
MSFD Criterion 5.1: Nutrient levels	**TARGET**: Non Problem Areas 2007/2010. No increase in the assessed dissolved inorganic nitrogen and phosphorous concentration, resulting from anthropogenic nutrient input using data from periodic surveys.

[13] The Eutrophication targets in this section are assessed holistically to determine whether eutrophication is occurring. Failure with respect to any individual target does not, on its own, lead to identification of eutrophication problems.

	Problem Areas 2007/2010. A downward trend in dissolved inorganic nitrogen and phosphorous concentration, resulting from decreasing anthropogenic nutrient input over a 10 year period **MSFD Indicator 5.1.1:** Nutrients in the water column.
MSFD Criterion 5.2: Direct effects of Nutrient enrichment	**TARGETS:** Non Problem Areas 2007/2010. No increase in the chlorophyll 90 percentile in the growing season (linked to increasing anthropogenic input) based on periodic surveys, and If there is evidence of nutrient enrichment and accelerated growth, then: No trend in a eutrophication-relevant plankton index that is attributable to increases in nutrient loading, winter nutrient concentrations or trends in nutrient ratios Problem Areas 2007/2010. A downward trend in the chlorophyll 90 percentile in the growing season over a 10 year period (linked to decreasing anthropogenic input), and Changes in a eutrophication-relevant plankton index that is attributable to decreases in nutrient loading, winter nutrient concentrations or trends in nutrient ratios. **MSFD Indicator 5.2.1:** Chlorophyll concentration in the water column **MSFD Indicator 5.2.2:** Water transparency related to increase in suspended algae, where relevant [14] **MSFD Indicator 5.2.3:** Abundance of opportunistic macroalgae **MSFD Indicator 5.2.4:** Species shift in floristic composition such as diatom to flagellate ratio, benthic to pelagic shifts, as well as bloom events of nuisance/toxic algal blooms (e.g. cyanobacteria) caused by human activities.
MSFD Criterion 5.3: Indirect effects of nutrient enrichment	Problem Areas 2007/2010. 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

[14] This indicator is not considered relevant for UK waters

	to anthropogenic input of nutrients. **MSFD Indicator 5.3.1** - Abundance of perennial seaweeds and seagrasses (e.g. fucoids, eelgrass and Neptune grass) adversely impacted by a decrease in water transparency **MSFD Indicator 5.3.2** - Dissolved oxygen, i.e. changes due to increased organic matter decomposition and size of the area concerned
Monitoring programme name	**Description of monitoring programme**
Integrated monitoring programme for nutrients and eutrophication effects	The programme for eutrophication will measure the concentrations of nutrients, and the direct and indirect effects of nutrient enrichment (particularly levels of chlorophyll, plankton and oxygen) in coastal waters where eutrophication problems tend to occur, using the existing programme set up to assess eutrophication status for compliance with the WFD. A more limited programme using the OSPAR Common Procedure for the assessment of the Eutrophication Status of marine waters of the North East Atlantic will address the status in Marine Waters. The programme will also check that there is no deterioration in the nutrient status of areas potentially at risk, and that nutrient concentrations in existing eutrophication problem areas (located in a small number of coastal embayments and estuaries) are falling. Monitoring programmes will be implemented using the indicators, assessment procedures and monitoring guidelines developed for the WFD, the OSPAR Common Procedure and the associated common indicators which OSPAR countries have agreed to use for MSFD purposes. Individual programmes for England, Wales, Scotland and Northern Ireland will focus on issues of local concern, but will be coordinated by UKMMAS through the Clean and Safe Seas Evidence Group. Development work already underway on how the use of models, satellites, ships of opportunity and buoys and, combined with outputs from research projects and shelf seas programmes which monitor eutrophication-related parameters, will be used to help enhance and to better focus and streamline the core programmes with a view to reducing costs in future years.
Regional coordination	The state of coordination with other countries in both the Celtic and the Greater North Seas is good.

	Indicators, methodologies and assessment procedures have been agreed with other countries sharing the North East Atlantic through the OSPAR Comprehensive Procedure and with EU Member States through inter-calibration processes currently being undertaken through the WFD Common Implementation Strategy. The UK will use the common indicators adopted by OSPAR for the assessment of eutrophication for the MSFD. In addition, the UK has already set up cooperation arrangements with other Member States, for example on the shared use of a fixed mooring monitoring platform in the southern North Sea and has cooperated with other countries through OSPAR to obtain better access to satellite information on chlorophyll.
Section 2: How will the monitoring programme meet the requirements of the directive?	
(i) How will the monitoring programmes evaluate whether the targets have been achieved?	There are well established procedures in both OSPAR and the WFD through which the monitoring results for nutrient concentrations and direct and indirect effects of eutrophication are assessed, to establish whether eutrophication is occurring. Regionally agreed procedures are available to establish whether the trend-related targets have been met.
(ii) How does the monitoring programme meet the requirements of Annex III (indicative lists of characteristics, pressures and impacts) of the Directive?	The characteristics set out in Annex III for Descriptor 5 are: “Physical and chemical characteristics” which require relevant information on the spatial and temporal distribution of nutrients and oxygen; and “Biological features”, which require information on the phytoplankton and zooplankton communities, including the species and seasonal and geographical variability, and on angiosperms, macroalgae and invertebrate bottom fauna, including species composition, biomass and annual/seasonal variability. The pressures relevant to Descriptor 5 are “inputs of fertilisers and other nitrogen” and “phosphorus-rich substances, and inputs of organic matter”. As described above, the monitoring programmes cover the requirements of Annex III through the monitoring of nutrient concentrations, various types of plankton and macroalgae and oxygen concentrations. The associated risk assessment process to target the monitoring programmes, together with previous eutrophication assessments provide us with good knowledge and understanding of where the inputs from fertilisers and sewage treatment works are likely to cause eutrophication problems, and where eutrophication-related effects are likely to occur.

(iii)How will the monitoring programme assess the effectiveness of measures?	There is a relationship between measures to reduce nutrient inputs from various sources and the incidence of eutrophication. However, if measures have been taken under EC Directives but there is no discernible downward trend in riverine inputs and direct discharges of dissolved inorganic nitrogen, over a few years, this may be explained by the long lag time in environmental systems and by the possible confounding effects of environmental change. Experts have indicated that, due to the large existing reservoirs of nitrogen in soils and sediments, it could be decades before measures, such as improved agricultural practice with respect to fertiliser and manure use, will begin to show measurable improvements in environmental quality. There are circumstances where, in relation to management of point sources, environmental benefits can be realised quickly. For example, there is local evidence that inputs of phosphorus are lower in recent years, resulting from the introduction of improved urban waste water treatment.
Section 3: Gaps and issues	
There are no significant gaps or issues relating to this descriptor.	

Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 7 Hydrographical conditions	
Overall summary	Our approach to MSFD Descriptor 7 is to track and record the licensing applications of any proposed developments that are large enough to have the potential to alter hydrographical conditions. Any proposed large scale developments that have the potential to affect hydrographical conditions are recorded. This will confirm whether there is a need for any additional licensing, monitoring, or assessment requirements for Government, marine licensing authorities or developers. The monitoring and modelling of hydrographic conditions will continue alongside engagement with wider European and worldwide initiatives.
Status of hydrographical conditions in UK seas	The UK initial assessment for the MSFD published last year (http://cdr.eionet.europa.eu/gb/eu/msfd8910) based on the report "Charting Progress 2" (http://chartingprogress.defra.gov.uk/chapter-4-clean-safe-seas) indicates that: • 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. • 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 CO_2. Scotland's Marine Atlas (www.scotland.gov.uk/Topics/marine/education/atlas) and the Northern Ireland "State of the Seas report" (www.doeni.gov.uk/niea/water-home/state_of_the_seas_ni_report.htm) provide greater regional details.
Section 1: UK Marine Strategy Part 1 Targets, indicators and monitoring programmes	
MSFD Criterion 7.1: Spatial characterisation of permanent alterations	**TARGET:** 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.

	MSFD Indicator 7.1.1: Extent of area affected by permanent alterations
MSFD Criterion 7.2: Impact of permanent hydrographical changes	**TARGET:** 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. **MSFD Indicator 7.2.1:** Spatial extent of habitat affected by the permanent alteration
Monitoring programme name	**Description of monitoring programme**
Monitoring of hydrographical condition through the regulatory assessment process	No specific monitoring programme will be developed for Descriptor 7. Currently there are no significant broad scale alterations of hydrographical conditions affecting ecosystems in UK waters beyond those currently covered by provisions of the WFD, through classification as heavily modified water bodies. Licensing applications of any proposed developments large enough to have the potential to alter hydrographical conditions, either at a broad scale or through acting cumulatively with other developments, will be tracked or recorded by regulators. Work is underway to review existing guidance for developers on addressing impacts on hydrographical conditions and cumulative impacts as part of the Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) processes. A number of case studies were undertaken of existing or potential future planning applications to test the assertion that the current regulatory regime is sufficiently robust to ensure GES can be achieved. This work confirms there is no need for additional licensing, monitoring, or assessment burdens for Government, marine licensing authorities or developers. An approach for accounting for cumulative impacts that could result from an array of smaller developments is currently being developed. The UK is also involved in various initiatives to develop its understanding and evaluation of cumulative effects both at a national and European level. Careful consideration will be given to ensure that impacts from groups of smaller scale developments can be distinguished from changes in prevailing conditions. Data and information from the licensing and consents process will be stored and will be accessible, subject to appropriate licensing arrangements, to UK scientists, policymakers, the European Commission and the European Environment Agency in compliance with EC 2003/4/EC on public access to environmental

	information. Information regarding prevailing conditions will continue to be required to develop a baseline. Hydrographical conditions in UK waters are relatively well monitored and modelled with regular assessments being undertaken. It is important that the impacts of human developments at local or subregional scales are set against increasing evidence of wider regional scale shifts in hydrographic conditions as a result of changing climate and increased levels of atmospheric CO_2. By using this evidence the licensing and consent processes may be appropriately adapted. The UK has a number of monitoring programmes) and projects (e.g. Marine Scotland Sciences' offshore and inshore Long Term Monitoring Programme, EU FP7 Global Monitoring for Environment and Security (GMES) project and MyOcean (http://www.myocean.eu/) which support the development of this baseline. As new technologies become available (e.g. Autonomous Underwater Vehicles) they will be trialled alongside existing tools that measure hydrographic variables.
Regional coordination	UK's approach is strongly aligned with that of other OSPAR Contracting Parties. Options for further coordination regarding the approach for accounting for cumulative impacts resulting from a range of smaller developments are being considered. The UK is well placed to contribute to this work through its active involvement in the OSPAR Intersessional Correspondence Group on Cumulative Impacts. The UK will continue to engage with European and international initiatives to develop and improve its understanding of prevailing conditions. For example, the UK is already actively involved in a number of European research projects, including MyOcean.
Section 2: How does the monitoring programme meet the requirements of the directive?	
(i) How will the monitoring programmes evaluate whether the targets have	The current planning and licensing system, which applies the requirements of the EIA, SEA, Habitats Directive and WFD, will allow the detection of any potential large scale hydrographical changes arising from offshore developments.

been achieved?	
(ii) How does the monitoring programme meet the requirements of Annex III (indicative lists of characteristics, pressures and impacts) of the Directive?	The current planning and licensing process covers the following requirements of Annex III: • Physical loss e.g. smothering, sealing (e.g. by permanent constructions); • Physical damage e.g. changes in siltation, selective extraction; and • Interference with hydrographical processes e.g. significant changes in thermal regime, significant changes in salinity regime.
(iii) How will the monitoring programme assess the effectiveness of measures?	The licensing process will ensure that any developments large enough to have the potential to alter hydrographical conditions, either at a broad scale or through acting cumulatively with other developments, are identified and potential impacts are mitigated. Where required, a licensing authority (under Part 4 of the Marine and Coastal Access Act 2009) can impose conditions on a marine licence for monitoring of impacts of an activity – in some cases that requires the use of control sites, away from the impacted zones, which can help understanding of the temporal context and enable any change as a direct result of the project to be measured. This can provide reassurance that the assessment carried out and any mitigations put in place were accurate, or could highlight areas where further mitigation is required.
Section 3: Gaps and issues	
Work is underway to review existing guidance for developers on addressing impacts on hydrographical conditions and cumulative impacts as part of the EIA and SEA processes. The UK is reviewing how best to strengthen its understanding of prevailing environmental conditions and how they are changing.	

Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 8 Concentrations of contaminants are at levels not giving rise to pollution effects	
Overall summary	The existing programmes for assessing the concentrations of contaminants and their effects in coastal and marine waters that have been developed under the WFD, Environmental Quality Standards Directive (EQSD) and the OSPAR Convention are all regionally coordinated to a large extent and have already been applied successfully to assess contaminant status. Integration of these programmes, and updating them to reflect changes in the Directives, will provide a sound basis for the monitoring requirements of Descriptor 8, and provide a robust assessment of whether levels are giving rise to pollution effects or not, and whether status is improving.
Status of contaminants in UK seas	The UK initial assessment for the MSFD (http://cdr.eionet.europa.eu/gb/eu/msfd8910) based on the report "Charting Progress 2" (http://chartingprogress.defra.gov.uk/chapter-4-clean-safe-seas) Indicates that most problems (i.e. where concentrations or biological effects parameters exceed assessment thresholds) are local in nature, and close to the sources particularly in industrialised estuaries and coasts and largely caused by historic pollution. Scotland's Marine Atlas and (www.scotland.gov.uk/Topics/marine/education/atlas) the Northern Ireland "State of the Seas report" (www.doeni.gov.uk/niea/water-home/state_of_the_seas_ni_report.htm) provide greater regional details. 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.
Section 1: UK Marine Strategy Part 1 targets, indicators and monitoring programmes	
MSFD Criterion 8.1: Concentrations of Contaminants	**TARGET:** Concentrations of substances identified within relevant legislation and international obligations are below the concentrations at which adverse effects are likely to occur (e.g. are less than Environmental Quality Standards applied within the Water Framework Directive and Environmental Assessment Criteria applied within OSPAR). **MSFD Indicator 8.1.1**: Concentrations of the contaminants mentioned in the COM DECISION, measured in the relevant matrix (such as biota, sediment and water) in a way that ensures comparability with the

	assessments under Directive 2000/60/EC.
MSFD Criterion 8.2: Effects of Contaminants	**TARGET:** The intensity of those biological or ecological effects due to contaminants agreed by OSPAR as appropriate for MSFD purposes are below the toxicologically-based standards **MSFD Indicator 8.2.1** Levels of pollution effects on the ecosystem components concerned, having regard to the selected biological processes and taxonomic groups where a cause/effect relationship has been established and needs to be monitored
MSFD Criterion 8.2: Effects of Contaminants	**TARGET:** Occurrence and extent of significant acute pollution effects (e.g. slicks resulting from spills of oil and oil products or spills of chemical) and their impact on biota affected by this pollution should be minimised through appropriate risk-based approaches **MSFD Indicator 8.2.2**: Occurrence, origin (where possible), extent of significant acute pollution events (e.g. slicks from oil and oil products) and their impact on biota physically affected by this pollution.
Monitoring programme name	**Description of monitoring programme**
Concentrations of contaminants in marine waters, sediments and biota	The programme will measure concentrations of contaminants in water, sediments and biota in coastal and marine waters in areas considered to be at risk and assess whether they are meeting EU and OSPAR standards. It will integrate the monitoring of contaminants used to implement the WFD and the EQSD for coastal waters and the monitoring used in the OSPAR Convention Coordinated Environmental Monitoring Programme to address the contaminant status of coastal and marine waters, and will be coordinated by UKMMA) through the Clean and Safe Seas Evidence Group, which covers all UK seas. The chemicals that will be monitored are identified using a risk-based assessment of their usage patterns and pathways from the EQSD list of priority chemicals judged to be of national concern, and from the OSPAR priority chemicals

	which have been identified by OSPAR as common indicators for MSFD purposes[15].
Effects of contaminants in marine waters	The programme for biological effects will monitor those effects identified by OSPAR as common indicators for MSFD purposes (currently imposex in gastropods) and any OSPAR candidate indicators that are agreed as common indicators in the next 2 years and assess whether these exceed agreed OSPAR standards and whether further monitoring is appropriate. In this connection, a number of ad hoc surveillance and investigatory surveys are planned to address specific risks and questions about GES using biological effects. These currently include: i. English and Scottish risk-based programmes of biological effects monitoring of fish, shellfish (mussels) and benthic invertebrates to supplement chemical monitoring and assess whether pollutant effects are occurring. Determinants will include: micronucleus, liver histopathology, external disease, 7-ethoxyresorufin O-deethlyation (EROD) activity, biliary polycyclic aromatic hydrocarbon (PAH) metabolites, and lysosomal membrane stability; and ii. UK surveys of imposex/intersex in gastropod molluscs and UK surveys of externally visible fish disease.
Significant pollution effects	The UK-wide National Contingency Plan for Marine Pollution from Shipping and Offshore Installations will be used to assess the occurrence and extent of significant acute pollution effects. This develops appropriate monitoring programmes using the associated PREMIAM Guidelines[16] to assess the long-term, as well as the short- and medium-term environmental impacts of any spills which are expected to have significant effects.
Regional coordination	There has been a concerted effort to coordinate the UK's monitoring programmes with those of other Member States sharing the North East Atlantic to ensure that the assessments carried out are comparable,

[15]OSPAR common indicators are: metals (Hg, Cd, Pb in sediments and biota), PCBs and PBDEs in sediments and biota, PAHs in sediments, and organotins in sediments. Imposex/intersex in dogwhelks/snails has also been agreed as a common indicator. OSPAR also agreed on a number of candidate indicators where further work is required before a decision can be taken to include them as common indicators. These include PAH, HCB and HCBD in biota, HCB and HCBD in sediment, and the biological effects externally visible fish disease, Lysosomal stability, bile metabolites, micronuclei and EROD.)

[16] Pollution Response in Emergencies Marine Impact Assessment and Monitoring.

	and this has been carried out in both the OSPAR Convention, and through the Common Implementation Strategy of the WFD and the EQSD. In the OSPAR Convention, common indicators, with agreed assessment thresholds and methodologies are available for contaminants and biological effects. The WFD and the EQSD have also set binding Environmental Quality Standards for a number of contaminants which apply to coastal waters of EU Member States. The UK will continue to work within the OSPAR and EU frameworks to update UK programmes in the light of new knowledge and progress made. Regional coordination on oil spills is also addressed through participation in the Bonn Agreement.
Section 2: How will the monitoring programme meet the requirements of the directive?	
(i) How will the monitoring programmes evaluate whether the targets have been achieved?	There are well established procedures in both OSPAR and the WFD/EQSD through which the monitoring results for both contaminant concentrations and biological effects are assessed against the Environmental Assessment Criteria or Environmental Quality Standards which have been agreed and the UK will use these to evaluate whether the targets have been achieved. An assessment of the results of the ad hoc monitoring programmes developed in response to pollution events will enable an evaluation of whether the target has been achieved.
(ii) How does the monitoring programme meet the requirements of Annex III (indicative lists of characteristics, pressures and impacts) of the Directive?	The pressure set out in Annex III for Descriptor 8 is “contamination by hazardous substances”, and the associated impacts are: a) Introduction of synthetic compounds (e.g. priority substances under Directive 2000/60/EC)”; b) Introduction of non-synthetic substances and compounds (e.g. heavy metals, hydrocarbons); and c) Introduction of radionuclides. The UK considers that the introduction of synthetic and non-synthetic compounds will covered by the OSPAR and WFD/EQSD monitoring programmes mentioned above, which cover the relevant chemicals. The UK also considers that the introduction of radionuclides is covered by the OSPAR radioactivity monitoring programme in which the UK participates, which covers key radionuclides of concern.

(iii) How will the monitoring programme assess the effectiveness of measures?	There is generally a direct relationship between measures to reduce contaminant inputs from various sources and the concentrations found in water sediments and biota. Measured over a number of years, the concentrations of contaminants in various environmental matrices can provide statistically significant trends, which can demonstrate whether control measures to restrict chemicals from entering the marine environment are working. However, there can be a significant time lag due the persistence of the chemicals, which form reservoirs in sediments and biota, or where trans-generation effects occur (e.g. in cetaceans where PCBs are transferred from mother to offspring though lactation). A good example is the occurrence of imposex in dogwhelks, where monitoring has shown that since the ban on the use of TBT as an antifoulant, the incidence of imposex has significantly declined. See: http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=12690
Section 3: Gaps and issues	
The contaminants which are currently monitored are those which have been recognised to be of most concern, and have been prioritised onto the OSPAR and WFD/EQSD priority lists. However, it is recognised that further substances of concern may need to be targeted in future, and that possible risks posed by the impacts of mixtures of chemicals can be evaluated by the use of investigative tools including biological effects techniques. The revision of the EQSD in 2015 will require 15 additional substances to be considered, together with a watch list to allow targeted EU-wide monitoring of substances of possible concern. The monitoring programmes will be updated to adapt to these evolving requirements.	

Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 9 Contaminants in fish and other seafood for human consumption do not exceed levels established by community legislation or other relevant standards	
Overall summary	Previous retail surveys of seafood, enhanced by new investigations into contaminant levels in seafood extracted from known fishing grounds in the North and Celtic Seas, will provide a sound basis for the monitoring requirements of Descriptor 9, and provide a robust assessment of the extent to which contaminants in fish and other seafood exceed the levels established by Community legislation or otherwise present a risk to health.
Status of contaminants in fish and other seafood for human consumption	The UK Initial Assessment (http://cdr.eionet.europa.eu/gb/eu/msfd8910) based on the report "Charting Progress 2" (http://chartingprogress.defra.gov.uk/chapter-4-clean-safe-seas), pointed out that monitoring of fish and other seafood for human consumption indicate that contaminant levels rarely exceed maximum levels established by Community legislation. However, this report did not include data from commercial fish species of marketable size. Data from Food Standards Agency surveys are not generally related to specific geographical areas in UK waters, but based on surveys of marketed fish and seafood; although data from bivalves often have geographical information. Work in Scottish waters has found mercury and lead in fish from representative sea areas in both the Greater North Sea and Celtic Seas subregions were 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 the higher concentrations were related to a fish species that forms only 0.03% of landings from that area. Scotland's Marine Atlas (www.scotland.gov.uk/Topics/marine/education/atlas) and the Northern Ireland state of the seas report (www.doeni.gov.uk/niea/water.../state_of_the_seas_ni_report.htms) provide greater regional detail on contaminants in shellfish.
Section 1: UK Marine Strategy Part 1 targets, indicators and monitoring programmes	

MSFD Criterion 9.1: Levels, number and frequency of contaminants	**TARGET:** 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 **MSFD Indicator 9.1.1** Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels **MSFD Indicator 9.1.2** Frequency of regulatory levels being exceeded
Monitoring programme name	**Description of monitoring programme**
Concentrations of contaminants in seafood	The Food Standards Agency is carrying out an investigation into contaminant levels in fish and other seafood taken from commercial fishing grounds in the Greater North Sea and Celtic Seas, targeting higher-risk species identified by the previous retail surveys. Some samples are being provided by Cefas and bodies from the Devolved Administrations. In addition, Marine Scotland will be analysing commercial fish species based upon landings and targeted for their ability to accumulate contaminants. Testing will encompass environmental contaminants that are presently regulated, together with those currently under discussion in the Expert Committees that advise the Standing Committee on the Food Chain and Animal Health or have been identified as emerging risks within UK or international programmes. This will provide a baseline of contaminant data, give an initial indication of the level of non-compliance (if any) with the current EU limits set out in Commission Regulation 1881/2006 as amended and highlight any unusual patterns that indicate contamination hotspots that might be associated with localised sources. The initial survey will be used to inform on the frequency of future surveys; in the event that concentrations are below the maximum permitted concentrations, future surveys of commercial fish species would be conducted once per MSFD reporting cycle. Where relevant, data will be supplemented by data obtained from national bivalve shellfish monitoring programmes carried out under annex II of Regulation (EC) 854/2004. All testing will carried out in accordance with the relevant analytical performance criteria set out in Commission Regulation 333/2007 as amended or Commission Regulation 252/2012 as a minimum. For contaminants for which analytical performance criteria are not set out in regulations, testing will be done following equivalent criteria and using accredited methods
Regional coordination	The regulations mentioned above have already ensured that there is significant coordination on how

	monitoring should be carried out at Community level. As yet there are no plans to coordinate the research cruises that will be used to collect samples of seafood from commercial fishing grounds, but the UK will explore this option with other countries that express interest, and the IBTS may have potential for a coordinated regional approach. If non-compliances or other concerns are found regarding fish taken from waters of another Member State, the Food Standards Agency will liaise with the competent authority of that Member State.
Section 2: How does the monitoring programme meet the requirements of the directive?	
(i) How will the monitoring programmes evaluate whether the targets have been achieved?	Fish and shellfish taken from UK waters will not contain contaminant levels above the maximum permitted concentration (Commission Regulation 1881/2006 as amended) for the species concerned.
(ii) How does the monitoring programme meet the requirements of Annex III (indicative lists of characteristics, pressures and impacts) of the Directive?	The characteristic set out in Annex III for Descriptor 9 is "other features" and requires "a description of the situation with regard to chemicals, including chemicals giving rise to concern, sediment contamination, hotspots, health issues and contamination of biota (especially biota meant for human consumption. As described above, the monitoring programmes will enable us to provide an assessment of the contamination of biota intended for human consumption.
(iii) How will the monitoring programme assess the effectiveness of measures?	Where the results of the baseline investigation identify specific problems that need addressing, further targeted testing will be carried out to evaluate the effectiveness of any improvement measures.
Section 3: Gaps and issues	
There is currently limited information gathered for seafood (particularly fish) for human consumption originating from UK waters. However this will be rectified through the introduction of the targeted investigation in various fishing grounds in the North and Celtic Seas.	

Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 10 Marine litter	
Overall summary	The UK marine litter monitoring programme will be based around existing programmes on beach litter and litter in the stomachs of fulmars. These programmes have been developed through OSPAR and have been undertaken for many years. Marine litter on the seafloor has been collected on a more opportunistic basis on fisheries surveys. Currently there are agreements in place across these surveys which ensure a steady and constant stream of this more qualitative data. Work is underway to determine options for the establishment of a more robust approach to monitoring marine litter on the seafloor. The aim is that this will help develop baselines to assess targets in the future. The UK's marine litter monitoring programmes have been developed in accordance with regional guidance[17] to ensure the methods are robust. Further research and development will also aid our understanding of marine litter and its impacts on the marine environment. As new information is gathered the programmes will be reviewed and revised, ensuring we continue to coordinate our programmes with those of other Member States and OSPAR Contracting Parties.
Status of marine litter in UK seas	The report Charting Progress 2 (http://chartingprogress.defra.gov.uk/chapter-4-clean-safe-seas) identifies some problems from marine litter in all regions within the Greater North Sea and the Celtic Seas where there are systematic surveys of beach litter density. However, the UK initial assessment for the MSFD published last year (http://cdr.eionet.europa.eu/gb/eu/msfd8910), which was based on the "Charting Progress 2" report, was not able to provide an assessment of marine litter and its impacts because there is "a limited understanding of current levels, properties and impacts of marine litter. As such marine litter experts were unable to propose quantitative targets indicating the point at which GES would be achieved. Instead a trend based target for litter on coastlines has been developed which requires an absolute reduction in visible litter items on coastlines within specific categories" (initial assessment 2012). Further regional detail can be found in: Scotland's Marine Atlas

[17] Marine Litter Technical Recommendations for the Implementation of MSFD Requirements EUR 25009 EN – 2011, MSFD GES Technical Subgroup on Marine Litter (http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/22826/2/msfd_ges_tsg_marine_litter_report_eur_25009_en_online_version.pdf)

	(www.scotland.gov.uk/Topics/marine/education/atlas) and the Northern Ireland "State of the Seas report" (www.doeni.gov.uk/niea/water-home/state_of_the_seas_ni_report.htm).
Section 1: UK Marine Strategy Part 1 targets, indicators and monitoring programmes	
MSFD Criterion 10.1: Characteristics of litter in the marine environment	**TARGET:** Overall reduction in the number of visible litter items within specific categories/types on coastlines **MSFD Indicator 10.1.1:** Trends in the amount of litter washed ashore and/or deposited on coastlines, including analysis of its composition, spatial distribution and, where possible, source.
MSFD Criterion 10.1: Characteristics of litter in the marine environment	**TARGET:** Surveillance indicator to monitor the quantities of litter on the seafloor **MSFD Indicator 10.1.2:** Trends in the amount of litter in the water column (including floating at surface) and deposited on the sea floor, including analysis of its composition, spatial distribution and, where possible, source.
MSFD Criterion 10.1: Characteristics of litter in the marine environment	**TARGET:** Surveillance indicator to monitor the amounts of plastic found in the contents of fulmars stomachs[18] as a method of determining litter floating at the surface (in line with OSPAR Ecological Quality Objective) **MSFD Indicator 10.1.2:** Trends in the amount of litter in the water column (including floating at surface) and deposited on the sea floor, including analysis of its composition, spatial distribution and, where possible, source.
Monitoring programme name	**Description of monitoring programme**

[18] Plastic is only collected from dead fulmars that are washed up on beaches

OSPAR Beach Litter Monitoring Programme	This monitoring programme is well developed and beach surveys are carried out on a quarterly basis. OSPAR have produced an agreed set of protocols for this programme[19]. In England, Wales and Scotland the programme is administered by the MCS, who have been collecting data for over 10 years. In Northern Ireland the programme is also established and is being run by Keep Northern Ireland Beautiful. Whilst the MCS coordinate hundreds of litter surveys of UK beaches, the MSFD monitoring programme is based on the data for the sub-set of OSPAR-designated beaches. Where marine litter is deposited and accumulates is influenced by its source (the majority of marine litter is from terrestrial sources) and the complex nature of marine ocean processes and weather patterns. The OSPAR beach litter monitoring methodology takes into account beaches which act as deposition areas for marine litter. Given the complex nature of marine litter issues and the transboundary nature of litter, the target relating to beach litter will remain trend-based until the sources and movements of beach litter are better understood and characterised through continued data collection. Further data analysis is currently under development within the OSPAR Intersessional Correspondence Group on Marine Litter (ICG-ML). This aims to provide a robust, OSPAR-agreed, statistically sound baseline to determine trends for beach litter.
Benthic Litter Monitoring Programme	Options for a benthic litter monitoring programme are currently being developed by Cefas for English and Welsh waters. The options will be based on existing surveys, offer a statistically robust programme and take into account litter accumulation zones. A decision on how the programme will be taken forward, including decisions on the best place to collate data and information relating to benthic litter, will be made by 2014. Fish stock and scientific survey data (collected in spring and autumn) have formed the basis of benthic litter monitoring programmes in Northern Ireland and Scotland. Data have been collected annually for the last 4 years and this work will continue to provide data for MSFD monitoring purposes. Benthic litter monitoring methods have not yet been fully developed and standardised. Work within a number of forums e.g. EU Technical Sub-Group on Marine Litter, is looking to develop and agree suitable standards.

[19] http://www.ospar.org/v_publications/download.asp?v1=p00526

OSPAR Common Indicator Fulmar Programme	This is a common indicator in OSPAR Region II, Greater North Sea. The programme will form the basis of the proposed surveillance indicator for marine litter in the water column. Defra will continue to work with the Institute for Marine Resources and Ecosystem Studies (IMARES) to process UK fulmars in order to monitor the quantities of plastic present in their stomachs. A baseline has already been established for UK fulmars collected from three geographic regions (Northeast England, Shetland and Orkney) and annual assessments will continue to be made using a 5 year average to monitor amounts of plastic, in line with the previous Ecological Quality Objective (EcoQO). For full details relating to methodology and quality assurance see the OSPAR EcoQO handbook[20]. Collection of fulmars is under voluntary agreement and Defra presently pay for the laboratory work and analysis. The birds are collected opportunistically. IMARES holds data relating to plastic found in fulmars and reports these for the OSPAR region to OSPAR as required[21]. IMARES also provides annual reports regarding data from UK fulmars to Defra[22]. Data from the surveillance indicator will be used to develop targets for 2018, if appropriate. Several other Member States are using this common indicator of Region II, Greater North Sea, to examine the impacts of litter on marine life. UK experts currently consider that the links to harm are unclear. There are investigations in OSPAR looking at ingestion of plastics by other species/functional groups (e.g. fish) in addition or as an alternative to fulmars, to increase the geographic relevance of the common indicator.
Regional coordination	There has been a concerted effort to coordinate our monitoring programmes with those of other Member States sharing the North East Atlantic to ensure that the assessments carried out are comparable. This work has been conducted both in OSPAR (primarily the ICG-ML) and the EU Technical Sub-Group on Marine Litter (TSG-Litter), where the UK is represented and is leading on most of the Descriptor 10 indicators.

[20] OSPAR (2009) EcoQO Handbook: Handbook for the application of EcoQOs in the North Sea. Second Edition. Publication Number: 307/2009. OSPAR Convention. pp.65 (http://www.ospar.org/v_publications/download.asp?v1=p00307)
[21] See OSPAR Quality Status Report (2010) http://qsr2010.ospar.org/media/assessments/p00406_supplements/p00406_suppl_9_plastic_particles.pdf
[22] http://www.ospar.org/html_documents/ospar/html/data/assessment_fact_sheets/ospar_assessment_sheet_fulmar_2013.pdf

	In OSPAR work has focussed on the harmonisation of targets and indicators, potential measures, monitoring programmes and areas for further research. OSPAR is developing a Regional Action Plan on Marine Litter to enhance coordination of actions and a set of common indicators for marine litter, which, subject to agreement by Contracting Parties, could be used as a basis for MSFD monitoring programmes. The OSPAR beach litter indicator has already been identified as a common indicator across the OSPAR Region and the OSPAR EcoQO on fulmars is a common indicator across the Greater North Sea area (OSPAR Region II). An indicator for litter on the seafloor has been identified as a priority for further development.
Section 2: How does the monitoring programme meet the requirements of the directive?	
(i) How will the monitoring programmes evaluate whether the targets have been achieved?	The monitoring programme for addressing indicator 10.1.1 is well developed. Beach litter data for OSPAR has been collected for over 10 years and can be used for identifying trends in the amount of litter washed ashore and/or deposited on coastlines. Insufficient baseline data currently exist for seafloor litter. Options for a monitoring programme to address indicator 10.1.2 seafloor litter are currently being developed. The options will be based on data from existing surveys (including the Clean Seas Environment Monitoring Programme and the IBTS) which have been collected data for ca. 20 years (since 1992) around England and Wales. The surveillance indicator adopted will allow relevant monitoring data to be collected with a view, if appropriate, to developing targets for 2018. In Northern Ireland and Scotland benthic litter has been collected on fish stock and scientific surveys for the past 4 years. The OSPAR common indicator fulmar programme which will be used to address indicator 10.1.2 has been in use in The Netherlands as an OSPAR EcoQO since 1982 and was expanded to cover UK fulmars in 2002.
(ii) How does the monitoring programme meet the requirements of Annex III (indicative lists of characteristics, pressures and impacts) of the Directive?	The monitoring programmes will address ‘Other physical disturbance – marine litter’ as detailed in Annex III.

(iii) How will the monitoring programme assess the effectiveness of measures?	The surveys will be able to detect changes in trends over time. However, because litter enters seas and coastal areas from a variety of sources and because of the transboundary nature of marine litter it will be difficult to make direct links between changes in trends and measures. It should also be noted that litter degrades slowly, accumulating on some coastlines and in natural 'sinks' in the seabed, determined by prevailing marine weather or hydrographic systems. These 'hotspots' will be taken into account in our monitoring programmes as it may take far longer for these areas to show any response to measures.
Section 3: Gaps and issues	
Insufficient baseline data currently exist with regard to seafloor litter and litter in the water column. The surveillance indicators adopted will allow relevant monitoring data to be collected with a view to developing targets for 2018 where necessary. Defra and the Devolved Administrations are committed to gaining a better understanding of issues relating to marine litter and are engaged in a number of projects and initiatives to support this objective. In the UK's Marine Strategy Part One no target was put forward in relation to the Commission Indicator on micro-particles and therefore no monitoring programme has been developed. The nature of micro-particles in the marine environment and their propensity to cause harm is currently not well understood. Defra is supporting further work on micro-particles to get a better understanding of the issues and Northern Ireland is considering a pilot project to be carried out by AFBI, supported by the Department of the Environment. Marine Scotland has a 3 year research project underway on the occurrence of micro-plastics in the seas around Scotland. New evidence will initially be considered through the Clean, Safe Seas Evidence Group of UKMMAS and through the OSPAR ICG-ML and EU TSG-Litter.	

Marine Strategy Framework Directive (MSFD): Summary of monitoring programme for Descriptor 11 Underwater noise	
Overall summary	The monitoring of underwater noise is still in its infancy and there are considerable uncertainties with respect to current levels and impacts. To address impulsive sounds the UK is developing a noise registry of activities such as seismic surveys and pile driving, bringing together data and information already required by regulators. This will help to assess whether noise generating activities have a significant negative effect on the distribution of populations of noise-sensitive species. A feasibility study to inform the design of an ambient noise monitoring programme is currently underway. The aim of this work is to examine anthropogenic noise inputs and to help in the development of robust baselines with a view to developing an appropriate target for 2018. Defra is supporting research that will also aid the understanding of underwater noise and its impacts on marine life. The UK will continue to play a leading role in Europe and OSPAR to help coordinate programmes with those of other Member States and OSPAR Contracting Parties.
Status of underwater noise in UK seas	The UK initial assessment for the MSFD published last year (http://cdr.eionet.europa.eu/gb/eu/msfd8910) based on the report "Charting Progress 2" (CP2, http://chartingprogress.defra.gov.uk/chapter-4-clean-safe-seas) was not able to provide a robust assessment of underwater noise and its impacts, and was not able to provide a baseline. CP2 concluded that there is currently insufficient evidence to provide a quantitative assessment of underwater noise. There is insufficient monitoring data to support an assessment of current ambient noise levels or their impact on marine animal populations. With respect to impulsive sounds; whilst a good scientific understanding exists with regard to noise levels that can cause physical harm, there is far less certainty about the levels of noise that are likely to cause negative behavioural impacts which could have an effect at a population level. The difficulty in setting thresholds for behavioural impacts is further complicated by the fact that behavioural change is very context-specific. For example, animals may respond differently in prey-rich areas compared with prey-poor areas. Further regional detail can be found in: Scotland's Marine Atlas (www.scotland.gov.uk/Topics/marine/education/atlas) and the Northern Ireland

	"State of the Seas report" (www.doeni.gov.uk/niea/water-home/state_of_the_seas_ni_report.htm) provide greater regional details.
Section 1: UK Marine Strategy Part 1 Targets, indicators and monitoring programmes	
MSFD Criterion 11.1: Distribution in time and place of loud, low and mid frequency sounds	**TARGET:** 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 186 dB re 1 $\mu Pa^2 m^2 s$; or the zero to peak source level of 224 dB re 1 $\mu Pa^2 m^2$ over the entire UK hydrocarbon licence block area. **MSFD Indicator 11.1.1:** Proportion of days and their distribution within a calendar year over areas of a determined surface, as well as their spatial distribution, in which anthropogenic sound sources exceed levels that are likely to entail significant impact on marine animals measured as Sound Exposure Level (in dB re 1µPa2.s) or as peak sound pressure level (in dB re 1µPa peak) at one metre, measured over the frequency band 10 Hz to 10 kHz
MSFD Criterion 11.2: Continuous low frequency sound	**TARGET:** Surveillance indicator to monitor trends in the ambient noise level within the 1/3 octave bands 63 and 125 Hz (centre frequency) (re 1µPa RMS; average noise level in these octave bands over a year) measured by observation stations. **MSFD Indicator 11.2.1:** Trends in the ambient noise level within the 1/3 octave bands 63 and 125 Hz (centre frequency) (re 1µPa RMS; average noise level in these octave bands over a year) measured by observation stations and/or with the use of models if appropriate.
Monitoring programme name	**Description of monitoring programme**

Impulsive Sound Noise Registry	A noise registry is being developed that will record in space and time noise generating activities such as seismic surveys and pile driving. The register will incorporate sound generating activities in the categories proposed and where possible the metrics of that sound will also be stored. It will not be limited by specific measurement units. These data and information are already collected by industry and regulators to meet existing obligations (managed through the current licensing and consents process). The registry will facilitate the assessment of whether current, and where possible projected, noise generating activities have a significant negative effect on the distribution of populations of noise-sensitive species. Longer term ownership and maintenance of the registry has yet to be finalised.
Ambient Noise Monitoring Programme	Given uncertainties with respect to current levels and impacts of ambient noise, a specific target has not been developed and instead a surveillance indicator has been put forward to support the development of appropriate monitoring programmes. Once sufficient baseline data have been collected consideration will be given to the appropriateness of developing a specific, quantitative target by 2018. Cefas, funded by Defra, are currently scoping out an ambient noise monitoring programme which will be coordinated through the UK Clean and Safe Seas Evidence Group with input from the Underwater Sound Forum and the EU Technical Sub-Group (TSG) on Noise. This project will identify the most appropriate equipment for monitoring ambient noise and provide sample data to determine its suitability for meeting the requirements of the Directive. After this it will be necessary to design and implement an appropriate UK monitoring programme (post/during 2014) which will be developed taking a risk-based approach i.e. identifying those areas where shipping levels are highest. Hydrophone deployments are being undertaken in Northern Irish waters as part of the moored inshore monitoring programme to test the potential for background noise assessments and to help develop the science for making these assessments adequately. This work aims to define background noise levels (using the MSFD descriptor) and to help inform the development of a formal monitoring programme suitable for regional assessments. Marine Scotland is developing a programme for the deployment of monitoring devices off the east coast of Scotland to monitor noise levels from anthropogenic activity. The primary aim is to monitor noise from offshore renewable developments, but the devices are also capable of recording ambient

	noise at the frequencies required in the MSFD indicators. Due to the infancy of underwater noise monitoring work a number of forums (TSG Noise and the International Maritime Organisation) are currently developing suitable standards. The TSG Noise has recently produced (May, 2013) monitoring guidance documents[23] which include guidance on technical specifications. There are several other projects that are working towards a standardised approach for ambient noise monitoring in which UK representatives are involved. Information about the ambient noise monitoring programme will be logged in the UK Directory of Marine Observing Systems (UKDMOS). Discussions are yet to take place with respect to where best to store/archive the data longer term.
Regional coordination	There has been a concerted effort to coordinate UK monitoring programmes with those of other Member States sharing the North East Atlantic. A common approach has been developed for impulsive sounds within the EU TSG Noise and work to build on this continues. This has also been discussed in OSPAR within which approaches have been shared to help ensure coordination. Coordination efforts will continue within both groups to ensure that the assessments carried out for both indicators are comparable.
Section 2: Will the monitoring programme meet the requirements of the directive?	

[23] Monitoring Guidance for Underwater Noise in European Seas - 2nd Report of the Technical Subgroup on Underwater noise (TSG Noise). Part I Executive Summary. Interim Guidance Report. May, 2013.
Monitoring Guidance for Underwater Noise in European Seas - 2nd Report of the Technical Subgroup on Underwater noise (TSG Noise). Part II Monitoring Guidance Specifications. Interim Guidance Report. May, 2013.
Monitoring Guidance for Underwater Noise in European Seas - 2nd Report of the Technical Subgroup on Underwater noise (TSG Noise). Part III Background Information and Annexes. Interim Guidance Report. May, 2013.

(i) How will the monitoring programmes evaluate whether the targets have been achieved?	The intention of the operational target associated with Indicator 11.1.1 is to establish a noise registry to record in space and time noise generating activities, such as seismic surveys and pile driving. These data and information are already collected by industry and regulators to meet existing obligations (managed through the current licensing and consents process). Whilst some amendments to administrative procedures/industry reporting might be necessary, no new monitoring will be required. This target will bring together information to facilitate the assessment of whether current, and where possible projected, noise generating activities may affect the distribution of populations of noise-sensitive species. Given uncertainties with respect to current levels and impacts of ambient noise, a specific target has not been developed to address Indicator 11.2.1 and instead a surveillance indicator has been put forward to support the development of appropriate monitoring programmes. Once sufficient baseline data have been collected consideration will be given to the appropriateness of developing a specific, quantitative target.
(ii) How does the monitoring programme meet the requirements of Annex III (indicative lists of characteristics, pressures and impacts) of the Directive?	The monitoring programmes will address 'Other physical disturbance – underwater noise (e.g. from shipping, underwater acoustic equipment)' as detailed in Annex III.
(iii) How will the monitoring programme assess the effectiveness of measures?	For impulsive sounds the noise registry is intended, in the first instance, to facilitate the assessment of whether past noise generating activities have potentially resulted in significant impacts on noise-sensitive marine life i.e. resulting in significant negative changes in distribution. Once the risks from disturbance have been examined and assessed there is the potential to use the registry to look at planned work to determine the risk of significant impacts occurring. The registry could be used as a tool to inform on licence applications and the subsequent need for mitigation measures. With regard to ambient noise there is likely to be a direct relationship between measures to reduce shipping

	noise and ambient noise levels, in many areas. The development of measures to address shipping noise is the responsibility of the International Maritime Organisation. The monitoring of ambient noise will help to assess the effectiveness of any such measures.
Section 3: Gaps and issues	
There are still gaps in our understanding of the effects of underwater noise, particularly relating to the impact of impulsive sounds on marine life. Defra-funded research has furthered our understanding of the effects of impulsive noise on fish, invertebrates and zooplankton. Short-term behavioural effects were observed in individuals, but highlighted that the reactions are complex and further work is required to understand the effects of impulsive noise at the population level. Work is being undertaken by Cefas to develop an ambient noise monitoring programme.	